Questions to the Soil — Guide 1: Erdreich-Entdecker

For Children and Youth (Ages 8–18, School Classes)

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Guide 1: Erdreich-Entdecker — The Soil Explorers

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Overview

Title	Erdreich-Entdecker / Soil Explorers / Odkrywcy Gleby
Target Group	School classes, youth groups (ages 8–18, with age-differentiated variants)
Group Size	10–30, divided into teams of 3–5
Duration	Half day (3–4 hours including breaks)
Location	Erdpuls campus garden (Zone B) and surrounding areas
Season	All seasons (with seasonal adaptations noted below)
Learning Objectives	By the end of this workshop, participants will: (1) demonstrate bodily observation of soil using at least four senses and articulate at least three distinguishing properties of their assigned patch compared to another team's patch; (2) compare at least two sensor measurements with bodily perception and identify one agreement and one discrepancy between instrument data and embodied observation; (3) count and record at least five living organisms in their soil patch and enter the data as a citizen science contribution to the Erdpuls soil record; (4) name one concrete action they will take to protect or improve soil health in their daily life — at home, at school, or in their neighbourhood
Sustainability Dimensions	**Ecological** (direct biodiversity observation; soil as living system; organism-habitat relationships; seasonal soil dynamics); **Economic** (soil as the foundation of all food production; the economic value of healthy topsoil and biodiversity); **Social** (team-based inquiry; citizen science as community contribution; school-campus-community partnership); **Cultural** (Goethean observation as European scientific heritage; local landscape stewardship; embodied knowing as legitimate form of knowledge)

SDG Links	**SDG 4** (Quality Education — experiential, inquiry-based, hands-on learning; OER publication of all outputs); **SDG 15** (Life on Land — biodiversity documentation, soil organism awareness, iNaturalist contribution); **SDG 13** (Climate Action — soil carbon storage, phenological data contribution to longitudinal monitoring)
4A-Pathway Focus	Awareness and Acknowledgment (younger); full pathway for older youth
Curriculum Links	Biology (soil ecology, organisms), Geography (geology, landscape), Chemistry (pH, minerals), Mathematics (measurement, data), Art (observation drawing), Sachunterricht (primary)
Methodological Foundations	Goethean phenomenology (Goethe, 1820; Naydler, 1996): observation-before-interpretation as foundational scientific discipline. Situated learning (Lave & Wenger, 1991): authentic participation in real-world practice as the most effective learning mode. Citizen science methodology (Bonney et al., 2009): participant-generated data of genuine scientific value contributing to longitudinal datasets.
BNE Competencies	3.1.1 (experiential), 3.1.3 (activating), 3.1.7 (holistic), 4.1.3 (interdisciplinary), 4.3.3 (empathy)

Preparation and Materials

Per team (3–5 children): - 1 sturdy trowel or digging stick - 1 hand lens (10x magnification) — inexpensive plastic ones work well - 1 white plastic tray or plate (for sorting soil life) - 1 spray bottle with water - 1 small jar with lid (for taking a soil sample home) - 1 Soil Explorer Field Sheet (see below — printed, one per child) - Colored pencils (at least 6 colors) - 1 timer or smartphone (facilitator holds for younger groups)

For the group: - pH test strips (simple color-change type, not digital) - 1–2 soil temperature probes or digital thermometers - If available: 1 portable soil moisture sensor per team - A bucket of warm water and soap for handwashing at the end - First aid kit - Erdpuls campus soil sensor dashboard displayed on a tablet or printed screenshot

Advance Preparation by Facilitator: - Walk the site the day before and select 4–6 soil patches with visibly different characteristics (e.g., under a tree, in open garden, near a building wall, in compost area, in a path, in a meadow). Mark them with small flags or stones. - Prepare a "mystery soil" — a jar of soil from an unusual location on campus (e.g., under the heritage brick building, from the compost pile, from the sandy subsoil). This is used in the closing activity. - Print Soil Explorer Field Sheets. - Charge tablet for sensor dashboard display. - Brief any accompanying teachers on the hands-on nature of the experience: children will get dirty. This is correct and intended.

The Soil Explorer Field Sheet

This is a simplified, visual version of the 13 Questions, designed for field use by children. It should be printed as a single A4 sheet, double-sided, with space for drawing and writing.

Side 1:

MY SOIL PATCH Date: **_ Season:** ***Weather:*** **My name: _ Team:** ***Patch location:***

FIRST LOOK — Before you touch anything, draw what you see. Use colors. [Large blank box for drawing]

WHAT COVERS THE GROUND? Circle what you see: Living plants / Dead leaves / Bare earth / Moss / Stones / Crust / Mulch / Water / Other: _____

COLOR — What color is the surface soil? **_ Dig 10 cm down. What color is the soil there?** ***Are they the same or different?*** **__**

TOUCH — Pick up some soil from 10 cm down. Circle the words that fit: Gritty / Smooth / Sticky / Crumbly / Hard / Soft / Cool / Warm / Damp / Dry Can you roll it into a worm shape? Yes / No. How long before it breaks? _____ cm

SMELL — Bring the soil close to your nose. Describe the smell (not just "earthy"!):

Side 2:

LIFE COUNT — Look carefully at the soil surface and in your hole for 2 minutes. Draw and count everything alive:

What I Found	How Many	Drawing
Total living things found: _____		

WATER TEST — Pour a small cup of water on the surface near your hole. Count slowly. How many seconds until the water disappears? _____ seconds Did it: soak in / pool on top / run to one side? Circle one.

SOUND — Put your ear close to the ground. What can you hear? Insects? Water? Wind? What I hear at ground level: **_ What I hear standing up:** ***What changed?*** **__**

ROOTS — Look at the sides of your hole. Draw the roots you see. How deep do the biggest roots go? _____ cm [Box for drawing]

THE BIG QUESTION — If this soil could talk, what would it say? Write or draw your answer. [Box for response]

MY SOIL'S MEASUREMENTS: Temperature: **_ °C pH:** ***Moisture:*** **__**

Welcome and Framing (15 minutes)

Gather the group at the garden entrance (Zone B threshold — the pattern "Schwelle" from Ring 1). Do not begin indoors.

For ages 8–12: "Today you are scientists. Not the kind who sit in laboratories — the kind who go outside and discover things nobody has noticed before. You are going to meet the ground. You walk on it every day, but have you ever really looked at it? Listened to it? Smelled it? Today you will. And you'll discover that the ground is alive — more alive than you think."

Introduce the teams, distribute materials, assign each team to a pre-marked soil patch. Explain: "Every team has a different patch. At the end, we'll compare — and discover why the same garden has so many different soils."

For ages 13–18: "We have sensor networks that measure this soil continuously — temperature, moisture, pH, every few minutes, all year. That data is real and important. But today we're going to ask a harder question: what can you find out about this soil *without* any technology? Just your hands, eyes, nose — your body as a measuring instrument. Then we'll compare what your body tells you with what the sensors say. The disagreements are where the interesting science starts."

Introduce the citizen science framing: "The observations you make today will become part of the Erdpuls soil database. You're not practicing — you're contributing real data."

The Experience (90–120 minutes)

Phase 1 — Solo Encounter (15 min)

Each child kneels or sits at their team's patch. Two minutes of silence — just looking. They complete "First Look" on the Field Sheet (drawing). No talking during this phase. This is often difficult for younger children; the facilitator should model it themselves.

Proxemic note: This phase moves children from social/public distance (the group, the garden overview) to intimate distance (face-to-ground, one patch). The facilitator should kneel or squat to the same height as the children — standing over kneeling children introduces vertical proxemic dominance that undermines the participatory intention. Model the behavior: kneel, look closely, be still. Children follow modeled proxemic behavior more readily than verbal instruction.

Phase 2 — Guided Questions (45–60 min)

The facilitator moves between teams, reading the questions aloud (one at a time, for the whole group to hear, then time for each team to investigate). The questions are the simplified versions on the Field Sheet:

Question 1–2 (Surface and Cover): Teams document what covers their patch. Introduce the vocabulary: "mulch," "crust," "litter layer."

Question 3 (Color): Teams dig their hole (10–15 cm). Younger children may need help with the trowel. Immediately attend to color — compare surface and depth.

Facilitator prompt for curiosity: "Why do you think the surface color and the deep color are different? What happened to make them different?" Do not answer this yet. Let it sit.

Question 4 (Touch/Texture): The ribbon test. Show the technique once: wet a marble-sized ball of soil, roll it between palms into a cylinder, then flatten it between thumb and forefinger into a ribbon. How long before it breaks? Short ribbon (< 2 cm) = sandy. Long ribbon (> 5 cm) = clay. In between = silt or loam. Children enjoy this enormously — it is tactile, skill-based, and produces a tangible result.

Question 5 (Smell): Encourage specificity. "It smells earthy" is not enough. "It smells like mushrooms after rain" or "like the inside of a flowerpot" or "like nothing at all" — all are better because they are precise.

Question 6 (Structure — simplified for children): "Pick up a clump. Does it break into smaller clumps, or does it just fall apart like sand, or does it stay as one hard lump?" Younger children can categorize into "crumbly," "sandy," or "clumpy."

Question 7 (Life Count): The highlight for most children. Give each team a white tray. They gently crumble soil from their hole onto the tray and look for anything alive or moving. Use the hand lens. Count for exactly 2 minutes (use the timer). Record every organism, even if they cannot name it. "Something small and white that jumps" is a valid observation (likely a springtail). "A red spider thing" is a valid observation (likely a mite).

Proxemic note: This is the proxemic peak for children — faces within 10–20 cm of the soil surface, deep intimate distance. For some children this is thrilling; for others it triggers discomfort (unknown creatures at intimate distance). Normalize both: "Some of you will want your nose right in the tray. Some will want to stay a bit further back. Both are fine. The hand lens brings things close without requiring your face to be close."

For ages 8–12: This often becomes the most remembered part of the experience. Children who were reluctant to touch soil are now fascinated. Give this phase extra time if the group is engaged. Have magnifying glasses available for sharing.

For ages 13–18: Introduce the concept of soil food webs. "Everything you found is connected. The mites eat the fungi. The springtails eat the bacteria. The beetle larvae eat the springtails. You're looking at an ecosystem as complex as a coral reef, but under your feet."

Question 8 (Water Test): Each team pours exactly one cup (100 ml) of water onto the undisturbed surface next to their hole. They count seconds until the water disappears. This is a quantifiable measurement — it produces a number that can be compared between teams.

Question 8b (Sound — Proxemic Enrichment): "Now put your ear close to the ground — as close as you can. What can you hear? Insects moving? Water? Wind in the grass above you? Now stand up. What changed? What sounds disappeared?" This completes the full sensory circuit: touch (Question 4), smell (Question 5), sight (Questions 1–3, 6–7), water observation (Question 8), and now sound. The contrast between ear-to-ground and standing-height sound is itself a proxemic lesson: the world sounds different at different distances.

Questions 9–10 (Roots and Layers): For younger children, combine these into "Look at the sides of your hole. Draw what you see — the roots, the colors, the layers." For older youth, distinguish between root architecture (spreading vs. tap root) and soil horizons (the visible layering).

Question 11 (History — adapted): "What do you think has happened to this soil? Was it ever a road? A garden bed? A forest? A building site? What clues tell you?"

Question 12 (Relationships — adapted): "Look around from where you're kneeling. What is uphill from your patch? What is downhill? Where does the rain go when it hits your patch? What grows on the next patch over, and is it the same or different?"

Question 13 (The Big Question): "If this soil could talk, what would it say?" This is deliberately open — children may respond scientifically ("I need more water"), emotionally ("I'm tired of being walked on"), or imaginatively ("I remember when there was a forest here"). All responses are valid and revealing.

Phase 3 — The Measurement Round (20 min)

Now introduce the instruments. The facilitator demonstrates:

- **Soil thermometer:** Insert 10 cm deep, wait 60 seconds, read. Each team measures their patch.
- **pH strips:** Take a small soil sample, mix with a little distilled water, dip the strip, compare to the color chart.
- **Soil moisture sensor (if available):** Insert probe, read the value.

Teams record these measurements on their Field Sheet. The facilitator also reads out the nearest permanent sensor's current values from the Erdpuls dashboard.

Sensor Dialogue (15 minutes)

Gather the whole group. Display the Erdpuls sensor dashboard on the tablet.

"Your hands told you something. The instruments told you something. The permanent sensors on this campus tell us something continuously. Let's compare."

Write the teams' measurements on a shared chart (whiteboard, large paper, or verbally):

Team	Patch Location	Temperature (felt)	Temperature (measured)	pH	Moisture	Life Count	Water Infiltration (seconds)
1	Under the apple tree	Cool	9°C	6.5	High	14	8 sec
2	Open garden bed	Warm	14°C	7.0	Medium	7	15 sec
3	Near the brick wall	Very warm	16°C	7.5	Low	3	45 sec
4	Compost area	Warm and damp	18°C	6.0	Very high	22	5 sec

The differences between patches — often dramatic even within a small garden — are the teaching moment. "You all live in the same town, go to the same school, stand in the same garden. But the soil under your knees was completely different from the soil under your neighbor's knees. Why?"

This is where the 4A-Pathway activates: Awareness ("I notice the soil is different here") becomes Acknowledgment ("I am connected to this specific ground, which has its own character and needs").

Citizen Science Output

For ages 8–12: Each team's Life Count, Water Infiltration time, and measurements become entries in the Erdpuls Soil Diary — a simple logbook kept in Zone B. If the visit is repeated in another season, the comparison is displayed on a poster. Children sign their entries.

For ages 13–18: Data is entered into the Erdpuls open data system (spreadsheet or API, depending on infrastructure). Species observations from the Life Count can be uploaded to iNaturalist if identifiable to species level. The data set joins the longitudinal record — if another class visits the same patches next month or next year, the comparison enables genuine research questions.

If sensor-building workshops (Zone C) are part of the school program, the soil observation becomes the *reason* for building a sensor: "You discovered that the soil near the wall is hotter and drier. Let's build a sensor to monitor that continuously and see if it changes through the year."

Closing and Reflection (20 minutes)

The Mystery Soil: Show the jar of soil prepared beforehand. Pass it around. "Where on this campus does this soil come from? Use everything you learned today to figure it out." Teams discuss, make guesses based on color, texture, smell, moisture. Reveal the answer. This reinforces the transferability of what they learned — they can now "read" soil.

Circle Closing:

For ages 8–12: Each child says one word about what they discovered today. For ages 13–18: Each person shares one thing the soil told them that the sensor could not, or one thing the sensor told them that their body could not.

Handwashing. (Important — do not skip. This is the transition back to "normal" mode, and it also models hygiene after soil contact.)

Follow-Up and Continuation

In School (1–2 lessons): - Complete a "Soil Portrait" — a drawing or painting combining the observations into a single image of their patch. These can be displayed in the school and photographed for the Erdpuls archive. - If the class has a school garden: repeat the protocol on their own soil. Compare school soil with Erdpuls soil. - Write a "Soil Story" — a short narrative from the soil's perspective (links to creative writing curriculum). - Older students: graph the class data set. What correlations emerge between temperature, moisture, pH, and life count?

At Erdpuls (seasonal return): - The class is invited to return in a different season and repeat the protocol at the same patches. The seasonal comparison is one of the most powerful longitudinal learning experiences: "In spring, your patch had 22 organisms. In winter, how many? Where did they go?" - Return visits activate the token pathway (Cooperation tokens for seasonal commitment).

Token Economy Integration

Activity	Token Element	Notes
Completing the field sheet	Cooperation	Team effort, collective observation
Life Count data entering the Erdpuls database	Mutualism	Data serves future visitors and researchers
Returning for a seasonal repeat	Cooperation + Regeneration	Longitudinal commitment
Creating a Soil Portrait for the Erdpuls archive	Mutualism	Cultural contribution to the commons

Activity	Token Element	Notes
Building a sensor to monitor their patch (Zone C follow-up)	Reciprocity	Learning flows both ways: soil teaches child, child monitors soil

Tokens are explained age-appropriately: "When you share your observations with the Erdpuls community, you're doing something generous — like a plant sharing oxygen. That generosity is recorded, and it means something."

Facilitator Notes

BNE Qualification Requirements (Areas 6.1.1/6.1.2 — minimum: one of the following): Facilitator should hold either (6.1.1) formal qualifications in a relevant field (biology, ecology, environmental education, outdoor education, science education) or (6.1.2) demonstrated personal qualification through equivalent experience: minimum 2 years leading outdoor science workshops with school-age groups, plus completion of the Erdpuls facilitator induction (including personal practice of the full 13 Questions protocol). Basic ecological literacy (ability to identify common soil organisms with reference materials, interpret pH and moisture readings) is a practical prerequisite for all facilitators of this guide.

Pre-Workshop Participant Preparation (Area 3.3.1): Send to accompanying teachers or group leaders at least one week before the visit: (a) brief information about the workshop format — students will be outdoors, hands-on, getting dirty; appropriate clothing is required; (b) a one-page "What is citizen science?" primer (available from the Erdpuls facilitator pack); (c) the "Soil Curiosity Sheet" — five simple questions for students to consider before arrival ("When did you last look at soil closely? What do you expect to find if you dig a hole in a garden?"). Pre-visit teacher briefing (by phone or email) is recommended for classes with SEN participants to agree on individual adaptations.

Post-Workshop Follow-Up Resources (Area 3.3.3): Provide to teachers and students after the visit: (a) the class's data export from the Erdpuls soil database (PDF or spreadsheet, generated within one week of the visit); (b) the "Soil Portrait" continuation activity guide (one-page PDF); (c) an invitation to return for a seasonal repeat visit with pre-booked dates; (d) iNaturalist project link for any species observations made during the Life Count; (e) digital or printed copy of the student's completed Soil Explorer Field Sheet (facilitator photographs all sheets before students take them home).

Common Challenges:

"I don't want to touch it." — Never force. Offer the hand lens instead: "You can be the team's microscope scientist." Most reluctant children come around when they see peers enjoying the texture and smell activities. If not, observation-from-a-distance is a valid participation mode.

Over-excitement at the Life Count — Children may want to collect organisms. Emphasize: "We observe, we count, we gently return them. They live here." Model the gentle handling.

"Is this the right answer?" — This is the most important moment. "There is no right answer. There is what you observe. Your observation is your data."

Weather concerns — The protocol works in rain (soil behaves differently when wet — a learning opportunity). It does not work well in hard frost when the ground cannot be dug. Snow cover creates a modified version: "Questions to the Snow" (what is under the snow? How does the soil underneath differ from exposed soil?).

Age Differentiation:

Element	Ages 8–10	Ages 11–14	Ages 15–18
Questions	8 of 13 (skip Structure, Layers, History in detail)	11 of 13 (simplify History and Relationships)	Full 13
Recording	Mostly drawing, circling, single words	Drawing + short written descriptions	Full written observations + data tables
Sensor integration	Facilitator demonstrates; children read	Children operate instruments with guidance	Independent measurement, data entry
Citizen science output	Logbook entry, Soil Portrait	Logbook + iNaturalist attempt	Full data set, database entry, possible research question
Reflection depth	"What surprised you?"	"What did your body know that the sensor didn't?"	"What hypothesis would you test next?"
Duration	2.5 hours	3 hours	3.5–4 hours

Seasonal Variations

Season	Key Adaptations
Spring (March–May)	Focus on emergence: what is waking up in the soil? Root growth visible. Soil warming measurable day by day. Ideal for first visit.
Summer (June–August)	Maximum biodiversity in Life Count. Soil temperature contrasts strongest (sun vs. shade). Drying patterns visible. Water infiltration test most dramatic.

Season	Key Adaptations
Autumn (September–November)	Decomposition focus: leaf litter arriving, fungi fruiting, soil organisms processing organic matter. Color changes in soil surface. Ideal for "History" question (layers of decay visible).
Winter (December–February)	Reduced but not absent life. Frost effects on soil structure. Snow cover as insulation (measure temperature under snow vs. exposed soil). The "emptiness" is itself a teaching moment: "Where did everything go?"

Risk and Safety

- **Handwashing** mandatory after soil contact (bucket with soap at site)
- **No soil ingestion** (remind younger children; this is about smelling, not tasting)
- **Tetanus** — ensure school has current vaccination records; inform accompanying teachers
- **Allergies** — ask in advance about mold or pollen allergies; participants with severe allergies can use gloves and observe from slight distance
- **Sharp objects** in soil — facilitator pre-checks each patch; children use trowels, not bare hands for digging
- **Sun/weather** — hats and water in summer; warm clothing in winter; rain gear if needed
- **Accompanying adults** — minimum 1 adult per 10 children (in addition to facilitator)

Proxemic Design Notes

The proxemic arc of this guide: The workshop moves from public distance (arrival, garden overview) → intimate distance (soil encounter, Phases 1–2) → social distance (sensor dialogue, group comparison) → personal distance (mystery soil, circle closing). This arc provides the proxemic scaffolding that prevents engagement from dropping: the intense intimate phase is bookended by social/personal phases that allow participants to process what they experienced.

Age-differentiated proxemic comfort: - Ages 8–10 have fewer proxemic inhibitions — they readily touch, smell, and get close. The challenge is channeling energy, not overcoming resistance. - Ages 13–16 have heightened proxemic self-consciousness, especially around peers. The soil protocol requires intimate behavior (kneeling, smelling, putting face near ground) that can feel "embarrassing." The professional frame ("This is how geologists work") gives older adolescents proxemic permission. Pair work reduces vulnerability — two people sharing an intimate-distance activity feel less exposed than one person performing it before a group.

The transition from soil to sensors is a proxemic shift: Children move from intimate distance (hands in soil, face near ground, all channels active) to social/public distance (gathered around a tablet, vision-only). This shift can cause restlessness if not scaffolded. Solution: during the sensor dialogue, pass soil samples between teams. "Team 3, pass your soil to Team 1. Feel the difference." The physical passing maintains intimate-distance connection while the cognitive work operates at social distance.

Facilitator height: During all soil-contact phases, the facilitator should be at the same level as the children — kneeling, squatting, or sitting on the ground. Standing instruction during intimate-phase work introduces a vertical power dynamic that closes the learning space. Save standing height for safety scanning and group transitions.

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