



Graminhais Plateau

Tarso Costa, Yasmin Redolosis, Rui Botelho,
Azucena de la Cruz, Diana Fernandes, Pedro Teiga,
Philip Meier, Charlotte Seckler

Organisation responsible for the site:

Portuguese Society for the Study of Birds (SPEA)

Country: Portugal

Region: Azores (São Miguel Island)

Type of Sponge territory: Peatland

Geographic coordinates of the site centroid point:

37.8028466 N, -25.2411007 E

The Graminhais Plateau, with a highest point at 947 m, is home to the largest area of peatlands on São Miguel Island, covering more than 100 hectares. Included in the Pico da Vara/Ribeira do Guilherme Special Protection Area (part of the Natura 2000 network) and the São Miguel Island Natural Park, the peatlands of the Graminhais Plateau can be considered a unique habitat at a national level, due to their importance in terms of biodiversity as natural water reservoirs and a pioneer area in restoration actions.

In the past, the peatlands experienced significant degradation due to their use as grazing land and the introduction of invasive species. The main effects of these impacts were the alteration of the water dynamics of this ecosystem, affecting its water retention capacity, and the loss of native biodiversity. As a result, downstream cities experienced severe floods.

Thanks to the implementation of the projects LIFE Laurissilva Sustentável (LIFE07 NAT/P/000630) and LIFE IP Azores Natura (LIFE17 IPE/PT/00010),



restoration work has been carried out, and long-term monitoring has been established. At present, the knowledge gained through these efforts is being shared and further developed within the SpongeBoost project.

It also constitutes the first formally identified restoration area in the Azores and has been presented at both international and national conferences regarding the restoration work carried out.



SpongeBoost receives funding from the European Union's Horizon Europe research and innovation programme under grant agreement No.101112906.

Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the EU nor CINEA can be held responsible for them.

Site characteristics

Climate

- 🌿 The main source of water in the Graminhais Plateau is rainfall and fog.
- 🌿 During August, rainfall decreases in this area, but this is not a critical change.
- 🌿 The average annual rainfall in 2024 is about 175 mm (ranging from 97 to 249 mm).
- 🌿 The weather is characterised by the occurrence of extreme events (storms and hurricanes) with strong winds and high precipitation, especially in winter.

Soil

- 🌿 Volcanic soils (Andosols) formed from volcanic ash, pumice, and basaltic materials.

Hydrology

- 🌿 The Graminhais Plateau is located in a hydrographic basin where the Achada stream originates.
- 🌿 The peatland has a high-water retention capacity, and the water level in this area (as well as the flow of the Achada stream) is strongly related to rainfall.

Key endemic species in the Graminhais Plateau



Juniperus brevifolia, Photo: SPEA Azores



Vaccinium cylindraceum, Photo: SPEA Azores



Sphagnum sp., Photo: SPEA Azores

Exotic species that pose a threat to this habitat are *Gunnera tinctoria*, *Dicksonia antarctica*, *Cyathea cooperi*, *Clethra arborea*, *Hedychium gardnerianum* and *Rubus* sp.



Gunnera tinctoria, Photo: SPEA Azores



Dicksonia antarctica, Photo: SPEA Azores

RESTORATION EFFORTS

Restoration program

Invasive Alien Species (IAS) control in the peatland is ongoing and will be implemented until 2026. Logging of *Cryptomeria japonica* in the Achada River margins is planned until the end of 2025. After these interventions, NbS will be applied, followed by the planting of native species. Additionally, NbS will be applied in the peatland to be restored (2026) in order to promote water retention.

Conservation program

This area is included in two Natura 2000 sites: The Special Protection Area (SPA) of Pico da Vara/Ribeira do Guilherme (established under the Birds Directive to maintain or restore the conservation status of certain species of wild birds and their habitats) and the Special Protection Area (SPA) of Serra da Tronqueira/Planalto dos Graminhais (established under the Habitats Directive to contribute to ensuring biodiversity).

As part of the LIFE Laurissilva Sustentável project (2009–2013), this area was targeted for ecological restoration of peat bogs. Livestock was removed through the termination of grazing leases on these public lands managed by the Regional Government of the Azores.

Economic investment

The actions undertaken were carried out by SPEA in partnership with the Government of the Azores. A total of 418,269 thousand euros was spent on the restoration of 75 hectares of peat bogs in the Graminhais Plateau under the LIFE Laurissilva Sustentável project. The planned actions described above in the Graminhais Plateau cover an area of 4 hectares, inserted in the larger area previously intervened.

SPONGEBOOST'S ROLE

The specific objectives for the Graminhais Plateau case study area are:

1. Describe the hydric dynamics of the area and highlight the importance of the peat bog in water retention.
2. Compare data collected before and after ecological restoration in this area to assess the effects of the actions on hydric dynamics.

Monitoring program

February 2024

Four stations were installed measuring water level in the peatbog, rainfall, soil surface temperature and flow in the Achada River. The hydrological monitoring in the study area collected data hourly. Calibration activities were performed under both dry and wet conditions to ensure the accuracy of the recorded data.

May 2025

Preparatory actions for implementing field restoration measures began. One of the ongoing initiatives is the development of an experiment in the SPEA native plant nurseries, which aims to promote rooting of cuttings from native Azorean species using indole-3-butyric acid (IBA). The goal was to evaluate their combined use with NbS to help restore the basin's sponge effect.

June 2025

A **drone** equipped with a **LiDAR sensor** was used to survey the terrain. The collected data were processed in a Geographic Information System (GIS) environment to produce a digital elevation model and perform exploratory analyses. This information has been instrumental in supporting hydrological modelling and developing the operational plan for ecological restoration.



Polytrichum commune, Photo: SPEA Azores

A **biodiversity survey** was conducted in the study area, focusing on vegetation cover and nocturnal insect presence, with a focus on the Lepidoptera order. This baseline data will be used to assess the future impact of the implemented restoration measures on these ecological indicators.

Technical teams from SPEA and ERio carried out **field visits** to assess the natural engineering techniques to be applied and to define the monitoring plan for evaluating the sponge effect restoration measures in Graminhais.

From August 2025: SPEA's operational team conducted field interventions with the removal of *Cryptomeria japonica* along 1 hectare of the stream margins.

Interpretation and analysis

The area's hydrological dynamics are being analysed as part of Charlotte Seckler's Master's thesis at [RWTH Aachen University](#), using data collected from the installed monitoring stations (using HEC-HMS model).



Photo: SPEA Azores

	Technique
 Rainfall	1 hour and 10 minutes on selected rainfall; Rain gauge, data in mm
 Soil temperature	1 hour and 10 minutes on selected rainfall; Temperature sensor, data in Celsius degrees
 Water flow	10 minutes; Flow meter with Doppler system
 Vegetation cover	Once a year; Taxonomic identification in multiple plots
 Surface elevation	Once a year; Drone flights and modelling

