It’s All Pants – An AI Conversation

The following is a conversation I had with AI following the unexpected results I got from my It’s All Pants experimental pilot exploring soil as a single metric upon which to compare the ecological health of differing land use/management approaches. (visit www.exploring.place for more).

Conventional thinking and advice told me that the more the y-fronts decomposed, and the greater the number of earthworms present in the soil, the healthier the soil, and by inference the ecological health of the land.

This consensus did not agree with my own findings.

So I asked AI – noting that I have not altered what was presented to me through my questions, and that I do not necessariliy agree or disagree with the findings, which have not been tested in any ways).

There follows the AI conversation outcomes…

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QUESTION ONE
Does the presence of earthworms indicate a healthy soil?

Yes, the presence of earthworms strongly indicates healthy soil because they physically improve soil structure, fertility, and water drainage, and they are sensitive indicators of soil conditions like pH, moisture, and compaction. Earthworms break down organic matter, incorporate nutrients into the soil, aerate it, and improve water infiltration. However, soil health is a complex concept, and while high earthworm numbers are a positive sign, the absence of earthworms, or the presence of only one type, can signal underlying issues such as soil compaction, waterlogging, or excessive tillage.

QUESTION TWO
And is nitrogen fed non native species grassland where glyphosate has eradicated native species considered healthy?

Not really, no.

A **nitrogen-fed, non-native grassland** where **glyphosate has been used to wipe out native species** would not generally be considered *healthy* from an ecological perspective. Here’s why:

- **Low biodiversity** – Native grasses, wildflowers, mosses, and soil fungi often support a wide web of insects, birds, and mammals. Replacing them with a handful of non-native species dramatically reduces that diversity.
- **Artificial nutrient balance** – Extra nitrogen (whether from fertiliser or deposition) tends to favour fast-growing, competitive plants that crowd out slower native species, leading to a homogenised sward.
- **Chemical disruption** – Glyphosate may initially clear a field, but it also harms soil microbes and the recovery of native plant communities, making it harder for a balanced ecosystem to re-establish.
- **Ecological function loss** – A healthy grassland usually cycles nutrients naturally, supports pollinators, provides habitat structure, and builds soil health. A simplified, fertilised, non-native pasture offers much less of that.

Such a grassland can still be *productive* (for grazing or silage), but it is not the same as being *ecologically healthy*. In conservation terms, it’s often classed as **species-poor improved grassland**, which ranks low in habitat value.

QUESTION THREE
But it also has lots of earthworms. How do you explain that?

Great point — and it makes sense. Having lots of earthworms doesn’t automatically mean a grassland is “ecologically healthy,” it just reflects the conditions earthworms thrive in. Here’s how it fits together:

- **Earthworms love fertile, moist soils.** Nitrogen inputs and the dense root systems of fast-growing grasses create exactly that environment: steady organic matter, plenty of root exudates, and softer soils that worms can move through easily.
- **Simplified systems can still be worm-rich.** Even if plant diversity is low and native species have been lost, earthworms can flourish because their needs (food, moisture, soil structure) are being met.
- **But worms aren't the whole story.** While earthworms improve soil structure and nutrient cycling, they don't replace the ecological roles of the lost plants, pollinators, fungi, and other soil life. You can have a high worm population in an ecosystem that is otherwise species-poor and functionally simplified.
- **Analogy:** Think of it like a field of wheat or maize — highly productive, often full of earthworms, but not considered a *healthy ecosystem* in terms of biodiversity or resilience.

So: earthworms indicate soil fertility and good conditions for decomposition, but not overall ecosystem health.

QUESTION FOUR

So a truly healthy soil may not have many earthworms. If so, what is a true test, or tests, to determine soil health?

Excellent question 👌 — you've nailed a really important point: **a truly healthy soil doesn't necessarily have lots of earthworms.**

For example:

- **Upland heath, moorland, or ancient woodland soils** often have few or no earthworms, yet they are ecologically rich and functioning exactly as they should.
- Earthworms prefer neutral-to-alkaline, fertile soils. Acidic, sandy, or organic-rich soils (peat, heathland, podsols) can be "healthy" in their natural state *without worms*.

So, what's a **better test of soil health?** It depends on what you mean by *health*: **agricultural productivity** or **ecological integrity**. A good assessment usually combines several measures:

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🔬 **True Tests of Soil Health**

1. Biological Indicators

- Microbial diversity and activity (measured via respiration, DNA sequencing, or enzyme activity)
- Presence of fungi, especially mycorrhizal associations
- Invertebrate diversity (not just worm counts)

2. Chemical Indicators

- Soil pH (suited to the ecosystem type)
- Balanced nutrient levels (not too much nitrogen or phosphorus)
- Absence of chemical residues (herbicides, heavy metals, pollutants)

3. Physical Indicators

- Soil structure (crumbly, well-aggregated, not compacted)
- Water infiltration and retention (doesn't flood or dry out too quickly)
- Organic matter content (supports fertility and resilience)

4. Ecological Context

- Is the soil supporting the *right* plant and animal community for that habitat?
- For example: peat soils should be wet, acidic, and moss-rich; limestone grasslands thin and species-rich; lowland meadows fertile but balanced.

QUESTION FIVE

Does the presence of earthworms indicate a healthy soil?

(Same question as question one but asked after the above discussion)

Not necessarily — it depends on the context.

✅ **When earthworms can indicate healthy soil**

- In **farmland, gardens, and neutral-to-alkaline grasslands**, lots of earthworms often signal:

- Good organic matter
- Active nutrient cycling
- Decent soil structure and aeration

- In these systems, worms are usually a *positive indicator* of soil fertility and biological activity.

⚠️ **When earthworms don't indicate health**

- In **naturally acidic or nutrient-poor soils** (peat bogs, heathlands, conifer woodlands, some ancient woodlands), earthworms may be absent — yet those soils are perfectly healthy for their ecosystem.
- In **North America**, introduced European earthworms have disrupted native forest floors, stripping leaf litter too quickly and harming native plants and fungi. There, earthworms can actually signal *ecological disturbance*.
- High worm numbers can also appear in intensively managed, nitrogen-enriched pastures: productive, but not necessarily *ecologically healthy*.

🌍 **Bottom line**

- **Earthworm presence = healthy soil function in fertile, neutral systems.**
- **Earthworm absence ≠ unhealthy soil** if the habitat is naturally acidic, low-nutrient, or worm-free.
- The best assessment of soil health comes from **multiple indicators**: structure, organic matter, water infiltration, pH, and biodiversity — not worms alone.

QUESTION SIX

Does the presence of earthworms indicate a healthy soil?

(Identical question asked by a third party after I had asked question 5 to see if AI had learned)

Yes, the presence of earthworms strongly indicates healthy soil because they are sensitive to soil disturbances and their activity, such as burrowing and consuming organic matter, improves soil structure, drainage, aeration, nutrient cycling, and overall soil fertility. A healthy and diverse earthworm population reflects a balanced soil environment with sufficient organic material, adequate moisture, and minimal compaction or chemical pollution.

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Seeking Answers

Following the above results, I then asked what other simple tests could help us understand soil and ecological health of the land, with this reply

Practical Soil Health Field Toolkit

1. Soil Structure & Compaction

- **Spade Test** – Dig a spade's depth, lift out a block of soil. Look for:
  - Crumbly, aggregated structure = good.
  - Dense, smeared, layered = compaction.
- **Penetrometer / DIY stick test** – Push a metal rod or stick into the ground. Resistance at shallow depth = compaction.

2. Water Infiltration

- **Simple ring test** – Push a tin can (both ends removed) 5 cm into the soil, pour in 1 cup water, and time how long it takes to soak in.
  - Fast = good drainage.
  - Very slow = compaction, poor porosity.

3. Soil Organic Matter

- **Colour & feel** – Darker soils generally have more organic matter. Rub between fingers: friable and spongy = higher organic content.
- **DIY "burn test" (with care)** – Heat a dry soil sample in a metal spoon. Organic matter will smoke and leave lighter ash.

4. Soil Life

- **Earthworm count** (useful in fertile soils) – Dig a 20 x 20 cm block, hand-sort and count worms.
- **Other invertebrates** – Look for beetles, ants, springtails, millipedes. Their presence shows habitat variety.
- **Root inspection** – Gently wash roots. Fine root hairs and fungal threads = healthy soil biota.

5. Soil Smell

- Healthy soil has a **"rich, earthy" smell** (from actinomycetes). Sour or chemical odours may suggest poor health or contamination.

6. pH Test

- Use a cheap garden soil pH kit or strips.
  - Neutral to slightly acidic (pH 5.5–7) suits grasslands.
  - More acidic (pH 4–5) can be normal for heath or peat.
  - The key: is pH consistent with the habitat type?

7. Biodiversity Above Ground

- Look at what the soil supports. A healthy soil will usually correspond with:
  - Diverse plants (unless it's naturally low-diversity like bog/heath).
  - Pollinators, birds, and other wildlife using the habitat.

Summary

Healthy soil = good structure, organic matter, infiltration, biological activity, and appropriate chemistry for its ecosystem.

Earthworms may or may not be present depending on habitat type.

With these results I then generated the following AI table to indicate the ecological health of the various land uses and managements approaches in the pilot. These are based around a very small pilot project, but the answers are interesting and differ dramatically from conventional teaching and policy drivers.

Table of ecological health

Soil / Habitat Type	Plant Diversity	Soil Life	Associated Fauna	Overall Biodiversity Value
Nitrogen-enriched silage pasture	Very low	Worms abundant, microbes simplified	Low insects, low birds	Low
Improved grazing pasture	Low	Worms abundant, microbes simplified	Some invertebrates, some birds	Low–Moderate
Unimproved pasture	Moderate–High	Balanced worms, richer fungi	Good insect and bird life	High
Organic hay meadow	High	Rich soil food web	Excellent for pollinators & birds	Very High
Organic wood pasture	High	Diverse fungi, invertebrates	High insect, bird, and mammal richness	Very High
Conifer plantation (1st rotation, 25 yrs, unthinned)	Very low (closed canopy, acidic)	Low worms, fungi dominated by mycorrhizae	Sparse fauna, few specialists	Very Low
Conifer plantation (2nd rotation, 40 yrs, thinned)	Low–Moderate (light gaps allow some flora)	Slightly improved soil life	Some bird and invertebrate recovery	Moderate (but below semi-natural)
Mixed native ancient woodland	Very high	Complex soil web	Rich insects, birds, mammals	Exceptional

And to complete the thinking with respect to my wider “If Place Mirrors Who We Are, What Does It Reflect? I asked a similar value-based question based on some of the land uses I explored and which are presented elsewhere on this website exploring.place.

I do not necessarily agree with the findings represented in this table – they are AI generated and not tested in any way – but they are interesting in that they do help us ask questions on how we use and manage different forms of urban and rural land, and the extent to which they may or may not be balanced with respect to all users of place, and which could be improved towards a more positive future.

Table Showing Overall Value of Different Land Use Types

Soil / Habitat Type	Plant Diversity	Soil Life	Associated Fauna	Carbon Content	Community Value	Commercial Value	Overall Biodiversity Value
Mixed native ancient woodland	Very High	Complex soil web	Rich insects, birds, mammals	Very High	Exceptional	High	Exceptional
Organic wood pasture	High	Diverse fungi & invertebrates	High insect, bird, mammal richness	High–Very High	Very High	Moderate	Very High
Organic hay meadow	High	Rich soil food web	Excellent pollinators & birds	High	Very High	Moderate	Very High
Unimproved pasture	Moderate–High	Balanced worms & fungi	Good insect & bird life	Moderate–High	High	Moderate	High
Urban park / designed greenspace	Low–Moderate	Moderately compacted	Common birds, pollinators in wildflower areas	Low–Moderate	Very High	Low–Moderate	Moderate
Conifer plantation (2nd rotation, 40 yrs, thinned)	Low–Moderate	Improved soil life	Some recovery	Moderate–High	Low–Moderate	High	Moderate
Improved grazing pasture	Low	Simplified soil life	Some invertebrates & birds	Low–Moderate	Low–Moderate	Moderate–High	Low–Moderate
Nitrogen-enriched silage pasture	Very low	Simplified microbes	Low insects & birds	Low	Low	Moderate–High	Low
Housing estate (lawns, amenity grass, ornamentals)	Very low–Low	Compacted	Limited insects & birds	Low	Moderate–High	High	Low
Road network (verges & embankments)	Very Low (pockets of Moderate)	Severely compacted	Road-tolerant fauna	Very Low	Moderate	High	Very Low
Industrial estate / industrial complex	Very low	Compacted/ contaminated	Very limited fauna	Very Low	Low	High	Very Low
Conifer plantation (1st rotation, 25 yrs, unthinned)	Very low	Low worms; fungal dominance	Sparse fauna	Moderate	Low	High	Very Low

This further AI generated table introduces values for carbon, community and commerce into the thinking, to arrive at an overall land use value matrix for all users of place.