AQUARESilience
Cascading Failures in Water Systems

GENESIS–Gran Canaria platform for cascading-failure simulation in water–energy systems

GENESIS Project — HORIZON-MISS-2023-CLIMA-01-02 (Ref. 101157447)

Horizon Europe Framework Programme – European Union

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Universidad de La Laguna, March 2026

This document is a public summary prepared for DOI dissemination, excluding information of a security sensitive nature. It presents the platform scope, methodology, and aggregated results, while omitting asset-level operational detail for security reasons. Sensitive asset-level and operational details (including exact locations, facility-specific capacities, interdependency mappings at asset level, and parameters that could enable misuse) have been removed or generalized for critical infrastructure security reasons.

Disclaimer: Cascading Failure Simulation Platform (GENESIS Project)

This simulation platform has been developed within the framework of the European project GENESIS as a decision-support tool intended to explore vulnerability and resilience patterns in interdependent critical infrastructure systems, particularly in island environments.

Access to the platform is restricted to authorized public entities operating under a formal cooperation agreement with the University of La Laguna. It is not designed for open public release, commercial exploitation, or redistribution outside the scope of such institutional arrangements.

The outputs generated by the simulation engine are exploratory representations of scenario-based interactions between infrastructure systems. They do not constitute deterministic forecasts, official risk assessments, engineering certifications, regulatory determinations, or legally binding planning instruments. They should not be interpreted as operational instructions.

The modelling framework relies on network-structure assumptions, interdependency matrices, and datasets available at the time of development. As with any system-level model, results are conditioned by data quality, completeness, updating frequency, and by the parameters selected for each scenario. Uncertainties are inherent and may affect outcome sensitivity.

This platform does not replace the technical analyses, statutory procedures, or formal risk assessments required under applicable legislation concerning civil protection, infrastructure safety, land-use planning, emergency management, or public-service regulation.

Users are responsible for verifying the adequacy and contextual applicability of the input data used in each simulation and for independently assessing the relevance of the results within their institutional and regulatory framework.

Any operational, administrative, strategic, or policy decision informed by this platform must be evaluated and validated by the competent authorities in accordance with their own technical criteria and legal obligations.

The developers, researchers, and participating institutions assume no liability for decisions derived from, informed by, or based upon the outputs produced by this simulation tool.

Contents

1. The GENESIS project

GENESIS (Geologically Enhanced NaturE-based Solutions for climate change resiliency of critical water InfraStructure) is an EU-funded Horizon Europe project focused on making critical water infrastructure more climate-resilient in island territories, especially in Macaronesia, where groundwater is the main freshwater source and is highly exposed to climate stress.

What makes GENESIS distinctive is the mix of Macaronesian, geology-informed nature-based solutions, such as dry galleries and underground dyke-impounded dam systems, combined with more "standard" NbS like rainwater harvesting and wetland restoration. The idea is to create synergies and test what really works under non-linear, island constraints.

At its current stage (TRL ~7), GENESIS operates as a demonstration framework across several Macaronesian islands, with multiple pilots including La Palma, El Hierro, and Gran Canaria, and it aims to deliver a deep demonstrator in La Palma, with a long-term goal of producing approaches that can be replicated in other islands and vulnerable mainland areas.

GENESIS is not limited to abstract NbS concepts. It focuses on the capture, storage and protection of freshwater from different sources, the improvement of use and reuse efficiency, and the strengthening of system resilience to drought, flooding and wildfire. These objectives are pursued through technically grounded measures in island hydrogeology and are evaluated under real operating conditions.

Link to the project: https://genesisnbs.eu/

2. Executive summary

This report describes the GENESIS Platform for Gran Canaria (Canary Islands, Spain), a cascading failure simulation tool designed to simulate impacts induced by natural processes on the island's hydraulic systems and critical infrastructure. Developed within the EU-funded Horizon Europe project GENESIS, the platform models the interdependencies between different essential services, such as water supply, energy, transport, education, healthcare and communications. In doing so, it enables to evaluate how a localised disturbance may propagate across the island-wide network.

Gran Canaria is the second most populated island of the Canary Islands (875,589 inhabitants) (INE, 2025) and one of Spain's most popular tourist destinations, with 4.7 million visitors in 2024 (Turismo de Gran Canaria, 2025). The island has limited freshwater, which has led to a diversification of the water supply system to meet demand: 53% comes from seawater desalination (88.1 hm^3/year from 46 plants), 33% from historically overexploited groundwater, 7.5% from reclaimed water and 6.5% from island reservoirs (CIAGC, 2023). This results in a structural energy dependency, as the production of desalinated water accounts for 10% of the island's electricity consumption (Santamarta & Cruz-Pérez, 2025).

The model includes 6,115 nodes corresponding to 36 categories of critical services. It represents interdependencies between water supply, energy generation and distribution, transport infrastructure, telecommunications, and essential public services. Regarding the energy generation, the island operates with the following energy mix: 74% comes from diesel and 26% from renewable energy (17.5% wind and 8.5% solar) (Santamarta et al., 2026; REE, 2025).

To demonstrate the platform's functionality, two scenarios are presented: a coastal flood in the island's capital, Las Palmas de Gran Canaria, under the 2100 climate projection; and island-wide forest fires comparing the effects under the 2050 and 2100 climate projections. The design of different scenarios allows the assessment of cascading effects that could potentially affect infrastructure integrity and service continuity. They also offer indicative estimates of impacts on different population groups, the availability of the workforce due to school closures, and the agricultural areas affected by interruptions to irrigation supply.

Main findings

1. **The island's main vulnerability lies in its reliance on energy for desalination.** 53% of the total water supply (88 hm^3/year) is produced by 46 desalination plants (SWDP), organised into 17 complexes. These include both coastal seawater reverse osmosis facilities and brackish water desalination plants, which remain exposed to marine flooding and storms. Collectively, they account for approximately 10% of the island's electricity consumption (CIAGC, 2023; 2026).

2. **Historical aquifer overexploitation is effectively irreversible on human timescales.** Over half of the island's groundwater (2,125 hm^3) have already been depleted (Custodio, 2020). Natural recovery would require decades, if not a century, even in the event of a complete cessation of groundwater extraction.

3. **Gran Canaria has the highest density of large dams in the world.** The island has over 69 dams (approximately one each 25 km^2). Despite this, as of September 2025, the total stored volume was only 4.21% of its total capacity, concentrated in two reservoirs: El Mulato and La Gambuesa (CIAGC, 2025)

4. **Seawater intrusion threatens three coastal fronts.** The north (Guía-Gáldar), east (Telde), and south-east (Vecindario-Juan Grande) coastal fronts are threatened by seawater intrusion. The chloride concentrations range from 700 to 1,500 mg/L, and there's a potential inland advance up to 200 meters over the next 20 years (Custodio, 2020; Santamarta et al., 2014).

5. **Climate change acts as a cascade amplifier**. Comparisons of the impacts of forest fires for the 2050 and 2100 climate projections reveal significant differences because of the cumulative effect of temperature and wind alerts.

6. **It is important to explore alternatives for energy-water resilience.** There are projects currently addressing this objective, such as the Chira Soria project. This initiative features a reversible hydroelectric system that will provide 200 MW of regulation capacity, functioning as a 'battery' for the island's electrical system (CIAGC, 2023).

3. Introduction

A brand-new high-performance simulation engine modelling the cascading failure of critical infrastructure services has been developed from the ground up using a new proprietary algorithm by the contractor "*Ramparts & Light limited*" in the Rust programming language (a new language known for its safety and performance, as it reduces loading times and consequently improves user experience) and applied to three complete case studies (Canary Islands of El Hierro, La Palma and Gran Canaria).

The proprietary cascading failure engine uses complexity science coupled with network science, as well as principles akin to economics and disease propagation modelling to introduce a co-dependency between population and critical services, where the nodes represent infrastructures whose disruption could propagate through interdependencies, potentially triggering cascading failures across connected sectors.

Specific and relevant demography and employment data are applied for each smallest electoral district in order to obtain sufficient granularity when capturing the feedback loop between critical service disruptions and population e.g. when a disruption to critical services impacts the population and workforce availability, that in turn impact critical services again. The introduction of a co-dependency between population and critical services is extremely important for the accuracy of the model because demography can amplify or absorb disruptions to critical services up to a considerable degree. One common example is how one particular industry can be disproportionally impacted if most of its workforce is composed of working parents of young children – in that case, closure of primary schools will have a significant impact on productivity in that sector.

Simulated results display the state of critical services as well as the impact on the population at a generic level down to the smallest electoral statistical area level (akin to a neighbourhood size wise). This level of precision allows not only to think in terms of emergency reactive planning, but also in terms of pre-emptive strategic thinking.

Some defining exploratory features of the simulation engine are the ability to simulate what would happen if certain critical nodes were shielded from a specific type of damage (i.e. if a node is protected from flood damage), what would happen if some critical nodes were undisturbed by disruption to some input services (e.g. a backup generator will make the node impervious to a decrease in power input service), and what would happen if some infrastructure node could be switched from providing one type of service to providing another, effectively changing the topology of the interconnected networks to manipulate the resilience of the system as a whole. Another notable feature is the possibility to introduce additional layers of factors impacting critical services interdependencies e.g. adding hydrology areas where reservoirs depend more on a certain type of input source than another.

Finally, from the disruption to critical services, additional impacts derived from GENESIS climate scenarios can be calculated e.g. how an increase in the predicted number of high temperatures and extreme wind alerts can increase expected damages from forest fires to crops for example. For more detailed information on the GENESIS Climate Projections, refer to Reyes Parrilla (2025).

Models capturing the interdependencies between critical infrastructure services were created and tailored for each one of the three islands. These models show significant differences regarding the way critical infrastructure services relate to water and energy between El Hierro, La Palma, and Gran Canaria.

The presented work is not just an evolutionary but a qualitative step up from exploratory proof of concepts of cascading failure engines developed within other HORIZON projects such as ARSINOE and NATALIE in the sense that the new proprietary simulation engine can deliver comparable results a hundred to a thousand times faster, with fundamentally new groundbreaking features such as real-time GIS based network topology reconstruction when switching critical node roles. The implications are that:

(i) It is possible to prepare for disruption, and improve resilience in advance by prioritising limited resources to identify and protect critical assets;

(ii) It enables the identification of what type of input service vulnerabilities can be protected by which appropriate backups;

(iii) It facilitates the identification of critical infrastructure nodes that can switch roles to create an adaptable resilient network akin to the human brain (where plasticity allows other neurons to take over the function of a damaged neuron to keep the overall system able to perform critical tasks).

In this work, the critical infrastructure services are exposed to different types of disruptions. The RIESGOMAP project ("Prevention of Natural and Technological Risks in Territorial and Urban Planning - RIESGOMAP", 2013) belonging to the Madeira-Azores-Canarias Transnational Cooperation Program is used to provide six different types of disruptions: volcanic eruptions, earthquakes, forest fires, landslides, coastal floods, and fluvial floods.

Work developed in GENESIS adds a climate-based modifier to these baseline disruptions, using the projected number of alerts per year (+1% damage per alert). This modifier is applied for three future periods: 2050, 2075 and 2100; which represent near-, mid- and long-term climate conditions relative to the present baseline.

(i) For forest fires, the damage is increased by 1% for each wind alert and each high temperature alert that impacts a critical infrastructure node. E.g. if you have a node that would normally have a health of 50% after disruption in a normal RIESGOMAP scenario, you will subtract 1% x 10 wind alerts and 1% x 5 high temp alerts, which amounts to subtracting in total 15% to the integrity of the node.

(ii) For landslides, the damage is increased by 1% for each precipitation alert.

(iii) For coastal floods, the damage is increased by 1% for each storm alert, wind alert (wind has a significant role in these), and coastal alert.

(iv) For pluvial floods, the damage is increased by 1% for each precipitation alert, and storm alert.

Users can apply these scenarios to a chosen area or several of them and see the consequences on critical infrastructure services in general, look at the impact on services per area on the map, check workforce availability for the area, examine impact on the population, and see the state of different crops after disruption. Details on the nodes used for each island, the hazards encountered, and the resulting cascading failures are provided below.

4. Cascading-failure platform: operational definition

A cascading-failure simulation platform can be described as a computational framework used to represent interdependencies between critical infrastructure systems. Its purpose is to examine how an initial disturbance may propagate across connected services and generate indirect impacts beyond the directly affected assets. In Gran Canaria, this approach is especially relevant given the scale of the system (875,000 inhabitants, 4.7 million tourists (INE, 2025; Turismo de Gran Canaria, 2025)) and the concentration of desalination infrastructure along the Las Palmas coastal front.

What it simulates and what it does NOT simulate

The platform simulates:

(i) the topology of the critical infrastructure network (6,115 nodes, 36 service types);

(ii) functional dependencies between interconnected systems (water, energy, transport, telecommunications);

(iii) temporal propagation of service degradation;

(iv) progressive reduction of functional integrity under defined hazard scenarios.

The platform does not simulate:

(i) detailed hydraulic behaviour of reservoirs and pipelines;
(ii) price dynamics;
(iii) real-time human decisions;
(iv) physical evolution of hazards.

Minimum input components

(i) **Geospatial inventory of critical infrastructure and service assets:** location, function and operational capacity (e.g., groundwater abstractions for drinking water and irrigation, desalination plants, transmission pipelines, pumping stations, storage tanks and reservoirs, energy generation and distribution nodes, transport facilities and essential service nodes).

(ii) **Interdependency matrix:** defining functional dependencies between infrastructure and service sectors, with energy-source weighting included as a system parameter (for Gran Canaria: diesel 0.74, wind 0.175, solar 0.085).

(iii) **Spatial hazard or disruption layers:** used to define scenario-based initial disturbances.

(iv) **Failure propagation logic:** based on service-dependency thresholds, where node functionality degrades or fails when required input services fall below defined operational levels.

Model output metrics

These indicators are derived from demographic and socioeconomic datasets integrated into the modelling framework and should be interpreted as indicative system-level estimates.

(i) **Global system integrity:** normalized aggregate service functionality (%).

(ii) **Category-level integrity:** functionality percentage relative to maximum capacity within each infrastructure or service category.

(iii) **Workforce availability by industry:** sectoral reduction in workforce participation due to school closures, based on affected parents, differentiating single-parent and two-parent households.

(iv) **Population impact by service type:** number and percentage of people experiencing 10–50% and >50% functionality loss for each essential service, disaggregated for total population, vulnerable groups (aged <5 and >85) and economically deprived groups (income below defined threshold).

(v) **Agricultural integrity by crop type:** cultivated area (descriptive attribute), starting integrity (direct hazard impact) and integrity after cascading failure (reflecting irrigation service disruption).

Assumptions and uncertainty

The platform is intended for exploratory, scenario-based analysis. Results depend on modelling assumptions and on the quality and completeness of the available datasets. For that reason, outputs should be interpreted as system level representations of potential cascading dynamics, not as precise forecasts of specific outcomes. Principal assumptions and sources of uncertainty include:

(i) **Availability of backup power at pumping stations.** The model presumes that diesel backup generators are both present and operational. In practice, their effectiveness depends on site physical accessibility, equipment condition, start-up reliability, fuel reserves, and the logistics of fuel supply during a disruption.

(ii) **Repair and restoration durations.** Recovery processes are simplified. In areas of steep terrain with limited alternative access, actual restoration times may exceed those assumed, particularly when road access is restricted or multiple assets fail simultaneously.

(iii) **Infrastructure condition and degradation.** The current cascading failure simulation does not explicitly account for asset age, corrosion, material fatigue, or deterioration associated with high-pressure segments in pipelines or coastal exposure. These factors can influence both failure probability and recovery duration.

(iv) **Simplified representation of the water system.** Several factors may affect the accuracy of this representation: the water infrastructure data available is less up to date than La Palma and El Hierro; reclaimed water is yet to be fully integrated into the cascading failure analysis; crop reliance on irrigation reservoirs is used as a proxy for the complete irrigation system; and private SWDP plants serving hotel complexes aren't included.

(v) **Hazard scenarios.** Hazard disturbance layers represent scenario impacts in a simplified form. They do not reproduce the physical progression of hazards or fine scale spatial variability, both of which can condition direct damage and site accessibility.

(vi) **Dependency thresholds and propagation rules.** Cascading dynamics development is determined by the adopted dependency configuration, threshold values, and criticality weighting. Alternative parameter settings can produce different propagation sequences; results are therefore sensitive to these modelling choices.

Where feasible, uncertainty should be reduced through progressive refinement of input data, including updated asset inventories, operating parameters, telemetry integration, and confirmed backup characteristics, together with targeted sensitivity analysis of influential variables.

5. Gran Canaria: socioeconomic profile and natural constraints

Gran Canaria, the third-largest island in the Canary Islands, covers approximately 1,560 km² (Figure 1). With a population exceeding 875,000 inhabitants, it is the second-most populous island, accounting for 40% of the archipelago's total population (INE, 2025). The island's economy is largely driven by coastal tourism, although agriculture continues to play a significant role in rural areas. In particular, cultivation of bananas, tomatoes and potatoes remains a key factor both in terms of land use and water demand (Santamarta & Cruz-Pérez, 2025) (Tables 1 and 2).

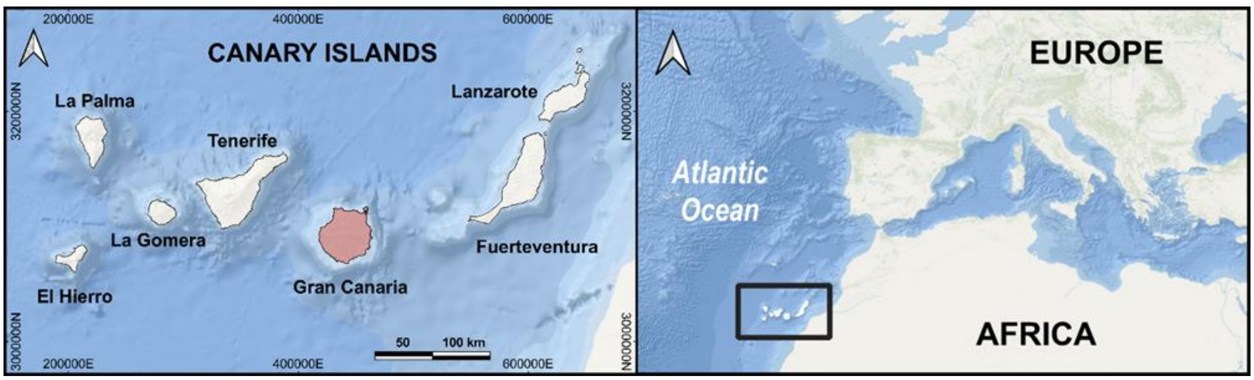

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Figure 1. Gran Canaria's location within the Canary archipelago and wider regional context.
Source: authors' elaboration (2026)

Table 1. Socioeconomic indicators for Gran Canaria. Latest available year shown per indicator; values are not intended to represent the same reference year.

Indicator	Value
Resident population (2025)	875,589
Island GDP (est. 2018)	17,300 M €
GDP per capita (est.)	≈ 20,000 €
Economic structure (2022)	Services 85%; industry 8%; construction 6%; primary 1%
Passenger arrivals (2024)	4.7 M visitors

Cultivated area (2023)	≈ 9,211 ha.
Main agricultural uses	Banana, tomato, vegetables, papaya, potato

Sources: Santamarta & Cruz-Pérez, 2025; ISTAC, 2024.

Table 2. Physical constraints of the water system

Variable	Value / Description
Geological age	≈ 14 Ma (shield stratovolcano)
Area	1,560 km^2
Maximum elevation	1,956 m a.s.l. (Morro de la Agujereada)
Mean annual precipitation	~ 300-520 mm (From 100–115 mm (southern coast) to 900–1,000 mm (north-west summit))
Horizontal rain[1]	Up to 180 mm/year between 600-1200 m a.s.l.
PET[2]	950–1350 mm/year
Effective recharge	Gross infiltration / potential recharge: ≈19% of precipitation (≈82 hm^3/year). Outside the humid ridge, effective recharge rarely exceeds 120-150 mm.
Water balance	65% evapotranspiration, 16% runoff, 19% infiltration
Calima (Saharan dust)	Frequent Saharan dust intrusions: this affects the hydrogeochemistry

Sources: Santamarta & Cruz-Pérez, 2025; Santamarta et al., 2026.

[1] **Horizontal rain (fog precipitation)** refers to water inputs generated when wind-driven fog or low clouds are intercepted by vegetation (canopy) or collectors; droplets coalesce on surfaces and drip to the ground, contributing to effective precipitation even when rainfall is low (Santamarta Cerezal & Seijas Bayón, 2010).

[2] **Potential evapotranspiration** (PET) refers to the amount of water that can evaporate and transpire from a plant-covered surface when it isn't subject to water stress, whether because of deficit or excess of moisture. It depends on the location, temperature, wind speed and humidity (Santamarta, 2013).

Operational implications

Gran Canaria presents an average groundwater exploitation index of 0.68, but with significant internal disparities: the ES70GC004 aquifer reaches an exploitation index of 0.9, whereas the aquifers in the north-west have an exploitation index below 0.4. The operational implications are (Santamarta & Cruz-Pérez, 2025):

- **Historical overexploitation:** Over half of the groundwater reserves (2,125 hm^3) have already been depleted, with piezometric declines of 0.3-0.7 m/year observed along the south-east and south-west coastal fronts.
- **Coastal salinization:** In coastal sectors, sustained pumping can induce a transition in groundwater composition from sodium-bicarbonate to sodium-chloride facies, indicating seawater intrusion.
- **Energy dependency:** Desalination accounts for approximately 10% of the island's electricity consumption, which makes the continuous electricity supply an operational necessity.
- **High nitrate concentration:** Groundwater shows a mean nitrate concentration of around 78 mg/L, with peaks exceeding 300 mg/L in areas under banana cultivation in greenhouses.
- **Reservoir storage at critically low levels:** As of September 2025, reservoirs had, out of their total capacity, only 4.21% stored; the current adaptation strategy includes increased use of reclaimed water.
- **Fragmented governance:** Water management is shared among multiple entities, such as municipalities, private operators, and the Island Water Council. This fragmentation limits the systematic integration of flow and piezometric data, as there is no fully unified control supported by telemetry systems.

6. Gran Canaria hydraulic system: structure and sources

Water sources

Gran Canaria's water supply system is highly diversified, reflecting a long history of adaptation to overexploitation (Custodio, 2016). The supply system is composed of seawater desalination plants (SWDP), groundwater, reclaimed water, and surface water (Table 3). Providing 53% of the total supply, seawater desalination is the main source. However, its operation depends on a continuous electricity supply. This dependence, combined with the plants' exposure to coastal hazards and marine conditions, generates vulnerabilities related both to energy security and coastal risks. Groundwater constitutes the second most important source, though its availability is constrained by low recharge rates and localised salinization of coastal aquifers (Santamarta & Hernández-Sánchez, 2007). Reclaimed water is a strategic reserve for the system, being the only source with potential for expansion without additional groundwater abstraction or increased desalination capacity. It also has an important role in agriculture, as does surface water, which remains a key resource for some regions. This is despite the fact that, even with a dense network of dams, surface water contributes only ~7% of the island's total water supply (CIAGC, 2023; Santamarta et al., 2026).

Table 3. Water sources in Gran Canaria (2019)

Resource	hm^3/year	%	Notes
Seawater desalination	88.1	53%	46 plants; key energy–water driver of the system. Account for approximately 10% of the island's electricity consumption.
Groundwater (wells, galleries)	54.7	33%	Water abstraction is taking place at increasing depths. Over 50% of the reserves have been depleted.
Reclaimed water	12.8	7.5%	10 WWTPs with tertiary treatment, used mainly for agriculture and golf courses. The main plant is the

			Barranco Seco WWTP, and produces around 700-800 m^3/h.
Surface water	11.0	6.5%	67–69 dams. Because of the highly irregular regime, reservoirs are at 4.21% capacity (September 2025).

Sources: Santamarta & Cruz-Pérez, 2025; CIAGC, 2023.

Consumption by sector

Table 4. Water consumption by sector (2019)

Sector	Demand (hm^3/year)	%	Source and notes
Agriculture + farming	71.1	42.5%	Traditional irrigation is declining, while localised irrigation methods are gaining ground.
Households + public services	61.1	36.5%	Water losses in the distribution network reach 16%, indicating moderate efficiency.
Tourism	16.9	10%	Hotel complexes can be supplied by private SWDP facilities; peak season creates spikes in water demand.
Recreational (golf, parks)	11.8	7%	Reclaimed water covers recreational use almost completely.
Industry, energy and other services	6.8	4%	Two thermal plants: Jinámar and Arinaga.

Sources: Santamarta & Cruz-Pérez, 2025; CIAGC, 2023.

Agriculture and farming are the sectors that demand water the most (42.5%). A disruption in irrigation could therefore have significant economic impacts on the island. Households and public services are the second largest consumers (36.5%), followed by tourism (10%). The lower share for tourism is because many hotels have their own private SWDPs. Recreational use accounts for 7% of the total water demand, while industries use 4%.

Desalination infrastructure

Gran Canaria has 46 desalination plants, although this number increases when private facilities are included. These are organised into "desalination complexes", which group installations managed by different entities. The first plant was installed in 1970 in Las Palmas, with a capacity of 18,000 m^3/day. The current combined capacity of all plants is 229,184 m^3/day, equivalent to approximately 84 hm^3/year (CIAGC, 2026).

For reference, desalinated water in 2006 was distributed as follows: urban supply 68% (48.6 hm^3), tourism 10% (10 hm^3), agriculture 10% (7.3 hm^3), and industry 7% (5 hm^3), with the remainder used for recreational purposes. These figures reflect the earliest available baseline and predate significant expansion of the desalination system; current distribution patterns may differ substantially (Santamarta & Cruz-Pérez, 2025; Santamarta et al., 2026).

Main groundwater abstraction points

Currently, there are 2,387 groundwater extraction points on the island, including conventional water galleries, simple wells, boreholes, springs and mixed structures (e.g., wells with bottom galleries, and wells combined with boreholes). The water body ES70GC009 – Medianías Norte, the second largest in Gran Canaria's hydrographic district, hosts 44% of the active abstraction points and accounts for 40% of the total groundwater extraction. Overextraction of the island's groundwater bodies has resulted in a reduction both in their quantitative and qualitative capacities (CIAGC, 2023).

Groundwater status

Quantitative status: The island-wide exploitation index is 0.68, with some aquifers like ES70GC004, reaching 0.9. Piezometric levels are also declining at a 0.3–0.7 m/year rate along the south-east and south-west coastal fronts. Of all the registered abstraction points, only 805 were in use in 2010, compared to 1,337 in 1997 (Custodio, 2020).

Qualitative status: Available hydrological planning information indicates that salinization is the dominant issue, with chloride concentrations ranging from 700 to 1,500 mg/L in coastal fronts. The models project that seawater intrusion could advance up to 200 m inland over 20 years if coastal pumping stations are not reduced. Nitrate concentrations average 78 mg/L, with peaks exceeding 300 mg/L in areas of intensive agriculture (Santamarta & Cruz-Pérez, 2025; Santamarta et al., 2026).

Surface water reservoirs

Gran Canaria has 69 large dams, approximately one every 25 km², the highest density worldwide. The majority (88.5%) are situated in the southern municipalities (Artenara, Tejeda, Mogán, San Bartolomé de Tirajana, Santa Lucía), with the remaining 11.5% located in the northern municipalities. The average dam height is 32 m, with a mean storage capacity of 1.3 hm³. The largest dam, Soria, reaches 120 m in height and has a capacity of 32 hm³, however, it has never overflowed nor exceeded 50% of its capacity (CIAGC, 2023; 2025).

As of September 2025, the total stored volume across the island was 4.21%, concentrated in the El Mulato and La Gambuesa reservoirs (CIAGC, 2025). Although dams contribute less than 10% of the island's annual water demand, they remain critical for agricultural supply in basins such as La Aldea, the operation of the reversible Chira-Soria hydroelectric project (200 MW) and for flood mitigation (Santamarta et al., 2026; CIAGC, 2025).

Reclaimed water

The main source of reclaimed water is the Barranco Seco WWTP, providing 700–800 m³/h, equivalent to 4.5 hm³/year of tertiary-treated water for irrigation. Reclaimed water is distributed to the eastern, southern, and northern areas, with additional contributions from the south-eastern WWTPs. There are also some localised isolated systems in Guía-Gáldar and Agaete. Reclaimed water represents a key component of climate resilience and has become a strategic resource following the prolonged drought (Santamarta et al., 2026; Cabildo de Gran Canaria, 2025).

Water conveyance and storage infrastructure

Gran Canaria's water is conveyed from groundwater abstraction points and seawater desalination plants to regulatory and distribution reservoirs, through a combination of pressurised pipelines and gravity-based sections (Figure 2).

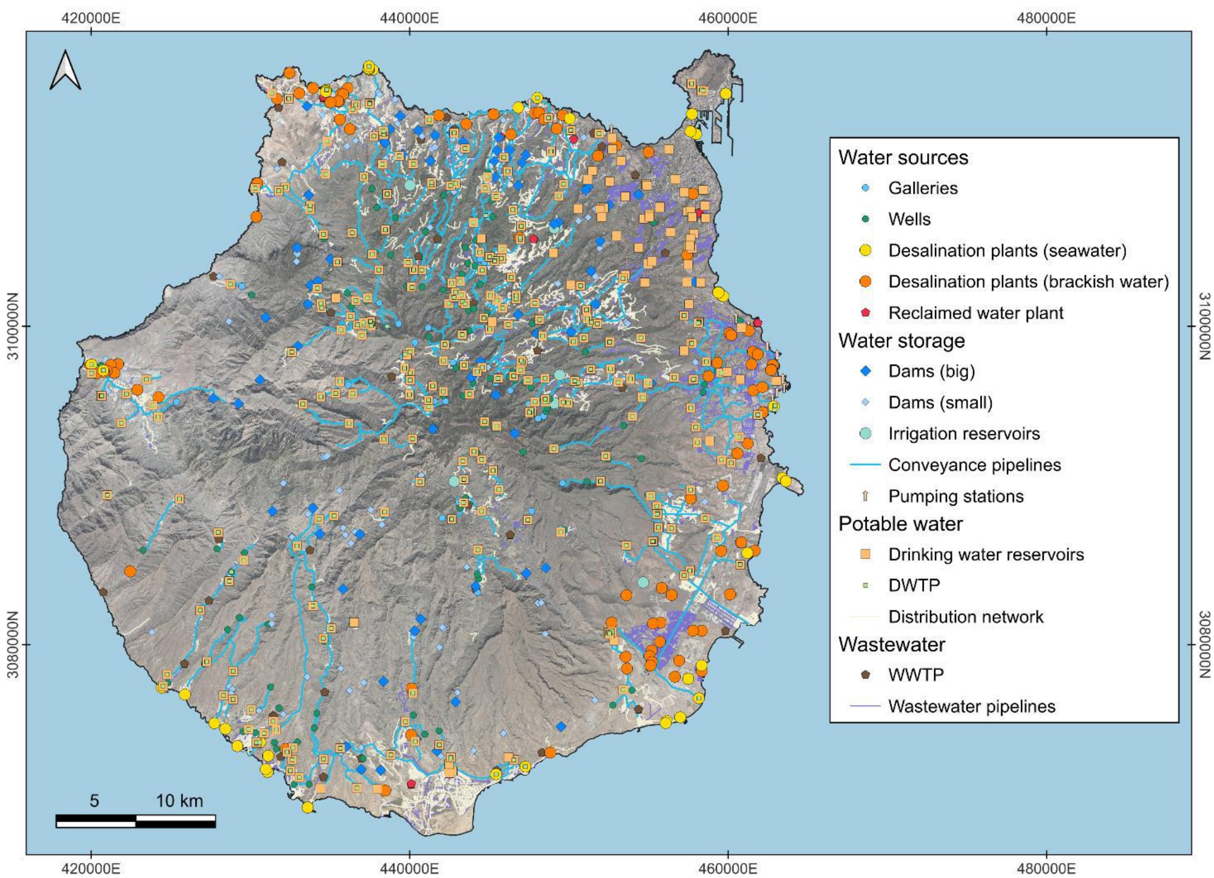

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Figure 2. Gran Canaria's water supply system and infrastructure.
Source: authors' elaboration based on data from CIAGC and IDECanarias (2026).

Storage infrastructure is dispersed, with areas such as the southern mid-elevations relying more on surface water than other areas (CIAGC, 2023).

7. GENESIS–Gran Canaria cascading-failure simulation platform

Factsheet: size and complexity

The model includes 6,115 nodes distributed across 36 categories of interdependent critical infrastructure services (Figure 3). The assessment of agricultural impacts considers approximately 111,750 fields. In this public summary, in which security sensitive information is not included, asset categories are described at a generalized level; site-specific identifiers and operational details are omitted.

The scope encompasses the principal systems that determine service continuity on the island:

- **Water system:** groundwater abstraction (water galleries, boreholes, wells, and combined systems), seawater desalination, brackish water desalination, water reservoirs, pumped and gravity conveyance, drinking-water storage and distribution, irrigation storage and distribution, and wastewater treatment.
- **Energy system:** electricity generation (diesel, wind, and solar), fuel storage and supply, and electricity distribution.
- **Transport and telecommunications:** key transport nodes and functional connectivity, together with radio/TV, broadband, and mobile network infrastructure.
- **Essential services:** health and emergency services, public administration functions, food supply, and primary/secondary education, represented as service categories rather than as operational guidance.
- **Agriculture:** agricultural areas classified by crop type, used to explore irrigation-related impacts under service disruption.

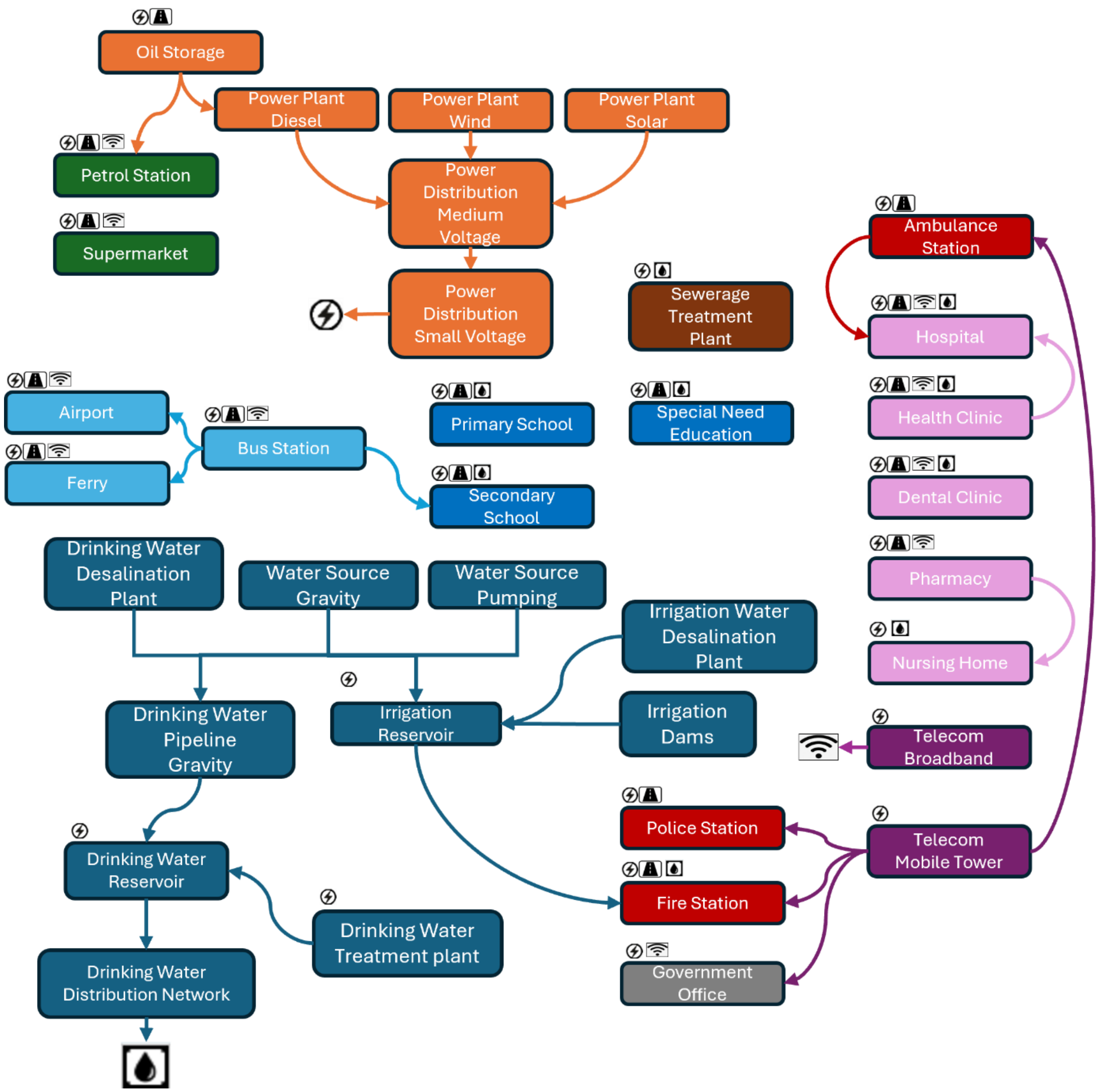

Figure 3. Simplified view of service dependencies between the 36 types of Critical Infrastructure nodes in Gran Canaria.

Criticality weights

Criticality weights are applied to indicate the degree of dependence of certain service categories on specific upstream inputs. In this model, weights were defined on the basis of reported production shares, the mapped dependency structure of the infrastructure inventory, and expert assessment. They represent modelling parameters intended for scenario analysis and can be adjusted as required.

- **Energy.** The weights assigned to the electricity distribution nodes reflect the island's generation mix: diesel 0.74, wind 0.175, and solar 0.085.
- **Water.** Water is modelled with a clear separation between drinking water and irrigation networks. Drinking water relies mainly on desalination plants and groundwater, while irrigation depends on irrigation reservoirs, as reclaimed water has not yet been fully integrated into the model.

These weights do not constitute audited operational fractions. They provide a practical way to explore how changes in dependencies influence cascading dynamics in the simulated scenarios.

Demonstrative simulated scenarios

Two scenarios are included to demonstrate how the platform behaves under different types of disturbance (Santamarta et al., 2026):

- **Coastal flood in Las Palmas under the 2100 GENESIS climate projection.** A coastal flood scenario in the city of Las Palmas de Gran Canaria, under the GENESIS 2100 climate projection. Results show that despite being a very localised coastal flood, the impact goes well beyond the main area that was directly damaged by the disruption.

- **Island-wide forest fires, comparing 2050 and 2100 GENESIS climate projections.** This experiment shows the consequences of island-wide forest fires and how different climate projections (2050 vs. 2100) can change the impact on critical infrastructure services significantly as damages due to fires are amplified by the number of high temperature alerts and wind alerts that increase from 2050 to 2100.

Use for prioritizing interventions

The platform is intended to support exploratory comparison of resilience options. In practice, it can be used to:

(i) highlight candidate high-centrality nodes and functions (e.g., major abstraction points, pumped conveyance corridors, and coastal seawater desalination);

(ii) test how targeted protection measures may change failure propagation pathways under different scenarios;

(iii) compare configurations with and without contingency measures, such as backup energy generation, backup water storage, or telecommunications redundancy;

(iv) support prioritisation discussions by using various criteria (for example, reduction in the exposed vulnerable population and reduction of agricultural area affected by irrigation disruption), rather than relying on a single metric.

8. Cascading failure examples in Gran Canaria

Experiment 1: Coastal flood in Las Palmas de Gran Canaria with the GENESIS climate projection for 2100

This experiment shows the consequences of a coastal flood in the capital of Gran Canaria, using the 2100 GENESIS climate projection. Critical infrastructure services are impacted as shown in the results displayed by the visualisation part of the simulation engine. Figure 4 shows the integrity scores for each critical service (these percentage scores represent the sum of all services produced by all nodes per category over their maximum possible combined output). Figure 5 shows an estimation of the number of parents impacted by the loss of primary schools and secondary schools' services. Figure 6 shows an estimation of the number of people facing a critical service loss where these services are impacted by 10-50% services loss, and above 50%. Figure 7 shows an estimation of how workforce availability per type of industry is impacted by the fact that services such as primary schools and secondary schools are closed, preventing some parents from going to work. Figure 8 shows how crops are affected by the coastal flood.

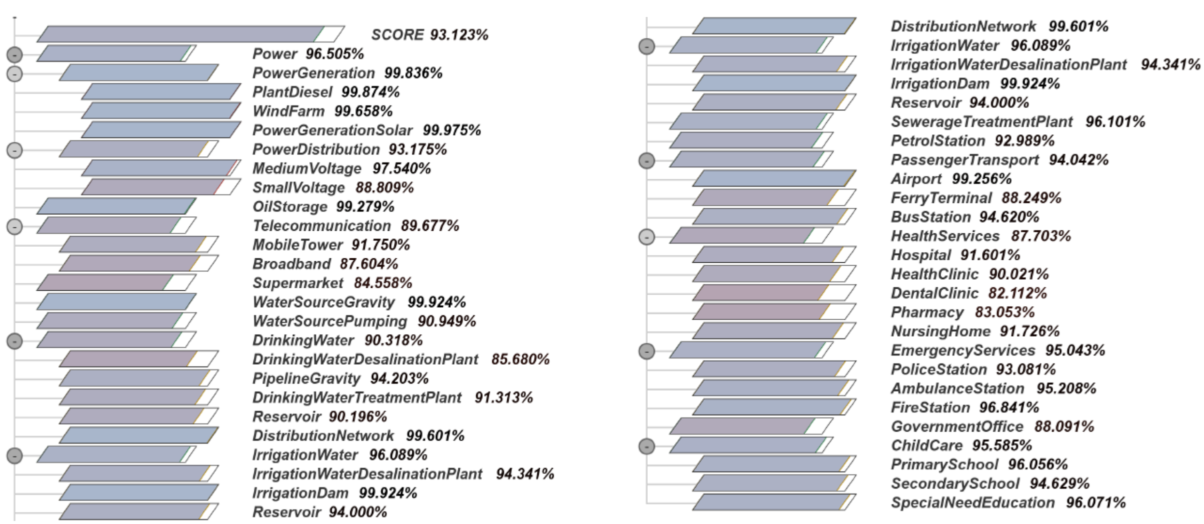

Figure 4. Simulated effects of a coastal flood on critical infrastructure services in Gran Canaria.

Service	Parents Facing 10-50% Service Loss	Parents Facing (+50%) Service Loss
Primary School	85,284 (0.0%)	446,344 (0.1%)
Secondary School	0 (0.0%)	1715,477 (0.2%)
Special Education	0 (0.0%)	0 (0.0%)

Service	Parents Facing 10-50% Service Loss	Parents Facing (+50%) Service Loss
Primary School	131,874 (0.0%)	690,175 (0.1%)
Secondary School	0 (0.0%)	2652,62 (0.3%)
Special Education	0 (0.0%)	0 (0.0%)

Figure 5. Simulated effects of a coastal flood in Las Palmas in 2100 on the number of lone parents (top) and parents in pluri-parental families (bottom) facing primary & secondary school service loss.

Service	People Facing 10-50% Service Loss	People Facing (+50%) Service Loss
Pharmacies	450.869 (52.9%)	25.539 (3.0%)
Hospitals	421.465 (49.4%)	0 (0.0%)
Health Clinics	429.822 (50.4%)	0 (0.0%)
Dental Practices	210.506 (24.7%)	22.011 (2.6%)
Bus Transport	379.222 (44.5%)	0 (0.0%)
Mobile Telecommunication	374.723 (43.9%)	0 (0.0%)
Clean Water	1996 (0.2%)	0 (0.0%)
Power	378.027 (44.3%)	0 (0.0%)
Total Population		852.688

Figure 6. Simulated effects of a coastal flood in Las Palmas in 2100 on the number of people facing critical infrastructure loss of service between 10-50% and above 50%.

Industry	Workforce (Current / Initial)	Availability (%)
G Comercio al por mayor y al por menor; reparación de vehículos de motor y motocicletas	48.949 / 49.263	99.36%
I Hostelería	38.139 / 38.287	99.61%
O Administración Pública y defensa; Seguridad social obligatoria	29.646 / 29.851	99.31%
Q Actividades sanitarias y de servicios sociales	27.928 / 28.134	99.27%
P Educación	24.989 / 25.170	99.28%
F Construcción	18.366 / 18.485	99.36%
H Transporte y almacenamiento	18.362 / 18.477	99.38%
C Industria manufacturera	15.727 / 15.826	99.37%
N Actividades administrativas y servicios auxiliares	12.566 / 12.640	99.41%
S Otros servicios	11.957 / 12.033	99.37%
M Actividades profesionales; científicas y técnicas	11.418 / 11.496	99.32%
A Agricultura; ganadería; silvicultura y pesca	9566 / 9624	99.39%
K Actividades financieras y de seguros	6302 / 6346	99.31%
R Actividades artísticas; recreativas y de entretenimiento	5935 / 5972	99.38%
J Información y comunicaciones	5661 / 5700	99.31%
T Actividades de los hogares como empleadores de personal doméstico y como productores de bienes y servicios para uso propio	5312 / 5350	99.28%

Figure 7. Simulated effects of a coastal flood on workforce availability in Gran Canaria.

Crop Type	Area (m²)	Starting Integrity	Integrity after cascading failure
Pepino	1,337,928	100.0%	98.7%
Asociación Cítricos-Hortaliza	16,990	100.0%	95.2%
Asociación Cítricos-Papa	29,469	100.0%	94.7%
Próteas	48,744	100.0%	93.3%
Olivo	2,452,891	100.0%	96.7%
Tunera	473,189	100.0%	96.1%
Templado Otras Mezclas	4,241,079	100.0%	94.5%
Huerta Limpia	7,540,706	100.0%	93.8%
Hortaliza Otras Mezclas	7,414,876	100.0%	95.7%
Millo	1,817,005	100.0%	94.6%
Barbecho	14,312,366	100.0%	93.6%
Almendro	887,682	100.0%	95.7%
Viveros	268,246	100.0%	96.2%
Asociación Templados-Papa	40,408	100.0%	94.1%
Papa	8,876,552	100.0%	92.6%
Cereal Otros	2,009,774	100.0%	92.5%

Figure 8. Simulated effects of coastal flood in Las Palmas de Gran Canaria on crops in Gran Canaria. Indirect damages due to loss of irrigation are significant compared to direct damages.

Experiment 2: Island-wide forest fires in Gran Canaria when comparing effects of climate projection for 2050 and for 2100.

This experiment shows the consequences of island-wide forest fires, with increased disruption from wind and high temperature alerts (+1% damage to an already impacted node per alert) estimated for 2050 and 2100. Figure 9 shows the integrity scores for each critical infrastructure service.

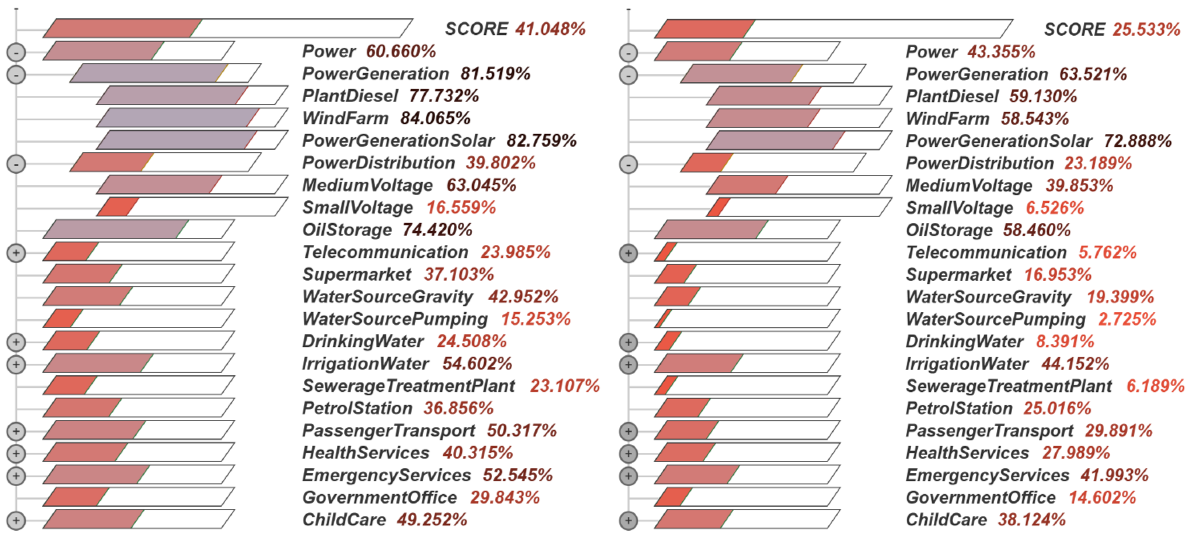

Figure 9. Simulated effects of island-wide forest fires, where the number of estimated wind and high temperature alerts from the 2050 and 2100 GENESIS climate projection impact critical infrastructure services in Gran Canaria.

Additional cascading pathways

The following two examples present additional experiments that can be conducted using the cascading-failure platform, beyond the standard RIESGOMAP hazard inputs and GENESIS climate projections. These examples establish simplified base conditions by manually adjusting the integrity values of selected nodes in order to explore alternative cascading pathways. They are structured according to the following scheme: trigger; affected nodes; propagation; impact; time to recovery; measures; indicators; and are intended to demonstrate further cascading mechanisms relevant to Gran Canaria.

Example 1: Power outages affecting desalination plants

- **Trigger:** A prolonged interruption of the electricity supply affecting desalination facilities can be triggered by generation failures, grid outages, or the inability of the system to meet peak demand.
- **Affected nodes:** The water supply would be the most affected assets, through the 46 seawater desalination plants (SWDP) which together produce around 88 hm^3/year (53% of total supply), alongside the Jinámar and Arinaga thermal power plants, and the medium-voltage distribution network.
- **Propagation:** When electrical supply is disrupted, desalination plants may be forced to suspend operations. This can result in a rapid loss of desalinated water production, which over time may lead to shortages. As output declines, the system would have to rely on alternative sources, particularly groundwater and reclaimed water. If reserves in storage tanks deplete before electricity supply is restored, the situation may escalate into a widespread interruption of the public water supply.
- **Impact:** Desalination, while providing more than half of the island's potable water, accounts for approximately 10% of total electricity. Such reliance on energy-

intensive production constitutes a structural vulnerability within the overall supply system.

- **Time/recovery:** Recovery depends mainly on the available storage capacity within the reservoir network and the time required to restore electricity supply.
- **Measures:** Several measures could be implemented to prevent this scenario from happening: the deployment of 90 MW of photovoltaic and wind generation for SWDPs by 2030, the equipment of critical plants with backup generators, and the Chira-Soria project functioning as a 200 MW system 'battery'.
- **Indicators:** The impact of this disruption could be monitored through various indicators, such as the number of hours of water autonomy provided by storage tanks, the relationship between SWDP production and overall demand, and the carbon footprint associated with desalinated water production.

Example 2: A prolonged drought that causes empty reservoirs and widespread water stress

- **Trigger:** Water stress may arise during prolonged periods of drought, particularly when reservoir levels fall below the emergency threshold.
- **Affected nodes:** This kind of events can affect a wide network of hydraulic and agricultural infrastructure, including the island's 69 dams, associated irrigation network, and the crops that depend on them.
- **Propagation:** The availability of water for irrigation decreases as reservoir levels decline. Areas such as La Aldea de San Nicolás would be specially affected, due to their dependence on irrigation reservoirs. Reclaimed water would then be mobilised to sustain agricultural activity. This would place additional pressure on WWTPs, which, if unable to meet the water demand, could result in crop

abandonment. This would consequently reduce local agricultural output and weaken the island's food sovereignty.

- **Impact:** According to the Drought Plan, water restrictions are triggered when dam storage falls below 20 hm^3 or when SWDPs are unable to satisfy peak summer demand. Although reservoirs contribute less than 10% of island's total water supply, they are critical for agricultural basins, where they remain a primary source of irrigation water.
- **Time/recovery:** Recovery from water stress is determined by the duration of the dry period. Even when rainfall returns, replenishment of reservoir may be slow, as precipitation patterns are both irregular and spatially uneven across the island.
- **Measures:** Several measures can be pursued to strengthen resilience. One of these measures is the increase in tertiary treatment coverage from 62% to 90% by 2027 in line with the requirements of Directive 91/271/EEC. Other measures include the use of reclaimed water as an alternative source in areas traditionally supplied by dams, and the implementation of managed aquifer recharge in mid-altitude regions to enhance groundwater storage.
- **Indicators:** The impact of this disruption can be monitored through a set of operational indicators, including dam storage levels (%), the volume of reclaimed water allocated to irrigation, the extension of agricultural land abandoned due to water shortages, and the thresholds levels defined within the Drought Plan.

9. System vulnerabilities and mitigation options

Main stress points in the system

The following elements are particularly vulnerable due to their high concentration of dependencies and may therefore become critical in disruption scenarios:

- Coastal desalination complexes, which provide over 50% of Gran Canaria's total water supply, are exposed to marine flooding and remain heavily reliant on electricity.
- The island's main electricity generation capacities are the Jinámar and Arinaga thermal power stations. They are approximately 74% diesel-based, and require substantial volumes of water for their cooling processes.
- The Chira and Soria dams are key components of the 200 MW reversible pumped-storage hydropower scheme, which is intended to operate as the island's main energy storage system.
- Barranco Seco WWTP is the island's main source of reclaimed water (700–800 m^3/h, 4.5 hm^3/year). This source is strategically important for agricultural resilience.
- ES70GC004 aquifer is under an exploitation index of 0.9, approaching a condition of potentially irreversible deterioration.
- The coastal fronts (Guía-Gáldar, Telde, Vecindario-Juan Grande) are affected by marine intrusion, exhibiting chloride concentrations between 700 and 1,500 mg/L.
- The urban water distribution network in Gran Canaria has significant losses, amounting to approximately 16%.
- Irrigation reservoirs are a critical water source for agriculture in catchments lacking viable alternative supplies, such as La Aldea de San Nicolás.

- Forest corridors intersecting infrastructure networks are vulnerable to forest fires, a risk that is further intensified by climate change.
- The production and consumption volumes of private desalination plants in hotel complexes are not reflected in official public statistics. Tourism influences water supply, generating seasonal peaks in demand.

Interventions targeting principal system constraints

The developed scenario experiments suggest that the following interventions may provide comparatively high leverage in reducing cascading-failure impacts:

- Deployment of renewable energy into desalination processes to lower the carbon footprint and decrease reliance on diesel-based generation.
- Management of aquifer recharge in the north-eastern mid-altitude regions through the injection of treated reclaimed water to sustain piezometric levels, combined with the activation of the infiltration ponds network.
- Increase the availability of reclaimed water for irrigation by expanding the tertiary treatment to 90% coverage by 2027, ensuring compliance with Directive 91/271/EEC.
- Reduce network losses to 10% (currently at 16%), through the implementation of district metering areas and advanced telemetry systems.
- Diversifying supply and improving redundancy in coastal production functions, together with measures to reduce energy vulnerability.
- Hardening and securing access to critical nodes (redundant routes, rapid access planning), in order to reduce restoration delays after slope failures.

- Improving integrated monitoring governance (data harmonisation, shared telemetry, and consistent reporting), to support timely decision-making during disruption.

Data gaps for model improvement

Model performance and interpretability could be improved by imposing better constraints on recovery dynamics and on operational contingencies. The following data are missing from the model:

- Recovery times for specific assets and restoration sequences, including delays dependent on access.
- Integration of reclaimed water infrastructure, which is not currently represented within the cascading-failure platform.
- Detailed representation of the irrigation network, currently characterised using proxy indicators based on reservoir dependency.
- Verified backup generation data, covering capacity, fuel autonomy, start-up reliability, maintenance status, and fuel logistics during disruptions.
- Real-time water quality and quantity data from desalination plants and reservoirs.

These elements can be improved progressively without increasing public exposure, as long as asset-level details remain within restricted documentation available only to authorised stakeholders.

10. References

Cabildo de Gran Canaria. (2025). El Cabildo da un paso más en su estrategia de riego agrícola en Gran Canaria con el nuevo depósito de aguas regeneradas de El Fondillo. https://cabildo.grancanaria.com/w/el-cabildo-da-un-paso-m%C3%A1s-en-su-estrategia-de-riego-agr%C3%ADcola-en-gran-canaria-con-el-nuevo-dep%C3%B3sito-de-aguas-regeneradas-de-el-fondillo

Consejo Insular de Aguas de Gran Canaria (CIAGC). (2023). *Plan Hidrológico de Gran Canaria: Ciclo de Planificación 2021–2027. Memoria*. Consejo Insular de Aguas de Gran Canaria (CIAGC).

Consejo Insular de Aguas de Gran Canaria. (2025). *Volúmenes de las presas* [Data set]. https://www.aguasgrancanaria.com/presas/volumenes.php

Consejo Insular de Aguas de Gran Canaria (CIAGC). *Consejo Insular de Aguas de Gran Canaria*. Consejo Insular de Aguas de Gran Canaria. Retrieved January 2026, from https://www.aguasgrancanaria.com/

Custodio, E., Cabrera, M. D. C., Poncela, R., Puga, L-O., Skupien, E. & del Villar, A. (2016). Groundwater intensive exploitation and mining in Gran Canaria and Tenerife, Canary Islands, Spain: Hydrogeological, environmental, economic and social aspects. *Science of the Total Environment, 557-558*, 425-437. https://doi.org/10.1016/j.scitotenv.2016.03.038

Custodio, E. (2020). Hidrogeología y recursos de agua subterránea en formaciones e islas volcánicas: HIRAVOL. CETAQUA Barcelona. https://doi.org/10.5821/ebook-9788498809473

European Commission. (2021). CLIMATE RESILIENT-REGIONS THROUGH SYSTEMIC SOLUTIONS AND INNOVATIONS (ARSINOE) (Grant agreement No. 101037424). CORDIS. https://cordis.europa.eu/project/id/101037424 (Project DOI: https://doi.org/10.3030/101037424) https://arsinoe-project.eu/

European Commission. (2023). Accelerating and mainstreaming transformative NATure-bAsed solutions to enhance resiLIEence to climate change for diverse bio-geographical European regions (NATALIE) (Grant agreement No. 101112859). CORDIS. https://cordis.europa.eu/project/id/101112859 (Project DOI: https://doi.org/10.3030/101112859) https://www.natalieproject.eu/

European Commission. (2024). Geologically Enhanced NaturE-based Solutions for climate change resiliency of critical water InfraStructure (GENESIS) (Grant agreement No. 101157447). CORDIS. https://cordis.europa.eu/project/id/101157447 (Project DOI: https://doi.org/10.3030/101157447) https://genesisnbs.eu/

Instituto Nacional de Estadística (INE). (2025). *Población según isla y sexo (Identificador API: 73026)*. datos.gob.es. https://datos.gob.es/es/catalogo/ea0010587-poblacion-segun-isla-y-sexo-identificador-api-73026

Instituto Canario de Estadística (ISTAC). (2024). Contabilidad Regional de España: Estimaciones insulares armonizadas. Series anuales de macromagnitudes. Islas de Canarias [Dataset]. Gobierno de Canarias. https://www.gobiernodecanarias.org/istac/estadisticas/economiageneral/cuentaseconomicas/contabilidadreginonal/E30014B.html

Red Eléctrica Española (REE). (2025). *Datos del sistema eléctrico* [Dataset]. https://www.ree.es/es

Reyes Parrilla, D. (2025). *GENESIS D1.2 Climate risk profiles to each Macaronesian island (1.0). Zenodo*. https://doi.org/10.5281/zenodo.17813870

RIESGOMAP. (2013). *Prevención de riesgos naturales y tecnológicos en la planificación territorial y urbanística* (Programa MAC 2007–2013) [Dataset]. Gobierno de Canarias. https://opendata.sitcan.es/upload/seguridad/gobcan_riesgomap_memoria-metodologia.pdf

Santamarta J.C., & Hernández-Sánchez, C. (2007). La isla de El Hierro (archipiélago canario, España); solución a la intrusión marina y futuro de la gestión hidráulica de la isla. En Los acuíferos costeros: retos y soluciones. Coastal aquifers: challenges and solutions (pp. 1085-1094). Instituto Geológico y Minero de España.

Santamarta, J. C., & Seijas Bayón, J. (2010). Fundamentos y tecnologías para la captación y uso del agua procedente de la lluvia horizontal en los montes canarios. Revista Montes, (100), 15–21.

Santamarta, J. C. (2013). Hidrología y recursos hídricos en islas y terrenos volcánicos: Métodos, Técnicas y Experiencias en las Islas Canarias. Colegio de Ingenieros de Montes.

Santamarta, J. C., Lario-Bascones, R. J., Rodríguez-Martín, J., Hernández-Gutiérrez, L. E., & Poncela, R. (2014). Introduction to Hydrology of Volcanic Islands. *IERI Procedia*, 9, 135–140. https://doi.org/10.1016/j.ieri.2014.09.053

Santamarta, J. C., Cruz-Pérez, N., Paradinas Blázquez, C., Prado López, C., Galiano Sánchez, L. (2025a). Escenarios locales de cambio climático en las Islas Canarias, adaptados al VI Informe del Grupo Intergubernamental de Expertos sobre el Cambio Climático (IPCC) [Plataforma web]. Fundación para la Investigación del Clima, Meteogrid, Universidad de La Laguna. Proyecto ARSINOE https://doi.org/10.25145/o.canarias.sicma.2025

Santamarta, J. C., Koritnik, J., Cruz-Pérez, N., & Expósito-Brazier, M. (2025b). *D1.3 Critical water infrastructure's vulnerability and weaknesses assessment report. Zenodo.* https://doi.org/10.5281/zenodo.17491717

Santamarta, J. C., & Cruz Pérez, N. (2025). Agua y cambio climático en las Islas Canarias. Universidad de La Laguna, Servicio de Publicaciones. https://doi.org/10.25145/b.2025.04

Santamarta, J. C., Cruz-Pérez, N., Koritnik, J., Khoury, M., Expósito-Brazier, M. (2026). Infraestructura hídrica de las Islas Canarias: riesgos naturales y fallos en cascada. Universidad de La Laguna. https://doi.org/10.25145/b.2026.01

Turismo de Gran Canaria (2025). *Informes y estadísticas: Informes de coyuntura*. Turismo de Gran Canaria – Área Profesional. Retrieved 18 May 2025, from https://www.grancanaria.com/turismo/area-profesional/informes-y-estadisticas/informes/

11. Acknowledgments

This work has been partially funded by the European Union's Horizon Europe Research and Innovation Framework Programme, under the GENESIS project with reference 101157447 mission HORIZON-MISS-2023-CLIMA-01-02.

12. Security and access disclaimer

The GENESIS–Gran Canaria cascading-failure platform is not publicly accessible, given the security requirements associated with critical infrastructure and related risk management considerations. This document provides a public summary prepared for DOI dissemination, from which information of a security sensitive nature has been intentionally omitted. Asset-level details are not included, such as precise locations, operational capacities, interdependency mappings on facility level, or other parameters that could be misused. The information herein is provided "as is" for scientific communication only and shall not be construed as operational guidance. Access to the full platform and detailed documentation is restricted to authorized stakeholders, subject to prior approval and applicable confidentiality conditions.

How to cite this platform

Santamarta, J. C., Cruz-Pérez, N., Koritnik, J., & Khoury, M. (2026). GENESIS–Gran Canaria platform for cascading-failure simulation in water–energy systems [Application software]. Universidad de La Laguna. https://doi.org/10.25145/o.GENESIS_Gran-Canaria.2025