

EXPERIENTIAL AND MOBILE TOOLKIT FOR CLIMATE-RESILIENT AGRICULTURE AND SOIL REGENERATION



Summary

The theoretical benefits of nature-based solutions (NBS) are well established, yet farmers and advisors consistently report that available information remains abstract, real-world examples are scarce, and the principles of NBS are difficult to translate into everyday practice. The **NBS Toolkit**, developed within the trans4num project, was created in direct response to this challenge: it establishes an experiential learning environment in which farmers, advisors and students can tangibly discover what NBS look like in practice.

The need

Climate change and intensive farming pose a direct threat to soil life, water balance and nutrient cycling. Feedback gathered at trans4num project meetings made one thing clear: stakeholders are frustrated by contradictory and hard-to-interpret information.

NBS remain conceptual, and the processes of soil degradation are largely 'invisible' in daily life: what happens beneath the surface simply cannot be seen.

The **NBS Toolkit** bridges this knowledge gap by making the hidden processes of the soil visible and comprehensible, establishing a direct link between principle and reality.



The benefits

- **Immediate visualisation:** NBS Tools make the invisible visible – the links between soil erosion, compaction and healthy soil life are demonstrated directly through hands-on experiments.
- **Risk-free simulation:** Acting as a 'future simulator', the toolkit allows farmers to test their ideas in a safe environment and receive immediate feedback on the potential impacts of their decisions.
- **'Seeing is believing' experience:** The toolkit dissolves uncertainty around NBS techniques, providing farmers and advisors with tangible evidence of the effectiveness of sustainable practices.
- **A bridge between generations:** Story-driven content developed with young people through co-creation, using comic-style illustration, makes complex scientific connections emotionally accessible to all age groups.
- **Social dialogue:** The toolkit connects policy objectives with physical reality, facilitating communication and shared responsibility among farmers, decision-makers and local communities.



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trans4num solution

Developed by the Pisztráng Kör Association, the **NBS Tools** are a fully mobile, modular and scalable learning ecosystem designed to make nature-based solutions visible, understandable and interactive.

The toolkit departs from the methodology of abstract educational materials. In their place, portable, tactile and story-driven physical models allow participants to directly observe, compare and test real agricultural processes. Integrated into wheeled demonstration cabinets (housing a wind tunnel, rain simulator, soil compaction tester and worm hotel) and complemented by analogue, page-turning information carriers, the toolkit is immediately deployable in indoor classrooms, professional events and outdoor demonstration sites alike.

The innovation is grounded in the integration of real biological and farming patterns:

- **Diverse soil samples:** Side-by-side comparisons of different cultivation methods (conventional vs. sustainable, compacted vs. optimal structure, bare vs. covered surface) deliver immediate, tangible insights.
- **Living organisms:** The worm composter and multi-layered mini soil profiles featuring live earthworms, demonstrate active soil life and the process of biological loosening.
- **Living vegetation:** Various cover crops and vegetative elements illustrate the benefits of crop rotation, nutrient cycling and biological erosion protection.

Operating the tools produces rapid and measurable results, bringing to life the 'seeing is believing' experience that participants consistently highlight in their feedback.

The toolkit is built on two main tool categories:

1. **Observation & Problem-Raising Tools** — spark curiosity and help identify root problems (e.g. the soil management causes behind dust storms and mudflows).
2. **Investigation, Analysis & NBS Exercise Tools** — enable participants to test their own hypotheses, model physical processes, and deepen their understanding of nature-based solutions.

The modular structure ensures that the depth and focus of the message always adapts to the needs of the target audience: from farmers and advisors seeking practical evidence, to policymakers visualising strategic goals, to school groups, university students and the general public.

What were the challenges / limitations in the implementation process?



- Development and testing revealed a clear finding: digital solutions (e.g. digital picture frames, embedded audio) restrict mobility due to power requirements, particularly at field-based demonstrations. Analogue, page-turning information carriers proved consistently more reliable and robust. A physical constraint is the considerable weight of glass containers filled with soil, which demands careful attention during transport. The effectiveness of the tools is also strongly dependent on the methodological competence of the facilitator: the best results are achieved with a trained, experienced presenter.

What kind of resources do you need to implement the proposed solution?



- **Local craftsmen and designers:** The involvement of carpenters, metal and plastics technicians, and graphic designers is essential for manufacturing the physical structures and developing the visual identity.
- **Methodologically trained educators and advisors:** Effectively running the programmes requires qualified environmental educators, agricultural advisors or engineers capable of facilitating both problem-raising and solution-oriented processes.
- **Ongoing maintenance resources:** The long-term operation of a toolkit built on a living ecosystem demands regular, planned maintenance as a core operational requirement.

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Practical recommendations for users

- **Co-creation and local embedding:** Before introducing the tools, it is advisable to organise joint workshops with local educational institutions, researchers and farmers (as demonstrated by the trans4num INSPIRE Hackathon) to ensure that local specificities are genuinely built into the practices.
- **Structured learning pathway:** Demonstrations should follow the four-pillar methodological sequence: engaging storytelling → visual modelling → interactive experimentation → systemic strategic dialogue. This sequence ensures that participants not only see but also understand and internalise the lessons.
- **Routine maintenance:** Since the tools contain real soil and living organisms, their care requires regular, dedicated attention. Earthworms need feeding, plants need watering, and the soil in glass containers must be fully replaced every 3–4 months to prevent algae growth and the blurring of layer boundaries caused by intensive earthworm activity. Before transport, fixings should be checked to avoid damage.

Next steps & scaling

- Following the close of the project, NBS Tools operates as a permanent base at the Szigetköz Élmenyközpont (Szigetköz Experience Centre). Its mobile format, however, provides an excellent foundation for adaptation to other regions, new NBS types and future EU-funded projects contributing to the development of a growing European sustainability knowledge network.
- Explore the tools: <https://trans4num.eu/en/trans4num-nbs-tools/>
- Find more Practice Abstracts: <https://trans4num.eu/library/?type=ABS>

