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Hydrochory as a means for Mediterranean vineyards revegetation

Martin Faucher, Fabrice Vinatier, Jean-Stéphane Bailly

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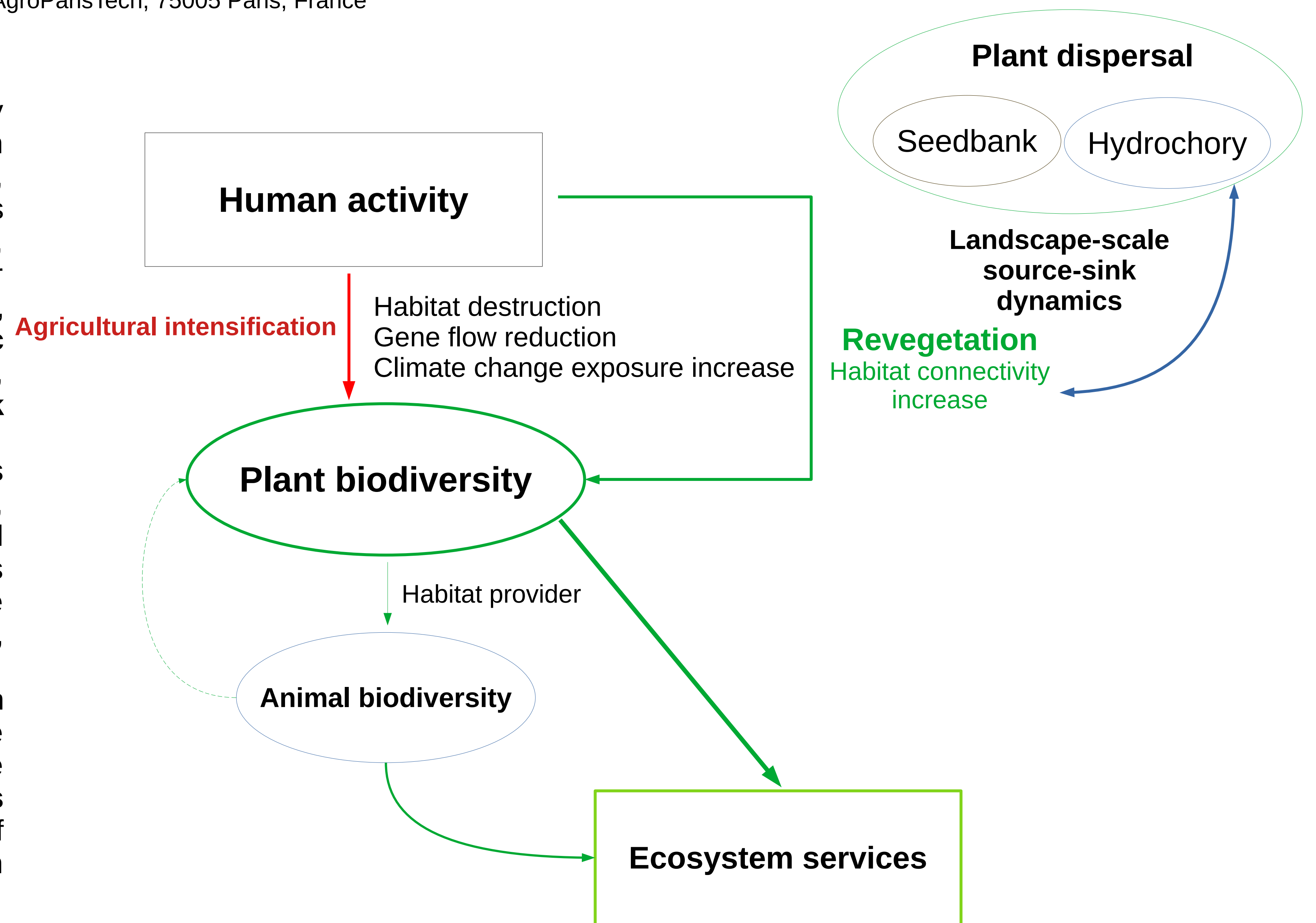
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Context

Due to the consequences of human activities, maintaining biodiversity has recently become a major concern, especially among western countries. Maintaining biodiversity means protecting natural habitats, but also **facilitating biodiversity circulation** since human activities impede biodiversity circulation in fragmented habitats (Foley et al., 2005; Newbold et al., 2015). Habitat restoration is one of the major responses put forward to **mitigate the ongoing biodiversity crisis**, but is also presented as a means to **alleviate the growing climatic stresses** caused by climate change. Concerning plant communities, restoration can be achieved through two mediums : **soil seedbank and seed dispersal**.

Agroecosystems are interesting zones for restoration projects because they represent an major land use which grows every year, and because they are often surrounding or in contact to natural habitats. Increasing the biodiversity inside agroecosystems has recently gained interest thanks to the growing literature describing the ecosystem services it can provide (Petit et al., 2010; Wezel et al., 2014 ; Gaba et al., 2017 ; Garcia et al., 2018).

By studying seedbank dynamics and **seed dispersal by water** in vineyards located in the south of France, we aim to assess the potential benefits of keeping the inter-rows vegetated around the year, and to this extent we want to **characterize plant communities inside and outside our vineyards**, as well as build a frame of reference concerning biodiversity circulation inside and between Mediterranean vineyards.



Can plant dispersal and different management practices achieve non-cultivated surfaces' revegetation in a viticulture context ?

Materials & methods**Study site**

The study will take place in a vineyard located near Montpellier, south of France (43.659903, 3.767451, Fig. 1). **Warm and dry climate with intense episodic rainfalls** occurring sparsely during the year. The exact study site is part of a 2 ha vineyard. We selected **6 inter-rows grouped by adjacent pairs**, with one vegetated inter-row and the other left bare.

Slopes are over 20 meters long and their maximums vary between 10 and 15%. Slopes are oriented in the same direction as the inter-rows and are perpendicular to a nearby ditch.

Study design

Marked seeds will be placed on the ground 5 meters upstream from the end of the inter-rows at the start of an intense rainfall episode with a high probability of strong runoff or as soon as runoff is observed. In each inter-row, **5000 marked seeds** from 3 different species will be disposed. Seeds dispersal will be followed using UV lights and seed count will be surveyed at regular intervals between the starting points and the end of the inter-rows. Climate permitting, we will reproduce the experiment at least two times, the first time taking place during the first rainfall generating runoff, on a unaffected soil surface, and the second time when gullies are fully formed.

Seed marking

3 species were selected in order to represent main seeds' morphologies of species found in Mediterranean vineyards : **small round seeds** (poppy), **seeds with pappus** (*Bothriochloa barbinodis*), and **seeds with spikes/hooks** (wild carrot). Seeds were marked using **UV-light reflecting powders** of different colors (Fig. 2). During our experiments, only 2 different colors will be used to separate seeds put into vegetated inter-rows from the seeds put into the adjacent bare soil inter-row.

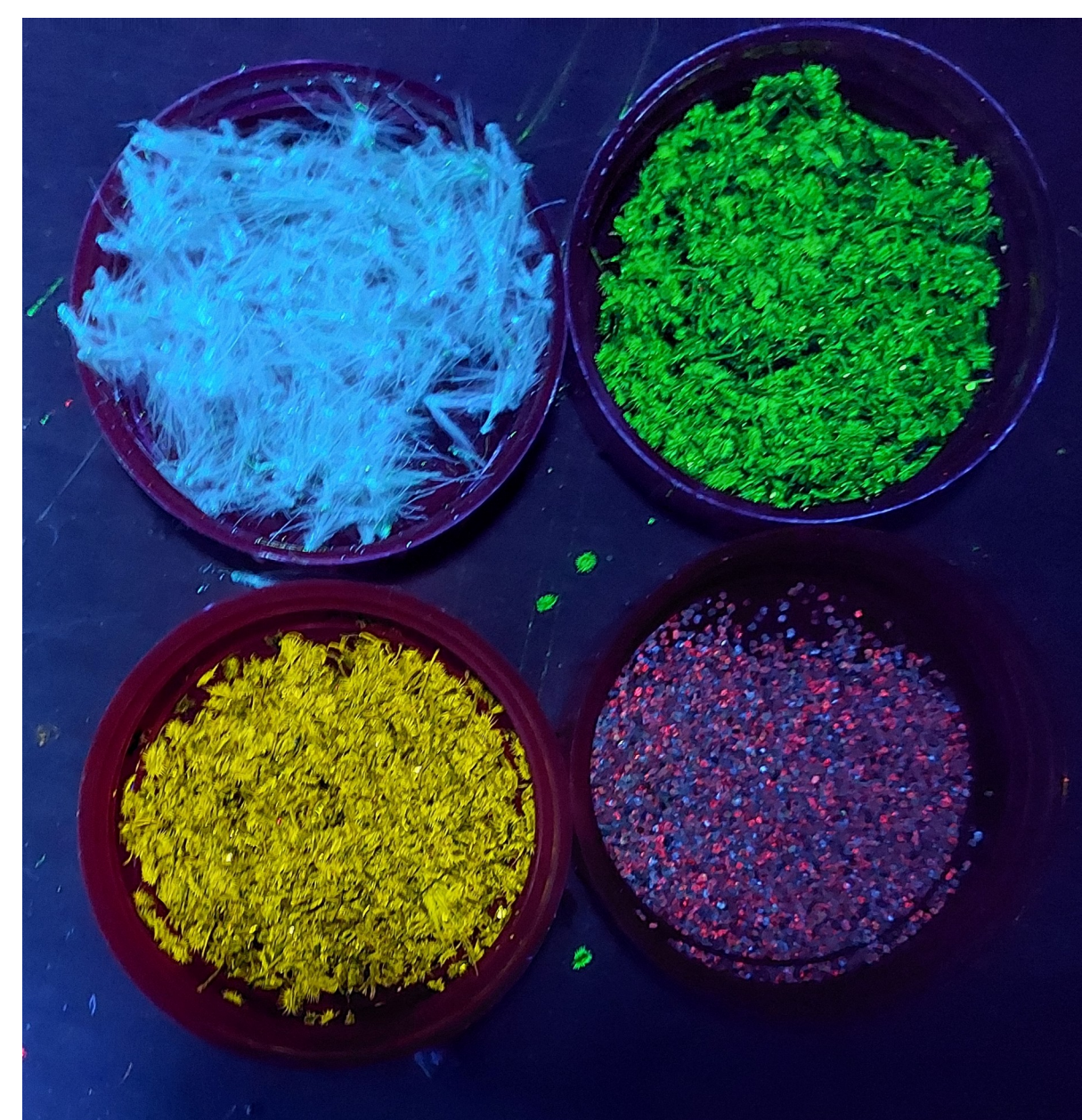


Figure 2 Marked seeds under a UV light

Experimental setup

Wooden weirs with plastic structures designed to redirect incoming runoff were installed at the bottom of the inter-rows (Fig. 3). Nets were placed before and after the weirs to trap seeds and sediments to facilitate *a posteriori* runoff description (number of seeds, sediment fraction, particle size distribution). Water level sensors will be installed next to each weir and set up to record every 10 seconds. A pluviometer will also be installed to measure rainfall intensity.

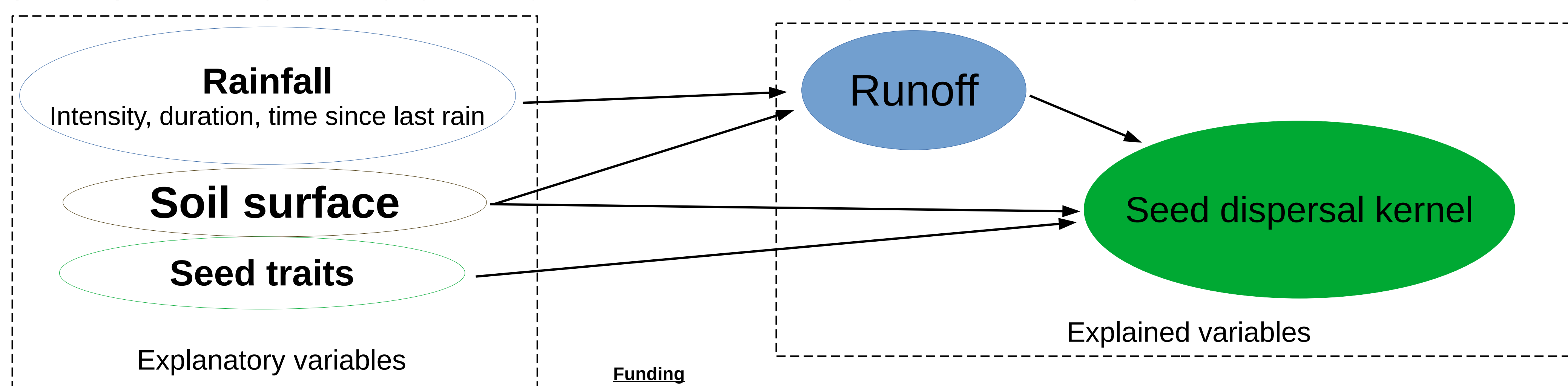


Figure 3 DEM of our study site and experimental setup at the bottom of our inter-rows

(Expected) results

We hope to obtain data on **runoff characteristics** linked to rainfall (intensity, duration, days since last rain, ...), soil surface and slope, as well as informations regarding **seeds dispersal capacity** in regards to their morphology and the aforementioned data. Collected data will be primarily used to **produce estimations of dispersal distances distribution** depending on remarkable seeds traits (i.e. small, round, presence/absence of appendices, shape of appendices, ...) and to **describe runoff and erosion events in Mediterranean vineyards**.

The conclusions of the study will be of further use in the development of a modeling approach to be implemented in a plurispesific vegetation growth model in order to simulate a spatially explicit dispersal of vegetation by hydrochory inside a network of vineyards interconnected by ditches.



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