

Nature-Based Solutions for Sustainable Nutrient Management-Introducing the "trans4num" Project

FROM RESEARCH TO PRACTICE –TRANS4NUM & ÓVÁR SCIENTIFIC DAY
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The challenge |  →  →  →  → 
Fertilizer → Nutrient loss (leaching) → Air pollution → Global stress → Environmental risk

The Transition |  →  →  →  → 
Water → Soil → Biodiversity → Circularity → Nature-Based Farming



From Imbalance to Innovation: Working with Nature, Not Against It

Rebalancing Global Nutrient Flows through Nature-Based Solutions (NBS)

Uneven nutrient flows = local pollution + global inefficiency

- **Surpluses** in intensive systems → runoff, eutrophication, GHG emissions
- **Deficits** in low-input systems → soil nutrient depletion
- Root causes:
 - Crop–livestock separation
 - Poor recycling of urban/food-system wastes
 - Global feed trade (South → North)

NBS can rebalance nutrient cycles:

-  Bio-based fertilizers & nutrient recycling
-  Diversified & perennial rotations
-  Integrated soil–water–nutrient management
-  Improve biodiversity
-  Circular bioeconomy value chains

Yet adoption remains limited



Co-Creation



Science & Practice



Transformation
Pathways



Multi-actor
Networks

The trans4num Project

Transformation for Sustainable Nutrient Supply Management

- **Horizon Europe / China** collaboration (2022 – 2026)
- Coordinated by **University of Hohenheim**; 20 partners across Europe & China
- Focus: co-developing and scaling **Nature-Based Solutions (NBS)**



Transformation for sustainable nutrient supply and management



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Turning Vision into Action

trans4num's Objectives and Pathways to Impact



Our ambition:

Transform nutrient management in intensive farming systems through **Nature-Based Solutions (NBS)** and **social-ecological innovation**.

How we make it happen (7 objectives):

- 1 Co-create inter- & transdisciplinary learning for sustainable practices
- 2 Understand NBS potential across diverse farming contexts
- 3 Map innovation processes using the AKIS framework
- 4 Develop a smart decision-support tool (DSS) for nutrient planning
- 5 Assess food systems & policy leverage points for scaling NBS
- 6 Disseminate evidence & engage stakeholders through practice abstracts & policy briefs
- 7 Strengthen EU–China collaboration for aligned green agriculture agendas

Expected impact:

-  Evidence-based NBS solutions tailored to local conditions
-  Tools & data for smart nutrient management
-  Policy recommendations to enable circular nutrient flows
-  Greater farmer capacity & uptake of sustainable practices

Where Science Meets Practice

trans4num's NBS Case Study Sites

Testing Nature-Based Solutions across Europe and China

7 case-study regions – co-developing and testing NBS under real-world conditions

-  Sites / regions
-  Water systems
-  Digital & decision-support tools
-  Collaboration & co-creation
-  Monitoring & impact assessment
-  Soil & plant growth
-  Biodiversity & soil life
-  Energy & climate resilience
-  Crops / farming
-  Field experimentation



Each site explores

- Locally adapted **NBS** for nutrient efficiency & reduced pollution
- **Co-creation** with farmers, advisors & policy actors
- **Soil, water & biodiversity** monitoring
- **Europe–China mutual learning** and policy exchange

Where Science Meets Practice

trans4num's NBS Case Study Sites



Testing Nature-Based Solutions across Europe and China

7 case-study regions – co-developing and testing NBS under real-world conditions

Europe

Denmark

- Grass-based & perennial crop rotations for biorefinery feedstock
- Bio-based fertilizers from manure and waste streams

Hungary

- 20 ha trial site; 3-year rotation (durum wheat, sorghum, soy)
- Soil, plant, and biodiversity monitoring (206 bird species)

Netherlands

- Farm-level innovations to reduce nutrient losses
- Circular nutrient-flow strategies

United Kingdom

- Soil-improving rotations and organic fertilizers
- Mixed-system nutrient management and policy links

Chinese Sites

Chongqing

- Partial Organic Substitution for Chemical Fertilizer

Northeast China Plain

- Soybean - maize rotation technology and No tillage with deep soiling technology

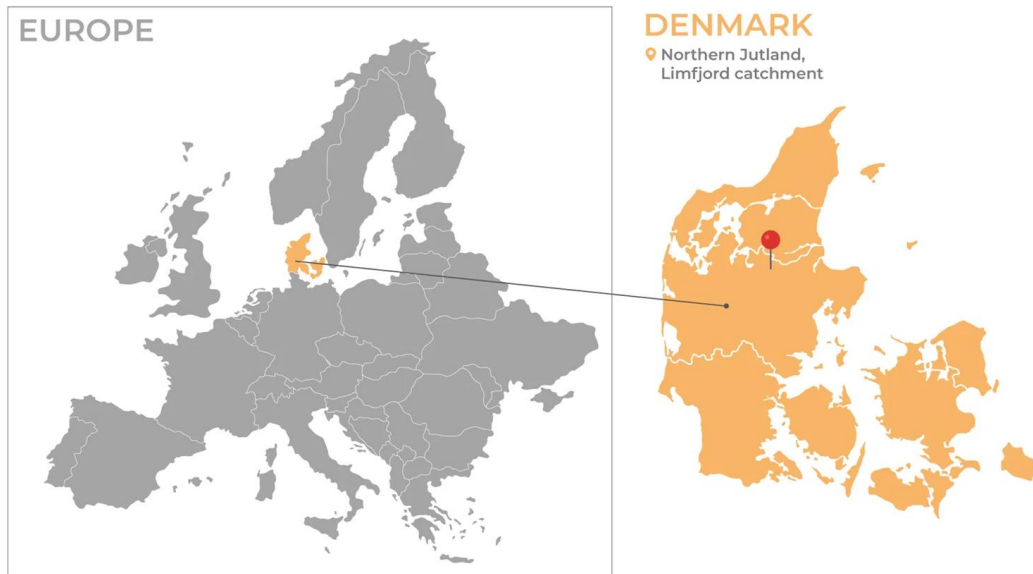
Henan Province

- Incorporating edible fungi into the wheat- maize rotation system



Denmark: The Challenge and the Opportunity

The Northern Jutland, Limfjord catchment– testing NBS at landscape scale



- **Location:** Northern Jutland, Limfjord catchment (~260 000 ha; ~63 % farmland)
- **Challenge:** High nitrogen leaching to coastal waters → eutrophication risk
- **Target:** Reduce N load by ~1 500 t N/year from this catchment (part of national 13 000 t goal)
- **Focus:** Develop and test Nature-Based Solutions that keep yields while cutting nutrient losses

Denmark

The Grass-Clover NBS: Circularity in Action

Perennial rotations for cleaner water and higher soil health

 **System:** Grass-clover mixtures integrated into crop rotations

Functions:

- Fix N biologically → less mineral fertilizer needed
- Deep roots → less nitrate leaching & better soil structure
- Produce green biomass for **biorefinery** feedstock

 Residues reused as bio-fertiliser → closing nutrient loops

 **Outcome:** lower N loss + carbon gain + new value chains



Field visit to the Ausumgaard Biogas and Biorefinery Site, Denmark

Turning perennial biomass into renewable fertiliser & feed

Ausumgaard Biogas – A Model for Sustainable Organic Farming

1 Grass-clover cultivation

- Deep roots capture nutrients & store carbon
- Legumes fix nitrogen naturally

2 Green biorefinery process

- Press fresh biomass → extract plant protein for feed
- Remaining fibre & liquid used for bioenergy or soil conditioner

3 Circular return

- Residues converted into **bio-based fertilizers**
- Nutrients recycled back to fields
- Reduced dependence on mineral N fertilizer



Impact:

Less nutrient loss | Lower GHG emissions | More renewable products | Improved soil health



From Research to Practice: Lessons from trans4num



trans4num demonstrates how Nature-Based Solutions can:

- Reduce nutrient losses while sustaining productivity
- Strengthen circular bioeconomy links between farming and industry
- Combine science, practice, and policy for systemic change
- Enable collaboration and learning between **Europe and China**
- Turn research into actionable solutions for soil, water, and climate health

*Transformation happens through collaboration —
connecting people, practice, and policy*

Thank you for your attention !

Collaboration with transformation:

-  **Project Coordination:** University of Hohenheim (trans4numcoordination@uni-hohenheim.de)
-  **Partners:** 20 institutions across Europe and China
-  **Funding:** Horizon Europe & Ministry of Science and Technology, China
-  **Duration:** 2022–2026
-  **Contact:** info@trans4num.eu
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