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Following the severe drought event that occurred in Italy in 1988–90, the Italian Department of Civil Protection published a report, *Drought in Italy 1988–90* (in Italian; edited by G. Rossi and G. Margaritora), containing a comprehensive description of the drought event, its impacts, and the mitigation measures adopted in the most affected regions.

Since the beginning of the drought, the Department promoted and coordinated a number of initiatives, aiming mainly to mitigate domestic and agricultural water shortages. The Department also formed a drought committee, which included representatives of various government agencies (in charge of hydrometeorological data collection and water supply system management), with the aim of acquiring timely information on the evolution of the drought in different parts of the country and suggesting adequate actions. The book presents the results of the activities coordinated by the Committee—namely, the description of the meteorological and hydrological characteristics of the 1988–90 drought, the main impacts of the drought on municipal and irrigation systems, and the assessment of measures implemented at the national and local levels. The following summary of the book provides a picture of the most severe drought experienced in Italy in the last fifty years and some information on recent initiatives and laws at the national level to reduce the risk of water shortage during future drought events.

A study of the meteorological trends in the 1988–90 period, prepared by the Italian Air Force Meteorological Service, shows that the position of the 500 hPa isobaric surface over the Mediterranean basin during the drought period was significantly higher than the reference average values. The presence of persistent anticyclones during the entire decade (1980–90) became especially critical between September 1988 and March 1989 and between September 1989 and March 1990, leading to precipitation lower than long-term average values for all of Italy.

On the basis of precipitation data recorded by the Hydrographic Service using a network of 163 gauging stations, the average precipitation during the three-year drought period was approximately 80% of the long-term average values for the entire country, with much lower values in certain areas and for shorter periods. For example, the total precipitation for the Piemonte region (Torino compartment) between September 1989 and March 1990 was 38% of the average for the same period. Meteorological drought led to more severe hydrological drought, the average flows in all water courses being lower than long-term mean values.

Records show that the drought also affected snow depths, with snow precipitation lower than average, most likely as a result of the higher temperature fields. The stations used for the study belong to three separate networks, covering different but slightly overlapping areas. The networks are operated by three agencies: Meteomont Service of the Defense Ministry, the National Electricity Board, and the State Forestry Corps. Consistency of measurements from the three different sources was also checked by comparing snow depths collected from at least two agencies at two nearby locations.

The analysis of the effects of drought on irrigation water availability in central and southern Italy shows that the irrigated land in 1989 and 1990 decreased by 50% as a direct consequence of water shortage. In some areas of southern Italy, water was released to irrigate tree groves only, mainly to sustain trees until the following rainy season rather than to save production; farmers were severely discouraged from planting summer crops.

Lack of surface water for both domestic and irrigation use caused overexploitation of ground water supplies. Many temporary wells were dug; their numbers and locations, as well as the volumes of water drawn, are mostly unknown; thus it is impossible to accurately assess the contribution, certainly essential, of ground waters in mitigating drought. To a very small extent, waste waters and brackish waters were also used. In the most affected areas, drought effects on water resources persisted long after termination of the event.

The report takes a closer look at Sicily, one of the most affected regions, to make a comparison between the precipitation deficits and runoff deficits

	—Zamberletti—		—Gaspari—		—Lattanzio—			
	10^9 Liras	%	10^9 Liras	%	10^9 Liras	%	Totals	%
Abruzzo	—	—	3.346	67.0	1.650	33.0	4.996	0.140
Calabria	—	—	2.949	54.0	2.500	46.0	5.449	0.150
Campania	—	—	159.135	34.0	307.461	66.0	466.596	13.540
Emilia-Romagna	5.500	8.0	—	—	68.934	92.0	74.434	2.160
Friuli-Venezia Giulia	1.200	8.0	1.029	7.0	12.160	85.0	14.389	0.400
Lazio	—	—	200.000	4.0	4.845	96.0	5.045	0.140
Liguria	—	—	—	—	3.570	100.0	3.570	0.100
Lombardia	76.536	28.0	4.419	2.0	193.285	70.0	274.267	7.960
Marche	770.000	1.0	7.633	9.0	73.590	90.0	81.993	2.370
Molise	—	—	—	—	2.650	100.0	2.650	0.100
Piemonte	44.808	44.0	1.051	2.0	54.608	54.0	100.467	2.910
Puglia e Basilicata	1.080	0.2	150.000	0.1	568.300	99.7	569.530	16.530
Sardegna	32.491	25.0	5.970	4.0	96.782	71.0	135.203	3.920
Sicilia	33.338	3.0	729.250	51.0	662.911	46.0	1,425.499	10.370
Toscana	8.965	50.0	2.643	14.0	6.320	36.0	17.928	0.520
Umbria	—	—	1.500	4.0	9.382	96.0	10.882	0.310
Val D'Aosta	—	—	—	—	1.486	100.0	1.486	0.043
Veneto	12.000	5.0	—	—	238.960	95.0	250.960	7.427
Total	216.675	7.0	919.275	26.0	2,309.394	67.0	3,445.344	100.000

Table 1. Allocation of funds by the Department of Civil Protection under the Zamberletti, Gaspari, and Lattanzio ministries (1985–90) for pollution and drought emergencies.

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in the watersheds of the major reservoirs of the island. As a result, even though the average precipitation deficit in the 1988–90 period is slightly higher than 16%, the average runoff deficit is close to 63%, with the highest values in the third year; the discrepancy between precipitation and runoff deficits is probably the result of the increasingly reduced contribution from the aquifers, due to a high cumulative precipitation deficit. With very little or no recharge, all lakes and reservoirs for agricultural or multiple use attained minimum storage levels. Several mitigation measures were adopted on the island by private and regional authorities to deal with domestic and agricultural water shortage. During the summer, municipalities and water companies reduced domestic water delivery to a few hours every 2 or 3 days (7 days in the severest cases) in the most affected urban areas and substantially increased water pumping rates. To exploit the water supply to the maximum extent, the regional government funded the construction of new water supply facilities and new connections between existing aqueducts and reservoirs, thus facilitating within-basin and interbasin water transfers. Some of the water supply devoted to agricultural uses, both from reservoirs and wells, was diverted to satisfy the municipal demand. Most of the mitigation measures in agricultural areas were implemented by farmers and consisted mainly of drilling new wells and constructing small storage facilities for collection of winter runoff. No direct estimates could be made of the additional volumes of water available through these storage facilities, increased pumping from existing wells, or pumping from new wells, since in most cases drilling and construction activities were not reported to the public authority. From data available for the Catania Plain on the increased number of small storage reservoirs (from 664 in 1987 to 1,239 in 1991), it has been estimated that the storage capacity increased from 6×10^6 m^3 in 1987 to more than 20×10^6 m^3 in 1991, with the current storage capacity of private ponds satisfying almost one-fifth of the total water demand for irrigation use.

Among actions taken by the central government and the regional authorities in all drought-affected areas after the drought event was recognized as exceptional, a series of relief programs and funds was set up to compensate farmers for their economic losses and to support mitigation plans devised by local administrations. Many water plans designed to mitigate water shortages (including water transfers and desalination plants) were funded by the Department of Civil Protection. In particular, a high percentage of the 3,445 billion lira (approximately US$2.15 billion) distributed by the Department for water emergencies in each Italian region (see Table 1), especially during the appointments of Gaspari and Lattianzio as civil protection ministers, was devoted to drought mitigation measures.

With the aim of reducing the risk of future water shortages in agriculture, the Ministry of Agriculture emphasized that, in the framework of medium and long-term water policies, water availability could significantly improve with reuse of treated waste waters, use of brackish waters, artificial recharge of aquifers, plans for the restoration of small storage facilities, and widespread information on efficient use of water for irrigation.

The 1988–90 drought produced very severe impacts on domestic and agricultural water supplies mainly because the management policies of water systems did not take into account the occurrence of a three-year drought. The event analysis has pointed out the need for an improvement of operational schemes and organization of drought control and mitigation strategies at both local and central levels.

With the passage of national law no. 225 in 1992 establishing guidelines on natural disasters defense strategies and organization of civil protection, plans are being developed for prevention of water emergencies due to drought and for reducing the vulnerability of water systems. Within the framework of the recent law on urban water service (national law no. 36; 1994), criteria to identify areas subject to drought risk are being created.