**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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# UNCNET

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

## D1/2: Report from the first project plenary

Due date of deliverable: **30/06/2020** Actual submission date: **30/09/2020**

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

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

Authors: Wilfried Winiwarter, Katrin Kaltenegger, Lin Zhang

| 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 first annual UNCNET project conference has been held after 17 months of project duration. Due to the COVID-19 pandemic it was organized as a two-day ZOOM teleconference. The conference revealed significant progress in all work packages. Reports are available on the UNCNET dissemination portals and scientific publications are produced from within the project.

Current activities focus on establishing draft N budgets for the test areas. Data are being collected and allow to identify gaps or lack of understanding between the respective sectoral approaches. This process is essential to focus improvements and refinements needed for the final N budgets, which need to be shaped comparable across the different test areas. Stakeholder interaction is seen as a key pathway to collect expertise still missing in the project team.

## 2. Objectives:

With project activities mainly within each participating institution or on a bilateral level and only occasional online "project conferences", a more general exchange of concepts, ideas and approaches became necessary. The Annual Plenaries had been included in the project concepts already in the proposal phase. Plenaries serve to take stock of progress, identify issues that do not work properly and especially note on points of ill-defined information transfer. Plenaries, including this teleconference, ideally resolve any issues or conflicts immediately, or at least identify pathways towards a solution. With respect to current UNCNET work, both on the individual sector level (work packages 3-6) and on the conceptual level (work package 2) progress has been made and guidance has been provided to intersect the respective approaches. It will be up to the establishment of the urban nitrogen budgets to see if concepts work out. Thus, the plenary aimed to discuss the sectoral progress and their fit to the general concept. Interactions between the sectoral experts on the one hand and the responsible groups of the four test areas (cities) had to be identified.

## 3. Activities:

Presentations were prepared on the scientific progress and put into context with some of the completed deliverables. A meeting was organized by ZOOM with participation from each work package and every test area (city).

## 4. Results:

Results and agreements are described in detail in the Annex. Discussions during the Plenary laid open to all participants the ample material that is available. Agreement was found that (i) an "overview" nitrogen budget for each of the four test areas will be created as the next step to identify issues that require further interaction; (ii) sectoral expertise (as of WP 3-6) may be requested to help out for each test area; (iii) the conceptual framework (as described in D2/2) should be checked for full compatibility with the respective sectors for application in each test area; and (iv) interaction with stakeholders will be used to further bring together expertise to improve N budgets and conclude accordingly.

## 5. Milestones achieved:

As a result of this Plenary, Milestone 1 of UNCNET "Model requirements to N budget guidelines agreed" has been reached.

## 6. Deviations and reasons:

This project plenary originally was scheduled for May 2020 in Zielona Góra, Poland, as a back-to-back meeting of the INI2020 in Berlin. With the COVID19 pandemic, travel was not possible and the plenary had to be cancelled (like many other meetings). Also, delay in project tasks has been built up due to impossibility of exchange on a personal level. The meeting described in this deliverable also had the task to take stock on measures needed to get back on track, but with general uncertainty on travelling prevailing the situation remains challenging.

## 7. Publications:

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## 8. Meetings:

UNCNET first project plenary, ZOOM teleconference, September 10-11, 2020

## 9. List of Documents/Annexes:

Agenda and Minutes of first project plenary meeting

## REFERENCES

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# ANNEX 1

Minutes of UNCNET first project plenary

Teleconference (Zoom), September 10 – 11, 2020

# AGENDA

Sept 10

Session 1 (9-10.30 CEST / 15 – 16.30 Beijing):

- Introduction & Welcome (30 min)
- Status of work (20 min each)
    - WP 2 - Model Framework: Katrin
    - WP 3 - Atmospheric Impacts and effects: Lin
    - WP 4 - Soil impacts and leaching: Feng

Session 2 (11-12.30 / 17 – 18.30):

- Status of work (20 min each)
    - WP 5 - Urban agriculture: Zhaohai
    - WP 6 - Quantifying pools & recycling N flows: Monika
    - WP 7 - Urban Nitrogen Budgets: Wilfried
    - WP 8 - Urban Stakeholders: Lisa

Sept 11

Session 3 (9-10.30 / 15 – 16.30):

- Urban N budgets (20 min each)
    - Vienna: Katrin
    - Zielona Góra: Monika
    - Beijing: Lin
    - Shijiazhuang: Zhaohai
- Discussion

Session 4 (11-12.30 / 17 – 18.30):

- Way forward: reorganization under Covid19
- Scientific publications
- Status of policy interaction
- Dates of next meetings, agreements

# UNCNET first project plenary

# Teleconference (ZOOM), September 10-11, 2020

# Minutes

*Participants (alphabetical):*
Barbara Amon, Zhaohai Bai, Xiangwen Fan, Yixin Guo, Andrzej Greinert, Katrin Kaltenegger, Monika Suchowska-Kisielewicz, Haodan Wang, Wilfried Winiwarter, Lisa Wolf, Jiayu Xu, Lin Zhang, Feng Zhou

**Welcome**

Introduction
**Lisa** – working for E.C.O. Klagenfurt, Team sustainability, working with Markus from Brainbows, in charge of WP 8 – participation processes – to understand and explain scientific output of project
**Barbara** – affiliated with University of Zielona Góra & Leibnitz Institute ATB in Potsdam, N and GHG emissions from livestock husbandry systems
**Monika** - University of Zielona Góra, environmental engineering, waste treatment & minimizing emissions to environment & energy recovery, WP 6 – emissions from waste & wastewater treatment
**Zhaohai** – CAS, working on livestock & nutrient management, water demand, WP5 urban agriculture
**Lin** – PKU, atmospheric chemistry – regional air pollution, effect of urban agriculture on air pollution, WP 3
**Fan** – CAS, post-doc, urban agricultural model, background in geography & earth sciences
**Yixin** - Post-doc (IIASA & PKU), PhD from Princeton, improvement in agricultural management
**Jiayu** – PKU, student working with Lin Zhang
**Feng** – PKU, working on WP4
**Haodan** – CAS working with Zhaohai on WP5 urban agriculture

Aims of meeting
- Stock taking – achievements
- How to link separate strands of activities?
- Exchange first results on urban flows
- Initiate stakeholder processes – identify advantages for stakeholders in participation
- Review dissemination opportunities – general dissemination opportunities to local, national, international policy makers e.g. UNEP (UN Habitat) contact
- Revise time plan

Scientific Achievements
- 6 peer reviewed publications
- Review paper under revision
- Several more papers submitted/ under preparation
- Flyer for stakeholder information
- Need to make stakeholder process more central

Deliverables

- Well on track considering circumstances
- Interim and activity report submitted
- Important to keep Deadlines in mind

**Work Package Presentations**

Slides are available (for internal use only, converted to pdf) on the internal UNCNET web page

Work Package 2 – Model Framework - Katrin

- Constructing model framework & implementing it to stock & flow model (STAN)
- Uncertainty consideration
    - Transformation for not normally distributed standard errors
- Creating concept for data exchange between models
- Importance to bring together separate modules/models

Work Package 3 – Atmospheric Impacts/Effects - Lin

- Ammonia emission estimates
- Evaluate model simulation of PM2.5
- Assess change in urban agricultural
- Crop harvest needs to be expanded to include national particularities & years
- Agricultural data (fertilizer rates and types, application mode, livestock numbers, …) required for fine resolution from UNCNET test areas)
- China notes emission reduction due to change to synthetic fertilizers with lower emission factor (urea instead of ABC)
- Higher emissions for finer resolution due to pH input data
- WRF-Chem to link NH3 emissions with air pollution (PM2.5)

Work Package 4 – Soil N leaching - Feng

- Quantify N leaching from agricultural soils to optimize management practices for mitigation of groundwater pollution
- Public website available for dataset on crop specific N fertilization globally 5’
- Irrigation water use 1990-2017 annually, per municipality in Excel file
- Hydrological, management crop phenology and biochemical data used for N leaching calculation
- Field experiments for model validation
- Ammonia emission fluxes are not linearly related to N input
- Improved sensitivity of model to management practices
- Optimize management to mitigate emissions from NUE targets & crop demand
- Prediction data (crop etc) is needed for future scenarios
- Data can easily be separated into urban and suburban regions when GIS shape files are available

Work Package 5 – Urban Agriculture - Zhaohai

- Collected locations and scale of different livestock production systems in urban area
    - Analysis of changes in livestock units and GDP & relation between them
    - Working on getting more homogenous data
    - Spatial (county) distribution of livestock 2000,2005,2010 & 2016 for Beijing & Tianjin & Shijiazhuang & other cities available
- Analysis of related N flows
- Urban Agriculture Framework

    - Main N inputs from cropland
    - NUE higher in urban than peri-urban areas
- Spatial planning needed to reduce N surplus (publication – available on internal website) as mineral fertilizer & manure in same counties -> large surpluses
    - Link livestock & crop production
- Evaluating differenced of Urban Agriculture N flows for several Chinese cities

Work Package 6 – Waste and Wastewater - Monika

- Developing & describing quantification methods for N flows in waste & wastewater
- Two extensive studies on waste & wastewater treatment were conducted, are currently being translated and will be shared shortly
- Using visual and textual method to extrapolate methods developed for N to include other compounds like C as well
- Future work: N content in human dwellings and constructions (from waste composition) & assess potential for extracting valuable N from waste & wastewater (IIASA)
- Specific information on waste composition & transformation during most common treatment available in D6.2
- Sludge emissions need to be included in wastewater treatment

Work Package 7 – Urban N Budgets - Wilfried

- Differentiation between core region and surrounding area was done for all four cities
- Partial urban budgets (soil, water, atmosphere, food, waste) compared to complete budgets
- Outcome of literature review:
    - Some stratification of overall budget is possible: Fuel related emissions are connected to air pollution, food & feed are connected to water pollution & materials are connected to products
    - How much of N flows pollutes, how much is neutralized ($N_2$) and how much is recycled – important indicators
    - For total as well as sectoral budgets: imbalances (more N input than output; or even more, more N output than input) give reason to more detailed analysis
    - Indicators:
        - Temporal dynamics
        - Spatial parameters (N stock/flow per area or person)
        - N use efficiencies at different levels
        - Balance discrepancies & uncertainties
- report to stakeholders
    - N source apportionment to identify regulation needs
    - Identify N accumulation as a potential future pollution hazard
    - Benchmarking to compare cities, provinces, etc to stimulate ambition towards change

Work Package 8 – Urban Stakeholders – Lisa

- Selection and approach of stakeholders
    - Stakeholder mapping
    - 3 layers: decision makers, people involved (NGOs, waste treatment facility managers etc), interested public
- Edit the scientific approaches and results for use with lay audience
- Get stakeholders actively involved
- Think of strategies for decision making
- International and intercultural experience

    - First meeting with Polish partners
    - Refinement of stakeholder strategy related to local requirements
- Identify key outputs and present them to stakeholders
- Workshops
    - First workshop in November (online)
    - 12-15 people (virtual round table)
    - 3h duration
    - Thematic blocks (suggestion)
        - Air/living/transport
        - Forest/soil/agriculture
    - Tool: Miro – virtual white board: Please try!
      Link: https://miro.com/app/board/o9J_kmJkhkU=/
      PW: UncnetTest2020
    - Tool results (main messages to stakeholders, expectations from stakeholders) are relevant for further project work!

**September 11, 2020**

**Urban N Budgets**

<u>Urban N Budget Vienna – Katrin</u>

- Division between Vienna core and surrounding area according to NUTS3
- Waste flows and management/treatment integrated in STAN – refinement together with stakeholders and Monika

<u>Urban N Budget Zielona Gora – Monika & Andrzej</u>

- Division of Zielona Góra into old town and new town district (which until 2014 were two separate communities with own economy and development rules)
    - Extensive agriculture in new district – mostly typical rural area with some elements of suburban areas
    - Glasshouses & tunnels mainly used for horticulture not crop production – short rotations of decorative plants
- Pet breeding (cats and dogs) in the old town
    - Not big – 3 or 4 cats & dogs as reproductive units -> about 20 puppies/kittens per breeding place per year
    - Proper definition of pets to be investigated (e.g. horses in Europe)
- No livestock mass production
- Little use of mineral fertilizer on urban greens
- Compost is not reused – all deposited to the dump
- 1 centralized system of waste collection
- N content in soil is not high due to soil characteristics
- Water contamination -> affects ground water more contaminated in the city, but surface water in surrounding area
- Large forest areas both in the old town and new district being important N collectors
- Large per-area density of cats and dogs in the old town, hence more relevant (also comparing to other sources) in the old town
- Consideration of changes brought by EU waste management legislation – towards circular economy

- All types of waste except asbestos are sent to mechanical biological waste treatment installation in Zielona Góra
    - One of oldest compost plants
    - Composting – land fill
    - Trend determined based on annual values to calculate average waste generation and waste composition values for 2030

Urban N Budget Beijing – Lin

- Population mostly found in Beijing core area, some cities around
- High mineral fertilizer input (56.2Gg) – mainly wheat & maize
- NH3 emissions from agriculture mainly in south east of surrounding area
- N leaching in 1 km resolution available to calculate for city and surrounding area
- How to model trends?
- Close collaboration between CAS & PKU will be helpful

Urban N Budget Shijiazhuang – Fan

- Data collection for all pools of urban agriculture and extension of NUFER model to include all these pools
    - Literature questionnaire and NUFER model used for N inputs
    - Pets divided into homeless & domestic
    - NUFER can be used for farm or agricultural systems
    - NUFER can be run for other cities – city specific information needed (see presentation – Excel files)
- Calculations for manure & product export, emissions and runoff
- Shijiazhuang divided into urban and agricultural areas

**Way Forward:**
**draft urban budgets to identify needs of further interaction between scientists and with stakeholders**

General Remarks/ Recollection of previous decisions

- Please be aware of a change in the deliverable template as Wilfried
- Temporal resolution: 1995-2030 (annual increments), base year 2015
- No specific decision yet how to specifically address NOx and N2O emissions, but all N flows need to be considered
- NOx will be of interest and data should be collected
- JPI Urban Europe web seminar & final meeting of one project strand (ENSUF) September 29: max 3 participants from UNCNET – please inform Wilfried if interested (https://jpi-urbaneurope.eu/event-calendar/ensuf-final-event/)

Rearrangement under new COVID situation

- INI conference (central to UNCNET) has been postponed to May 30th – June 4th 2021
- Chinese partners remain interested, but unclear if they will be able to join
    - reassess in spring next year
- Provisional planning – Physical meeting in Zielona Góra + online setup for more people to join after INI

Joining different activities – Coupling

- Discussion on integrating waste considerations into STAN between Wilfried and Monika
- Feng and Katrin will discuss data need to implement N leaching into STAN

- Lin, Fan and Zhaohai will collaborate to integrate agricultural activity in Beijing area
- Zhaohai, Wilfried and Katrin will work on bringing the NUFER model and the STAN implementation of N budgets into better agreement.
- Barbara intends to contribute her knowledge on NH3 emission principles to improved NH3 inventories in China
    - Wilfried will share a relevant recent publication with her and Lin to initiate discussions

Integrating stakeholders

Define bilaterally the stakeholder process in Austria (Wilfried, Lisa, Markus)

- Information to all project partners, starting with Poland, for further stakeholder involvement

**Scientific Publications**

- Great collection of publications already
- All available on website as link or as documents on internal website

**Status of Policy Interaction**

- A recent report from European Environmental Agency on air pollution impacts on premature deaths (https://www.eea.europa.eu/publications/healthy-environment-healthy-lives) notes also on NH3 emissions.
- Interaction has started with UNEP
- Need to learn from stakeholders what triggers policies
- Task force of reactive Nitrogen – Wilfried & Barbara
    - Mitigation of reactive N – revisiting ways to reduce NH3 from agriculture
        - Framework for good agricultural practice & mitigation strategies
            - Results will be available within a year
            - Results can be used for UNCNET scenarios
- Task force of Emission Inventories – Barbara is participating – next meeting May/June
- CAS – possibility for scientific input to local authority
- Lin participates in a project with Beijing ministry – this could be a way to communicate UNCNET results (any documentation of such an interaction would be welcome)

**Next Deliverables:**

- Delay of report on first project plenary – will be immediately following this meeting based on these minutes
- Delay of stakeholder workshop – workshop will take place in November & deliverable will be completed after
- Delay of Satellite meeting – not feasible at this point in time – cancellation could be explained to funding agency
- Delay of deliverable 3.2 impact of NH3 emissions on PM2.5 – manuscript is being prepared within weeks
- Deliverable on clear concept of agricultural flows will be due next

**Next Meetings**

Project conferences

6th of November 2020: 10.30 am (Europe) / 5.30 pm (China)
26th of February 2021: 10.30 am (Europe) / 5.30 pm (China)
INI Conference, Berlin: 30th May – 4th June 2021
Project Meeting in Zielona Góra possibly after INI