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Review Article

Drought or Neglect? The Infrastructure Paradox of Sicily's 2026 Water Boom

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Abstract: In recent years, Sicily has been widely portrayed as one of the European regions most affected by water scarcity. However, the increase in rainfall recorded during the latest hydrological cycle has led to a significant rise in water levels in several reservoirs across the island. Despite this temporary improvement in water availability, many local communities continue to experience water rationing and structural supply shortages. This apparent contradiction highlights a deeper systemic issue that goes beyond climatic variability. This article examines the recent evolution of reservoir levels in Sicily and analyzes the structural weaknesses of the regional water management system. Through the analysis of precipitation trends, official reservoir data, and selected case studies of major dams such as Trinità and Fanaco, the study shows that the persistence of the water crisis is largely linked to infrastructural fragilities, high levels of network leakage, fragmented governance, and limited operational capacity of storage infrastructure. The findings suggest that the Sicilian water crisis should not be interpreted solely as a consequence of drought, but rather as the result of longstanding structural inefficiencies in water management and water efficiency. Even in years with above-average precipitation, inadequate infrastructure and lack of coordinated planning prevent the effective use of available resources. The paper concludes by outlining policy recommendations to improve infrastructure resilience, strengthen monitoring systems, and promote a more integrated approach to water governance.

Keywords: Water Management; Sicily; Hydrological Rebound; Water Scarcity; Water Waste; Discharge Paradox.

1. Introduction

The Sicilian Region's water monitoring, carried out by the River Basin Authority, has outlined a framework indicating a significant recovery in the quantity of the island's water reserves. The data concerns the first two months of 2026 and represents a positive sign not only for the current months but, above all, for the more critical conditions the region is forced to endure. Although water insufficiency affects the area over a fairly long period, it is undeniable that during the summer (specifically from June to September), conditions are more extreme. Notoriously, there are two determining factors: the radical increase in temperatures, with peaks ranging between 38 and 42°, and "human" demand. The flow of visitors, combined with the return of Sicilians who have been living abroad or who have jobs outside the region, is increasing significantly. The Sicily region boasts over 20 million annual tourist visitors (2025 data), resulting in a doubling, if not a tripling, of local water consumption compared to the winter months.

After a drought-stricken 2025 that had reduced reservoirs to survival levels, winter rainfall has met expectations, bringing overall volumes to figures not seen in a long time. The rainy winter led to a significant improvement, as indicated by monitoring data on volumes of water potted for drinking use.

2. The Winter Hydrological Rebound

The acceleration occurred in the first three weeks of February 2026, leading scholars to speak of a full-blown “water boom”. The volume accumulated in the thirteen reservoirs was equal to a volume of 157.95.188 m³. As the rains continued, this figure grew exponentially, reaching 217,740,473 m³. Net of this assessment, the increase is over 60 million m³. The figure is most impressive for the short timescales in which this increase was recorded.

2.1. Comparative Analysis

Comparing these data with those of last year, it was recorded that on February 19, 2025, Sicily was in a state of full-blown water suffering with a total reservoir volume of just 136,747,275 m³. A comparison between February 19, 2025, and February 19, 2026, reveals that overall reserves increased by more than 81 million cubic meters in one year, representing a growth of more than 59%. Below is a detailed overview of the volumes invaded in the Sicilian invasions, indicating the maximum authorized capacities and current volumes, updated to January 2026.

Table 1 Overview of Stored Water Volumes in Sicilian Reservoirs – January 1, 2026 - Source: Basin Authority of the Sicilian Hydrogeographic District.

PROSPETTO VOLUMI INVASATI NELLE DIGHE DELLA SICILIA AL 1° GENNAIO 2026
(Dati rilevati da strumenti di misura o da comunicazioni dei gestori al lordo)

	DIGA	CORSO D'ACQUA	CAPACITÀ TOTALE D'INVASO (Mmc)	VOLUME Mmc gennaio 2026	dicembre 2025	scarto mese prec.	gennaio 2025	UTILIZZAZIONE	ENTE GESTORE
1	ANCIPA	TROINA	30,40	11,99	12,51	-0,52	7,57	IRR. - POT. - ELETTR.	E.N.E.L.
2	ARANCIO	CARBOJ	34,80	6,17	5,27	0,90	3,56	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
3	CASTELLO	MAGAZZOLO	21,00	6,33	5,07	1,26	4,87	POT. - IRR.	DIP.TO DELL'ACQUA E DEI RIFIUTI
4	CIMIA	CIMIA	10,00	2,23	1,76	0,47	1,01	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
5	COMUNELLI	COMUNELLI	8,00	0,21	0,10	0,11	0,10	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
6	DISUERI	GELA	23,60	0,66	0,04	0,62	0,23	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
7	DON STURZO (Ogliastro)	GORNALUNGA	110,00	32,46	30,73	1,73	23,49	IRRIGUO	C.B.7- CALTAGIRONE
8	FANACO	PLATANI	20,70	2,01	1,68	0,33	0,38	POTABILE	SICILIACQUE
9	FURORE	BURRAITO	7,00	1,08	0,89	0,19	0,69	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
10	GAMMAUTA	SOSIO	2,00	0,04	0,09	-0,05	0,02	IRR. - ELETTR.	E.N.E.L.
11	GARCIA (M. Francese)	BELICE SINISTRO	80,00	6,00	6,08	-0,08	10,38	POT. - IRR.	C.B. 2 - PALERMO
12	GORGO LAGO	FOSSO GURRA	3,41	0,37	0,35	0,02	0,44	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
13	LENTINI	*FUORI ALVEO*	134,55	76,78	77,43	-0,65	61,19	IRR. - INDUSTRIALE	DIP.TO DELL'ACQUA E DEI RIFIUTI
14	NICOLETTI	CRISÀ	20,20	4,71	4,58	0,13	2,41	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
15	OLIVO	OLIVO	15,00	1,87	1,74	0,13	2,22	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
16	PACECO	BAIATA	6,70	3,07	2,13	0,94	2,19	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
17	PIANA DEGLI ALBANESI	BELICE DESTRO	32,80	5,18	5,68	-0,50	5,51	IRR. - POT. - ELETTR.	E.N.E.L
18	PIANO DEL LEONE	VERDURA	4,19	2,22	1,52	0,70	1,23	POT. - ELETTR.	SICILIACQUE
19	POMA	JATO	72,50	14,68	15,26	-0,58	17,20	IRR. - POT.	DIP.TO DELL'ACQUA E DEI RIFIUTI
20	POZZILLO	SALSO (SIMETO)	150,50	4,11	3,11	1,00	13,03	IRR. - ELETTR.	E.N.E.L.
21	PRIZZI	RAIA	9,25	1,45	1,31	0,14	1,65	IRR. - POT. - ELETTR.	E.N.E.L.
22	RAGOLETO (Dirillo)	DIRILLO	20,10	5,03	4,83	0,20	3,89	INDUSTRIALE - POT. - IRR.	ENI - RAFFINERIA DI GELA
23	ROSAMARINA	S. LEONARDO	100,00	14,56	15,62	-1,06	10,42	POT. - IRR.	DIP.TO DELL'ACQUA E DEI RIFIUTI
24	RUBINO	BIRGI	11,50	1,76	1,24	0,52	1,02	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
25	SAN GIOVANNI	NARO	16,30	5,91	4,81	1,10	5,00	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
26	SANTA ROSALIA	IRMINIO	20,00	9,34	9,06	0,28	7,31	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
27	SCANZANO	ELEUTERIO	18,00	3,16	3,72	-0,56	3,33	IRR. - POT.	DIP.TO DELL'ACQUA E DEI RIFIUTI
28	SCIAGUANA	SCIAGUANA	11,35	4,06	4,01	0,05	4,36	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
29	TRINITÀ	DELIA	18,00	2,48	2,48	0,00	2,85	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
30	ZAFFARANA	ZAFFARANA	0,90	0,03	0,01	0,02	0,01	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
	Scarto anno precedente	Scarto mese preced.							
	16%	3%	TOTALI	229,95	223,11	6,84	197,56		

(*) Volume al lordo interrimento, in fase di rivalutazione

A crucial parameter for valuation purposes is the Net Profit Volume (or net useful capacity) of a reservoir. Generally, it represents the actual quantity of water that can be withdrawn to meet users' needs. Utilities that can be civil, agricultural or industrial. Technically, it is considered the volume between the maximum reservoir level, i.e., the level reachable in safety and wind, and the minimum extraction level. The total volume of the reservoir is subtracted from the so-called "dead volume", that is, the lower layer where sediment and sludge accumulate. On the other hand, the time variable is not stable but decreases over time due to silting, which is the phenomenon of debris accumulation on the bottom, which reduces the real storage capacity of the reservoir. Adapted to the context considered below, the net profit value indicates the amount of water available for the summer beyond the theoretical capacity of the dams. Considering instead of the net profit volume parameter – i.e., the actual water mind intended for end users - it has undergone a radical change. Subsequently, the analysis focused on the data (Tables 1 and 2), which indicate that the net profit volume has almost doubled. Specifically, it went from 93,371,086 m³ in 2025 to (already mentioned) 178.9 million in 2026. This should provide water security for the summer season. Consideration that the previous year appeared to come as a mirage. Below is a detailed overview of the volumes invaded in the Sicilian invasions, indicating the maximum authorized capacities and current volumes, updated to February 2026.

Table 2 Overview of Stored Water Volumes in Sicilian Reservoirs – February 1, 2026 - Source: Basin Authority of the Sicilian Hydrogeographic District.

PROSPETTO VOLUMI INVASATI NELLE DIGHE DELLA SICILIA AL 1° FEBBRAIO 2026 (Dati rilevati da strumenti di misura o da comunicazioni dei gestori al lordo)									
	D I G A	CORSO D'ACQUA	CAPACITÀ TOTALE D'INVASO (Mmc)	VOLUME Mmc				UTILIZZAZIONE	ENTE GESTORE
				febbraio 2026	gennaio 2026	scarto mese prec.	febbraio 2025		
1	ANCIPA	TROINA	30,40	22,45	11,99	10,46	19,58	IRR. - POT. - ELETTR.	E.N.E.L.
2	ARANCIO	CARBOJ	34,80	11,12	6,17	4,95	4,91	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
3	CASTELLO	MAGAZZOLO	21,00	12,21	6,33	5,88	5,95	POT. - IRR.	DIP.TO DELL'ACQUA E DEI RIFIUTI
4	CIMIA	CIMIA	10,00	2,99	2,23	0,76	1,03	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
5	COMUNELLI	COMUNELLI	8,00	0,17	0,21	-0,04	0,07	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
6	DISUERI	GELA	23,60	0,48	0,66	-0,18	0,23	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
7	DON STURZO (Ogliastro)	GORNALUNGA	110,00	54,00	32,46	21,54	29,43	IRRIGUO	C.B.7- CALTAGIRONE
8	FANACO	PLATANI	20,70	6,31	2,01	4,30	1,52	POTABILE	SICILIACQUE
9	FURORE	BURRAITO	7,00	2,50	1,08	1,42	0,83	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
10	GAMMAUTA	SOSIO	2,00	0,40	0,04	0,36	0,09	IRR. - ELETTR.	E.N.E.L.
11	GARCIA (M. Francese)	BELICE SINISTRO	80,00	13,69	6,00	7,69	12,71	POT. - IRR.	C.B. 2 - PALERMO
12	GORGO LAGO	FOSSO GURRA	3,41	0,47	0,37	0,10	0,46	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
13	LENTINI	*FUORI ALVEO*	134,55	86,06	76,78	9,28	75,18	IRR. - INDUSTRIALE	DIP.TO DELL'ACQUA E DEI RIFIUTI
14	NICOLETTI	CRISÀ	20,20	7,46	4,71	2,75	3,92	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
15	OLIVO	OLIVO	15,00	3,78	1,87	1,91	2,56	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
16	PACECO	BAIATA	6,70	5,10	3,07	2,03	2,42	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
17	PIANA DEGLI ALBANESI	BELICE DESTRO	32,80	9,54	5,18	4,36	7,31	IRR. - POT. - ELETTR.	E.N.E.L
18	PIANO DEL LEONE	VERDURA	4,19	3,98	2,22	1,76	2,40	POT. - ELETTR.	SICILIACQUE
19	POMA	JATO	72,50	26,03	14,68	11,35	20,21	IRR. - POT.	DIP.TO DELL'ACQUA E DEI RIFIUTI
20	POZZILLO	SALSO (SIMETO)	150,50	34,38	4,11	30,27	23,59	IRR. - ELETTR.	E.N.E.L.
21	PRIZZI	RAIA	9,25	4,14	1,45	2,69	2,45	IRR. - POT. - ELETTR.	E.N.E.L.
22	RAGOLETO (Dirillo)	DIRILLO	20,10	10,03	5,03	5,00	5,47	INDUSTRIALE - POT. - IRR.	ENI - RAFFINERIA DI GELA
23	ROSAMARINA	S. LEONARDO	100,00	24,59	14,56	10,03	14,42	POT. - IRR.	DIP.TO DELL'ACQUA E DEI RIFIUTI
24	RUBINO	BIRGI	11,50	4,96	1,76	3,20	2,09	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
25	SAN GIOVANNI	NARO	16,30	10,50	5,91	4,59	5,79	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
26	SANTA ROSALIA	IRMINIO	20,00	17,53	9,34	8,19	7,82	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
27	SCANZANO	ELEUTERIO	18,00	7,02	3,16	3,86	5,85	IRR. - POT.	DIP.TO DELL'ACQUA E DEI RIFIUTI
28	SCIAGUANA	SCIAGUANA	11,35	4,79	4,06	0,73	4,55	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
29	TRINITÀ	DELIA	18,00	2,48	2,48	0,00	2,92	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
30	ZAFFARANA	ZAFFARANA	0,90	0,27	0,03	0,24	0,02	IRRIGUO	DIP.TO DELL'ACQUA E DEI RIFIUTI
	Scarto anno precedente	Scarto mese preced.							
	47%	69%	TOTALI	389,43	229,95	159,48	265,78		

(*) Volume al lordo interrimento, in fase di rivalutazione

3. Data Interpretation

3.1 Practical Value Assessment

To understand the value of this increase in practice, it is useful to translate the volumes accumulated in the reservoirs into *terms of real consumption*. Between 2025 and 2026, Sicilian water reserves increased from 93,371,086 m³ to approximately 178.9 million, an increase of more than 85 million m³. According to international estimates, the average household consumption in European countries is between 150 and 200 liters of water for each individual for each day, considering daily uses such as showers, cooking, and household hygiene. If this average is open to the additional volumes recorded in the Sicilian invasions, a significant dimension emerges. In detail, 85 million cubic meters correspond to approximately 85 billion liters of water, a quantity sufficient to cover the annual domestic needs of over a million people. In territorial terms, this means that water accumulated in a single year would theoretically be able to guarantee the entire consumption of a city the size of Palermo for several years, or to cover the household water demand of the entire Sicilian population for about three months. This comparison helps us understand the true extent of the phenomenon. Moreover, it is not a marginal increase in reserves, but a quantity of water potentially capable of significantly impacting regional water security.

4. Regional Case Studies

To further our understanding of the regional invasion system, the study analyzes several significant case studies. Each analysis examines the relationship between theoretical volumes and actual available water resources, highlighting the factors that influence the resilience of each infrastructure.

Case of authorized storage limit: Castello Dam

The Castello dam is located in the province of Agrigento, in the municipality of Bivona. It is an artificial dam built along the Magazzolo River that gives rise to Lake Magazzolo. The water resource is primarily intended for irrigation use for local agriculture. However, it is also used for civilian and drinking purposes. It typically has a storage capacity of around 20 million cubic meters of water per year, with a maximum reservoir level of approximately 296.65 m above sea level.

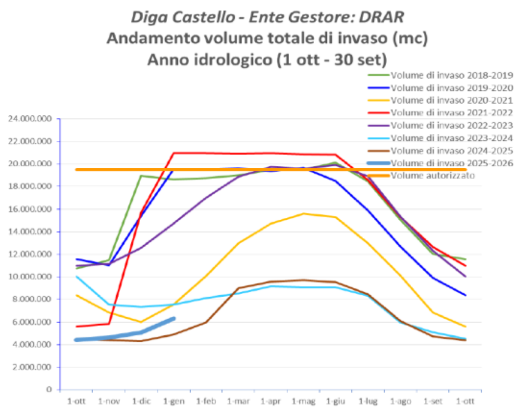

Figure 1: Reservoir storage levels in cubic meters– Status update: January 1, 2026.

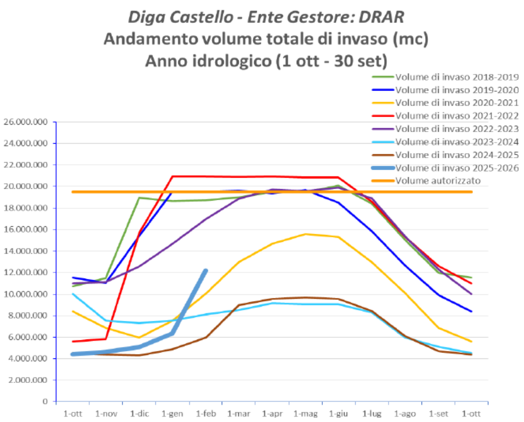

Figure 2 Reservoir storage levels in cubic meters– Status update: February 1, 2026.

Across nearly all annual series, a trend of progressive accumulation is observed from October through early winter. Generally, levels start from relatively low values at the beginning of the hydrological year and increase with the arrival of autumn precipitation. This suggests that the di-accumulation system is strongly dependent on seasonal autumn-winter recharge, which constitutes the main water supply-surveying phase for the reservoir. The most relevant point in the graphs is the peak growth in reservoir volume between January and February. The resulting implications are mainly twofold and concern the need for reservoir management. It is crucial to be very responsive in winter, as any structural or managerial problems that occur during this period can compromise the annual accumulation of necessary water. This pattern indicates that the reservoir's effectiveness in supporting regional water supply depends heavily on the efficiency of winter storage management, particularly during the critical January–February recharge phase.

Case of potabilization strain: Poma Dam

The Poma Dam serves as a critical node in the water supply chain for both the agricultural districts of the Jato valley and the metropolitan area of Palermo. During the February 2026 recharge, the reservoir's volume surged from 25.1 m³ to 41.8 m³. However, the Poma case highlights the qualitative challenge of water management. Rapid inflows often carry high turbidity and sediment loads, which can strain filtration systems and increase treatment costs at the downstream purification plants. This demonstrates that a "water boom" is not just a quantitative success but an operational challenge for the potabilization infrastructure, which must process sudden, massive volumes of raw water to meet urban demand.

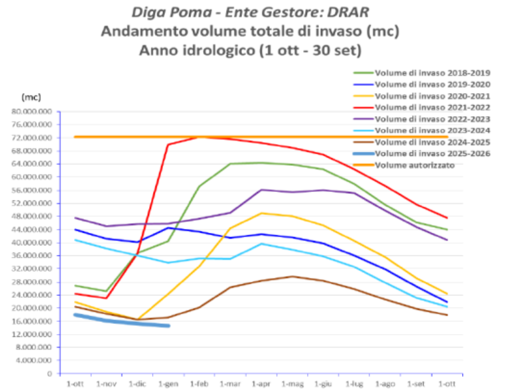

Figure 3: Reservoir storage levels in cubic meters– Status update: January 1, 2026.

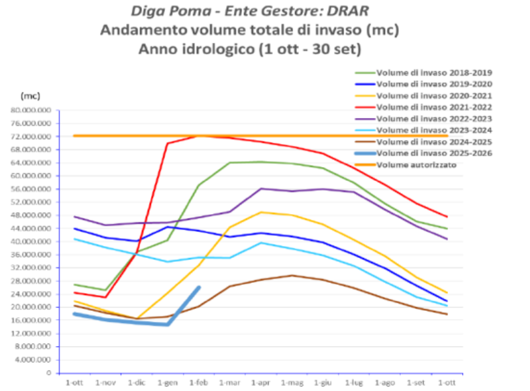

Figure 4: Reservoir storage levels in cubic meters– Status update: February 1, 2026

5. Sicilian Hydrological Paradox: Case Study Analysis

Although the percentage of reservoirs has grown significantly, reassuring the Sicilian people for the next few summer months, there is a problem with maintaining the balance between incoming and outgoing water in reservoirs. A completely paradoxical phenomenon, and the heart of this treatment, is the water spill. This picture is paradoxical because in the presence of a recurrence of severe water crises, especially in some months of the year, when favorable water storage conditions occur, these increases are not properly managed. In mid-February, once the regional water security quota (19.5 m³) was reached, the opening of the reservoirs was authorized, resulting in a leak. This is a safety measure that releases 1 cubic meter of water per second to prevent reserve levels from exceeding guard levels. The water loss escapes into rivers adjacent to reservoirs or directly into the sea. In the case of the Castello dam, the reserves flow into the Magazzolo river as they cannot be stored beyond the safety limits imposed by the supervisory bodies. Local and regional authorities have emphasized that, before proceeding with discharges to the sea, top priority has been given to filling irrigation canals to ensure the agricultural season in the Ribera area. A location that presents intense agricultural production with the specific target of citrus fruits. The summer period is particularly important for ensuring proper hydration of the plant. In the absence of this, there is a risk that there will be an alteration of production caused by water stress that alters the biological cycle and the quality of the final product. Possibly even the death of the plant itself.

5.1 When Water Is Discharged into the Sea

Due to the region's hydrogeological structure, there are also cases in which excess rainwater—therefore a potential freshwater reserve—is diverted and discharged directly into the sea.

5.1.1. Environmental Impacts of Marine Freshwater Discharge

The massive increase in freshwater reaching coastal areas has significant consequences. In addition to the losses in the agricultural sector already mentioned, another phenomenon must be considered: continental freshwater input. This process alters the balance of coastal ecosystems because it rapidly changes the physicochemical parameters of seawater.

The effects on biodiversity include:

- Salinity shock (halo-stress), which creates a zone of hyposalinity potentially harmful to sessile organisms and mollusks that are unable to move. Due to osmotic shock, these organisms may even die.
- Posidonia oceanica, a marine plant that plays a crucial role in Mediterranean biodiversity, is particularly sensitive to decreases in salinity.
- Eutrophication, caused by an excess of nutrients transported by freshwater, such as nitrogen and phosphorus. This leads to the proliferation of microscopic algae, which can cause hypoxia and, consequently, the suffocation and death of fish and crustaceans.

While many dams are now completely full, other natural reservoirs, such as Lake Gorgo, remain well below their effective capacity and can almost be considered empty. On the one hand, artificial reservoirs serve to support the needs of urban centres, while the water availability of natural reservoirs represents an important opportunity for irrigating orchards. Another example is the water from Lake Leone in Santo Stefano di Quisquina, which, after reaching its capacity of 4.2 million cubic meters, is discharged into the sea through the Sosio-Verdura River.

Case of spillway discharge: Fanaco Dam

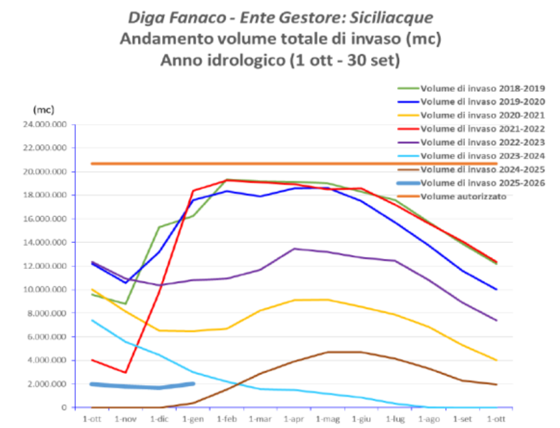

Figure 5: Reservoir storage levels in cubic meters– Status update: January 1, 2026

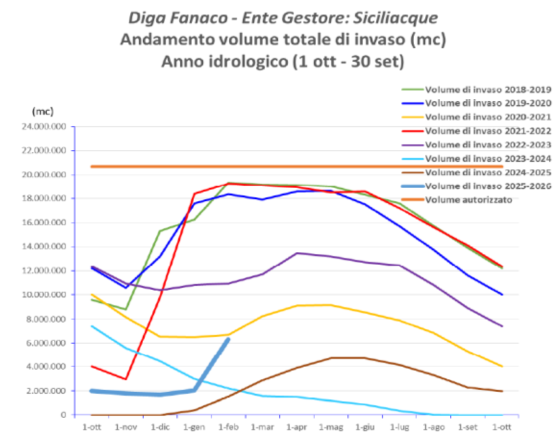

Figure 6: Reservoir storage levels in cubic meters– Status update: February 1, 2026

The comparative analysis of the Fanaco Dam storage data between 1 January and 1 February (2026) highlights an extremely aggressive "hydrological rebound" dynamic, raising significant questions about the flood attenuation and safe storage capacity of the Sicilian water system. The transition from the January historical series (Figure 5) to the February series (Figure 6) shows a net volumetric change of approximately +4 m^3 in a single month.

From a technical perspective, the blue curve (2025–2026) displays an almost vertical slope (angular coefficient), indicating high-intensity rainfall events concentrated in a catchment basin that was already saturated or characterized by a short concentration time. From a historical perspective, this increase mirrors the anomalies recorded in the 2018–2019 and 2021–2022 hydrological years, confirming an ongoing tropicalization of the local climate, characterized by long drought periods interrupted by sudden flood events.

The paradox of hydraulic safety and resource waste emerges as a critical point when comparing the actual storage volume with the Authorized Volume (orange line, ~20.7 M^3). Although the reservoir is still far from its theoretical maximum capacity, the speed of filling requires strict safety protocols:

- Flood attenuation: When water inflow is too rapid, the dam cannot operate simply as a storage reservoir but must function as a dissipation structure. To prevent structural stress on the dam, the operator is often forced to activate surface spillways.
- Loss of useful volume: Water released downstream to maintain the safety freeboard (the empty space necessary to contain sudden flood waves) inevitably flows into the sea. This results in a net loss of water resources due to the technical impossibility of retaining such violent inflows within infrastructure that was not designed for the new rainfall regimes.

The current management of the Fanaco reservoir demonstrates that increasing water volumes does not necessarily translate into greater long-term availability of irrigation or drinking water. A concrete risk is that the water accumulated in February may need to be partially released in order to ensure the safety of nearby populated areas and the structural integrity of the dam itself.

However, this situation prevents the effective use of water resources, which are generally under pressure, thereby highlighting a clear structural problem. It is therefore evident that this situation requires structural maintenance interventions as well as the implementation of predictive monitoring systems capable of optimizing water releases without wasting the resource during peak inflow months. The analysis of reservoir volumes cannot ignore an assessment of the resource's geographical coherence. Data from the Fanaco dam highlight massive recharge, which, however, risks remaining isolated from the needs of regional production centers. The current infrastructure configuration suffers from a critical asymmetry: water resources are accumulated over time and in geographic areas that do not coincide with peaks in economic demand. Without an improvement in supply structures and interconnection systems between basins (the so-called 'water ring'), the volumetric increase observed in February 2026 represents only a temporary and local relief, incapable of translating into water security for the entire Sicilian production system

5.2. Structural and Geographical Constraints

The mere presence of water in a tank does not guarantee its availability to the end user. In Sicily, a complex network of structural and geographical bottlenecks creates a decoupling between storage and supply. From dams that cannot be filled due to safety risks to basins geographically isolated from demand centers, these constraints represent the true ‘invisible limit’ of the island's water security.

5.2.1. The Paradox of the Volumes:

A. Case of regulatory limbo: Trinità Dam

The case of the Trinità Dam represents the pinnacle of the systemic inefficiency plaguing Sicilian water infrastructure. Built between 1954 and 1959, the reservoir never achieved definitive official testing, remaining in limited operational limbo for over seventy years.

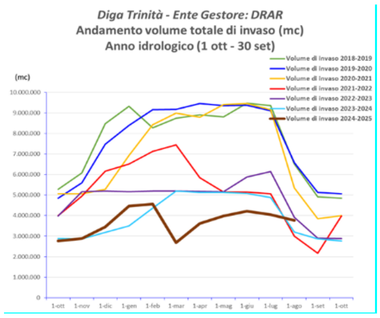

Figure 7: Reservoir storage levels in cubic meters– Status update: August 1, 2025.

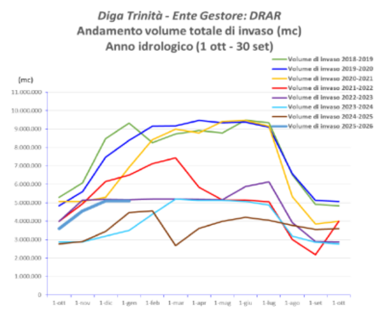

Figure 8: Reservoir storage levels in cubic meters – Status update: January 1, 2026.

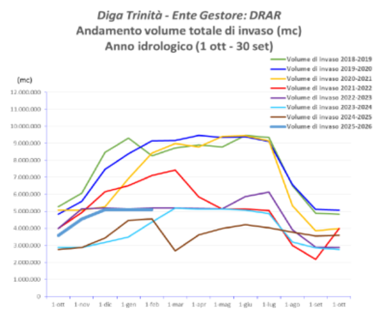

Figure 9: Reservoir storage levels in cubic meters – Status update: February 1, 2026.

Although the structure was designed for a total capacity of 18 million cubic meters (M^3), current safety restrictions imposed by the Ministry of Infrastructure and the Italian Dam Registry (RID) authorize a filling of only 2.5 M^3. This is drastically less than the minimum 6 M^3 required annually for the agricultural sector in the Trapani area (Castelvetrano, Campobello di Mazara, and Mazara del Vallo).

There is a crucial loss of resources (Over-processing). During heavy rainfall events, such as those detected in the February 2026 rebound, the operator is required to perform preventive discharges into the sea to maintain the level below 50 meters above sea level. This turns a vital resource into a hydraulic waste, an unacceptable paradox in a region affected by extreme drought. Moreover, the economic impact is inefficient due to the infrastructure system. The malfunction limits irrigation to only 800-1,000 hectares, compared to the potential 2,500, causing devastating losses for wine and olive cooperatives and production declines that operators describe as the worst in the last sixty years. Finally, the failure to maintain (Inventory Decay). The current crisis is not the result of a lack of rainfall alone, but of decades of political inertia and lack of compliance with modern seismic standards.

The case of the Trinità Dam represents the pinnacle of regulatory inefficiency stemming from structural decay. Due to long-standing issues with gate seals and discharge systems, the Italian Dam Registry (RID) has for years imposed an "authorized storage limit" significantly lower than the design capacity. This means that during intense rainfall events, such as those in February 2026, the operator is forced to release excess water into the Delia River in advance. This resource, though available and desperately needed for agriculture in the Trapani area, is sacrificed to the sea to prevent critical pressure levels on structures that have not been 100% certified.

B. Case of sedimentation and siltation: Pozzillo Dam

The Pozzillo reservoir, completed in 1958 and located near Regalbuto (Enna), represents the most critical example of how chronic sedimentation (siltation) compromises large-scale water management. Originally designed as the centerpiece of a complex hydraulic system for the multi-purpose utilization of the Salso and Simeto rivers, it remains the largest artificial basin in Sicily. Built on a foundation of sandstone and marly clays, the 59-meter-high concrete block dam was designed with an initial useful capacity of approximately 140 million cubic meters (M^3). However, decades of debris and mud accumulation on the reservoir bed have reduced its actual storage capacity to 118 M^3—a net loss of 22 million cubic meters. This phenomenon creates a dangerous technical illusion: during the "water boom" of February 2026, the dam appears to reach its maximum levels more quickly on monitoring graphs (Figures 10 and 11). In reality, this "accelerated filling" is merely the result of a shrinking basin. Consequently, the transition to spillway overflow occurs prematurely, preventing effective flood attenuation and resulting in the forced waste of resources that would otherwise be vital for the dry season. The reduction in the Pozzillo "water buffer" directly threatens the survival of the Catania Plain, one of Italy's most productive citrus districts. This phenomenon affects the agricultural backbone of Catania. The reservoir primarily supports intensive tree crops: 90% citrus groves (mainly oranges and tangerines), 5% pear orchards, and 5% irrigated arable land for open-field vegetables. Furthermore, the local practice of planting rows of olive trees as windbreaks around citrus orchards increases the ecosystem's overall water demand. Currently, the Reclamation Consortium manages a limited share of approximately 3.3 M³, with a potential increase to 5.0 M³ contingent on the restoration of the Ancipa connection. Without urgent desiltation interventions, the Pozzillo Dam will continue to lose its strategic function, transforming from a "water lung" into a structural bottleneck for Sicilian high-quality agriculture.

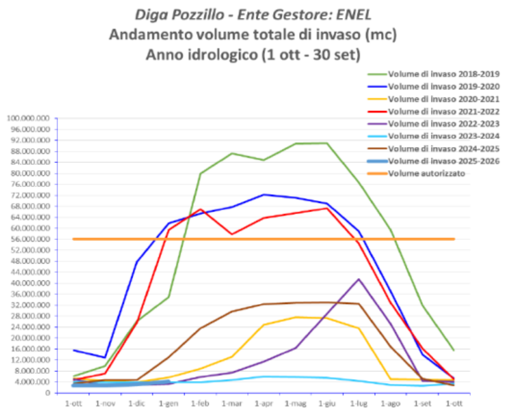

Figura 10: Reservoir storage levels in cubic meters– Status update: January 1, 2026

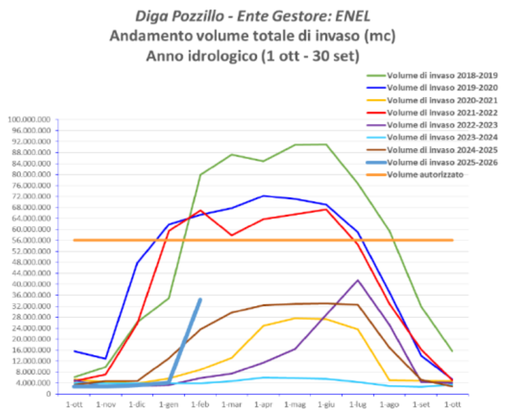

Figure 11: Reservoir storage levels in cubic meters – Status update: February 1, 2026

C. Case of Infrastructure isolation: Gibbesi Dam

The Gibbesi Dam embodies the disconnection between water accumulation and distribution. It represents a case of infrastructural isolation, and it is located in Sommatino. Despite its capacity to collect significant volumes, the infrastructure suffers from the lack of complete or efficient conveyance networks linking the reservoir to the surrounding irrigation districts. In a scenario of "hydrological rebound," Gibbesi may find itself in a condition of water surplus that nevertheless remains unusable for orchards or for civil water supply in other Sicilian areas experiencing shortages. This case confirms that water security does not depend solely on rainfall, but on the system's ability to transfer the resource from storage basins to centres of economic consumption through an integrated water network. The spatial heterogeneity of water accumulation is driven by catchment-area morphology and the orographic effect. Reservoirs like Scanzano and Gibbesi, situated in high-yield hydrographic basins, experienced rapid volumetric increases due to concentrated precipitation events, while others remained limited by their geographical positioning and soil permeability.

D. Case of paradox forced discharge: Fanaco Dam

Similar to the Fanaco reservoir, Lake Leone has demonstrated a filling rate capable of rapidly saturating its 4.2 million cubic meters of capacity. However, the absence of a secondary storage system or of interconnections with other reservoirs that remain underfilled (such as Lake Gorgo) turns this abundance into a systemic waste of resources. This is a case of forced discharge, a controversial example of forced discharge. The excess water is channeled into the Sosio-Verdura river system and ultimately discharged into the sea, exacerbating the coastal salinity shock already described and confirming the current system's inability to retain sudden hydrological "wealth."

6. Climatic Drivers and Infrastructure Limitations in the Sicilian Water System

Considering the cases analysed, two key variables emerge in understanding the Sicilian water management issue. The first can be defined as an independent variable, referring to the actual amount of water that the territory is able to receive. This depends on natural and climatic factors — such as rainfall, temperature patterns, and seasonal dynamics — which are inherently beyond human control.

The second can instead be interpreted as a dependent variable, relating to the capacity of the infrastructural and management system to retain, distribute, and effectively utilize available water resources. As demonstrated in the cases examined, water can arrive in significant quantities — as observed in recent months — yet the absence of adequate infrastructure, interconnection systems, and efficient storage capacity prevents this abundance from being transformed into a strategic resource over the medium and long term.
It is precisely at this point that the structural limitations of the Sicilian water system become evident. Water availability is not constant over time, and therefore requires infrastructure designed not only to manage scarcity but also to capture and store periods of abundance. When water resources become temporarily abundant, it is essential to have systems capable of accumulating and managing them as a strategic reserve for future needs.

The lack of adequate infrastructure and integrated water planning instead results in the systemic dissipation of the resource, with consequences that extend far beyond mere waste. The opportunity cost of this loss is particularly high: water scarcity not only creates deficits for local populations and economic activities but also represents a serious threat to the survival and stability of ecosystems that depend on water availability in areas surrounding reservoirs and water basins. In this sense, water management in Sicily cannot be interpreted solely as a climatic issue; rather, it must primarily be addressed as an infrastructural, governance, and strategic challenge.

7. Conclusion

Sicily is at a paradoxical crossroads. While "drought" has long been the main scapegoat for the island's water problems, the 2026 hydrological cycle demonstrates that climate is only one side of the coin. The shift from extreme scarcity in 2025 to the "water boom" of 2026 has not led to an end to rationing, but rather to a tragic irony: millions of cubic meters of freshwater are discharged into the sea while citizens and farmers remain under pressure. The case studies of Fanaco, Trinità, and Pozzillo confirm that the real crisis is structural. The persistence of limited operational testing (testing), the lack of interconnection between the basins (the "water ring"), and chronic silting act as a "leaking bucket" that prevents the island from exploiting its natural riches. To move forward, Sicily must stop treating water as an emergency to be managed and begin treating it as a resource to be designed. Without urgent infrastructure modernization and an integrated governance model, the island will remain "thirsty" not because of the lack of rain, but because of a system that has forgotten how to hold it back.

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