GloPi: **Gl**obal Recognition of Subsurface Erosion By Soil **Pi**ping

Healthy soils are essential for life on Earth, but they face a major threat: erosion. This project tackles the challenge of protecting soils, focusing on soil erosion. While most research has concentrated on surface erosion caused by water, such as sheet and rill erosion, less attention has been given to gully erosion and even less to soil piping. **Soil piping** is a subsurface soil erosion process that leads to the formation of underground tunnels (called pipes). Evidences of soil piping become visible on the surface when the roof of **a pipe collapses.** Soil piping can greatly impact landscapes by silently weakening the ground and contributing to overall soil loss. And, as such, it may change the conditions and methods for controlling soil degradation. A better understanding of soil erosion is not possible without including subsurface erosion. Since now, soil piping has not been studied globally, nor is it included in any existing soil erosion models. Researchers have explored its causes locally, like on hillslopes or small catchments, but we lack a global overview of where this process occurs. Identifying areas prone to soil piping is critical for designing better erosion control strategies and ensuring we can protect soils for future generations.

This project aims to **recognize soil piping on a global scale**, which, in in the long term, may contribute to better management of lands susceptible to soil piping. The specific objectives are:

1. to identify the locations around the world where soil piping occurs,
2. to understand the factors that influence the global patterns of soil piping occurrence,
3. to create the first-ever global map showing where soils are most susceptible to piping.

What makes this project unique?

1. Process itself – soil piping is the least recognized process of soil erosion.
2. Scale of the study – this is the first time soil piping is being examined on a global scale.
3. Impact of the results – the susceptibility map will reveal areas most at risk, helping to prioritize land management and conservation efforts.
4. Perspectives for future research – the project will shed light on where and why soil piping happens, laying the foundation for strategies to prevent and mitigate this soil erosion process.

The project will be carried out in three main stages:

1. Creating a global database of soil piping features.
2. Gathering data on environmental factors influencing soil piping: topography, soil properties, land use and cover, and climate.
3. Developing a global model of areas susceptible to soil piping.

Various machine learning techniques will be tested, ranging from simple logistic regression to more advanced methods like random forest, maximum entropy, or multivariate adaptive regression splines. The project will be done in close collaboration with worldwide soil erosion experts from Belgium, Iran and Brazil.