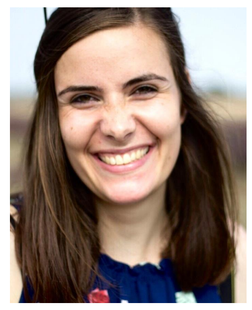
Stimulating the natural water cycle over the Mediterranean for more water



Jolanda Theeuwen

jolanda.theeuwen@wetsus.nl

Motivation

Unsustainable land use is an important driver for desertification and land degradation in dryland areas. Because of this, extreme weather patterns (e.g. droughts) will become more recurrent and intense, intensifying land degradation. Additionally, climate change enhances intensity and frequency of these patterns. Especially in the Mediterranean areas there is a high risk for droughts.

There are indications that vegetation reduces the risk of droughts (Figure 1). However, the exact impact of vegetation restoration on weather patterns is difficult to assess. This project aims at **better understanding the influence of vegetation restoration in the Mediterranean area on land-atmosphere interactions**. In this regard, this project aims to assess the feasibility to increase fresh water availability through vegetation restoration in Mediterranean areas.

Technological and Scientific challenge

Land-atmosphere interactions are not fully understood due to the uncertainty in multiple relations (see Figure 2). These relations need to be better understood to improve land surface models and experiments. **To increase this understanding more data sets of evapotranspiration and soil moisture are required and new methods to analyze these and existing datasets need to be acquired.** We will investigate how this knowledge can contribute to improve the assessment of the impact of vegetation restoration on land-atmospheric processes. For this, it is important to first, determine the location dependency of land-atmospheric processes to get a better understanding where greening should be applied, and second, understand the influence of the construction of wetlands on the energy balance and thereby on moisture transport.

Research goal

The goal of this research is **to investigate whether vegetation restoration in Mediterranean areas can increase fresh water availability**. For this research, four objectives are formulated:

- Determine where in the Mediterranean an increase in evaporation could enhance precipitation.
- Determine the effects of vegetation restoration on the local hydrological balance.
- Determine the effects of vegetation restoration on the hydrological balance of a remote area.
- Determine the effects of vegetation restoration on large scale weather and its impact on the hydrological balance.

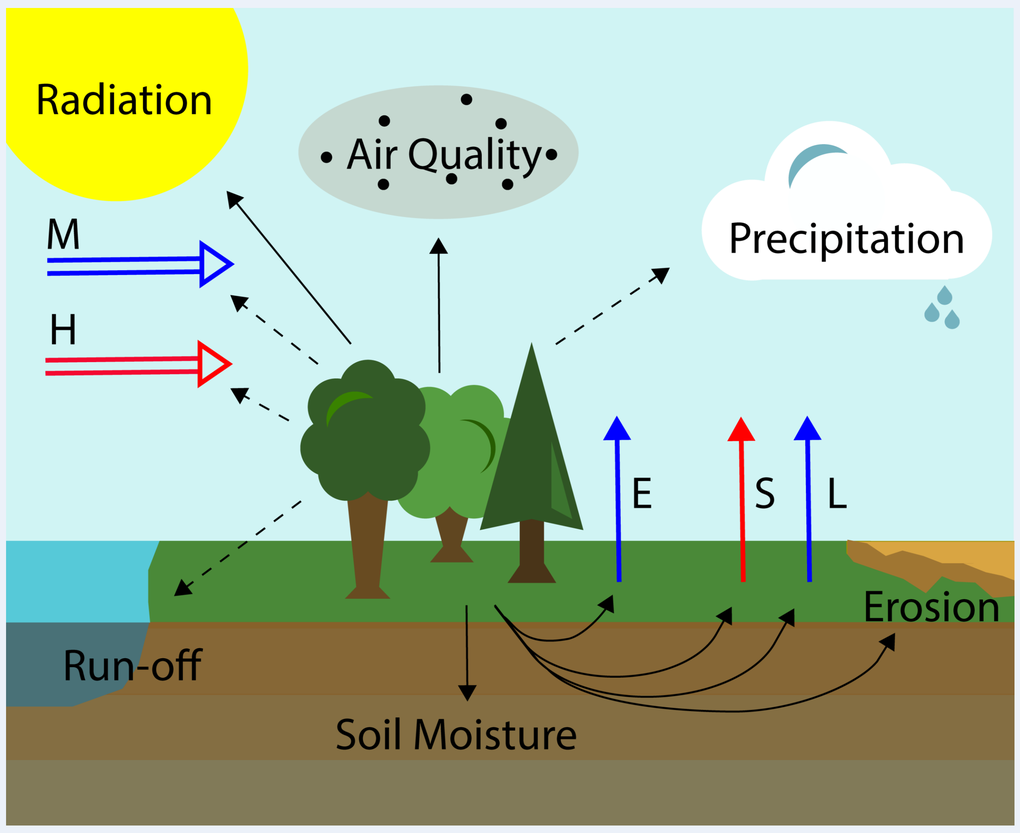


Figure 2. Schematic overview of land-atmospheric relationships. Black arrows indicate direct (continuous) or indirect (dashed) relation. M: transport of moisture, H: transport of heat, E: evaporation,
S: sensible heat flux, L: latent heat flux.

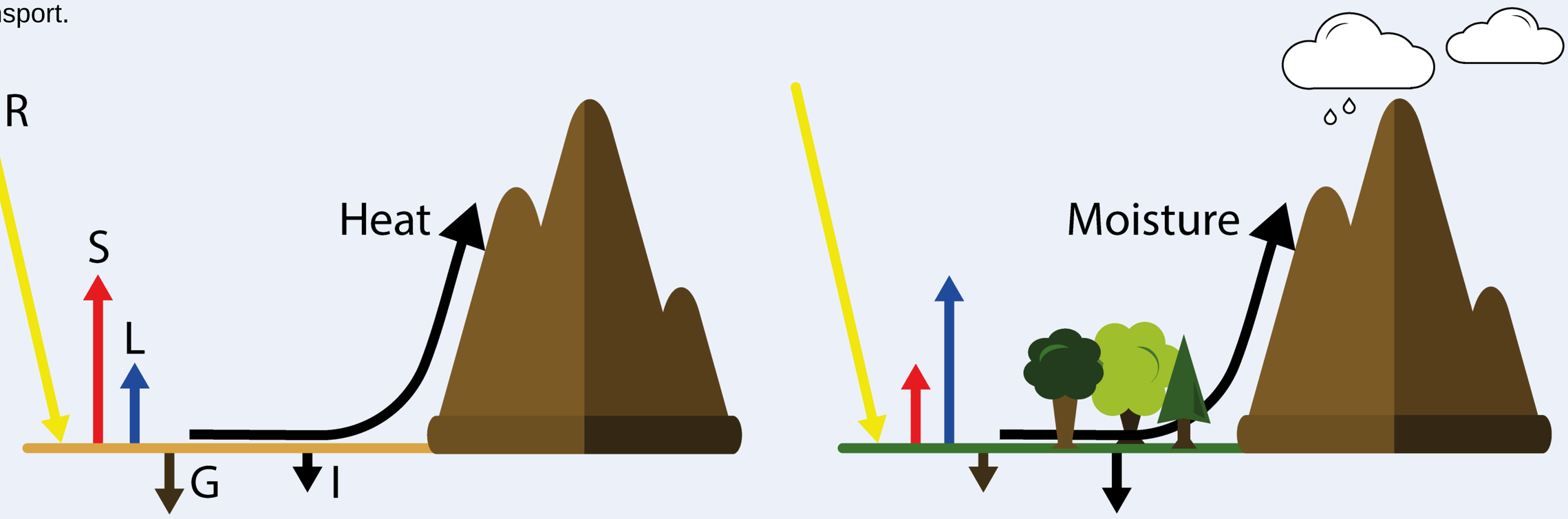


Figure 1. Graphical abstract: Vegetation restoration changes the energy balance the latent heat flux (L) is enhanced and the sensible heat flux (S) is reduced which minimizes the advection of heat and improves the advection of moisture, possibly resulting in fresh water. Also, vegetation enhances Infiltration (I) of water into the soil which allows for an increase in evaporation. R: incoming radiation, G: ground flux. (Icon made by Freepik from www.flaticon.com)

J.J.E. Theeuwen MSc, dr. O.A. Tuinenburg,
dr. ir. H.V.M. Hamelers, prof. dr. S.C. Dekker

Universiteit Utrecht
Copernicus Institute of Sustainable Development