Urban Europe and NSFC

Europe – China joint call on Sustainable Urbanisation in the Context of Economic Transformation and Climate Change: Sustainable and Liveable Cities and Urban Areas

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NCN (Poland), project UMO-2018/29 / Z / ST10 / 02986
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UNCNET

Urban nitrogen cycles: new economy thinking to master the challenges of climate change

D9/3: Outreach report and summary

Due date of deliverable: **31/01/2022** Actual submission date: **31/08/2022**

Start Date of Project: **01/04/2019** Duration: **35 months + 6 months**

Organisation name of co-chairs for this deliverable: **IIASA**

Authors: Katrin Kaltenegger, Wilfried Winiwarter

Dissemination Level		
PU	Public	☒
PP	Restricted to other programme participants (including funding agencies)	☐
RE	Restricted to a group specified by the consortium (including funding agencies)	☐
CO	Confidential, only for members of the consortium (including funding agencies)	☐

1. Executive Summary:

The outreach of the project progress and results was organized on different platforms. One platform was the UNCNET website (https://www.uncnet.org/). This website contains a general description of the project, its aims and work packages and its consortium. Additionally, all deliverables can be downloaded as well as all open-source publications are directly accessible via web link. A link to the website of the respective publisher is also provided for non-open-source publications, but access may require a license. Another section on the website informs the visitors about more recent activities such as meetings and stakeholder activities. The final stakeholder conference was advertised through pop-ups on the website as well. Another platform was a Twitter account where many project activities such as publications, preliminary results per work package, and final results in the form of "postcards" were presented. Dissemination also took place during the stakeholder meetings and through publications and presentations at conferences, all of which are listed here.

2. Objectives:

The main objective of the dissemination activities was to distribute the preliminary and final project results to people with diverse backgrounds who could become interested to contribute to or use these results.

3. Activities:

- Publishing papers
- Presenting UNCNET at conferences
- Updating the UNCNET website
- Updating the Twitter account

4. Results:

Results of these activities are the website (https://www.uncnet.org/), the Twitter account (https://twitter.com/UNCNET_project) as well as a list of conference presentations and publications. However, outreach will continue beyond the project period and three conference talks are already planned for October 2022 and several future joint publications, making use of the plentiful project results are already being discussed.

Website and Twitter: Please see Annex I and Annex II

Conferences (Past):

Winiwarter, W. (2021, June). "Nitrogen balances in urban areas: purpose and potentials" [Presentation]. INI 8th Global Nitrogen Conference, online.

Greinert, A. (2021, September). "Anthropogenic soils in the context of water and chemical elements circulation in urban environment" [Presentation, book contribution]. Plant productivity and food safety: Soil science, Microbiology, Agricultural Genetics and Food quality, online.

Conferences (Future):

Kaltenegger, K., Fan, X., Guéret, S., Suchowska-Kisielewicz, M. & Winiwarter, W. (2022, October) Urban Nitrogen Budgets – Comparison Across Cities. XXI International N Workshop, Madrid, October 24-28, 2022.

Suchowska-Kisielewicz, M., Winiwarter, W., Amon, B., Kaltenegger, K., Jędrczak, A., Myszograj, S., Płuciennik, E., and Greinert, A. (2022, October). The fate of nitrogen in the urban area – the case of Zielona Góra, Poland. XXI International N Workshop, Madrid, October 24-28, 2022.

Guéret, S., Kaltenegger, K., Fan, X., Bai, Z. and Winiwarter, W. (2022, October) From Urban Nitrogen Budgets to Sustainable Development Goals: N governance in Urban context. XXI International N Workshop, Madrid, October 24-28, 2022.

Publications:

Adalibieke et al. (2021). "Decoupling between ammonia emission and crop production in China due to policy interventions" [Global Change Biology]
https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15847

Bai et al. (2019). "Further Improvement of Air Quality in China Needs Clear Ammonia Mitigation Target" [Environmental Science & Technology – open access]
https://pubs.acs.org/doi/10.1021/acs.est.9b04725

Bai et al. (2022). "Relocate 10 billion livestock to reduce harmful nitrogen pollution exposure for 90% of China's population" [nature food]
https://www.nature.com/articles/s43016-021-00453-z

Chen et al. (2021). "Interannual variation of reactive nitrogen emissions and their impacts on PM2.5 air pollution in China during 2005-2015" [Environmental Research Letters – open access]
https://doi.org/10.1088/1748-9326/ac3695

Greinert et al. (2020). "The Use of Plant Biomass Pellets for Energy Production by Combustion in Dedicated Furnaces" [Energies – open access]
https://www.mdpi.com/1996-1073/13/2/463?type=check_update&version=2

Gu et al. (2021). "Abating ammonia is more cost-effective than nitrogen oxides for global mitigation of particulate matter air pollution" [Science]
https://doi.org/10.1126/science.abf8623

Jakubaszek (2021). "Nitrogen and Phosphorus Accumulation in Horizontal Subsurface Flow Constructed Wetland" [Agronomy – open access]
https://www.mdpi.com/2073-4395/11/7/1317

Jiang et al. (2021). "Is rice field a nitrogen source or sink for the environment?" [Environmental Pollution]

https://www.sciencedirect.com/science/article/pii/S0269749121007041

Jin et al. (2020). "Spatial Planning Needs to Drastically Reduce Nitrogen and Phosphorus Surpluses in China's Agriculture" [Environmental Science & Technology]
https://pubs.acs.org/doi/10.1021/acs.est.0c00781

Liu et. al. (2020). “The nonlinear response of fine particulate matter pollution to ammonia emission reductions in North China” [Environmental Research Letters]
https://doi.org/10.1088/1748-9326/abdf86

Lu et. al. (2021). “The underappreciated role of agricultural soil nitrogen oxide emissions in ozone pollution regulation in North China” [Nature Communications – open access]
https://www.nature.com/articles/s41467-021-25147-9

Shang et al. (2019). “Weakened growth of cropland-N2O emissions in China associated with nationwide policy interventions” [Global Change Biology – open access]
https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.14741

Suchowska-Kisielewicz, M. & Nowogonski, I. (2021), “Influence of storms on the emission of pollutants from sewage into waters” [scientific reports – open access]
https://www.nature.com/articles/s41598-021-97536-5

Wang H. et al. (2021). “Strategies to reduce ammonia emissions from livestock and their cost-benefit analysis: A case study of Sheyang county” [Environmental Pollution]
https://www.sciencedirect.com/science/article/pii/S0269749121016274

Wang Q. et al. (2019). “Data-driven estimates of global nitrous-oxide emissions from croplands ” [National Science Review]
https://academic.oup.com/nsr/advance-article/doi/10.1093/nsr/nwz087/5530920

Winiwarter et al. (2020). “Urban nitrogen budgets: flows and stock changes of potentially polluting nitrogen compounds in cities and their surroundings – a review” [Journal of Integrative Environmental Sciences – open access]
https://www.tandfonline.com/doi/full/10.1080/1943815X.2020.1841241

Zhan et al. (2020). “Improved Estimates of Ammonia Emissions from Global Croplands” [Environmental Science & Technology]
https://pubs.acs.org/doi/10.1021/acs.est.0c05149

Zhou et. al. (2020). “Deceleration of China’s human water use and its key drivers” [Proceedings of the National Academy of Sciences]
https://doi.org/10.1073/pnas.1909902117

5. Deviations and reasons:

Strong representation of UNCNET had already been planned for the INI conference scheduled for Berlin, May 2020, including the organization of a back-to-back policy meeting in Zielona Góra. Due to the Covid-19 outbreak, the conference had to be postponed and finally took place virtually in 2021 – at which occasion only key UNCNET results were shown. Also the policy meeting had to be cancelled due to the continuing uncertainty of the situation and travel restrictions still being in place for some project participants. Conference dissemination thus still is ongoing, and will extend beyond the formal project end. This and further scientific publications related to UNCNET will continue to be updated on the web page.

6. List of Documents/Annexes:

Annex I: Website archive

Annex II: Twitter archive

Annex I

Website Archive

UNCNET

Urban Nitrogen Cycles: New Economy Thinking to Master the Challenges of Climate Change

Urban life is characterized by high population density. Small scale environmental issues easily affect a large number of people. Nitrogen compounds contribute to very different environmental issues, some of which happen at very small scales. Human activities responsible for the release of such compounds are especially notable in cities – with special forms of high-value agricultural production in close proximity of consumers, with combustion to supply the high energy demand, and with waste materials concentrated where the number of people is high. In the UNCNET project we work on systematically developing "urban nitrogen budgets" to understand the reasons, pathways and possible intervention points of the release of such compounds. Specifically, we address the technological and the behavioral options that enable such interventions – considering the reclamation of useful materials like nutrients as possible pathways to support the development of a circular economy. Nitrogen budgets and their impacts will be studied in four European and Chinese cities (Vienna, Shijiazhuang, Beijing and Zielona Gora), learning from the differences – these impacts not only relating to pollution but also addressing the needs of climate protection. An organized stakeholder process will allow to familiarize city authorities and other interested parties to contribute to and learn from the project's experience.

Funded under the **JPI Urban Europe / China** pilot call

About Us

UNCNET is a project funded under the JPI Urban Europe / China collaboration, project numbers UMO-2018/29 / Z / ST10 / 02986 (NCN, Poland), 71961137011 (NSFC, China) and 870234 (FFG, Austria).
Coordinator: International Institute for Applied Systems Analysis (IIASA), A-2361 Laxenburg, Austria
Main scientific contact: Wilfried Winiwarter (winiwart [at] iiasa.ac.at)

Work Packages

The overall work within UNCNET has been divided into work packages with a clear assignment to partners responsible. This assignment meets the expertise of the respective partners, typically allowing two partners to share the work within a work package. No differentiation by country/region has been made, such that some work packages link partners from two continents, while others are mostly constructed within a single country. The main exception is the urban stakeholder work package (WP8), where only methods are exchanged between the countries, as stakeholders are expected to be confident in using their national language only. Here project partners and stakeholders will need to interact in Chinese, German, and Polish, respectively. The work packages are described in detail below, except for the administrative WP1, Coordination.

WP2: Framework

WP3: Atmosphere

WP4: Soils

WP5: Agriculture

WP6: Consumption

WP7: Urban N Budgets

WP8: Stakeholders

WP9: Dissemination

Project Partners

IIASA

The International Institute for Applied Systems Analysis (IIASA) is an international scientific institute that conducts research into the critical issues of global environmental, economic, technological, and social change that we face in the twenty-first century. Founded in 1972, IIASA now ranks among the leading think tanks globally in the science-policy interface, specifically in the context of global change. Situated in Laxenburg near Vienna, Austria, over 300 scientists from nearly 50 countries and widely different disciplines collaborate on issues related to climate and environmental sciences, using advanced scientific models to tackle imminent science questions relevant for policy. 23 countries, representing almost two thirds of the world population, are IIASA members via their national member organization (typically Academy of Sciences or National Research Councils) and make for a truly global perspective of the research performed.

UZG

The University of Zielona Góra (UZG) belongs to the elite group of 18 classical Polish universities. The mission of the UZG is to promote equal opportunities for the development of the region and its inhabitants and to increase the intellectual, economic and artistic potential by educating with highquality professional staff and conducting advanced research. The academic staff participate actively in the European Research Space and the European System of Higher Education. The Institute of Environmental Engineering is active in the fields of waste water and waste technology, applied ecology, hydrology and applied geology, land protection and reclamation, networks and sanitary installations. Recent research activities focused on: Modeling processes in environmental engineering (2017); Environmental conditions and effects of waste management (2016-2017); Environmental conditions of rational energy management (2014); Risk of environmental hazard and the possibility of its minimization (2013).

CAS

The Center for Agricultural Resources Research, Institute of Genetic and Developmental Biology, The Chinese Academy of Sciences (CARR, CAS) was known as Shijiazhuang Institute of Agricultural Modernization that was founded in 1978. The CARR, CAS is considering the particular agricultural needs of efficient utilization of water and nitrogen in North China Plain as well, has put stress on the following areas: farmland water transfer, crop and livestock flow, ammonia and nitrous oxide emission measure, and manure management etc.

PKU

Peking University (PKU) is a comprehensive and national key university. Founded in 1898, PKU was the first national university covering comprehensive disciplines in China. The university has now effectively combined research on important scientific subjects with the training of personnel with a high level of specialized knowledge and professional skill as demanded by the country's socialist modernization. It strives not only for improvements in teaching and research work, but also for the promotion of interaction and mutual promotion among various disciplines.

brainbows

brainbows information management gmbh is a consultancy company from Vienna which specializes in sustainability, energy & climate protection. With a permanent staff of 12 highly qualified professionals, we see ourselves as a "one-stop shop" for consultancy and communication services. brainbows pools its know-how in four pillars: sustainability & CSR, energy & climate protection, strategic advice, events & stakeholder communication.
Especially In the field of stakeholder communication the company shows a broad experience. From large international conferences and symposia such as the Austrian World Summit and professional stakeholder events such as the annual REWE Stakeholderforum to special workshops and roundtables, brainbows designs and organises various measures and processes. The environment management and stakeholder involvement in large infrastructure projects, for example for the City of Vienna, are also among the focal points of brainbows' work.

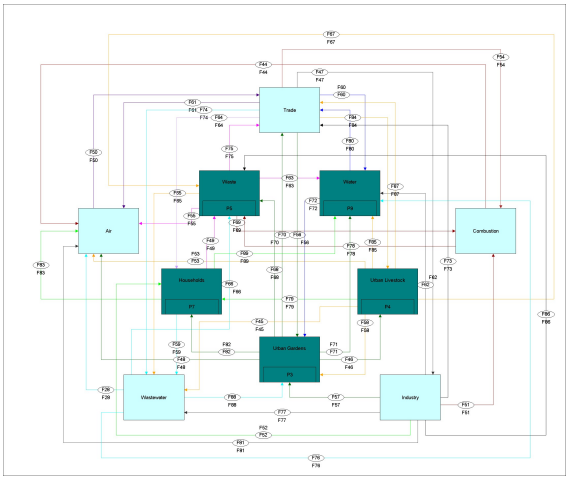
E. C. O.

E.C.O. Institute of Ecology is a specialized company for planning, consulting, research and training for nature conservation and protected areas since 1992. The company has been established in the form of a private limited company and is a licensed "Technical Office for Ecology". The company employs a permanent staff of 18 highly qualified professionals from the fields of ecology, geography, landscape planning and biology who work at the interface between applied research and practice. The company frequently conducts interdisciplinary applied research in the field of management of natural resources, protected areas and integration of conservation objectives into policy. E.C.O. develops solutions in cooperation with different stakeholders, researchers and project partners. Since 2012 the company is responsible for managing the largest urban protected area of Klagenfurt/Austria working together with a wide variety of urban stakeholders and interest groups.

WP2: Model Framework

Creating the outline for the overall system model to describe urban nitrogen flows will be decisive to recombine inputs received from the respective project elements. In this work package, foundations will be laid early in the project for all other elements to provide their results in proper shape and format. The model framework will make sure that inputs are harmonized, rendered comparable, and mismatches reported back to the other work packages for refinement.

- Using the open-source software STAN (Vienna University of Technology), a primary structure of relevant nitrogen flows in urban surroundings will be created. Concepts to consider import/exports of agricultural material and biogenic waste will be included, taking into consideration the specific situation of urban agriculture.
- A concept of uncertainty will be developed to handle uncertain or redundant information consistently and understand its effect on the outcomes.
- Harmonization of inputs will be achieved by providing feedback to budget elements (other work packages) on probable / improbable result.



WP3: Atmospheric Impacts and Effects

Emissions of reactive nitrogen to the atmosphere, including both NOx and NH3, have important contributions to the formation of PM2.5 air pollution in urban atmosphere over the world. The North China Plain, particularly the Beijing−Tianjin−Hebei (BTH) megacities, has been experiencing heavy PM2.5 air pollution in recent years, causing public concerns on human health.

In this work package, we will investigate the impacts of different mitigation pathways for nitrogen management in the urban agricultural activities on PM2.5 air pollution in the project test areas (greater Beijing as well as Europe), and their surround regions.

- Based on different scenarios of urban agriculture and considering different mitigation pathways of nitrogen management, the amount of ammonia emitting to the atmosphere from agricultural activities, including fertilizer applications and livestock waste will be estimated.
- Results of PM2.5 concentrations at fine resolution from two atmospheric chemistry models (GEOS-Chem model and WRF-Chem) will be evaluated using present-day emission inventory. GEOS-Chem can cover both China and Europe at a horizontal resolution of 1/4° × 5/16° (~25 km), and WRF-Chem runs at horizontal resolutions of 36 km and 4 km over the BTH region.
- The ammonia emission estimates from the first phase of the work package will be implemented to both atmospheric chemistry models, and their effect on the PM2.5 concentrations in the urban atmosphere will be quantified.

WP 4: Soil Impacts and Leaching

Agricultural soils account for considerable nitrogen leaching to groundwater. In China, especially in the Beijing−Tianjin−Hebei (BTH) region, this exceeds 50%. This poses a risk of adverse health effects such as methaemoglobinaemia in infants and gastric and oesophageal cancers for both urban and rural populations. In this work package, we will quantify regional-scale N leaching from agricultural soils at high spatial resolution and assess their potential health risks, as well as to optimize agricultural management practices to mitigate health risks.

- Based on massive surveys related to agricultural managements and county-scale statistic registers (Zhou et al., 2014), we will compile a high resolution and climate-adaptive N inputs and irrigation dataset, such the synthetic fertilizers, manure, crop residues, human excreta, and irrigation amounts. Combining the datasets with local schemes of fertilization and irrigation, we finally develop a high-resolution and real-time N inputs and irrigation datasets from targeted cities or regions.
- Both land surface model (ORCHIDEE-CROP, Wang et al., 2017) and flux upscaling approach (Gao et al., 2016, Hou et al., 2017) are applied for the estimates that are constrained by multi-source observations of N leaching fluxes. Regional N leaching at different soils and the associated N flow in aquifer groundwater will be quantified under different agricultural management and climate change.
- Based on probabilistic effect-response functions, we will assess negative effects of N applied in urban and rural agricultural soils on human and livestock health, and implement N inputs and irrigation datasets from different scenarios of agriculture management and climate change to models, thereby quantifying how they affect the N-related concentrations in the urban groundwater.

WP 5: Urban Agriculture

Agriculture plays an important role in the urban N flow (Ma et al., 2014). The diverse flows of N will be investigated and guidance to assess them will be provided. In particular, the following specific urban challenges will be treated: specific urban crops, urban livestock systems, and the prevalence of import and export of food and feed as a central element of urban metabolism.

- Estimations of the location and scale of different livestock production systems in the urban area and estimations of diet protein level and manure management situations in urban area will be used to quantifying changes of N flow and losses from the complicated urban livestock production chain.
- The food and feed imported by cities as well as an estimation of N flow of external imported agricultural products will be quantified .
- The coupling rate of crop and livestock production and an estimation of agricultural N flow though the cities will be quantified and the urban agricultural N flow will be linked with urban sustainable development goals.

WP 6: Quantifying N Pools and Recycling N Flows

Nitrogen compounds are embedded in many goods used by humans. They are being stored with other material in the settlements, forming N pools, but are largely also transferred in waste treatment. The aim of this work package is to develop guidance how to assess detailed information required to quantify N pools and fluxes related to consumption and storage of goods in private and public spaces.

- Quantification methods for the stocks and flows of N compounds in waste and wastewater will be developed and described.
- Methods developed for known N contents will be extrapolated to other compounds. Visual and textual methods of waste analysis will be used to assess N flows with lacking analytical information, and to estimate the uncertainty introduced.
- Waste and wastewater N as well as technology information on treatment methods will be used to quantify downstream fluxes (runoff, atmospheric release, groundwater seepage).
- Estimates of N content in human dwellings and constructions will be developed generally, again based on the available data on waste composition, in order to extrapolate N pools in the human sphere.
- The potentials for extracting valuable N compounds from the waste processing and returning them as a valuable raw material will be assessed using the respective waste flow for a circular economy.

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WP 7: Urban Nitrogen Budgets

Urban Nitrogen Budgets represent a key project result. The methods developed in this project will be applied to the four test areas, reflecting the home bases of the participating institutions. Implementation of the methods worked out in the project will demonstrate general feasibility. Comparisons to be drawn from the results of the four cities (2 Asian megacities, one large and one small European city) will allow to assess the value of the concept. The potentials for reclaiming N material (and other circular economy impacts) in the urban budgets will be quantified to alter the nitrogen flows for each of the cities.

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WP 8: Urban Stakeholders

The WP aims to discuss the project results and develop practicable approaches and solutions to implement them in practice. This requires to gather support needed from people involved in the process and to bring together the relevant stakeholders from urban areas, especially city authorities. In the internal project logics, a special focus will be on the Austrian stakeholders. Within the framework of a structured stakeholder process, selected actors will be involved in the project in several workshops in the city of Vienna and in the small town of Klagenfurt in Carinthia / Austria. In this process stakeholders are being involved early to contribute to the design and shape the outcome of the research, but also take over responsibility and ownership. Actors include city authorities, NGOs and citizens' representatives, companies, experts and planners as well as other interested parties. A recommendation paper will be prepared. Interaction with potential users of the concept of Urban Nitrogen Budgets and with other potentially affected parties (stakeholders) is a key concept of the UNCNET project. It will also be applied, in a less explicit manner than for Austria, in the other regions of investigation (Poland, China) to better understand input-output relationships and management options of individual stakeholders.

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WP 9: Dissemination and Contribution to Policy Processes

Results from a scientific project need to be communicated appropriately in order to achieve an impact. Three main channels of communication to be coordinated within have been identified, which reflect the habits of very different interest groups. In UNCNET, all of these are being coordinated in this work package. In the first channel, scientific results are will be shared via the classical instruments in science – conference presentations and peer-reviewed publications. The second channel aims to inform groups of general interest in science, like media, schools etc. and uses instruments such as social media and web page to share project results. Finally, an impact on policy processes can be achieved by directly contribute to policy processes. Active outreach to international policy processes focusing on environmental issues (Sustainable Development Goals, UN Habitat Assembly, and the UNEP project "Towards an International Nitrogen Management System – INMS") will be a decisive element for the successful dissemination of project results.

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News

Final Stakeholder Conference

On May 31 our final stakeholder conference took place in Vienna. Following input by Mark Sutton and Ika Djukic from the Austrian Environmental Agency (UBA), we presented how the expertise from each partner institute was fused in the development of the urban N budgets for our four test areas. Differences as well as similarities between these test areas were explained and the key messages describing the project results were developed. These results were more broadly discussed with local stakeholders from industry, administration and academia, as well as with Nitrogen budget experts joining the conference from the Expert Panel on Nitrogen Budgets who held their meeting back-to-back on the next day. These insightful discussions gave us a better ideas of potential uses and ways forward for our urban N budget. Have a look at our presentations for more information on the topics discussed.

Stakeholder Conference 2022

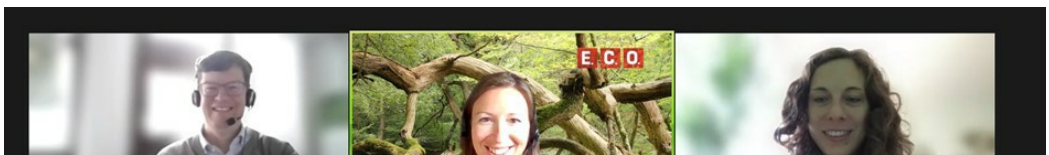
We are delighted to announce that after two fruitful stakeholder meetings in Klagenfurt and Vienna, our final stakeholder conference will take place on May 31 in Vienna. Join us to learn more about our project and exchange your thoughts with expert from around the world. Register here.

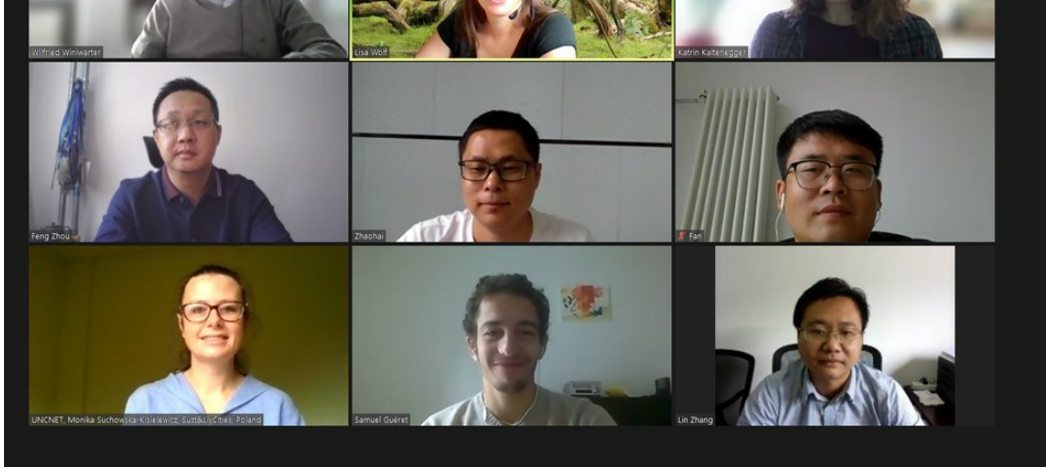
Stakeholder Workshops in Austria

On October 12 and 14, we organized stakeholder workshops in Klagenfurt and Vienna. We welcomed participants of different professional background and area of expertise, allowing for a fruitful exchange. During this exchange the first results for the Austrian test areas (Vienna, Vienna surrounding and Klagenfurt and Villach) were discussed as well as first comparisons between these areas and the Polish test areas (Zielona Góra, Zielona Góra new district). The focus in these discussions was on how to improve the presentation of the project outcomes to make them more understandable and applicable to a broader audience, and to identify items/results of specific value for the stakeholders.

UNCNET Annual Meeting 2021

This year's annual meeting and second project plenary again had to be held online. Sessions were organized for September 16 and 17, 2021. Project progress by methodology, by test area, and approaches for comparison were discussed. A high level of interaction between teams has been achieved already, as also demonstrated by numerous joint scientific publications. Interaction with stakeholders remains a priority issue, aiming for best use of top science for public purposes. October will see the next stakeholder workshops, including first results for an urban Nitrogen budget for the Klagenfurt/Villach region. Stay tuned to learn about upcoming activities and results!





Largest in-person UNCNET meeting since kick-off

IIASA welcomed Monika Suchowska-Kisielewicz and Lisa Wolf in Laxenburg (Austria) for the first meeting since kick-off to involve participants from two countries and three institutions. Goals of this meeting were to discuss and compare results of the respective urban N budgets for Vienna and Zielona Gora and discuss the stakeholder process in Poland as well as the upcoming stakeholder workshops in Vienna and Klagenfurt.

Global Nitrogen Conference 2021

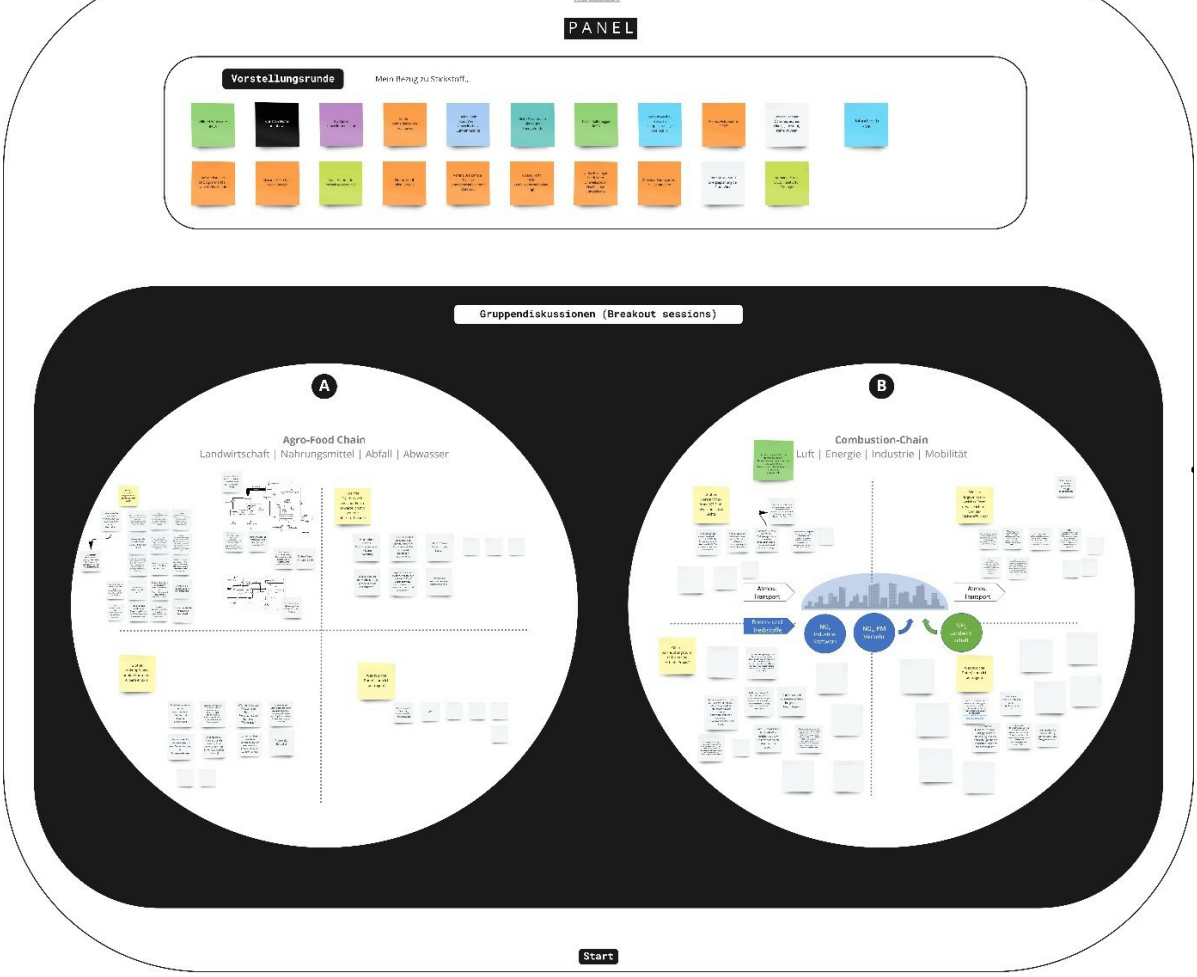
The 8th global Nitrogen conference of the International Nitrogen Initiative (INI) was held online from 30th of May to 4th of June 2021. As a contribution to this conference, Monika Suchowska-Kisielewicz presented her work on assessing the efficiency of Nitrogen removal from wastewater and Wilfried Winiwarter presented the framework of urban Nitrogen budgets derived within the UNCNET project. Being able to disseminate the ideas and outcomes of the UNCNET project we equally profited from the plentiful program of the INI inspiring further activities for UNCNET.

Paper published describing the UNCNET Framework

On December 15, 2020, our review paper on urban N budgets was published in the Journal of Integrative Environmental Sciences. We used this paper to derive a framework and key elements for further analysis from existing work on urban N budgets. Specifically, we were able to clearly separate the agri-food chain and the energy-chain of nitrogen flows that we will use in the budget calculations and benchmarking of the respective test areas in the UNCNET project. Have a look!

Stakeholder Workshops Klagenfurt/Vienna 2020

With a slight delay and a change of venue, the stakeholder workshop for Klagenfurt and Vienna took place online on 13th and 17th of November 2020. A combination of Zoom and the virtual Whiteboard Miro was used to facilitate and enhance the interaction between and with our participants. As no nitrogen budget is to be calculated for the city of Klagenfurt, the participants of this first workshop discussed the general framework of urban N budgets and the usefulness of the concept for their work. In the second workshop, a more detailed discussion on data requirements and availability was possible due to the vivid participation of representatives of Vienna city administration and of other stakeholders. Altogether the discussions in both workshops enabled us to get a more complete picture of the requirements to develop urban N budgets.

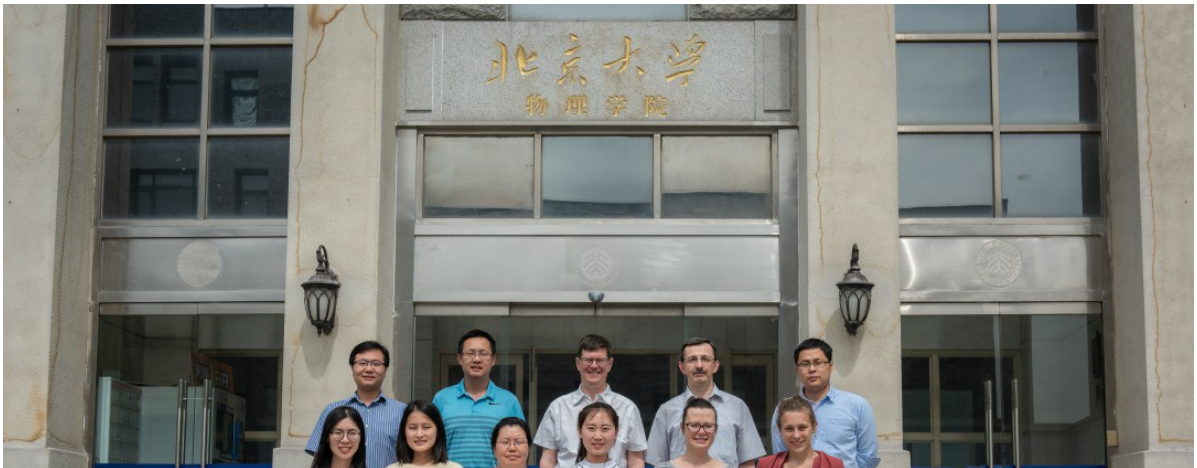


UNCNET Annual Meeting 2020

The annual meeting 2020 had to be moved to September 10 and 11, and had to be held online – both a consequence of the pandemic. In two 1.5 hour sessions each day, we discussed the progress of each work package as well as the progress of the urban N budgets for each test area. The meeting clearly showed that although the global health crisis altered workflows and interactions, significant progress was achieved by all partners.

Kick-off Meeting

From the 2nd of June to the 3rd of June the Kick-off meeting of the UNCNET project took place in Beijing. During this meeting with participants from Poland, China and Austria, expertise were exchanged and requirements for each work package were determined in order to define system boundaries and clarify each participating institution's role in this project.



Public Project Repository

The following list covers all outputs (deliverables, products and publications) allocated to the UNCNET project. As much as possible and useful in the context of project development, documents are made accessible via direct download or links. We expect the repository to be maintained beyond the duration of the project (April 1, 2019 – February 28, 2022, 35 months).

Deliverables:

D1/1: Kick-off meeting report including project inception report (not publicly available)

D1/2: Report from the first project plenary – CLICK HERE

D1/3: Report from the second project plenary – CLICK HERE

D2/1: Draft concept of urban nitrogen flows. To download this document – CLICK HERE

D2/2: Final concept of urban nitrogen flows including uncertainty considerations. To download this document – CLICK HERE

Erratum D2/2: Correction of the final concept of urban nitrogen flows including uncertainty considerations. To download this document – CLICK HERE

D2/3: Using probability approaches to inform, revise and improve contributions on the respective nitrogen flows. To download this document – CLICK HERE

D3/1: Estimates of ammonia emissions from urban agricultural activities. To download this document – CLICK HERE

D3/2: A quantitative estimate of the impacts of ammonia emissions on urban PM2.5 air quality. To download this document – CLICK HERE

D4/1: Development of high-resolution N inputs and irrigation datasets from agricultural soils. To download this document – CLICK HERE

D4/2: Land surface modeling simulation of N leaching and health effects assessment. (not publicly available)

D4/3: Optimization of urban agriculture management to mitigate groundwater N pollution under different climate changes. (not publicly available)

D5/1: Draft concept of urban agricultural nitrogen flows. To download this document – CLICK HERE

D5/2: Clear concept of urban agricultural nitrogen flows. To download this document – CLICK HERE

D6/1: General guidance to quantify N in waste and waste water. To download this document – CLICK HERE

D6/2: Waste uncertainty. To download this document – CLICK HERE

D7/1: Conceptual Nitrogen Budge. To download this document – CLICK HERE

D7/2: Final urban nitrogen budget. To download this document – CLICK HERE

D8/1a: Report from stakeholder workshops I. To download this document – CLICK HERE

D8/1b: Report from stakeholder workshops II. To download this document – CLICK HERE

D8/2, D8/3, D8/4: Combined report on the Final Stakeholder workshop – CLICK HERE

D9/1: Dissemination concept. To download this document – CLICK HERE

Publications:

Adalibieke et al. (2021). "Decoupling between ammonia emission and crop production in China due to policy interventions" [Global Change Biology]

Bai et al. (2019). "Further Improvement of Air Quality in China Needs Clear Ammonia Mitigation Target" [Environmental Science & Technology – open access]

Bai et al. (2022). "Relocate 10 billion livestock to reduce harmful nitrogen pollution exposure for 90% of China's population" [nature food]

Chen et al. (2021). "Interannual variation of reactive nitrogen emissions and their impacts on PM2.5 air pollution in China during 2005-2015" [Environmental Research Letters – open access]

Greinert et al. (2020). "The Use of Plant Biomass Pellets for Energy Production by Combustion in Dedicated Furnaces" [Energies – open access]

Gu et al. (2021). "Abating ammonia is more cost-effective than nitrogen oxides for global mitigation of particulate matter air pollution" [Science]

Jakubaszek (2021). "Nitrogen and Phosphorus Accumulation in Horizontal Subsurface Flow Constructed Wetland" [Agronomy – open access]

Jiang et al. (2021). "Is rice field a nitrogen source or sink for the environment?" [Environmental Pollution]

Jin et al. (2020). "Spatial Planning Needs to Drastically Reduce Nitrogen and Phosphorus Surpluses in China's Agriculture" [Environmental Science & Technology]

Liu et. al. (2020). "The nonlinear response of fine particulate matter pollution to ammonia emission reductions in North China" [Environmental Research Letters]

Lu et. al. (2021). "The underappreciated role of agricultural soil nitrogen oxide emissions in ozone pollution regulation in North China" [Nature Communications – open access]

Shang et al. (2019). "Weakened growth of cropland-N2O emissions in China associated with nationwide policy interventions" [Global Change Biology – open access]

Suchowska-Kisielewicz, M. & Nowogonski, I. (2021), "Influence of storms on the emission of pollutants from sewage into waters" [scientific reports – open access]

Wang H. et al. (2021). "Strategies to reduce ammonia emissions from livestock and their cost-benefit analysis: A case study of Sheyang county" [Environmental Pollution]

Wang Q. et al. (2019). "Data-driven estimates of global nitrous-oxide emissions from croplands " [National Science Review]

Winiwarter et al. (2020). "Urban nitrogen budgets: flows and stock changes of potentially polluting nitrogen compounds in cities and their surroundings – a

review" [Journal of Integrative Environmental Sciences – open access]

Zhan et al. (2020). "Improved Estimates of Ammonia Emissions from Global Croplands" [Environmental Science & Technology]

Zhou et. al. (2020). "Deceleration of China's human water use and its key drivers" [Proceedings of the National Academy of Sciences]

Conference Presentations

Winiwarter, W. (2021, June). "Nitrogen balances in urban areas: purpose and potentials" [Presentation]. INI 8th Global Nitrogen Conference, online.

Greinert, A. (2021, September). "Anthropogenic soils in the context of water and chemical elements circulation in urban environment" [Presentation, book contribution]. Plant productivity and food safety: Soil science, Microbiology, Agricultural Genetics and Food quality, online.

Stakeholder Information:

Have a look at our flyer!

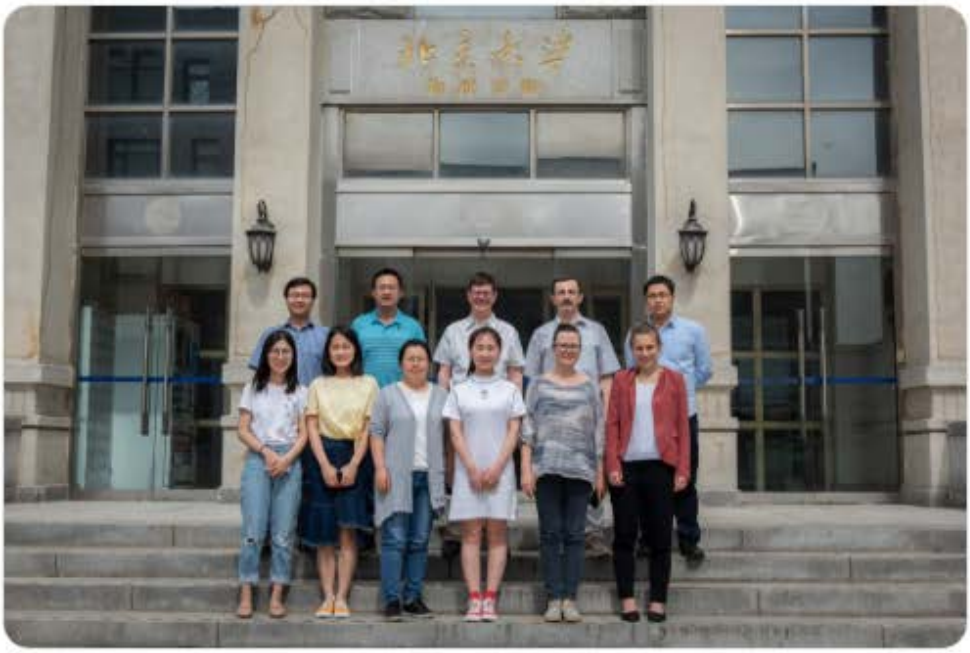
Download compact project insight as postcards here!

Annex II

Twitter Archive

Tweets

UNCNET Project @UNCNET_project · May 30, 2019
Inspired by input on city development from the #UFGC19 and on science support policies related to nitrogen from the @TowardsINMS project we are excited to get started! This project is funded by @JPIUrbanEurope together with NSFC and coordinated by @IIASAVienna https://t.co/cw5kwrlP2h



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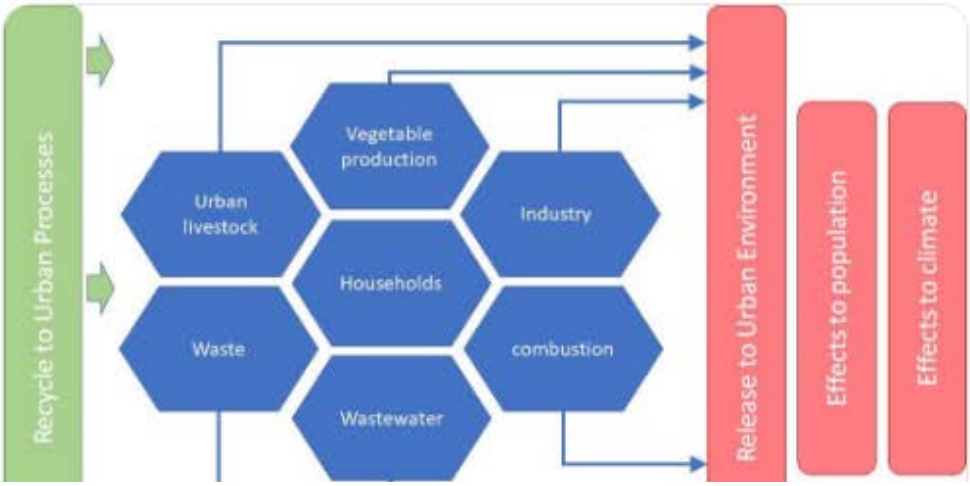
View on Twitter

UNCNET Project @UNCNET_project · May 31, 2019
#Nitrogen at different scales: https://t.co/1MKKT7dpj5 links global science-to-policy for countries (as provided by @TowardsINMS on behalf of @UNEnvironment) to urban scales. Hence project activities also support the current #UNHabitatAssembly in Nairobi. @IIASAVienna https://t.co/VmPNWzW1Q3



UNCNET Project @UNCNET_project · Aug 21, 2019
Urban #Nitrogen Cycles: Stay informed about our latest activities and learn more about our research on our new website: https://t.co/1MKKT7v0HF

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View on Twitter

UNCNET Project @UNCNET_project · Sep 24, 2019
First paper published under UNCNET: developing multi-effect strategies for China will reduce impacts of air pollution on human health and ecosystems in cities and beyond. See https://t.co/v0m5MAkvhL

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View on Twitter

UNCNET Project @UNCNET_project · Apr 1, 2020
Happy Birthday to us! @UNCNET_project just turned one and we have gifts for you. Stay tuned to get a glimpse of our first result!

0 1

View on Twitter

UNCNET Project @UNCNET_project · Apr 6, 2020
Tired from being locked up in your home? No reason to miss great #science from @UNCNET. Check out our recent publications:
https://t.co/HvCOjuX9d0
https://t.co/yw8624DF0w
https://t.co/tUGYHxf5jn
https://t.co/AizZRKCYDn

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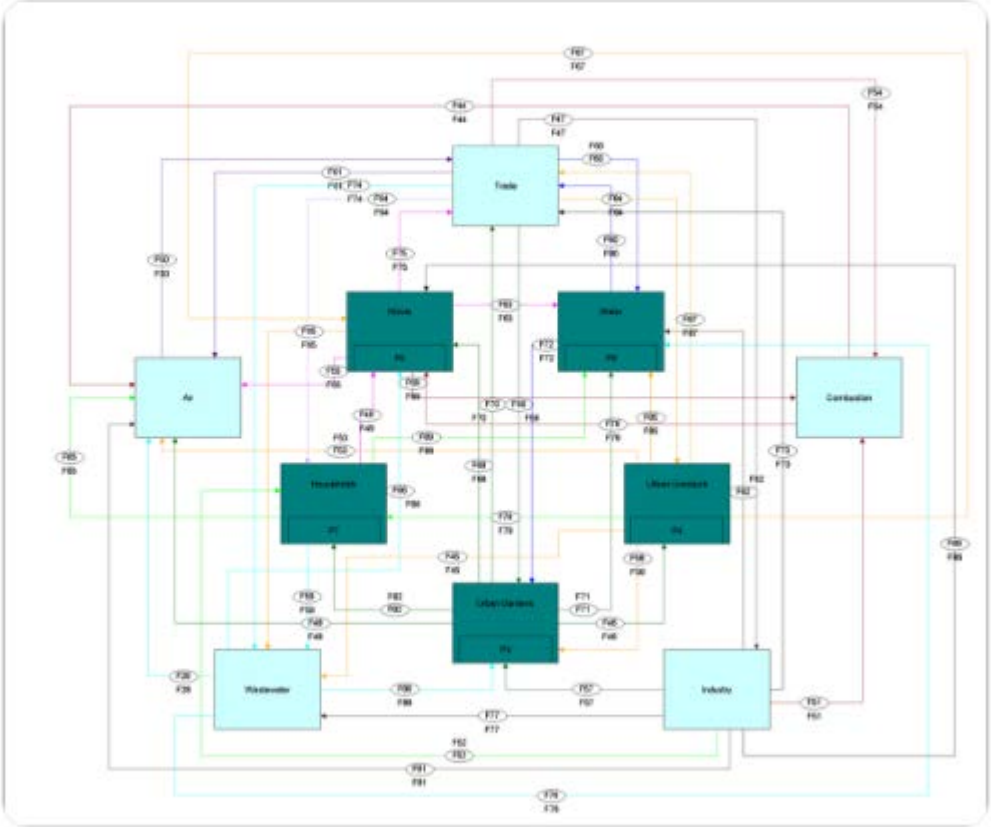
View on Twitter

UNCNET Project @UNCNET_project · Apr 8, 2020
Have a look at our #urban #Nitrogen flow model, following the concepts of pools and flows developed under the @unece TFRN. For more details please visit https://t.co/Ad402Qn5rH! https://t.co/TOBnZ9B699

UNCNET Project @UNCNET_project · Apr 8, 2020

Have a look at our #urban #Nitrogen flow model, following the concepts of pools and flows developed under the @unece TFRN. For more details please visit https://t.co/Ad402Qn5rH! https://t.co/TOBnZ9B699



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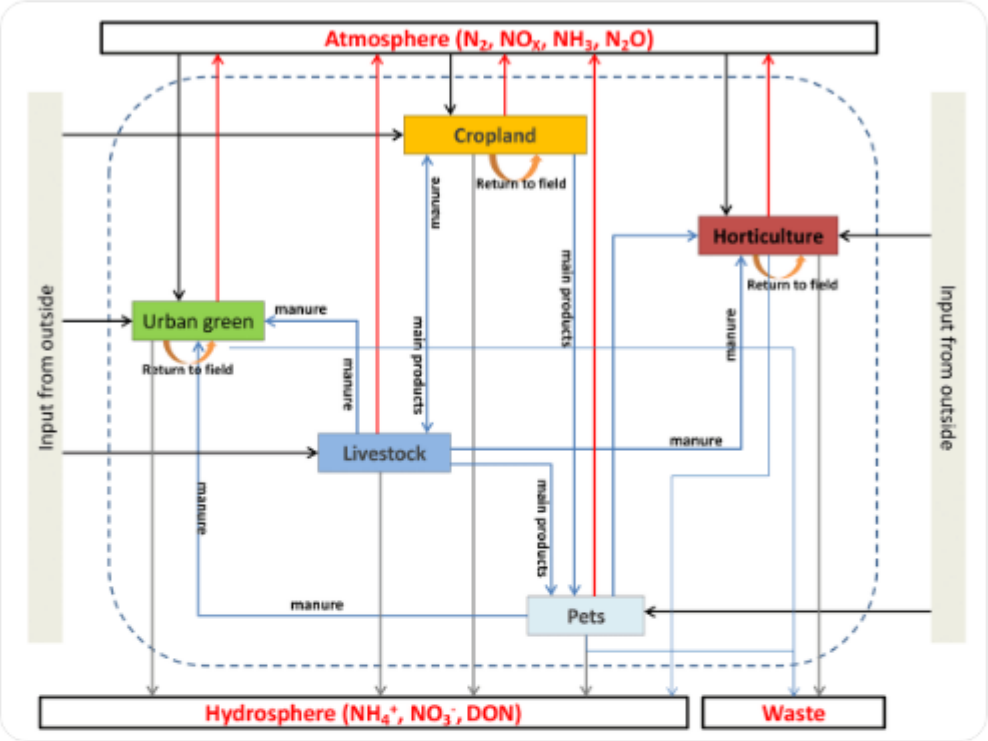
View on Twitter

UNCNET Project @UNCNET_project · Apr 14, 2020

Pets and #nitrogen? How does that fit together? We have an answer for you: #urban agriculture. Just check out our graphic below and get more details under https://t.co/Ad402Qn5rH. https://t.co/kxQbo5Spmb



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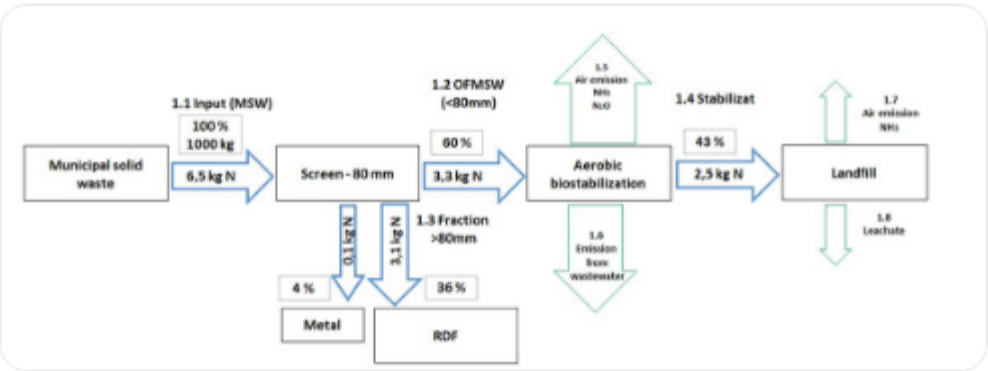
View on Twitter

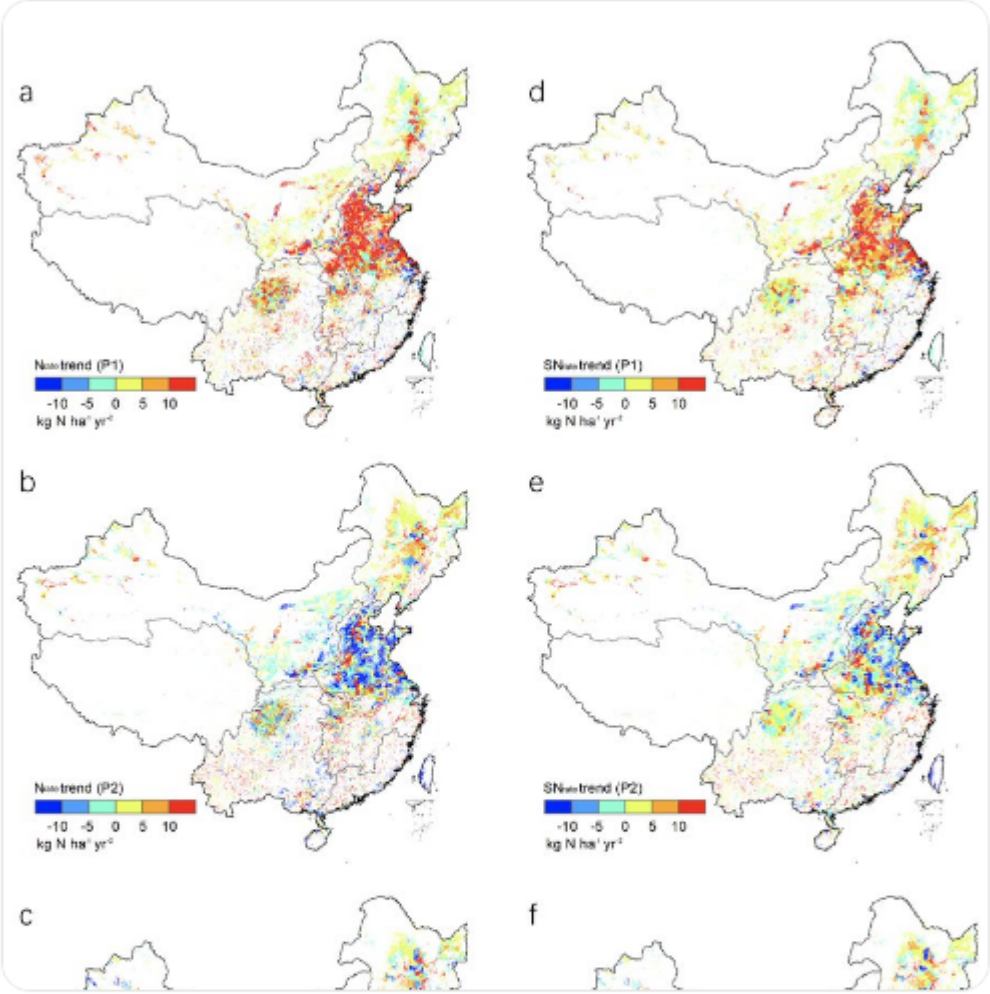
UNCNET Project @UNCNET_project · Apr 20, 2020

489 kg of municipal waste per capita were generated in the EU in 2018, 47% of it was recycled (#Eurostat). But what happens to #nitrogen during composting? See below! Also have a look at other treatment forms under https://t.co/Ad402Qn5rH! https://t.co/qv5xXA6VI7



UNCNET Project @UNCNET_project · Apr 27, 2020

#nitrogen and #water application in surrounding areas impacts the quality of #urban ground water. Our colleagues from @PKU1898 have developed maps showing the spatial patterns of #nitrogen application rates and water use intensities to Chinese croplands. https://t.co/RBgphARMO3 https://t.co/n74UuLz5zv



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View on Twitter

UNCNET Project @UNCNET_project · Sep 29, 2020

The place to be today? Where research and innovation meet!

Excited to learn more about cutting-edge ideas for smart urban futures and meeting the people behind the scenes at the cross-call and #ENSUF final event organized by @JPIUrbanEurope

0 2

UNCNET Project @UNCNET_project · Sep 29, 2020
The place to be today? Where research and innovation meet!

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View on Twitter

UNCNET Project @UNCNET_project · Dec 16, 2020
Back to the roots! Have you ever wondered where our project idea came from? In our newest publication (https://t.co/9WqXxgQBuc) we are taking you back, introducing you to previous work on urban #nitrogen budgets and the research gaps @UNCNET_project aims to fill.

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View on Twitter

UNCNET Project @UNCNET_project · Jan 4, 2021
Belated Christmas present or New Year's gift? We proudly present our newest publication offering an improved understanding of NH3 emissions: https://t.co/1gdRfrtAif. Stay tuned to find out more about its relevance for urban N cycles.

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View on Twitter

UNCNET Project @UNCNET_project · Sep 20, 2021

We've come a long way! We proudly looked back on our achievements while also planning future activities such as the next stakeholder workshop in #Klagenfurt during our second annual meeting last week. Stay tuned to learn about upcoming activities and results! https://t.co/G2Kx6TEPxy

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View on Twitter

UNCNET Project @UNCNET_project · Oct 19, 2021

What are #Nitrogen budgets and what can they be used for? These were only two of the questions discussed during our stakeholder workshops last week. We presented first results for Klagenfurt and Villach and compared to Vienna and Zielona Góra while receiving valuable feedback. https://t.co/rvjRQtgDeA

UNCNET Project @UNCNET_project · Nov 5, 2021
#Nitrogen budgets help explore global human health risks: @UNCNET_project demonstrates relevance of ammonia emissions impacting urban situations (see @IIASAVienna [https://t.co/QUrCyCN7y4] or @ScienceMagazine [https://t.co/VPq3Si0KR8])

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View on Twitter

UNCNET Project @UNCNET_project · Mar 31, 2022
How would the relocation of 10 bio livestock help 90% of #China's population's #Health prospect and how is this related to #Nitrogen? Find out more in the recently published paper by our colleagues @PKU1898: https://t.co/r7TGog82fX

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View on Twitter

UNCNET Project @UNCNET_project · May 3, 2022
We are getting excited about our stakeholder conference while its planning reaches the final phase! Hoping we get to see as many of you as possible (offline for a change)! Register here: https://t.co/KmMhWcGsRV https://t.co/ltnRVYKE2j

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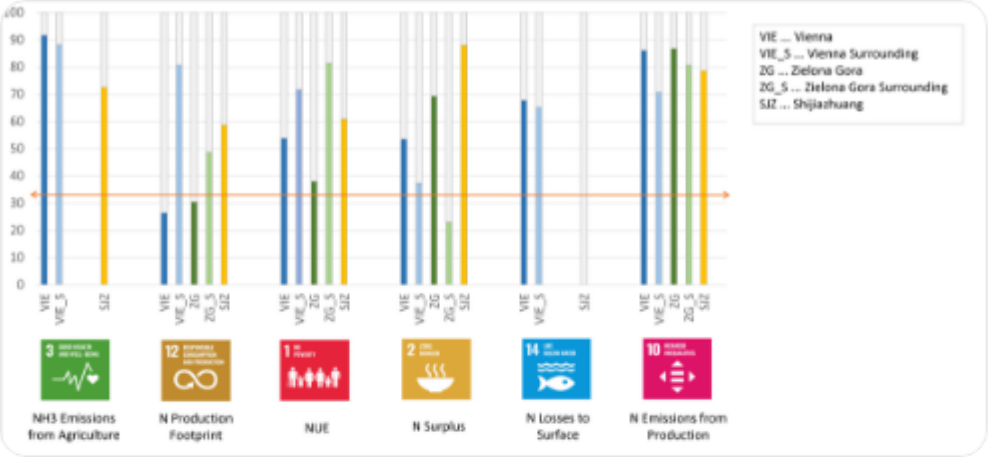
View on Twitter

UNCNET Project @UNCNET_project · May 24, 2022

Can we use Urban N Budgets to assess SDG scores? For this and related questions, see our Stakeholder Conference on May 31st in Vienna. To join register here: https://t.co/KmMhWcGsRV https://t.co/gA135tLf2m



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UNCNET Project @UNCNET_project · Jun 15, 2022

Like fish in a bowl just chattier.
Making use of the "Fishbowl" method, our final stakeholder conference was concluded by bringing together all expert knowledge from all participants on topics like potentials of N recycling in the urban environment.
https://t.co/toT5vf3WGP

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View on Twitter

UNCNET Project @UNCNET_project · Jul 14, 2022

The UNCNET postcards are here! Stay tuned to get compact insights into our project findings every Monday and Thursday over the next couple of weeks. If you are too excited to wait this long visit our website: https://t.co/Ad402Qn5rH

0 0

View on Twitter

UNCNET Project @UNCNET_project · Jul 14, 2022

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View on Twitter

UNCNET Project @UNCNET_project · Jul 18, 2022

'Waiting until we near some suggested limit for nitrogen deposition and other pollution will just permit us to continue to a point where it is too late.' - William Schlesinger, biogeochemist https://t.co/EDCQh5SIJ6

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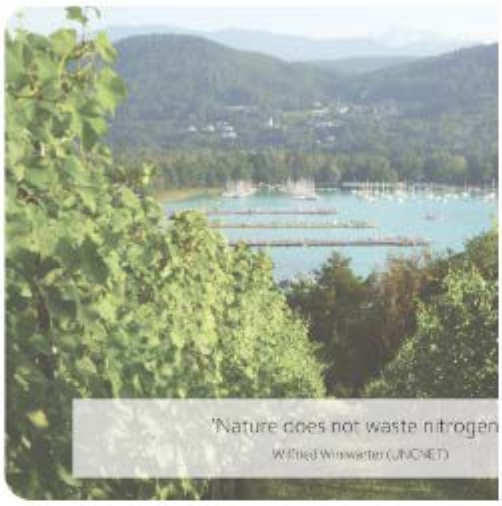
View on Twitter

UNCNET Project @UNCNET_project · Jul 22, 2022

'Nature does not waste Nitrogen' - Wilfried Winiwarter, UNCNET https://t.co/GwM7t6bVZZ



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View on Twitter

UNCNET Project @UNCNET_project · Jul 25, 2022

'Ammonia is contributing to health-damaging fine particles in cities. Measures against ammonia emissions have many times greater benefits than their implementation costs.' - UNCNET https://t.co/AqBifmZ6VI

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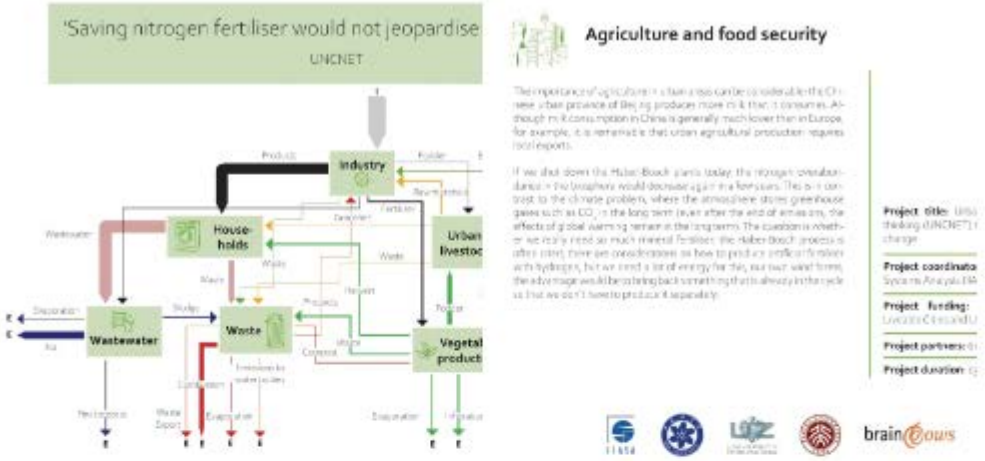
View on Twitter

UNCNET Project @UNCNET_project · Jul 28, 2022

'Saving nitrogen would not jeopardize food security' https://t.co/NwpNKFWXFt



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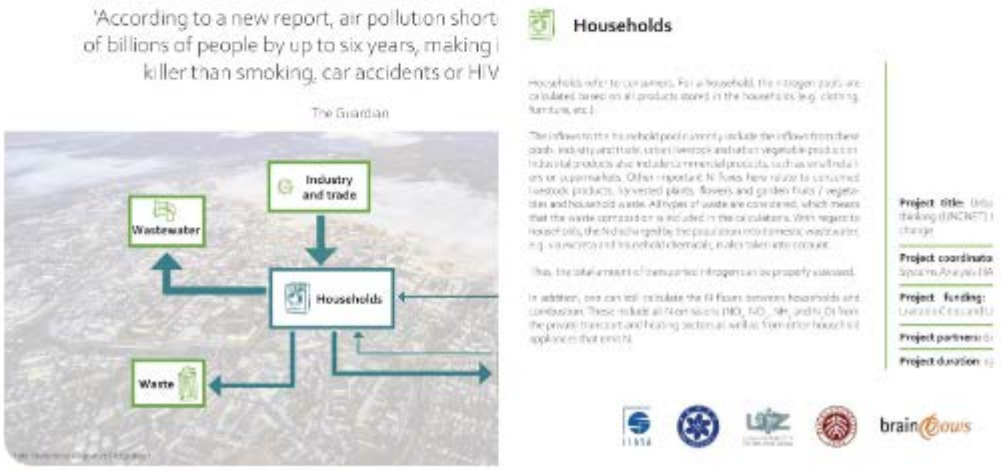
View on Twitter

UNCNET Project @UNCNET_project · Aug 1, 2022

'According to a new report, air pollution shortens the lives of billions of people by up to six years, making it a far bigger killer than smoking, car accidents or HIV/Aids.' - The Guardian https://t.co/WTwMp69qLt



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UNCNET Project @UNCNET_project · Aug 4, 2022

The chemical industry used to fix nitrogen requires about 1.3% of global energy, mostly using fossil fuels https://t.co/G5wIQrjkCq

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UNCNET Project @UNCNET_project · Aug 8, 2022

'The death of thousands of fish in the "Warme Fischa" River in the district of Wiener Neustadt is due to a lack of oxygen and excessive nitrate pollution.' - ORF https://t.co/GrSP3ve4yP

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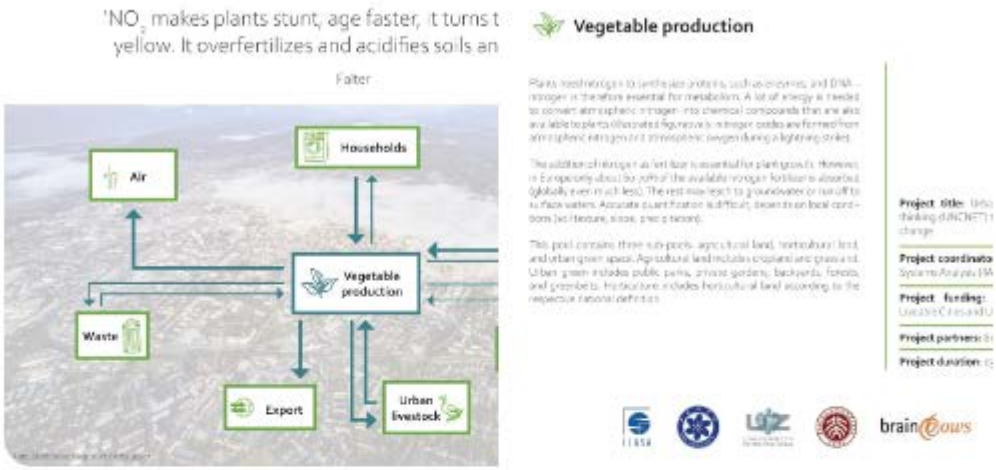
UNCNET Project @UNCNET_project · Aug 18, 2022

'NO2 makes plants stunt, age faster, it turns their leaves yellow. It over-fertilizes and acidifies soils and waters' - Falter https://t.co/oLnUZLvKt5



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View on Twitter

UNCNET Project @UNCNET_project · Aug 22, 2022

'Der Planet erstickt in Stickstoff/ The planet is suffocating in nitrogen' - Wilfried Winiwarter https://t.co/HLb4sSxPbx

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