

## So many Earthworms?

### The Most Important Points in Brief

In healthy meadow soils, there are 1-3 million earthworms per hectare. In the Swiss lowlands, 1.2-1.4 million earthworms per hectare in farmland soils are considered good. Earthworms serve various essential functions in the soil: aeration, improved water absorption and drainage, decomposition of dead plant material, enhancement of nutrient availability for plants, and more. New research results indicate that earthworms also play a significant role in carbon sequestration into soils. Through their burrowing activity, they transport carbon from the surface to deeper layers, effectively storing carbon in the soil and therefore reducing atmospheric CO<sub>2</sub>. Earthworms also promote numerous other organisms and increase biodiversity through their burrowing behavior, decomposition of dead plant material, and enhancement of nutrient availability. Intensive soil cultivation, excessive fertilization, and certain pesticides can reduce earthworm populations. Farmers can promote earthworms through compost application and sowing meadows (green manure).



Many topsoil-dwelling earthworms are found in meadows (Wikimedia commons)

### Facts

#### Species and Distribution

- While more than 3.000 species are known worldwide, only 400 species are found in Europe and 40 species in Central Europe. Their size ranges from a few centimeters to over 60cm in Europe. In Australia, there are relatives of earthworms that can grow up to 3 meters long.
- Earthworms belong to the group of oligochaetes, which are characterized by bristles on the underside which aid in their movement. The bristles are only visible with a magnifying glass.
- Contrary to popular belief, cutting a worm in half does not yield two worms. In the best case, the front part might survive.

#### Soil Fertility and Climate Protection

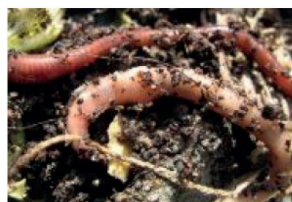
- The burrows of deep burrowing earthworms play a crucial role in draining rainwater. During heavy rainfall, the vertical burrows prevent flooding. These water-draining burrows also prevent fertile soil from being washed away (soil erosion).
- The deep burrowers, in particular, mix the layers of the soil. They transport material from the upper layer to deeper layers and vice versa. When soil passes through the digestive tract of earthworms, essential nutrients for plants become available. This is why plant roots often grow along or within earthworm channels. This contributes to soil fertility.
- When deep burrowing earthworms transport dark soil material and plant matter to deeper layers, a portion of this is carbon. This carbon is preserved in the deeper soil layers – a process known as carbon sequestration. Thus, earthworms contribute to bringing carbon (CO<sub>2</sub>) from the atmosphere into the soil, and therefore rendering it less harmful to the climate.
- Surface-dwelling earthworms decompose organic material (especially dead plant parts). Shallow burrowing earthworm species inhabit the uppermost soil layers, therefore mixing the topsoil and making nutrients available for plants.

#### Three Different Ecological Groups of Earthworms

Earthworms are divided into three groups: Surface dwellers (reddish-brown and 26cm long), shallow burrowers (pale and up to 18cm long), and deep burrowers (red-

dish-brown, darker head, and lighter towards the tail, 15-45cm long). These three groups differ in their effects on the soil, their habitat within the soil, as well as their size and coloration. Therefore, not all earthworms are the same.

### Distinguishing the Three Ecological Groups of Earthworms



Surface Dwellers (Lukas Pfiffner, FiBL)



Shallow burrowers (Lukas Pfiffner, FiBL)



Deep burrowers (Lukas Pfiffner, FiBL)

Surface Dwellers (epigeic)	Shallow burrowers (endogeic)	Deep burrowers (anecic)
Size 2-6cm	Size 2-18cm	Size 15-45cm
Entire body red-dish-brown	Entire body pale and translucent	Reddish-brown, head darker than tail end
Lives in the litter layer, rarely in cultivated soils	Lives in the upper soil, young individuals often in root mats	Lives in all soil layers, creates vertical burrows

### Current Research Questions to Think Ahead

Earthworms mix the soil. In doing so, they transport carbon into deeper layers of the soil along with digested plant material and dead organic matter from the topsoil. This carbon, which is originally CO<sub>2</sub> from the atmosphere, gets stored in the deep soil layers. As a result, earthworms contribute to a reduction of the greenhouse gas CO<sub>2</sub> in the atmosphere. The exact quantities of carbon stored in the soil by earthworms are not yet fully understood. It is also unknown whether the carbon incorporated into the soil might be released back into the atmosphere as CO<sub>2</sub> through plowing or other activities.

### Glossary

anecic	from annectare (lat.) to connect; another term for subsoil-dwelling earthworms
endogeic	living in the soil
epigeic	living directly on the soil surface
ecological (ecology)	interrelation and connections of organisms with each other and with their environment

### Further Informations

#### In-Depth Information

Earthworms are quite selective. They have requirements for their habitat: plentiful food (dead plant material), not too dry and not too wet, pH levels that are not too acidic, moderate temperature, soil that is not too compact and not too sandy. On the internet, you can find many information about earthworms.