

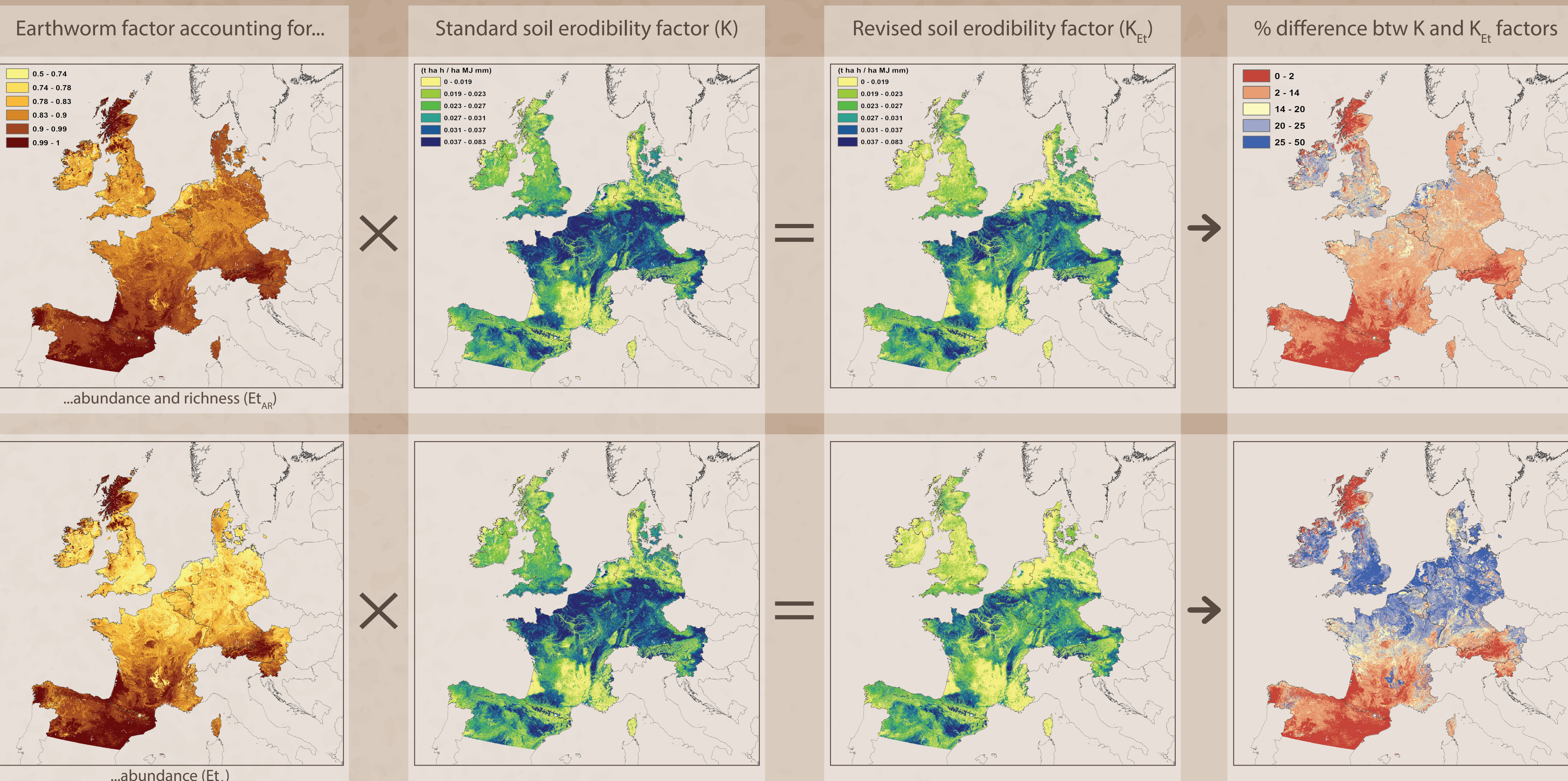
Erosion in living soil and life in eroded soil

Panagos P. and Orgiazzi A.

EARTHWORM FACTOR

- ✓ Soil biodiversity affects soil erosion.
- ✓ Current models for soil erosion estimates take into account many factors (i.e. soil properties, climate, land cover), but not the diversity of organisms living in the soil. A “biodiversity factor” has never been included into soil erosion models so far.
- ✓ Earthworms have complex effects on soil loss. The burrowing activity can reduce erosion by favouring water infiltration. Simultaneously, cast production by some species may accelerate erosion processes, as cast material could be easily moved away.
- ✓ The available data (i.e. earthworm richness and abundance distribution) allow the development of an “Earthworm factor” that may be used to refine soil erosion estimates

FROM PROPOSAL TO MAPS



OUR PROPOSAL

- ✓ We developed an “Earthworm factor” (Et-factor) to be included into “Soil erodibility factor” (K-factor) of RUSLE, the model most commonly used to predict long-term average annual erosion by water

- ✓ Based on the few available quantitative studies and personal communication with earthworm ecology/biology experts, we assumed that:

1. Earthworm abundance has a reduction effect on soil erodibility up to 50%
2. Earthworm richness has a dual effect (reduction and increase) on soil erodibility.

- ✓ Based on this, two formulas for calculating Et-factor were generated. First one ($E_{t_{AR}}$) accounting for abundance and richness, second one (E_{t_A}) just for abundance:

1. $E_{t_{AR}} = (1 - R) + [R / (A + 1)]$
2. $E_{t_A} = 1 / (A + 1)$

A is earthworm abundance (no. of individuals per m^2 , normalized to a 0–1 index) and R is richness (no. of taxa per m^2 , normalized to a 0–1 index).

- ✓ Both formulas are developed so that $E_{t_{A(R)}}$ -factor ranges from 0.5 to 1, which means that, at most, earthworm diversity halved the erodibility factor of soil (i.e. 50% reduction).

- ✓ Subsequently, a correction to the standard K-factor was incorporated to generate a revised K-factor (K_{Et}) - see maps beside:

$$K_{Et} = K \times E_{t_{A(R)}}$$

SOIL EROSION ECOLOGY

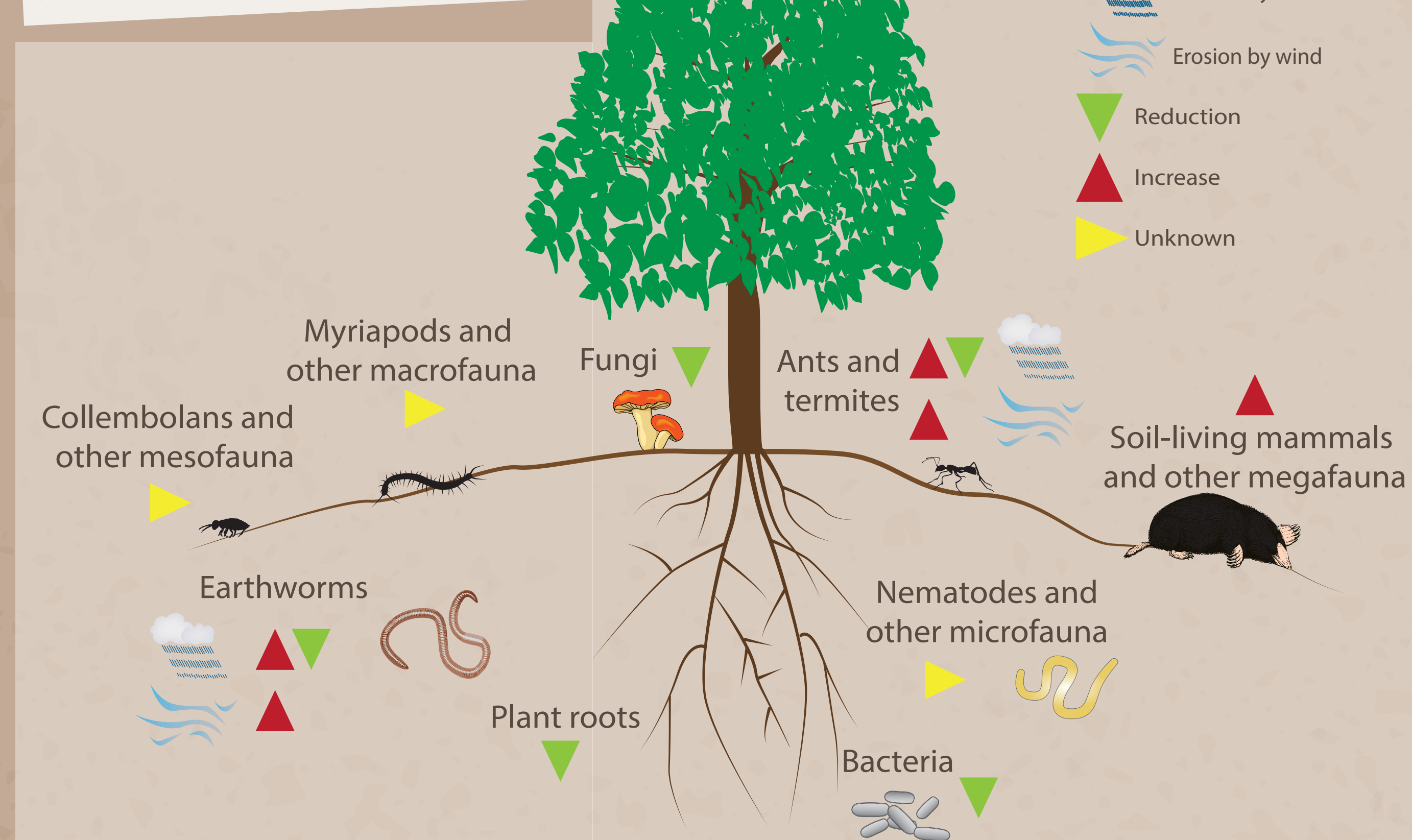
- ✓ Soil erosion affects soil biodiversity. Given the great abundance of organisms living belowground (e.g. 300 earthworms/ m^2) and the scale of soil erosion (e.g. mean soil loss rate in European Union is estimated to 2.46 tonnes/hectar annually), this loss surely has an ecological impact on belowground communities.

- ✓ Soil ecology has poorly investigated the effects of erosion.

- ✓ We identified six effects that require further investigations to shed light on soil erosion ecology:

1. Migration effect: erosion has a direct impact on soil population dynamics due to the displacement of large amount of organisms.
2. Invasion effect: soil runoff can move organisms to considerable distances acting as invasion facilitator.
3. Violence effect: the intensity of erosive events may alter and, potentially, destroy part or entire communities of soil organisms.
4. Defence effect: erosion being a stressor, it is likely that soil organisms have evolved mechanisms for reducing/eliminating potential related damage.
5. Rebuilding effect: some organisms (e.g. fungi) reduce soil erosion. Therefore, soil biodiversity may contribute to ecosystem restoration and promote soil conservation.
6. Functional effect: soil organisms support multiple ecosystem functions and services. By modifying soil communities, soil erosion also influences the services that they provide.

EFFECT OF SOIL ORGANISMS ON SOIL EROSION



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Contacts:

Panos PANAGOS and Alberto ORGIAZZI
European Commission - Joint Research Centre
Directorate D.3 - Sustainable Resources, Land Resources Unit
Email: Panos.PANAGOS@ec.europa.eu - Alberto.ORGIAZZI@ec.europa.eu