Microplastics, groundwater levels, and more

To begin with a metaphor:

“Imagine you have a carpet, and every day you drop a few crumbs onto it, and they slowly sink deeper into the middle layer.
Each crumb costs you €1 to remove from the carpet, but it also costs €1 more the deeper it sinks.

If you understand this and place a rubber sheet over it— for example when eating chips, cookies, or similar—you still have all the other crumbs inside the carpet.

But you cannot say: I now have a longer time window to fix it because the crumbs keep sinking, but they do not come back up on the other side. So the costs keep increasing.

Then the devil comes disguised and says: I will remove all the crumbs for you—no cost. Do you say yes? Then the devil sends ants. No crumbs anymore, but colonies of ants instead.

What a dream: your motorboat, yacht, or luxury sailing vessel is anchored in autumn, and when you return in spring—oops—a huge hole in the hull. You have it analyzed. Well, the ultra-light hull is made of plastic, and a swarm of plastic bacteria is living inside it now. “Plastic termites” in a fleet of city buses.

Note: Not all time estimates are precise.

Comic stile giant plastictermits feast on a Boad.

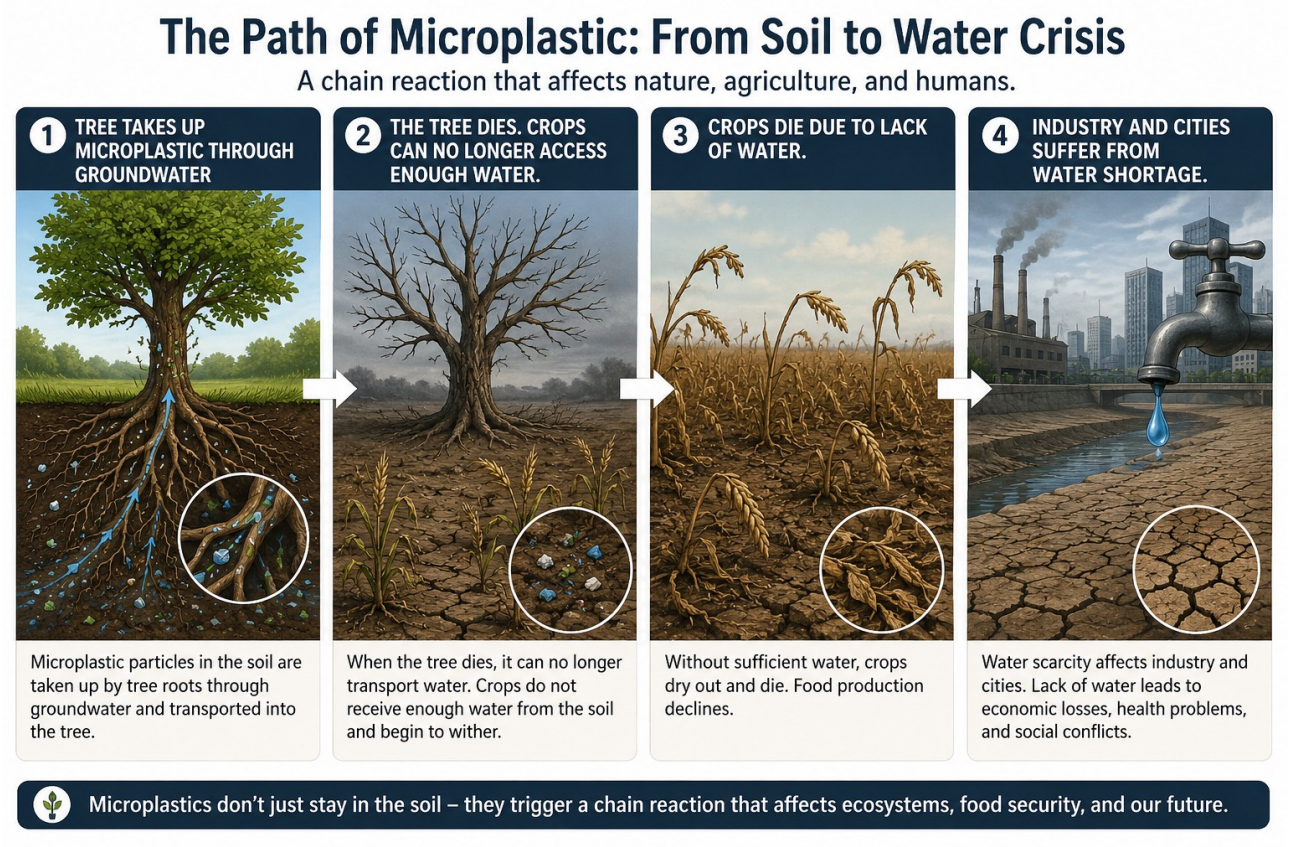
Through water, many organisms absorb microplastics.
Trees as well.

When trees have foreign particles in their system, they surround them with resin.
But this is similar to the human body slowly clogging its arteries and esophagus.

The tree dies.

But trees help stabilize the groundwater level, which is also needed for agriculture, as well as for the water supply of cities and industries.

Plants can no longer access water properly if the soil system is damaged or blocked.



Industry fears the costs of transformation. These fears are transferred into concerns about job losses. A distorted sense of freedom.

In reality: “Either extinction or major investment” — not caused by gods or aliens, but by the fear of decision-makers facing private losses.

But a dead customer is not a customer who generates profit.

A tree provides oxygen and much more for every human being. It knows no middle class, no super-rich, and no poor. No murderers, thieves, or agents where crimes are accounted differently, or ordinary citizens, children or retirees, livestock intended for meat, or dogs and cats taken into families, or wild animals.

They use sunlight for growth so that it is less harsh for other living beings under the

burning sun. And a city protected by trees can withstand icy winds in winter.

Unfortunately, children often pay for the decisions of their parents, but many of those parents are already adults and repeat the same patterns. Environmental protection and sustainability must not remain mere election slogans.

And certainly not deception—for example, boasting about recycling while recycled plastic is later used as construction material or fog-capture panels for water collection (because there are no more trees), exposing this plastic to conditions that accelerate its breakdown and microplastic formation.

The absence of trees along rivers also promotes riverbank erosion, which increases flow velocity and can lead to reduced or uncontrolled flooding during heavy rainfall.

This acceleration of flow can shorten evacuation times at dams and similar structures, as well as increase impact forces on dams and/or hydroelectric power plants.

These insurance costs can then be compared in long-term statistics with cleanup measures, such as organic filtration systems in groundwater streams and rivers, which are later “fed” again with plankton and other organisms.

A wooden stool still does not cost €1,000, because wood is still treated as a luxury.

Researchdata from the Net:

Plastic aging usually occurs in several stages:

1. UV damage

- Surface becomes dull
- Color fades

2. Brittleness

- Material loses plasticizers or polymer chains are damaged
- Small cracks begin to form

3. Crack formation

- Larger fractures appear under stress

4. Fragmentation

- Material breaks into increasingly smaller pieces
- This leads to microplastics and eventually nanoplastics

Caravans as an example

A caravan consists of different plastic components:

- GRP walls: often usable for 30–40 years
- ABS corner parts: often become brittle after 20–30 years
- Seals (EPDM/PVC): usually 10–20 years
- Acrylic or polycarbonate windows: around 20–30 years

Most old caravans are therefore not discarded because the plastics themselves fail completely, but because seals and wooden substructures develop moisture damage.

Long-term observations

The longest scientific studies now cover 40 to 60 years, since large-scale plastic use only began in the 1950s–1970s. In addition, researchers use accelerated aging tests (UV lamps, heat, humidity) to simulate decades of aging within months.

For environmental projects

When explaining the relationship between plastics and the environment, **service life is often more relevant than full degradation time**:

- Greenhouse film: 2–5 years of use
- Packaging film: minutes to weeks of use
- Caravan plastics: 20–40 years of use
- PVC pipes: 50–100 years of use

In contrast, plastic fragments in the environment often persist for centuries and tend to break down into smaller particles rather than fully biodegrade. This is why avoiding unnecessary plastic waste and ensuring long-term use of durable plastic products is particularly important from an environmental perspective.

Why plastics degrade

Plastics rarely “rot” in the biological sense. Instead, they age due to:

- UV radiation → polymer chains are broken
- Oxygen → oxidation processes
- Heat → accelerates chemical reactions
- Frost and temperature changes → material becomes brittle
- Mechanical stress → cracks expand

This is why greenhouse film often becomes brittle and tears after a few years, even though it is still chemically plastic.

Caravans (material-specific aging)

Different plastics in caravans age at different rates:

- Acrylic roof domes: 10–20 years, then cracks or yellowing
- GRP outer shell: often 30+ years
- Plastic bumpers: about 15–25 years
- PVC sealants: often need replacement after 10–15 years

A caravan does not fail all at once; individual components degrade and are replaced over time.

Long-term studies and weathering tests

Materials scientists conduct weathering tests where plastics are:

- exposed outdoors for 10, 20, or even 40+ years, or
- artificially aged using UV light, heat, and humidity to simulate decades in a shorter time

These studies show for example:

- Thin PE films often lose strength after 2–5 years
- UV-stabilized rigid plastics can remain functional for 20–50 years
- Buried plastics without sunlight can remain chemically stable for hundreds of years, even though they become brittle over time

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Responsibility sharing

The lifespan of a product depends not only on manufacturing quality but also on how it is used. Manufacturers design plastics for specific applications. If products are used outside their intended purpose—for example, using food packaging as a permanent outdoor plant container—sun, rain, and temperature fluctuations can significantly shorten their lifespan.

In such cases, the user also shares responsibility for the reduced durability. Sustainable behavior therefore also means selecting materials according to their properties and intended use.

Proposal for improved consumer information

Many plastics have already been studied for decades regarding their aging behavior. These findings could be used more effectively to support consumers in sustainable purchasing decisions. A voluntary label indicating expected service life under typical

conditions—such as indoor or outdoor use—could help match products to their intended applications.

At the same time, it would become clearer that not every plastic is suitable for every use. Misuse can significantly shorten product lifespan and lead to premature failure. Sustainability is therefore a shared responsibility: manufacturers provide relevant information, and consumers choose appropriate products for their needs.

Impact of transparent lifetime information on purchasing decisions

A clear indication of expected service life under defined conditions can align purchasing decisions more closely with actual product suitability. Consumers would be more likely to distinguish between improvised use and intended application.

This may reduce long-term reliance on unsuitable temporary solutions when it is clear that the material is not designed for such use. Instead, it increases the likelihood that products specifically designed for the intended application are chosen.

In this sense, transparent lifespan information supports both material efficiency and more appropriate product use. Economically, it leads to a shift toward more precise purchasing decisions rather than unplanned replacement purchases due to premature material failure.

Microplastics and trees – what is known so far

The exact amount is unknown. Scientists have not yet determined how much microplastic a tree can absorb before it dies. This depends on many factors:

- tree species
- age of the tree
- size of the root system
- type and amount of microplastics
- soil conditions
- water availability

What is already known

- Trees can absorb microplastics through their roots. Very small plastic particles can enter roots, and in some cases may reach stems and leaves.
- Microplastics can change soil structure. Soil may store water and nutrients less effectively or in altered ways.
- High concentrations can slow root growth and make it harder for trees to absorb water and nutrients.
- Most trees do not die immediately from this. Instead, they become weakened,

grow more slowly, and become more vulnerable to drought, diseases, and pests.

Simple comparison

Microplastics affect a tree in a way similar to dust in a machine.
A small amount may not cause noticeable damage at first. However, as the amount increases, the system works less efficiently, and over time damage can occur.

Simple summary for students

Can microplastics kill a tree?
Yes, in theory they can. However, scientists do not yet know at what concentration this happens. It is more likely that microplastics gradually weaken trees rather than killing them directly.

Knowledge note

Researchers have already found microplastics in the roots, wood, and leaves of trees. The long-term effects are still being studied. Since many trees live for decades or even centuries, some damage may only become visible after many years.

This is also important for scientific accuracy: claims should not go beyond what is currently proven.

Microorganisms that can break down plastics

There are several microorganisms capable of partially breaking down certain types of plastics. The best known are:

1. ***Ideonella sakaiensis***

- one of the best-known “plastic-degrading” bacteria
- discovered in Japan
- can break down PET (polyethylene terephthalate), e.g. plastic bottles
- uses two enzymes to break PET into smaller building blocks
- important note: it does not “eat” plastic like an animal, but chemically breaks it down

2. *Pseudomonas* species

- very diverse group of bacteria
- some strains can attack or degrade different plastics
- commonly found in soil and water

3. *Bacillus* species

- widely distributed in soil
- some strains can partially break down or structurally weaken plastics

4. *Rhodococcus* species

- known for breaking down complex organic substances
- also studied for potential plastic degradation

Important for school projects

- These bacteria break down plastics very slowly
- usually only specific types of plastic
- often only under laboratory or ideal environmental conditions
- they do not currently solve the microplastic problem in nature

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Key takeaway

"Plastic-degrading bacteria are not a fast solution, but rather small natural tools that slowly act on plastic structures over long time periods."

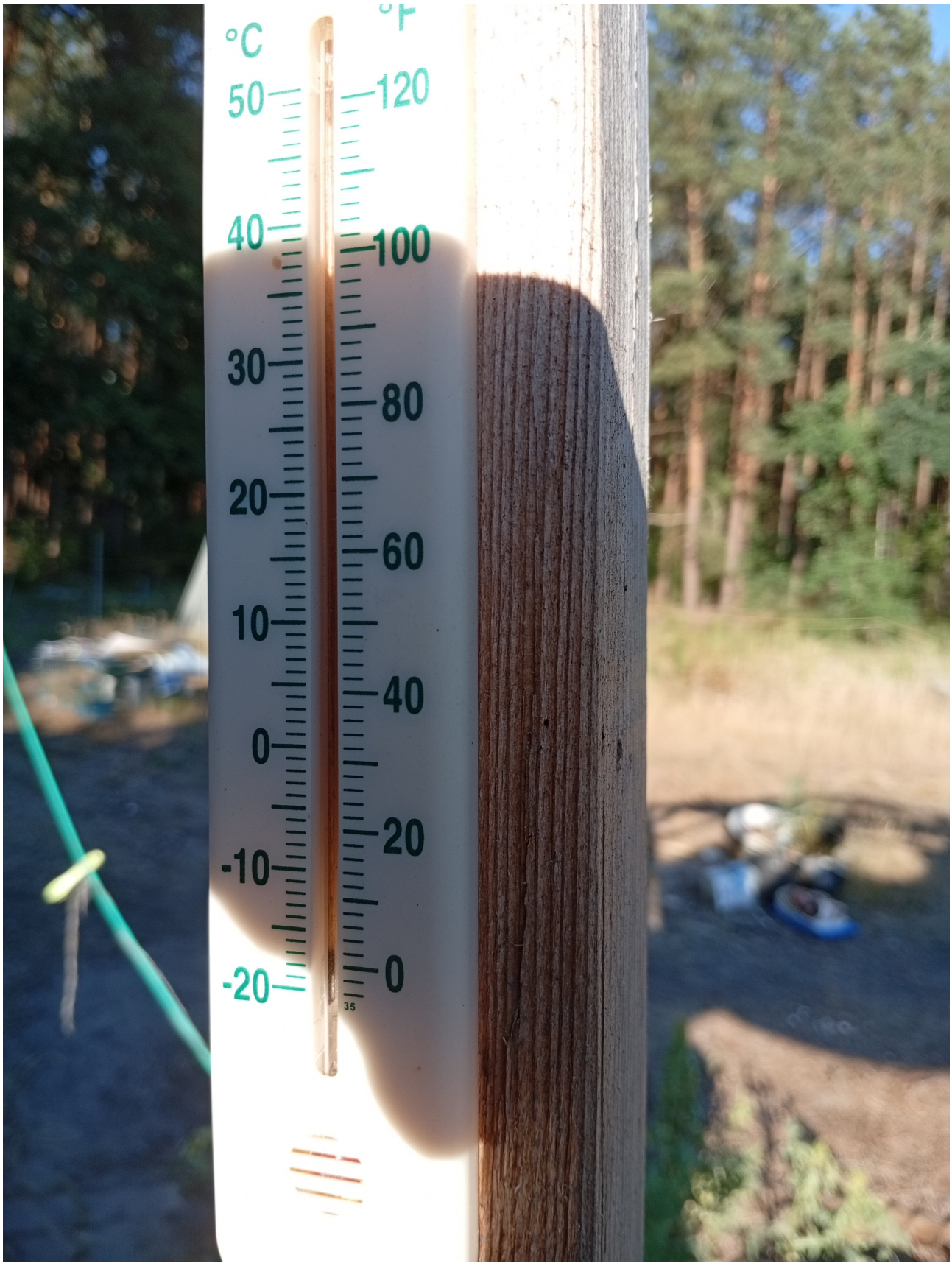
- "Is repurposing plastic still acceptable?"
- "Who bears responsibility – manufacturers or users?"
- "Should materials have an official durability rating?"

Careless Consuments

Product corrosion after 3 Year of use (cold frame tunnel film)

Landlord has cut all trees an bushes

no Shadow



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