

RISK AND RESILIENCE REPORT

Civil Protection Roadmap for Drought Resilience in Switzerland

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Content

Executive Summary	4
Context	4
Objective	4
Methodology and Structure	4
Results	6
1 Introduction	7
1.1 Definition and characterization of drought	7
1.2 Drought in Switzerland	8
1.3 The Swiss Civil Protection System	8
1.4 Drought relevance for Swiss civil protection	9
1.4.1 Drought-specific challenges for civil protection	9
1.4.2 Drought management capabilities in the Swiss civil protection	11
1.4.3 Swiss Civil Protection's evolution in drought management	12
2 Drought preparedness in Switzerland	13
2.1 Survey results	13
3 Drought mitigation toolkit: 10 Action Points	27
Action Point 1 – Establish and incorporate a national drought early warning system	29
Action Point 2 – Assess drought risk	31
Action Point 3 – Include drought in the cantonal hazard analysis	33
Action Point 4 – Translate drought risk to local action	34
Action Point 5 – Develop a drought response plan	36
Action Point 6 – Appoint a drought task force	38
Action Point 7 – Strengthen drought preparedness through exercises	40
Action Point 8 – Participate in knowledge exchange	43
Action Point 9 – Conduct community education and outreach programs	44
Action Point 10 – Embrace collaboration	46
4 Concluding Remarks	48
5 Bibliography	49

Executive Summary

Context

Climate-exacerbated hazards, particularly hydrological extremes, increasingly affect human and environmental systems across Switzerland. With the population acutely aware of these events, numerous initiatives are underway to strengthen the preparedness of institutions, communities, individuals, and ecosystems.

Recent assessments, such as the ETH Center for Security Studies' Trend Analysis Civil Protection 2035 report,¹ indicate that climate change adaptation is recognized as a strength of the Swiss civil protection system. However, the recently published Capability Analysis for Civil Protection (*Fähigkeitsanalyse Bevölkerungsschutz*)² by the Federal Office for Civil Protection (FOCP) has identified deficiencies in prevention, prompting a more comprehensive examination of the system's capacity to address slow-onset and long-lasting crises like drought.

From a federal perspective, drought presents an opportunity to enhance Switzerland's overall crisis management capabilities. The currently ongoing improvement of the federal crisis management structure (*Krisenmanagement der Bundesverwaltung*)³ can be leveraged to enhance both short-term coordination and long-term advisory functions in response to drought events. Furthermore, the anticipated new security strategy from the Federal Council in 2025 may provide an additional avenue for addressing drought and other natural hazards as significant threats requiring comprehensive mitigation and adaptation strategies.

Objective

This report is part of continuing research initiated by the FOCP and focuses on the assessment of the civil protection capabilities needed to cope with climate-exacerbated hazards in Switzerland. This study specifically addresses the multifaceted challenges posed by drought to civil protection systems in Switzerland. It seeks to provide a roadmap that includes current practices, vulnerabilities, and future directions in drought mitigation within the Swiss context.

The primary objective is to strengthen the link between civil protection systems and drought mitigation by advocating for an integrated risk-oriented approach. To this end, the report assesses the current state of drought preparedness in Switzerland, with a particular emphasis on the evolving role of civil protection. In addition, the goal is to identify and map existing initiatives and practices, breaking down organizational silos

and fostering a broader awareness and knowledge exchange.

Finally, this report aims to develop a practical and actionable Drought Mitigation Toolkit, which will serve as both a guiding resource for regional and cantonal preparedness plans and a foundation for future policy development in drought mitigation. The Mitigation Toolkit aligns with the integrated risk management cycle⁴ promoted by the FOCP, emphasizing early actions taken before or at the onset of drought to minimize its impacts. Additionally, the report advocates for the exchange of knowledge from past experiences to foster collaboration. In doing so, the report aims to strengthen Switzerland's overall resilience to drought and promote a more proactive, adaptable approach to managing drought-related risks.

The authors would like to express their gratitude to the cantonal civil protection authorities and national drought experts from the federal administration and federal institutions for their valuable contribution to this project. Their input has been essential to the development of this report, and we are deeply thankful for their collaboration and expertise.

Methodology and Structure

The research for this report employed a multidisciplinary approach that combined quantitative and qualitative research methods, including desk-based research, survey analysis, and expert interviews, as illustrated in **Figure 1**.

The initial phase of data collection began in April 2024 with the distribution of an online survey to authorities from all 26 cantonal offices of civil protection and civil defense in Switzerland. The survey was directed to those responsible for the strategic development of civil protection within their respective cantons, ideally heads of the Office of Military and Civil Protection/Civil Defense or members of the cantonal crisis management body (*kantonale Führungsorgane* or *kantonale Führungsstäbe*) involved in the cantonal hazard analysis (*kantonale Gefährdungsanalyse*) and preparedness planning (*Leitfaden Kataplan*).⁵ Survey participants were identified through research into each organizational structure of the cantonal Offices of Military and Civil Protection/Civil Defense. When this was not publicly accessible, personal networks were leveraged.

Grounded in the National Risk Analysis of Disaster and Emergencies (*Nationale Risikoanalyse "Katastrophen und Notlagen Schweiz" (KNS, English abbreviation: DES)*),⁶ which provides definitions and guidelines for drought management, the survey was structured in two sections. The first section collected baseline data on current drought management strategies, while the second evaluated responses to a hypothetical drought scenario, emphasizing strategic decision-making processes. The

survey was administered via the platform Qualtrics in April 2024, with responses collected throughout April and May. Out of the 26 cantonal representatives invited, 25 accepted the invitation to take part. The responses have been aggregated to ensure the anonymity of participants and provide insights from the perspective of cantonal civil protection authorities, which may not necessarily reflect the views of cantonal governments or other agencies. A detailed overview of the survey results can be found in Section 2.1.

Subsequent to the survey, expert interviews conducted between April and May 2024 provided insights into drought mitigation efforts across Switzerland. The analysis of these interviews identified key themes, challenges, and best practices, directly informing the development of the Drought Mitigation Toolkit’s 10 Action Points. While the detailed content of these interviews is not published, their influence is embedded within the Toolkit, alongside case studies and projects discovered through this process.

The first set of interviews was conducted with authorities from the civil protection and civil defense offices of six selected cantons – Basel-Stadt, Thurgau, Zurich, Bern, Fribourg, and Ticino – who are actively engaged in operational-level activities. This selection of the cantons ensured a diverse representation of Switzerland’s geographic, linguistic, and regional landscape. The interviews provided an opportunity to exchange information, gather insights on past drought events, assess current challenges to drought mitigation, and understand existing measures and ongoing initiatives.

To further complement the cantonal perspective, four additional expert interviews were conducted with national-level specialists involved in drought management across Switzerland. Representatives from the Federal Office of Meteorology and Climatology (MeteoSwiss), the Federal Office for the Environment (FOEN), the Steering Committee on Intervention in Natural Hazards (LAINAT), and the Swiss Federal Institute for Forest, Snow, and Landscape Research (WSL) provided valuable insights into ongoing national efforts.

This report is organized into four sections. After this executive summary, which introduces the report’s objectives, methodology, and an overview of the results, Section 1 presents a comprehensive overview of drought in Switzerland. Specifically, it provides a comprehensive overview of drought in Switzerland, starting with an examination of the phenomenon itself in Section 1.1 and its occurrence and impacts in Switzerland in Section 1.2. It then proceeds to describe the structure and functions of the Swiss civil protection system in Section 1.3 to prepare the ground for Section 1.4, which examines drought relevance for Swiss civil protection.

Section 2 presents the findings from the engagement with drought specialists and civil protection authorities. It begins by analyzing the survey results, aggregating responses from cantonal civil protection authorities in Section 2.1, and continues with insights gathered from interviews with national drought experts in Section 2.2.

Section 3 focuses on the Drought Mitigation Toolkit with its 10 Action Points for enhancing resilience

Figure 1 illustrates the methodology of the study

Target Group	Cantonal Strategic Civil Protection Authorities (n=25)	Cantonal Operational Civil Protection Authorities (n=6)	National Drought Experts (MeteoSwiss, FOEN, LAINAT, WSL) (n=4)
			
Methodology	Online Survey	Semi-structured Interviews	Semi-structured Interviews
			
Objective	<ul style="list-style-type: none"> Collect baseline data on existing drought strategies Evaluate institutional preparedness to droughts 	<ul style="list-style-type: none"> Gather detailed accounts of past drought events Understand current challenges Assess the effectiveness of existing measures 	<ul style="list-style-type: none"> Explore drought phenomena in Switzerland Gain insights into national drought mitigation efforts

to drought. In conclusion, Section 4 summarizes the key findings and outlines the opportunities and lessons learned that can inform and strengthen Swiss civil protection efforts in preparing for and responding to complex crises like droughts.

Results

This report explores the significance of drought hazards for civil protection organizations in Switzerland, both at the local and national levels. The findings indicate that drought poses a substantial risk to civil protection systems across Switzerland's diverse geographical and regional landscapes. This significance arises from the impacts that droughts have on the population and their livelihoods as well as from the nature of civil protection systems, which includes crisis response and proactive measures such as prevention and mitigation.

However, the study also identifies several shortcomings, particularly in early action and drought prevention. These challenges were revealed through the survey of Swiss cantons and expert interviews, complementing the findings of the Capability Analysis for Civil Protection published by the FOCP.⁷ Particularly, the study points to key areas of concern:

- **Fragmented drought management practices:** Responses to drought are often uncoordinated among different cantons, leading to inconsistent water bans and bottlenecks in the water supply systems. The institutional framework for prevention and mitigation remains disjointed, although there is potential for improvement through the increasing integration of drought into cantonal hazard analyses.
- **Gaps in proactive planning:** While cantonal civil protection authorities are increasingly aware of the risks posed by droughts, proactive planning remains limited. Only a few cantons have established drought-specific management plans, while the majority focus on reactive crisis management, which includes short-term response measures.
- **Challenges in water management:** Key challenges in water management include inadequate infrastructure for water storage and distribution, difficulties in balancing water use between sectors such as agriculture, industry, and public supply, and a lack of effective enforcement of water use restrictions and conservation measures. These issues have, in the past, led to local conflicts among water users, highlighting the need for more cohesive and coordinated water management strategies.
- **Need for improved collaboration:** Collaboration in drought management across different administrative levels in Switzerland remains underdeveloped. The survey results show that while cantonal authorities

recognize the value of cross-border cooperation, few practical steps have been taken to formalize these relationships. Despite the limited collaboration, there is strong interest in participating in a national knowledge exchange program on drought management.

To address these shortcomings and to provide an overview of ongoing initiatives in Switzerland related to drought management from a civil protection perspective, the report identified 10 Action Points included in a Drought mitigation toolkit:

- **Action Point 1** – Establish and incorporate a national drought early warning system
- **Action Point 2** – Assess drought risk
- **Action Point 3** – Include drought in the cantonal hazard analysis
- **Action Point 4** – Translate drought risk to local action
- **Action Point 5** – Develop a drought response plan
- **Action Point 6** – Appoint a drought task force
- **Action Point 7** – Strengthen drought preparedness through exercises
- **Action Point 8** – Participate in knowledge exchange
- **Action Point 9** – Conduct community education and outreach programs
- **Action Point 10** – Embrace collaboration

These Action Points provide a roadmap for Swiss civil protection organizations to adapt and prepare for droughts. They acknowledge that drought is a nationwide concern, impacting regions to varying extents. The report also emphasizes the necessity for a shift in focus from reactive crisis management to proactive risk reduction.

While the report primarily targets the Swiss context, the identified Action Points and the underlying methodology can be adapted and implemented beyond Switzerland. They serve as a valuable resource for any region dealing with the challenges of drought, offering a practical framework to strengthen preparedness and mitigate the impact of this slow-onset hazard.

1 Introduction

1.1 Definition and characterization of drought

Drought is a complex phenomenon that is difficult to define and subsequently to monitor. In its simplest definition, drought is the absence of water caused by insufficient precipitation or excessive evapotranspiration linked to climate warming.⁸ When extended over a season or longer, this deficiency results in water supplies that are insufficient to meet the demands of human activities and the environment. Other factors, such as temperature, wind, and low humidity, can exacerbate a drought's severity and duration. To better understand its diverse impacts, drought is generally classified into:^{9,10,11}

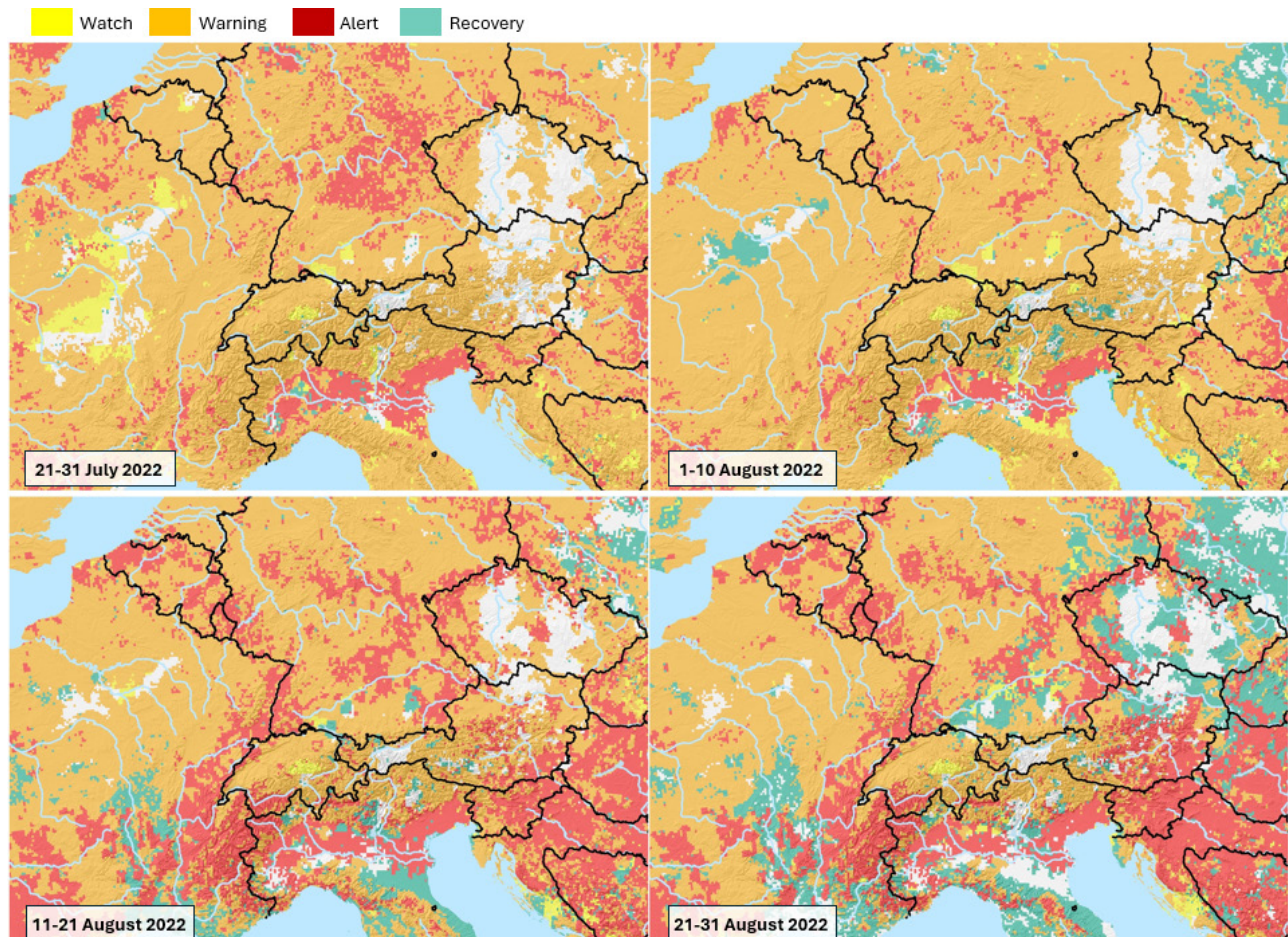
- **Meteorological drought** is characterized by a lack of precipitation over a long period of time;
- **Hydrological drought** occurs when water levels in lakes and rivers drop below normal due to insufficient rainfall in their catchment area;

- **Agricultural drought** manifests when plant roots receive inadequate water, affecting crop yields and agricultural productivity;
- **Socio-economic drought** arises when water supply fails to meet societal and economic demand, leading to adverse consequences;
- **Ecological drought** occurs when water availability in the ecosystem drops below the threshold required to sustain natural ecosystems and their services to society.

Drought typically begins with a period of below-average precipitation, which can gradually propagate through the hydrological cycle. This can lead to reduced soil moisture, declining groundwater levels, deteriorating water quality, and decreased river flows. As drought intensifies, it can impact agriculture, resulting in crop failures and reduced yields. Further escalation can lead to water shortages for essential human needs like drinking water, industrial processes, and recreation. In extreme cases, drought can push ecosystems beyond a tipping point, causing irreversible damage and loss of biodiversity.^{12,13}

Figure 2 illustrates the European drought situation from the end of July to August 2022.

Data used: Combined Drought Indicator v3 from [European Drought Observatory](#)



Drought impacts are largely, drought impacts are largely non-structural and spatially pervasive, making them difficult to assess and respond to effectively. The lack of visually striking drought damage also poses challenges to media coverage and public awareness.¹⁴ However, the consequences of drought are severe, contributing to 650,000 deaths globally between 1970 and 2019. The economic toll is also significant, with annual global costs estimated at six to eight billion US dollars a year.¹⁵ In the United States, one of the few countries with available drought data, total losses attributed to droughts since 1980 are reported to be around 360 billion US dollars.¹⁶ These figures are likely conservative, as they often fail to capture the full spectrum of drought's indirect impacts, which are rarely systematically recorded by monitoring and reporting systems.

1.2 Drought in Switzerland

Although Switzerland boasts abundant water resources, with lakes and rivers comprising 4% of its territory and providing about 6% of Europe's drinking water,¹⁷ it is not immune to the growing threat of drought. An increase in drought occurrence has been observed for the period from 1981 to 2020, especially during the summer months.¹⁸ This is exacerbated by warming temperatures, causing precipitation to fall more often as rain than snow, leading to reduced snowpack in lower-lying areas.¹⁹ These changes have the potential to significantly impact Switzerland's water supply, particularly in remote communities that rely on snowpack, glaciers, and springs for water. The repercussions of drier, warmer conditions have also triggered ecological shifts, such as an increase in insect pests like the European spruce bark beetle (*Ips typographus*), posing a threat to forests that act as a natural protector from avalanches.²⁰

Moreover, the decentralized nature of the Swiss water supply network complicates the equitable distribution of resources during drought periods. Past drought events have sparked conflicts over water usage. For instance, prolonged dry periods have heightened the demand for agricultural irrigation, drawing from underground reserves that supply households.²¹ Additionally, rising water temperatures further exacerbate the situation, as the chemical, nuclear, financial, and technology sectors demand more water for cooling purposes.²² Tensions over water usage have also emerged along Switzerland's borders, with France seeking more water from Geneva's Seujet dam for its nuclear plants²³ and Italy demanding greater water flow through Lake Maggiore for irrigation purposes.²⁴

In 2022, Switzerland, like much of Europe, faced a historic drought. Europe experienced its hottest summer and second-warmest year on record, enduring its

worst drought in 500 years, with far-reaching consequences for agriculture, forests, and glaciers.^{25,26} Low water levels in the Rhine River caused significant delays in shipping, with some vessels operating at 25% of their cargo capacity.²⁷

Drought in 2022 affected as much as 15% of Switzerland's area. Comparably, the average annual area impacted during the years 2000–2020 was around 2.7%.²⁸ A 2022 cantonal survey²⁹ on the impacts of the drought revealed that many cantons experienced prolonged low water levels in small and medium-sized watercourses and groundwater levels hitting historic lows. Particularly regions south of the Alps were prone to drought, for example Lakes Lugano and Lake Ceresio also reached record-low levels. In addition, deteriorating water quality, as well as record-high water temperatures, led to fish mortality in some regions. Reduced discharge rates curtailed electricity production at hydroelectric power plants. In response, many municipalities issued water-saving appeals and restrictions on agricultural irrigation withdrawals became widespread. Conflicts arose locally among water users, with some reports of illegal water extraction.³⁰ In many cantons, short-term measures included the formation of crisis teams, the convening of working groups, and public communication efforts to mitigate the effects of the drought.

The summer of 2022 serves as a harbinger of a new climate in Switzerland,³¹ where droughts are expected to become more frequent and severe. The associated challenges could trigger cross-border or cross-sectoral crises hindering the sustainable and equitable use of Switzerland's water resources. As droughts increasingly threaten both lives and livelihoods in Switzerland, their management also falls within the scope of civil protection, whose federal mandate is “to protect the population and its livelihoods in the event of disasters [...] and to contribute to the limitation and management of damaging events”.³² Swiss civil protection authorities across different administrative levels are tasked with making informed and inclusive decisions that integrate drought management into the broader disaster risk reduction framework.

1.3 The Swiss Civil Protection System

The Swiss civil protection system is a federally structured, multi-layered network consisting of five partner organizations: police, fire services, healthcare, technical services, and civil Defense (*Zivilschutz*). Each organization operates within its respective municipal, regional, and cantonal areas of responsibility, with the 26 cantons mandating and overseeing their activities based on the national law on civil protection and civil Defense,³³ as well as

their own cantonal legislation. This decentralized structure ensures localized responses tailored to the specific needs of the communities while allowing for flexibility in dealing with different emergencies. Complementing this localized approach, the FOCP plays a crucial role in assisting cantonal organizations in their civil protection mandate and responsibilities. In particular, it provides support and coordination for the cantonal hazard assessment and preparedness activities³⁴ as well as incidents that transcend cantonal boundaries, supporting a unified national response when necessary. Moreover, the FOCP is responsible for the national warning, alert, and information systems that notify authorities and the population of impending dangers and incidents.

Since the comprehensive revision of the Federal Law on Civil Protection and Civil Defense (*Bevölkerungs- und Zivilschutzgesetz*) in 2019, the Swiss civil protection system has continued to evolve and adapt to emerging challenges. Several cantons have partially revised their legislation to incorporate these changes and to respond to recent events like the Covid-19 pandemic, the war in Ukraine, migration crises, drought events, and potential energy shortages. The Canton of Schaffhausen, for example, has adopted an integrated risk management approach that expands civil protection responsibilities from prevention to damage management and recovery, emphasizing the use of knowledge gained from past events to inform preventive measures.³⁵ The Canton of Bern has introduced a business continuity management project to enhance the cantonal authority's ability to function effectively in times of crisis.³⁶ In the Canton of Thurgau, revisions to the Civil Protection Act (*Bevölkerungsschutzgesetz*) now include all civil protection-related activities, not just those related to extraordinary events.³⁷ In the Canton of Basel-Stadt, the cantonal crisis organization is currently developing a resilience concept applicable to the cantonal institutions.³⁸ Other cantons, such as Valais and Aargau, have focused on strengthening coordination between local authorities and civil protection organizations through streamlined procedures and transparent information sharing.^{39, 40}

At the national level, the Swiss Federal Council has initiated a major restructuring of its crisis organization in response to lessons learned during the Covid-19 pandemic and recent world events.⁴¹ This restructuring aims to overcome siloed actions and thinking between Federal Departments and agencies as well as to promote a more integrated and coordinated approach to crisis management. Although still under revision at the time of writing, the renewed approach consists of three staff organizations: the Political-Strategic Staff (*Politisch-strategischer Krisenstab*), which will be responsible for developing options for action and preparing decisions for the Federal Council; the Operational Crisis Unit (*Operativer Krisenstab*), which will be tasked with compiling compre-

hensive information for decision-making; and the Permanent Core Staff (*Permanenter Kernstab*), which will ensure the FOCP and the Federal Chancellery are prepared for crises also during normal times.⁴² While these changes hold promise for improving crisis response at the national level, their integration with cantonal crisis management bodies, which have valuable experience in crisis management, remains an area for ongoing evaluation and potential refinement.

1.4 Drought relevance for Swiss civil protection

As drought hazards become increasingly relevant in Switzerland, their prevention and mitigation also fall within the scope of civil protection. This section explores the multifaceted aspects of drought management within the Swiss civil protection system, reviewing past achievements and future expectations. It begins by examining the conceptual challenges civil protection organizations face when dealing with slow-onset hazards like drought. The Section then delves into the identified deficiencies in the Swiss civil protection system's capacity to address drought. Finally, it outlines the ongoing shift within the Swiss civil protection system toward a more proactive and resilient approach to drought management, highlighting the challenges and opportunities that this transformation presents.

1.4.1 Drought-specific challenges for civil protection

In contrast to rapidly unfolding disasters, such as earthquakes, cyber incidents, or terrorist attacks, droughts develop gradually. They are often perceived as part of a natural cycle rather than a hazard with the potential to severely impact populations and their assets.⁴³ The slow onset of droughts, coupled with their expansive spatial and temporal nature, significantly complicates planning and readiness efforts.

Existing drought risk management plans, however, tend to prioritize crisis management and **response** over hazard **prevention** and **risk reduction**.⁴⁴ This is often due to a perceived lack of structural measures, such as water-efficient infrastructure or early warning systems, that could effectively prevent or **mitigate** droughts. Moreover, the tendency of relevant agencies to identify prevention measures that obviate the necessity for civil protection intervention altogether can lead to neglecting the importance of building resilience skills within the civil protection system.

The emphasis on crisis response also shapes how civil protection organizations distribute their resources and allocate training efforts, often prioritizing

rapid-response capabilities over long-term efforts. Therefore, the crisis management approach can limit the effectiveness of long-term disaster risk reduction strategies.

The absence of clearly defined thresholds for identifying the start and end of a drought event further hinders proactive intervention, often resulting in delayed responses when substantial impacts have already manifested.⁴⁵ This lack of clear drought threshold levels has implications for the accountability and responsibilities of the various institutions involved in drought management.⁴⁶

As drought conditions persist and affect the population, critical infrastructure, and supply chains, the crucial role of civil protection becomes increasingly apparent. However, the absence of a clear mandate or established protocols, particularly for hazards with limited experience, can impede optimal collaboration between civil protection partners in emergency situations, resulting in delays in response efforts.⁴⁷

In many countries, civil protection and disaster management operate within a decentralized framework, involving a multi-level, multi-sector network of stakeholders across all the stages of the disaster cycle. While the decentralization of responsibility to local governments can be beneficial, it also necessitates effective vertical coordination among stakeholders at all levels of governance to ensure seamless communication, resource allocation, and decision-making during drought events.

Key Terminology

Based on the Sendai Framework Terminology on Disaster Risk Reduction⁴⁸

Prevention refers to activities and measures taken to avoid existing and new drought risks. While drought risk cannot be fully eliminated, prevention aims to reduce communities' vulnerability and exposure. This could involve implementing water conservation measures, improving land-use practices, or developing drought-resistant crops.

Mitigation involves actions taken to lessen or minimize the scale or severity of a drought, which often cannot fully be prevented. This might include engineering techniques and hazard-resistant construction as well as improved environmental and social policies and public awareness.

Preparedness indicates the increased knowledge and capacities developed by governments, professional response and recovery organizations, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of likely, imminent, or current disasters. Some examples are the development of emergency management organizations to plan and coordinate response, installing early warning systems, identifying evacuation routes, and preparing emergency supplies.

Disaster Risk Reduction goal is the substantial reduction of disaster risk and losses in lives, livelihoods, health, and in economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries.

1.4.2 Drought management capabilities in the Swiss civil protection

Recognizing the need for Switzerland’s civil protection system to evolve and adapt to complex challenges such as droughts and other climate-related extremes, the FOCP, in collaboration with federal and cantonal partners, has recently conducted a comprehensive analysis of Switzerland’s civil protection capabilities titled Capability Analysis for Civil Protection.⁴⁹ The analysis, referencing a drought scenario that could persist for six months, identified 39 key capabilities that are essential for effective mitigation and response. These include not only cross-cutting crisis management and civil protection capabilities but also specialized capabilities in data management, situational awareness, resource preservation, and water management logistics.

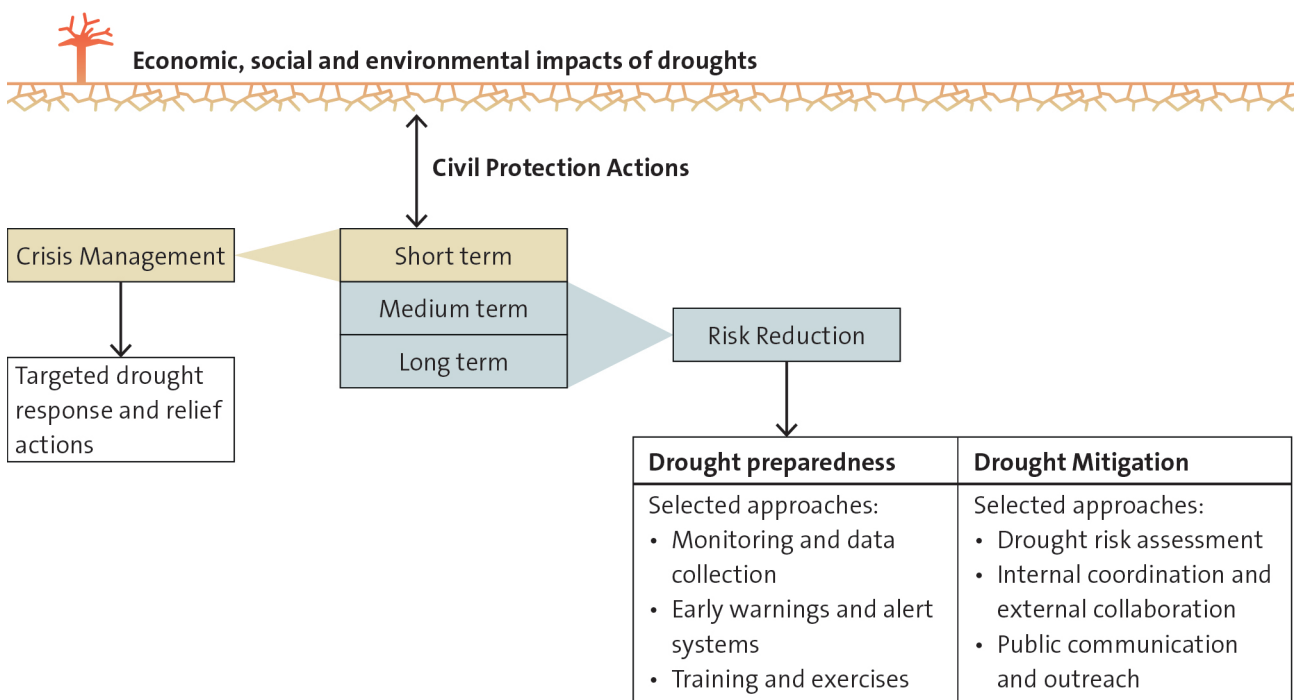
While the analysis highlights the breadth of necessary capabilities and resources required for effective drought mitigation, it also reveals significant deficiencies in the current capacity of the Swiss civil protection system. A substantial 19% of the identified capabilities in civil protection were rated as inadequate, with a disproportionate 67% of these deficiencies concentrated in the domain of leadership and management. Although 42% of the capa-

bilities were deemed as sufficient and 39% assessed as good, the overall findings underscore the need for targeted improvements in various aspects of drought management. Specifically, the analysis points to the need for improved strategies for allocating and prioritizing water resources in times of scarcity, a clearer definition of roles and responsibilities at different levels of government, improved public awareness and education about drought risks, and increased collaboration between civil protection and the entities owning and managing resources and assets.

To effectively address the outlined gaps and improve overall drought resilience, a reassessment of existing structures, policies, and strategies within the Swiss civil protection system is necessary to better account for drought risks. This entails a paradigm shift from a reactive crisis management approach to a proactive drought risk reduction approach, both of which are depicted in **Figure 3**. This shift fully embraces the integrated risk management cycle⁵⁰ promoted by the FOCP and focuses on enhancing and improving monitoring, mitigation, and response mechanisms. It, therefore, enables decision-makers to detect a drought early, respond promptly, and implement measures to reduce impacts before they reach a crisis stage.⁵¹

Figure 3 illustrates the civil protection actions framework in response to drought impacts, distinguishing between crisis management and risk reduction.

Graph inspired from Wilhite D. A., and Pulwarty R., S., Drought and water crises: integrating science, management, and policy, Second Edition, Boca Raton : CRC Press, 2018 p.100



1.4.3 Swiss Civil Protection's evolution in drought management

As civil protection in Switzerland shifts from focusing on crisis management to a more proactive approach to risk reduction by implementing the gaps that have also been identified in the Capability Analysis for Civil Protection,⁵² several significant changes are anticipated. This shift aims to increase resilience and ultimately reduce the impact and costs of disasters such as droughts and other climate-related extremes. For example, studies estimate that every dollar spent on drought risk mitigation saves at least two dollars in future disaster costs.⁵³ This transition will create new opportunities as well as new demands for civil protection organizations to evolve and successfully manage complex emergencies.

One of the most immediate impacts of this shift will be a strain on resources due to more frequent and resource-intensive operations.⁵⁴ Civil protection organizations will face increased demands on personnel, material, and time.⁵⁵ Innovative solutions will be needed, such as expanding the volunteer base and leveraging spontaneous helpers organized through social platforms. Engaging communities in civil protection efforts will not only increase the number of personnel but also promote a culture of early action and resilience.⁵⁶

Moreover, prolonged and intensified deployments due to more frequent and severe droughts can have a toll on the mental health of civil protection personnel. This requires the implementation of support mechanisms and strategies to address potential psychological impacts.⁵⁷ The provision of mental health resources, stress management training, and counseling services will be essential to maintain the well-being of civil protection personnel and ensure they remain healthy and effective in their roles.

The transition to risk reduction will also ask for a reassessment of equipment needs to ensure preparedness for future requirements. This may include the procurement of specialized assets, such as mobile water treatment units and emergency power generators, or the pre-positioning of emergency supplies. However, as budget constraints may limit some cantons' ability to acquire such equipment independently, the importance of inter-cantonal cooperation and resource sharing through bilateral agreements and the Federal Resource Management Mechanism (*Ressourcenmanagement Bund, ResMaB*) is underscored. By pooling resources and coordinating efforts, cantons can overcome financial constraints and ensure all regions have access to essential equipment.

Maintaining the operational continuity of critical infrastructure, including energy, water, transportation, and telecommunications systems, is another key responsibility of the technical services (*Technische Betriebe*) as one partner organization within civil protection.⁵⁸ This becomes even more important during prolonged drought condi-

tions, as many of these systems are particularly vulnerable to disruptions caused by water scarcity and shortages.

Furthermore, the shift towards proactive risk reduction will require a greater emphasis on training and prevention activities. This includes developing comprehensive risk management plans that include both proactive and reactive measures. Training programs must be updated to include scenarios that focus on slow-onset disasters, such as droughts, to ensure that personnel are well-prepared to deal with these complex situations. Ongoing professional development and regular joint exercises with other civil protection entities will be crucial in building a robust and adaptable civil protection workforce.⁵⁹

At a more strategic level, preparedness efforts will include reviewing existing water distribution protocols, engaging diverse stakeholders for unified action, and preventing fragmented responses such as uncoordinated water bans. To address these challenges, a greater emphasis will be placed on improving civil protection leadership capabilities, as highlighted in the Capability Analysis for Civil Protection.⁶⁰

Within cantonal offices, civil protection is expected to strengthen its role as a subject matter expert in both strategic and operational preparedness while serving as a platform for dialogue between the various specialized agencies involved in drought management. This could involve regular coordination meetings with relevant cantonal authorities and agencies, such as water management, forestry, and public health, to proactively address and plan for potential drought-related challenges – an approach already being implemented in some cantons. By facilitating collaborative discussions and collecting recommendations to present to the cantonal executive power, cantonal civil protection authorities can foster trust and cooperation within their canton. Between cantons, platforms such as the Conference of Cantonal Authorities for the Military, Civil Protection, and Civil Defense (*Konferenz der kantonalen Verantwortlichen für Militär, Bevölkerungsschutz und Zivilschutz, KVMBZ*)⁶¹ and other knowledge-sharing networks should be used to elevate ambitions, drive coordinated action and enhance overall community resilience in the face of drought.

At the national level, cantonal civil protection organizations could bring valuable local and regional knowledge and practical experience in crisis management to the table, ensuring that national policies and strategies are informed by real-world challenges and lessons learned.

2 Drought preparedness in Switzerland

To gain a holistic understanding of the diverse drought management practices across Switzerland, this study employed a two-step expert engagement process. First, an online survey was distributed to 26 cantonal authorities responsible for the strategic development of civil protection within their respective cantons or involved in cantonal hazard analysis and preparedness planning. This was followed by in-depth interviews with representatives from civil protection and defense offices in six selected cantons – Basel-Stadt, Thurgau, Zurich, Bern, Fribourg, and Ticino – as well as national-level experts from Meteo-Swiss, FOEN, LAINAT, and WSL. These interviews provided deeper insights into past drought events, current challenges, the effectiveness of existing measures, and ongoing national drought mitigation efforts.

The findings from this engagement offer a snapshot of current drought practices in Switzerland, revealing strengths and identifying areas for improvement. They have been instrumental in shaping the Drought Mitigation Toolkit presented and validate the 10 Action Points in this report. Moreover, the expert input offers a forward-looking perspective on planned projects and initiatives aimed at enhancing drought resilience at both the cantonal and federal levels.

2.1 Survey results

This section provides an analysis of drought preparedness across Swiss cantons based on quantitative data gathered from the survey's structured questions. Given that civil protection in Switzerland is primarily organized at the cantonal level, the survey aimed to capture baseline data on existing strategies and procedures, offering a snapshot of the cantonal approaches to drought management. Additionally, it sought to assess overall preparedness through the use of a hypothetical drought scenario.

The survey had participation from 25 out of 26 cantonal civil protection authorities from the cantonal Office of Military and Civil Protection/Civil Defense. This near-complete dataset allows for a comprehensive analysis of drought preparedness across Switzerland's diverse geographic, linguistic, and regional landscape. A detailed overview of the survey results can be found at the end of this Section.

A noteworthy finding from the survey is the pervasive acknowledgment of **drought risk** among cantonal civil protection offices, with 24 cantons rating it as medium to high for their respective canton (Question 1). This highlights the increasing recognition of drought as a significant threat to Switzerland, irrespective of regional

variations. Furthermore, 16 cantons have incorporated drought into their hazard analyses, typically in conjunction with heatwaves or wildfires as related hazards (Question 3). This number is likely to increase as some cantons are in the process of updating their cantonal hazard analysis. In fact, 9 cantons' hazard analyses are dated prior to 2018 (Question 2). However, the prevalent association of drought with heatwaves suggests that the drought impacts are primarily recognized during the summer months, coinciding with higher temperatures. This perspective may inadvertently overlook the critical role of winter conditions such as snow scarcity or low snow precipitation, which are crucial for water supplies, agriculture, hydropower production, and ecosystems throughout the year. Further investigation is required to ascertain whether this association restricts drought management to the summer season only.

A total of 19 cantons indicated that they experienced drought events in the past (Question 5). These experiences have prompted a range of responses, with 8 cantons conducting informal evaluations of these events and 5 undertaking comprehensive evaluations that yielded specific and actionable recommendations (Question 6).

The implementation of post-drought adaptation measures has resulted in the introduction of specific changes at the cantonal level, as reported by 18 respondents (Question 7). These include the establishment of drought-focused working groups or task forces in 15 cantons and enhancements to water storage and distribution infrastructures in 10 cantons. In the absence of the planned national drought early warning system at the time of the survey, 8 cantons have independently refined their monitoring and early warning systems in response to previous droughts.

As of May 2024, only 7 cantons had developed specific **drought management plans**, with 1 of these cantons in the process of doing so (Question 8). This highlights a gap in the overall national capacity to manage droughts. Existing plans frequently adopt a multi-hazard approach, addressing not only drought but also the interconnected risks of heatwaves, wildfires, the spread of invasive species, or air pollution (Question 11). Such plans typically incorporate a range of response measures, including the pre-established emergency protocols, the formation of dedicated drought task forces, clearly defined roles and responsibilities for civil protection partners, and ongoing drought monitoring activities. However, the absence of key elements such as proactive mitigation strategies, post-drought evaluation processes, updated analyses of historical drought impacts, or a clear identification of the sectors most vulnerable to drought represents a notable gap in the existing drought management plans. Furthermore, 4 of the 7 drought management plans lack clear criteria for declaring drought emergencies, which is a crucial element in ensuring timely and effective responses (Question 10).

So far, 15 cantons do not regularly publish a **drought bulletin** (Question 12). This observation underscores the potential benefits of the planned national early warning system and its associated national weekly drought bulletins.

Furthermore, 16 cantons have appointed a **drought expert or task force**, often led by specialists from the cantonal environmental or energy offices. This demonstrates an acknowledgment of the necessity for specialized knowledge in addressing drought-related challenges (Question 13).

The implementation of scenario-based **exercises or training** is an indicator of operational preparedness. However, 21 cantons lack this for drought scenarios (Question 15). **Cross-border collaboration** with neighboring cantons or countries, while under consideration in 16 cantons, remains limited (Question 14). This response highlights a significant area of concern, as droughts do not respect political boundaries and frequently impact extensive geographical areas.

Concluding the first part of the survey, 14 cantons have not yet initiated research and development programs to improve drought resilience within their canton. This finding indicates a gap in proactive measures and long-term planning or resource constraints for drought management (Question 16).

In the second phase of the survey, respondents assessed their **canton's preparedness** to address a drought scenario. With 17 cantons, a majority indicated "moderate preparedness", and 7 expressed an even lower level of readiness for the presented scenario (Question 17). This self-assessment raises concerns about the overall capacity of Switzerland to effectively respond to drought events. Despite this, 23 respondents attested that their cantonal civil protection possesses a sufficient legal basis to fulfill their mandate of protecting the population and its vital resources in the event of a drought emergency (Question 18). Additionally, 16 cantons indicated that they have implemented adequate strategies and plans to manage water shortages (Question 20). However, a recurring concern was the absence of an overarching framework that integrates all relevant actors, particularly municipalities responsible for local water management. Furthermore, challenges were identified with regard to public engagement in water conservation efforts and a lack of clear responsibilities and communication strategies at all decision-making levels (Question 21).

As indicated by the respondents, the three sectors that are expected to be most affected by drought are agriculture, drinking water supply, and energy production (Question 22). In order to raise awareness and promote water conservation, cantons employed a variety of strategies, including extensive media coverage, informational websites, social media campaigns, and targeted water conservation initiatives (Question 23).

The respondents identified several pivotal challenges associated with the management of drought scenarios in their respective cantons, with the majority of these challenges pertaining to the domain of **water management**. These challenges include the adequacy of infrastructure for water storage and distribution, the balancing of water usage for irrigation, industrial, and public supply needs, and the enforcement of water use restrictions and conservation measures. Securing financial resources for the implementation of mitigation measures also poses a notable hurdle (Question 24).

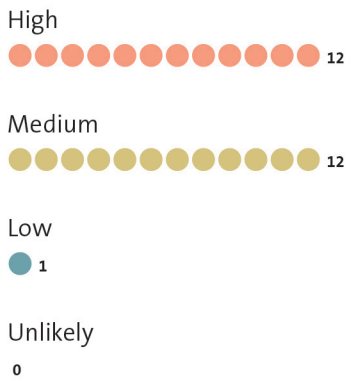
The allocation of **financial resources** to bolster drought response capabilities is primarily based on the cantonal budget, followed by federal assistance (Question 25).

Only three cantons have implemented **staff and personnel training** on drought preparedness and response, and one is in the process of doing so (Questions 26 and 27).

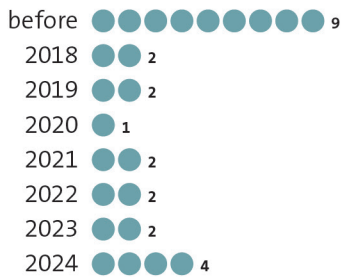
The survey results also point to promising developments. Despite the currently limited **cross-border collaboration** regarding drought management, 10 respondents expressed interest in engaging at both inter-cantonal and international levels, while 8 respondents indicated interest in inter-cantonal engagement only (Question 28). Furthermore, the considerable interest in participating in a **national knowledge exchange program** on drought management and resilience highlights a desire for shared learning and collaborative solutions (Question 29).

Section 1


1. How does your office estimate the risk of drought in your canton over the next ten years? (n=25)





2. When was your canton's hazard analysis last updated? (n=24)




3. How does your canton's hazard analysis address drought? (n=25)

Drought is included in the hazard analysis, but it is combined with a related hazard (e.g., drought and heatwave).
 16

Drought is recognized as a specific hazard and is included in the hazard analysis.
 4

While drought specifically is not directly included in the hazard analysis, heatwave is addressed.
 2

The hazard analysis does not specifically address drought or any related hazards.
 1

Other
 2

If Other, please specify:

- Not following the national classification of the National Risk Analysis of Disasters and Emergencies in Switzerland. 2

4. What are the reasons for not specifically addressing drought in the canton's hazard analysis? (n=3)

- Drought will be included in the future update of the hazard analysis. 2
- In the process of development of the hazard analysis, drought was categorised as a non-priority hazard for the canton. 1

5. Has your canton experienced drought events in the past 20 years? (n=25)

Yes



No



Unsure



6. Following the drought event that impacted your canton, was there a documentation and evaluation process to assess the effectiveness of drought response actions? (n=19)

An informal evaluation process was conducted without structured documentation.



A comprehensive evaluation process was conducted, resulting in actionable recommendations.



No formal evaluation process was conducted.



Other



7. Following the drought event that impacted your canton did your canton incorporate any of the following changes? (n=18)

Creation of a drought working group/task force



Enhancement of infrastructure for water storage and distribution



Refinement of the monitoring and early warning system



Revision and update of the hazard analysis



Inclusion of scientific advisory into the drought management



Elaboration of cross-sectoral strategies to address water scarcity



Establishment of a drought management plan



Expansion of cooperation with neighboring cantons and/or countries for shared resources and knowledge exchange



No changes were implemented



Increase of research and development to improve drought resilience



Introduction of educational programs and awareness-rising campaigns



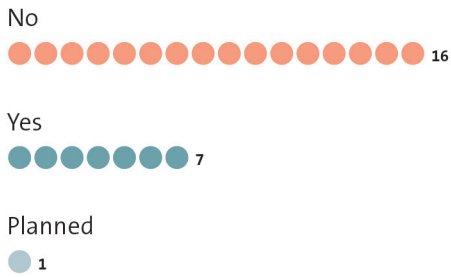
Other



If Other, please specify:

- Trink- und Brauchwasserplanung und Dokumentationen. 2
- Institutionalisierung der Lageanalyse und Massnahmengreifung. 1

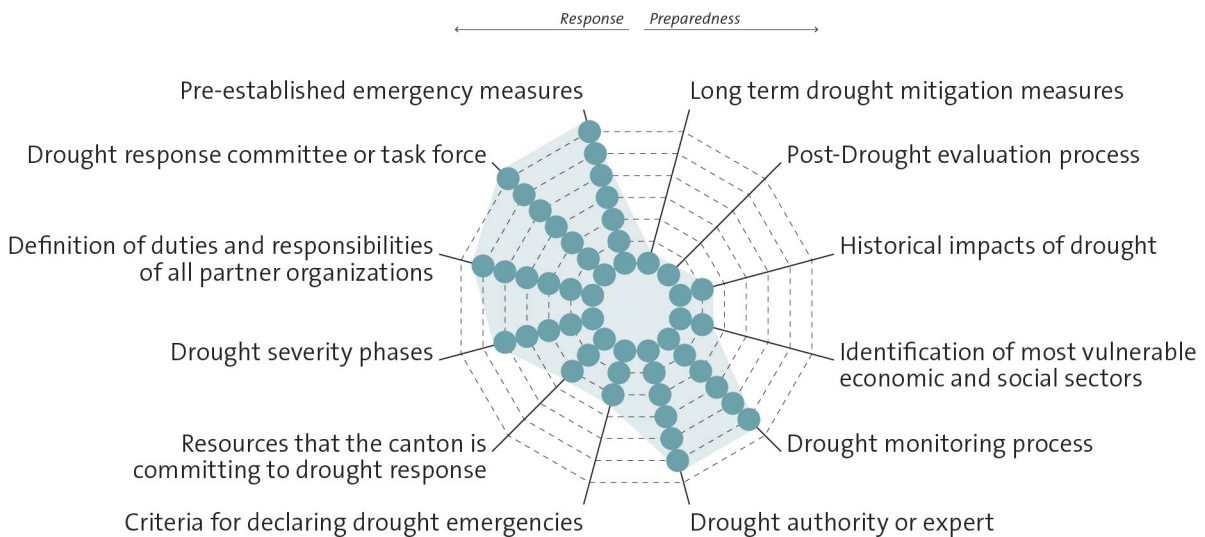
8. Does your canton have a drought management plan? (n=24)



9. Since when does your canton have a drought management plan? (n=7)



10. Which key elements does the drought management plan include / will include? (n=7)



11. Does the drought management plan also address the following drought-related hazards? (n=7)

Heatwave



Wildfires



Spread of invasive species (e.g. Bark Beetle)



Power failure/Power shortage



Low air quality



Restriction of navigation on waterways



Shortage of agricultural goods



12. Does the Canton publish a regular drought bulletin? (n=24)

No



Planned



Yes, and it is publicly available



Yes, but it is not publicly available



If Planned, please specify a timeframe:

- 2025 2

13. Does your canton have a drought expert/task force? (n=24)

Yes



No



Planned



If Planned, please specify a timeframe:

- 2025 2

- 2024–2025 1

14. Is your canton currently involved in addressing drought through cross-border collaboration with neighbouring cantons or countries? (n=23)

No involvement in any cross-border activities



Yes, involved in informal engagement



Yes, through established formal channels



No, but cross-border collaboration is under planning



15. Has your canton engaged in, or does it plan to engage in, drought scenario-based exercises and/or training? (n=25)

No



Yes



Planned

0

16. Has your office initiated research or development aimed at improving drought resilience in your canton? (n=24)

No



Yes



Unsure



Section 2

Drought Scenario Exercise

It is early March, and the seasonal outlook for the coming summer indicates that drought conditions could severely impact Switzerland. The country is already experiencing long-lasting, above-average temperatures combined with significantly low precipitation levels. These are affecting soil moisture and vegetation growth, crucial for Switzerland's ecosystems and agriculture. In particular, countries bordering Switzerland have already experienced significant impacts on their water resources due to prolonged drought conditions. Your Canton is at risk of facing significant water scarcity, potentially affecting local communities, economies, and ecosystems.

17. How would you rate your canton's current level of preparedness for the drought scenario outlined above? (n=24)

Very prepared

0

Moderately prepared



Somewhat prepared



Minimally prepared



18. To what extent do you agree or disagree with the following statement: "The cantonal civil protection has a sufficient legal basis to fulfil its mandate of protecting the population and its vital resources in the event of a drought emergency." (n=25)

Agree



Disagree



19. If you disagree, what do you believe is missing in the current legislation? (n=2)

- The process of implementing the revision of the Federal Law on Civil Protection and Civil Defense (520.1 Bundesgesetz über den Bevölkerungsschutz und den Zivilschutz) at the cantonal level is either underway or it should be improved. 2

20. To what extent do you agree or disagree with the following statement: “Our canton has sufficient strategies, plans and measures in place to manage potential water shortages.” (n=24)

Agree
 16

Disagree
 8

21. If you disagree, what do you believe is missing in your canton in order to manage potential water shortages? (n=7)

- A clear division of responsibilities. 1
- An emergency plan in case of water shortage. 1
- A strategy or an overall framework that includes and comprehensively addresses stakeholders, communes (which in Switzerland are responsible for water supply), regional, cantonal, or extra-cantonal levels. 1
- A clear communication strategy aimed at saving water resources upstream. 1
- The readiness of the population to implement measures to reduce water wastage. 1
- An emergency plan. 1

22. Given the scenario, which sectors in your canton do you anticipate being most affected by drought conditions? (maximum THREE options can be selected) (n=24)

Agriculture
 24


Public water supply
 16

Energy production
 11

Fishery
 11

Healthcare and public safety
 10

Timber
 5

Other, please specify
 3

Recreation and tourism
 3

Navigation and shipping
 2

23. Which public awareness strategies has your office implemented to improve drought awareness and water conservation efforts in your canton? (select all that apply) (n=18)

Extensive coverage in local newspapers



Creation of an informational website or online portal



Active engagement on social media via official cantonal channels



Water conservation campaigns (e.g., Water Awareness Week)



Targeted workshops for specific groups or sectors



Educational programs in schools



Community events aimed at raising environmental awareness



Collaboration with local businesses



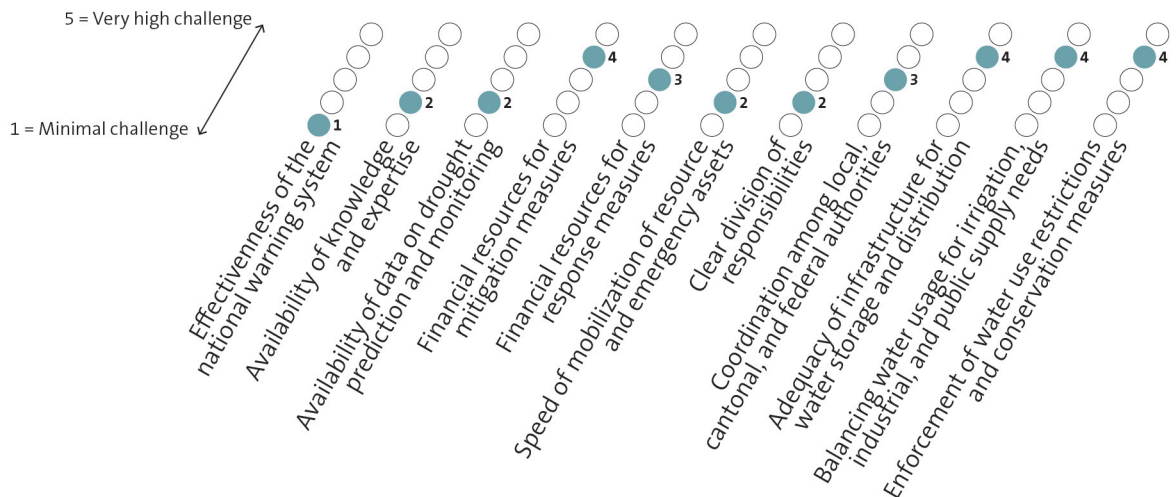
Installation of public displays or exhibitions



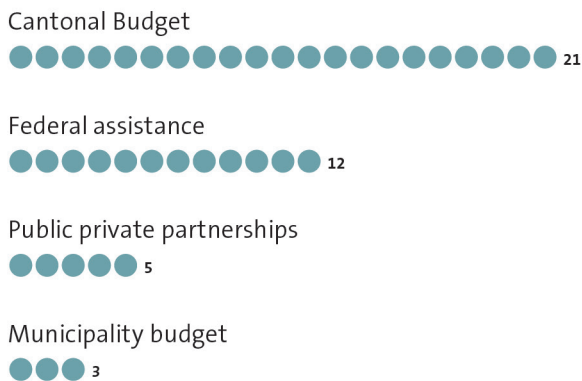
Other



24. Please assess the extent to which the following aspects could present challenges for your canton in managing the drought scenario. (1 = Minimal challenge, 5 = Very high challenge) (n=25)



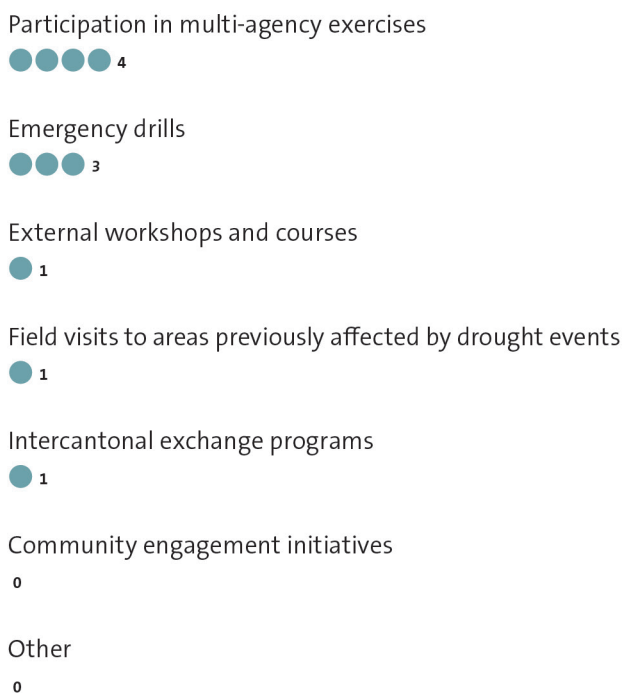
25. In terms of response capacity to the drought scenario, where would the primary source of support come from? (more than one option can be selected) (n=23)



26. Has your office conducted staff training on drought preparedness and response? (n=24)



27. If your office has conducted or is planning to conduct staff training, which of the following activities have been implemented, or will be implemented? (Select ALL that apply) (n=4)



28. Would your canton consider engaging in inter-cantonal or international cooperation efforts to address drought management? (n=24)

Yes, both inter-cantonal and international



Yes, inter-cantonal only



No



Yes, international only



29. Would your canton be interested in participating in a national civil protection knowledge exchange program on drought management and resilience building? (n=24)

Yes



Maybe



No



2.2 Expert interviews results

This section synthesizes the insights gained from the expert interviews on drought mitigation efforts across Switzerland. Although the individual interviews are not published, their findings encompass key theme key themes, shared challenges, and opportunities in drought management at different administrative levels.

- Institutional Framework and Coordination:** A complex network of institutions is involved in drought management in Switzerland, encompassing federal agencies such as the FOCP, the FOEN, Meteo-Swiss, and Federal Office of Topography (Swisstopo), alongside cantonal governments and municipalities. Coordination among these entities is essential but often challenging due to limited exchanges on drought-related issues, which can lead to siloed actions. The establishment of drought task forces and working groups at both federal and cantonal

levels reflects a growing recognition of drought as a significant issue that requires dedicated attention and resources.

Past drought events have acted as catalysts for creating these working groups and integrating drought considerations into cantonal hazard analyses. At the federal level, there are high expectations surrounding the restructuring of crisis management frameworks, including the establishment of a dedicated specialist team focused on drought (*Fachstab Trockenheit*). However, the specific role of the FOCP in this new structure is still being clarified.

At the cantonal level, drought working groups typically operate during summer months, highlighting their reactive nature in hazard management. These groups rarely function year-round, which limits proactive planning. While cantonal civil protection authorities are integral to these groups, there remains an opportunity for them to effectively convene and coordinate these groups.

- Role of Civil Protection:** Civil protection agencies are increasingly recognized for their crucial role in drought management at both federal and cantonal levels, particularly in coordinating responses and communicating alerts and measures to the public. However, the specific responsibilities and extent of their involvement in drought preparedness and response can vary significantly between cantons. This inconsistency reflects broader differences in approaches to drought management, levels of preparedness, and perceptions of drought risk across Switzerland. Some cantons have developed comprehensive drought management plans, while others are still in the early stages of addressing this issue. Platforms such as the Conference of Cantonal Authorities for the Military, Civil Protection, and Civil Defense or joint exercises in civil protection provide opportunities to exchange knowledge and advancements in drought mitigation.
- Challenges and Needs:** Managing past drought events in Switzerland has highlighted several key challenges and areas for improvement. One of the foremost issues is the need for stronger coordination between all levels of government – federal, cantonal, and municipal. Equally pressing is the need to raise public awareness about the complexity of drought, its long-term impacts, and the importance of water conservation. A lack of public understanding can weaken drought management efforts and may also lead to water conflicts.
- Early Warning System Development:** Switzerland's drought monitoring and early warning system aims to replicate the success of similar systems for other natural hazards like floods. The initiative presents significant opportunities, including enhancing coordination among federal, cantonal, and municipal bodies, as well as providing real-time data to support decision-making across sectors such as agriculture and water management. The system also plans to incorporate advanced monitoring tools like the soil moisture network and satellite data, offering precise regional forecasts. However, the system's success will depend on its ability to provide timely, accurate warnings while respecting Switzerland's federal structure and diverse regional needs.
- Long-term Resilience:** Many interviewees emphasized the importance of developing long-term strategies for drought resilience, considering factors such as climate change, population growth, and changing water use patterns. This includes not only reactive measures but also proactive steps to adapt water management practices and infrastructure.

Moreover, there is a widespread misconception that drought management can be handled solely within cantonal borders, overlooking the interconnected nature of water resources. Decisions in one canton can have far-reaching consequences, affecting water availability and management in others.

Another critical challenge is the development of more precise and localized drought indicators, a gap that the upcoming national drought monitoring and early warning system aims to address. There is also a clear need for more research into drought patterns, impacts, and management strategies tailored to Switzerland's unique geography and climate.

Enhanced networking and collaboration among experts, decision-makers, and stakeholders across sectors is considered to be crucial for developing integrated drought management strategies. Given Switzerland's central European location, cross-border cooperation is increasingly important. However, this cooperation is often hindered by differing administrative structures, conflicting priorities, and varying water management policies in neighboring countries.

3 Drought mitigation toolkit: 10 Action Points



The Drought Mitigation Toolkit offers a framework for developing regional drought management policies and preparedness plans. The toolkit has been designed to reflect the diverse realities of cantonal civil protection organizations in Switzerland and to be sufficiently flexible to meet different local needs, with the aim of enhancing drought resilience. Although the toolkit has been designed with the specific context of Switzerland in mind, its underlying methodology is applicable and adaptable to various levels of government and authorities worldwide.

The toolkit comprises 10 Action Points, identified as core to its functionality following the analysis of the survey results and expert interviews in Section 2. These Action Points are designed to address gaps in preparedness identified through the analysis and include:

- **Action Point 1** – Establish and incorporate a national drought early warning system
- **Action Point 2** – Assess drought risk
- **Action Point 3** – Include drought in the cantonal hazard analysis
- **Action Point 4** – Translate drought risk to local action
- **Action Point 5** – Develop a drought response plan
- **Action Point 6** – Appoint a drought task force
- **Action Point 7** – Strengthen drought preparedness through exercises
- **Action Point 8** – Participate in knowledge exchange
- **Action Point 9** – Conduct community education and outreach programs
- **Action Point 10** – Embrace collaboration

The Action Points offer general guidance for the development of drought management strategies, focusing strongly on early action and mitigation. The toolkit is consistent with the integrated risk management approach advocated for Swiss civil protection.⁶² As potential measures against drought are often of a long-term, preventive character, the 10 Action Points provide resources for the development of long-term mitigation strategies, as opposed to short-term response actions. Each Action Point includes illustrative examples and references to drought management practices from Swiss cantons, thereby showcasing the diversity of existing initiatives. The objective of the toolkit is to facilitate the exchange of resources and to highlight common challenges in order to foster inter-cantonal communication and, ultimately, inspire action.

A number of resources are available at the international, national, and regional levels and offer guidance on how to shape drought strategies. The most prominent one is the “10 Steps National Drought Management Policy,” which was developed by the Integrated Drought Management Programme, a platform developed by the World Meteorological Organization in collaboration with the Global Water Partnership.⁶³ Another valuable resource is the United Nations Convention to Combat Desertification’s Drought Toolbox, which provides drought stakeholders with easy access to tools, case studies, and other resources to facilitate the design of national drought policy plans and support the achievement of the United Nations Sustainable Development Goal 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss).⁶⁴

These resources have been vital in guiding the development of the Action Points in this toolkit that form a roadmap to drought resilience in Switzerland. By considering their indications, the Action Points ensure that the Swiss roadmap is aligned with the national strategies implemented by other countries.

The Action Points in the toolkit are not ranked in order of importance, as each contributes a unique element to strengthening drought resilience. However, recognizing that implementation requires resources, civil protection organizations are encouraged to prioritize Action Points based on their specific needs and circumstances. Moreover, certain Action Points will require efforts in another Action Point (e.g., the translation of drought risk to local action assumes that drought risk has been analyzed in one form or the other), which is indicated in the corresponding Action Points.

Lastly, the toolkit is conceived as a living document and dynamic process, anticipating that new information, inputs, and case studies will prompt an iterative approach to ensure that the toolkit remains relevant and reflective of the evolving institutional, social, and environmental landscapes of Switzerland.



Action Point 1 – Establish and incorporate a national drought early warning system

Drought monitoring and early warning systems (EWS) constitute the cornerstone of proactive drought management,⁶⁵ as they shift the focus from reactive crisis management to anticipatory action. These systems provide timely and accurate information regarding the development of drought conditions to decision-makers, stakeholders, and the public, thereby enabling them to take proactive measures to reduce the impact considerably. The goal of Action Point 1 is to illustrate how the establishment of a national-scale drought EWS amplifies these benefits by ensuring standardized monitoring, enabling a coordinated response across cantons and sectors, optimizing resource allocation, and fostering evidence-based drought policy development. This approach aligns with the “Early Warnings for All” Action Plan,⁶⁶ which was developed by the United Nations. The plan highlights the critical role of early warning systems in building resilience to drought and reducing its adverse socio-economic and environmental consequences.

With regard to hydrological extremes in Switzerland, due to past experiences, there has been a greater focus on managing flood events. In particular, the 2005 floods served as a driving force for substantial improvements in the national warning and emergency intervention processes.⁶⁷ However, the attention towards establishing a drought warning system has been slower in making its way onto the political agenda. As indicated in a 2018 *OWARNA* (Optimierung von Warnung und Alarmierung) report from the *Steering Committee Intervention against natural Hazards (Lenkungsausschuss Intervention Naturgefahren-LAINAT)*, the absence of a national drought monitoring system has resulted in the emergence of several challenges.⁶⁸

First, there is a lack of consensus regarding the definition of drought across cantons and sectors. Each actor defines drought based on its primary concerns, resulting in a fragmented understanding of this phenomenon. The FOCF has addressed this challenge in the National Risk Analysis by providing a baseline definition for drought and a scenario that cantonal civil protection authorities can utilize as a foundation for their own hazard analyses.⁶⁹

Second, most of the existing warnings tend to prioritize immediate threats to life and property,⁷⁰ while overlooking the prolonged nature of droughts. This ne-

Drought monitoring and early warning systems (EWS) facilitate proactive management by providing users with timely and accurate information, thereby enabling a shift from reactive to anticipatory action. A national-scale EWS for drought will standardize monitoring, support the coordination of responses across cantons and sectors, and strengthen evidence-based policy development in alignment with the UN’s “Early Warnings for All” Action Plan.

cessitates a novel type of forecasting and warning format that integrates various specialized disciplines.

Third, inconsistent response efforts across sectors and cantons remain a challenge, as drought warnings and related measures are often restricted to the administrative boundaries of individual cantons or municipalities.

In response to the recommendations set forth in the *OWARNA* report, which emphasized the necessity for a robust drought warning system, the Federal Council, on May 18, 2022, assigned to FOEN, MeteoSwiss, and Swisstopo the task of developing a unified national drought monitoring and early warning system by 2025.⁷¹ This initiative aims to integrate a range of resources to address the complex and multifaceted nature of drought, extending beyond the domain of agricultural drought. Furthermore, the initiative strives to harmonize and standardize drought-related information across the entire Federation, thereby ensuring a coherent and consistent understanding of what constitutes a drought.

The drought warning system will serve a broad user base, including cantonal and local authorities, as well as sectors that are impacted by drought, such as agriculture, hydropower, drinking water supply, shipping, nature conservation, and insurance. This system will provide an enhanced understanding of drought conditions in 36 Swiss regions by using environmental indicators and a combined drought index. It will help users across different sectors and administrative levels to implement preventive measures better, thus preventing damage and minimizing shortages of basic services.⁷² The system will incorporate several key components, as depicted in **Figure 4**, forming a comprehensive drought warning chain:

- **Drought Definition:** Establishing a clear, nationally consistent definition of drought, warning thresholds, and integration into the existing danger levels.
- **Monitoring:** Utilizing existing meteorological and hydrological measurement networks and incorporating soil moisture stations.
- **Analysis and Forecasting:** Developing an operational analysis and forecasting system based on a combined drought index calculated on a daily basis for each of the 36 Swiss regions, with predictions extending over a four-week period.

- Communication and Outreach: Disseminating a weekly national drought bulletin, similar to the Natural Hazards Bulletin, which provides comprehensive information on the current drought situation and forecasts in Switzerland.

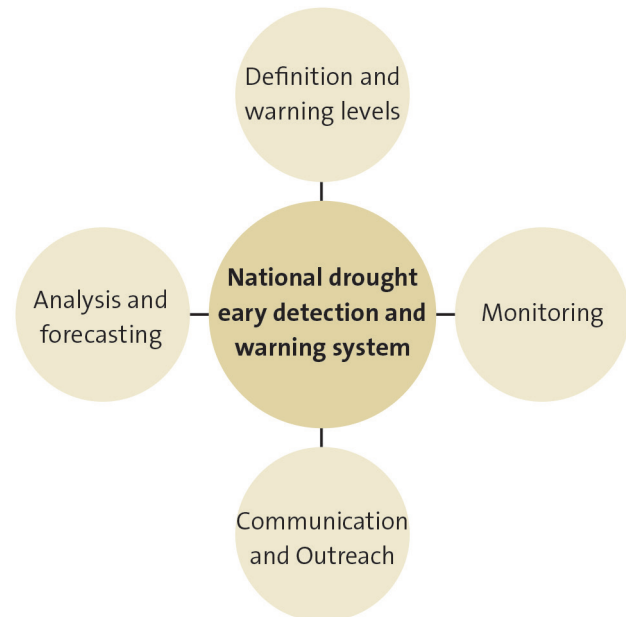
This approach of standardization will facilitate the dialogue and collaboration between cantonal authorities and the Federal Government by establishing a consistent baseline for discussions and decision-making processes. The introduction of a national drought EWS has been met with general acceptance by cantonal civil protection authorities, as evidenced by the findings of the conducted expert interviews in Section 2.2. The system can assist cantonal civil protection authorities in communicating effectively and consistently, utilizing uniform reference points, by providing an initial classification of drought conditions based on a standardized framework. This shared understanding will ensure that all stakeholders are operating with the same information, irrespective of the canton or sector. In conclusion, this should result in more coordinated and effective drought management strategies, thereby contributing to the overall enhancement of civil protection capabilities in Switzerland, as targeted in the Capability Analysis for Civil Protection.⁷³

The development of a national drought EWS can also strengthen Switzerland’s institutional capacity to deal with slow-onset or long-lasting crises. To date, the primary focus of national specialist staff, such as the Natural Hazards specialist staff (*Fachstab Naturgefahren*), has been the coordination of short-term warnings for acute events. Their secondary role as advisory bodies, providing necessary knowledge and expertise to federal staff during prolonged crises, has remained largely untapped. The national drought EWS offers a potential avenue for integrating these two functions, namely short-term coordination and long-term advisory capacities.⁷⁴

The efficacy and applicability of the national drought EWS will be assessed through an iterative process of improvements, forecast verification, and user feedback. The long-term objective is to extend the forecast horizon and enhance the accuracy and reliability of drought forecasts.

However, the development and implementation of this system are confronted with several challenges, as outlined in Section 2.2. First, ensuring the scientific precision of drought forecasts requires rigorous validation and ongoing refinement of prediction models. Second, effective coordination between the cantonal and federal levels is essential for a unified response. Striking the right balance between national guidance and respecting cantonal autonomy, however, can be difficult. Interviews with cantonal civil protection authorities have revealed that while the system’s monitoring, prognosis, and forecasting capabilities are welcomed, the responsibility

Figure 4 shows the components included in the upcoming Swiss national drought early detection and warning system



for implementing drought measures ultimately lies with the cantons. Therefore, drought warnings and related recommendations must be carefully crafted to reach the affected individuals and organizations and to avoid conflict with existing cantonal measures, which can create issues in the messaging process and successive communication to the public.⁷⁵

Lastly, expanding the drought analysis to include neighboring regions in bordering countries would provide valuable insights into cross-border dynamics. However, this requires a political mandate to facilitate data harmonization and cross-border collaboration, as outlined in Action Point 10 “Embrace collaboration”.

In conclusion, the establishment of a national drought monitoring and EWS signifies a substantial advancement for Switzerland in its endeavors to address the increasing risk of drought. This EWS will serve as a foundation for several Action Points, which are successively presented in this report. These include assessing drought risk, developing drought response plans, raising community awareness about droughts, and ultimately building a more drought-resilient Switzerland.



Action Point 2 – Assess drought risk

Drought is a hazard that encompasses both environmental and societal dimensions. The environmental aspect of drought relates to its probability and severity in a given region. However, it is the social dimension, specifically the vulnerability of societies and their infrastructure, that transforms a hazard into a risk. If this risk is manifested, it may potentially become a disaster.⁷⁶ Action Point 2 addresses this social dimension in the context of conducting a drought risk assessment, using the Canton of Basel-Stadt as a reference for the discussion. This assessment should identify the ways in which drought hazards manifest and impact both natural and social systems, thereby enabling civil protection organizations to more accurately determine intervention thresholds and develop effective mitigation strategies.

A comprehensive assessment of drought risk is a complex undertaking, particularly given the cascading and compounding effects that even moderate droughts can have on interconnected socio-ecological systems.⁷⁷ Nevertheless, a risk assessment is indispensable for determining when a drought hazard requires intervention from civil protection organizations, whether preventive or in response. The insights and recommendations presented here aim to inform these discussions and support other Swiss cantons initiating or refining their drought risk assessment processes.

Historically, Basel-Stadt has not perceived the exposure to drought as a significant threat, given that the canton's landscape is primarily urban and agricultural activity is relatively limited. The ever-flowing Rhine River⁷⁸ further reinforced this perception, directing attention toward flood management rather than drought preparedness. However, the recent increases in extreme weather events have heightened concerns about the canton's susceptibility to climate-related extremes. Although the Canton of Basel-Stadt is not directly affected by agricultural drought, its position as a key hub on the Rhine River renders it vulnerable to the logistical challenges that emerge during periods of low water levels. For instance, the decline in container traffic at Rhine port terminals in 2023 was partially attributable to unfavorable water levels,⁷⁹ with the economic consequences potentially spreading to Switzerland as a whole. This is because freight transport by water in Switzerland is essentially limited to shipping on the Rhine, with around 10% of all Swiss imports and exports in 2023 being han-

Drought is a complex phenomenon with both environmental and social dimensions, where the social vulnerability can often transform the hazard into a disaster. The Canton of Basel-Stadt shows that even regions with minimal exposure could experience significant drought impacts if vulnerabilities are not assessed.

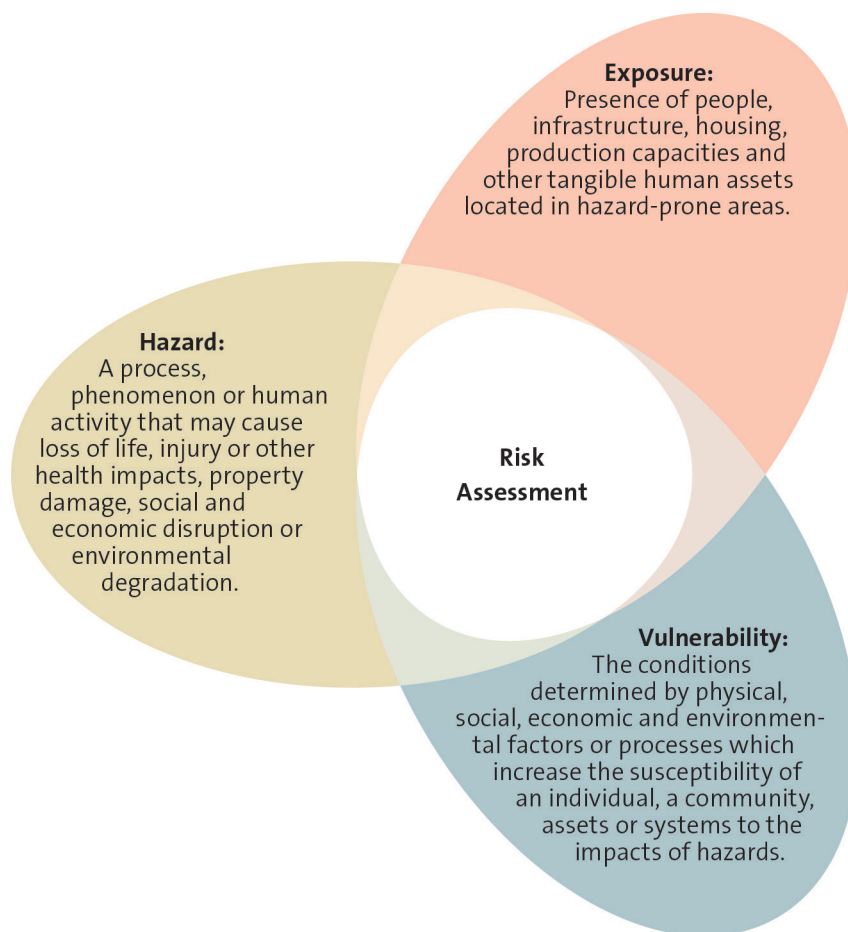
dled in the Rhine ports of Basel-Stadt and Basel-Landschaft.⁸⁰ The Rhine is arguably the most closely monitored and regulated river in Switzerland. It has been meticulously mapped to facilitate a rapid crisis response (*Einsatzplanung Rhein* project), and alarm systems have been established to alert the relevant authorities in the event of high water levels. Yet, a comparable framework for low water levels is absent. In contrast to the suspension of shipping during floods, there is no defined threshold for low water levels that could result in the cessation of maritime transportation despite the potential impact on national logistics.

Moreover, while drinking water shortages caused by drought are not a threat to Basel-Stadt, high water temperatures can pose an issue.⁸¹ Although Rhine water temperatures above 25°C are currently rare and limited to the months of July and August,⁸² they could become more frequent in the future due to a changing climate. Water temperatures exceeding 25°C in the Rhine could trigger a significant spike in overall water demand, as withdrawals for industrial cooling are prohibited above this threshold. This restriction may force industrial companies to reduce power plant output^{83, 84} or to rely on drinking water for cooling purposes,⁸⁵ potentially resulting in water conflicts. Combined low water volumes and high temperatures could also severely impact fish populations and other aquatic life, particularly in the minor *Birs* and *Wiese* rivers of Basel-Stadt.⁸⁶

The case of Basel-Stadt, an urban canton with historically low perceived drought risk, illustrates that even regions with seemingly minimal exposure to drought can experience significant sector-specific impacts. This vulnerability is shaped by societal factors such as community preparedness, existing infrastructure, and resource allocation within a region.⁸⁷ Thus, a comprehensive drought risk assessment must include the vulnerability component as shown in **Figure 5** to identify the underlying social, economic, and environmental drivers that determine who and what is at risk and why.⁸⁸ Moreover, vulnerability is dynamic, evolving with societal changes such as population shifts, technological advancements, and policy adjustments. For this reason, regular risk reassessments are critical to capture these dynamic changes and ensure that risk mitigation strategies remain effective.

Figure 5 illustrates the three key components that contribute to risk assessment: hazard, exposure, and vulnerability.

Source of the definitions: [Disaster Risk Reduction Terminology](#), UNDRR 2017



Recognizing the importance of vulnerability factors in risk management, the Cantonal Crisis Organization of Basel-Stadt (*Kantonale Krisenorganisation*) is currently developing a resilience concept, as mandated by the Cantonal Council (*Regierungsrat*).⁸⁹ This concept will define concrete actions to strengthen the canton's resilience to different crisis scenarios, including drought. It will also identify areas where resource allocation, particularly towards initiatives like business continuity management and organizational development, can substantially improve resilience.

Furthermore, due to the wide-ranging direct and indirect (and often cascading) impacts of droughts, risk assessments must be tailored to specific sectors and user needs.⁹⁰ For cantons initiating these assessments, priority sectors include agriculture, energy and industry, potable and domestic water supply, navigation, ecosystems, tourism, forestry, aquaculture and fisheries, and the financial sector (investors, insurers, asset owners).⁹¹ The population's reliance on each sector – for income, food supply, water, and electricity – along with the economic value of each sector are critical factors in determining the

canton's vulnerability to drought impacts. The National Risk Analysis assesses these sectors through the development of 12 damage indicators, including individuals, environment, economy, and society.⁹²

The experience of Basel-Stadt also highlights that drought impacts can extend beyond regional borders, potentially becoming a national issue. Therefore, the far-reaching effects of drought often transcend sectoral and governmental boundaries, emphasizing the need for cooperation and coordination between different offices and stakeholders.

In conclusion, the Basel-Stadt case study serves as a reminder of the importance of a comprehensive and thorough drought risk assessment that considers both environmental and societal factors. Despite a historically low perceived risk of drought, significant impacts can arise if vulnerabilities are not thoroughly assessed. This assessment of the components of drought risk sets the stage for Action Point 3, which emphasizes the importance of incorporating drought in the cantonal hazard analysis.



Action Point 3 – Include drought in the cantonal hazard analysis

Once a canton has identified the risk components of drought – specifically, the hazard, the exposure, and the vulnerability of people, assets, and sectors – the next critical step is to integrate it into the cantonal hazard analysis. This integration ensures the allocation of specific resources and plans for effective hazard management. Action Point 3 provides an overview of the process of incorporating drought in the cantonal hazard analysis, using the Canton of Zurich as a case study to illustrate the actions involved and the importance of a thorough and inclusive process.

The cantonal hazard analysis is a comprehensive, systematically derived, and risk-based assessment of relevant hazards within a canton.⁹³ As the cantons are primarily responsible for managing disasters and emergencies, this analysis is essential for hazard mitigation planning and provides a basis for cantonal preparedness and civil protection planning. Although cantons are not legally required to conduct a hazard analysis or to follow the cantonal hazard analysis guidelines (*Leitfaden Kataplan*) developed by the FOCP, they are strongly encouraged to do so.⁹⁴ These guidelines provide a common understanding and a uniform approach to identifying hazards and associated risks.

However, the process of developing a cantonal hazard analysis reflects the political, societal, and economic landscape of each canton, while not all cantons use the FOCP's cantonal hazard analysis guidelines. A canton's hazard analysis is supposed to be updated on a reasonable periodical basis, although some cantons have not updated their analyses since before 2018, as indicated by the survey results in Section 2.1. Conducting a cantonal hazard analysis requires significant resources, including financial investment, time, and the involvement of all relevant parties through a working group to assess each hazard. Specifically, the creation of a working group is essential to legitimize the analysis to a broader audience and to integrate operational and strategic levels of cantonal planning.

In the Canton of Zurich, the hazard identification process is legally anchored in the Cantonal Civil Protection Act (*kantonales Bevölkerungsschutzgesetz*). This law defines a hazard as relevant for civil protection intervention when an emergency or disaster overwhelms normal coping mechanisms, endangering people, assets, and

In the Canton of Zurich, while drought had been discussed in previous hazard analyses, which are anchored in the Cantonal Civil Protection Act, it was formally integrated in 2021, after a thorough assessment by the hazard analysis working group. This integration led to the development of robust drought management processes that include prevention, coordination, and communication.

essential services (adapted from Art. 2 of the Cantonal Civil Protection Act of the Canton of Zurich).⁹⁵

While drought was first discussed as a relevant hazard for the canton in 2015, it was formally included in the 2021 iteration of the cantonal hazard analysis. The combined risk of drought and heatwaves was classified as the second highest risk in the canton due to their high probability and impact on the environment and the population. The reference scenario is a prolonged dry period lasting six months with an additional heatwave exceeding 35°C, potentially resulting in deaths, numerous people requiring care, and significant environmental and economic damage.⁹⁶

Three key factors drove the inclusion of drought in the 2021 cantonal hazard analysis, as was explained during the expert interview process with the representative of the civil protection risk management responsible for the cantonal Office of Risk Management (*Risikomanagement Bevölkerungsschutz*) of the Canton of Zurich. First, the nationwide pilot project, "Adaptation to climate change",⁹⁷ prompted civil protection organizations to assess how these measures would affect their own operations. This assessment was critical to understanding the broader impact of climate change on the structure and responsibilities of civil protection, ensuring that all partner organizations were prepared for the evolving risk landscape.⁹⁸ Second, health concerns related to drought and heatwaves were raised by the cantonal health department, stressing the increasing need to manage people's health conditions in extreme scenarios. Third, previous experiences with water rationing in the region have sparked significant concerns about the availability of water for essential purposes, including drinking water, cooling systems, and agricultural activities such as dairy farming and vegetable cultivation.

Notably, the work for the 2021 cantonal hazard analysis took place during the COVID-19 pandemic. Despite the challenges posed by the pandemic, workshops were held digitally, bringing together 30 individuals from the cantonal administration, municipalities, and the private sector to examine various threats and build resilience in the Canton of Zurich. Many of these individuals were also deeply involved in the management of the pandemic, which strengthened the working group's ability to analyze complex crises. This dual involvement ensured

that valuable lessons learned from dealing with COVID-19 were seamlessly integrated into the hazard analysis.

The integration of drought into the cantonal hazard analysis has not only highlighted the need for clear processes in managing this hazard but has also led to the development and implementation of these very processes. This encompasses preventive actions, effective coordination among specialized agencies and cantonal offices, and streamlined communication with the public. These efforts have resulted in the institutionalization of drought management within the Canton of Zurich.

A collaborative working group comprising a diverse range of experts, from environmental scientists to emergency responders, has played a central role in this institutionalization. The group has outlined specific measures to be implemented in the event of a drought, ensuring clear roles and responsibilities for all stakeholders. It was led by the civil protection risk management team within the police organization of the Canton of Zurich, serving as a crucial platform in the canton and facilitating the connection between specialists involved at both the operational and strategic levels. This integrated approach allows for the development of both preventive measures and reactive strategies, ensuring a comprehensive and effective response to drought.

While awareness of drought existed previously in the canton, it has taken concerted effort and numerous initiatives to achieve widespread institutional recognition and integrate drought into both cantonal risk analysis and civil protection efforts. For cantons initiating their cantonal risk analysis, the case study from Canton of Zurich demonstrates that while challenging, institutionalizing drought management is achievable through collaboration, strategic planning, and a commitment to proactive risk reduction.



Action Point 4 – Translate drought risk to local action

Drought as a complex hazard requires coordinated management across multiple levels of government. To effectively address this challenge, Action Point 4 focuses on translating identified drought risks to the local level, where the impacts on people, communities, ecosystems, and infrastructure are most acutely felt.

Using the Canton of Bern as a case study, this chapter explores strategies to foster collaboration between cantonal and local authorities. Expert interviews with cantonal civil protection officials highlighted that such collaboration is not always seamless, with challenges such as the lack of centralized information on water restrictions implemented by municipalities. To bridge this gap, the Canton of Basel-Landschaft launched the online platform *Trockenheit*⁹⁹ in the summer of 2024. This resource provides users with direct access to current drought regulations implemented at both cantonal and municipal levels. This initiative directly addresses a key finding in the 2024 Capability Analysis for Civil Protection,¹⁰⁰ which identified insufficient capabilities in data and situation management of water regulations (*Trockenheitsfähigkeiten 104*).

In the Canton of Bern, the initial response to an incident is handled by the relevant administrative division, in accordance with the principle of federalism. The cantonal Office for Civil Protection develops the cantonal hazard analysis, which includes scenario analysis, risk matrices, and recommendations. The municipalities are responsible for carrying out the required measures, such as creating emergency plans, under the oversight of the cantonal Office for Civil Protection to ensure a coordinated and efficient response.¹⁰¹

The updated cantonal hazard analysis, scheduled for release in 2025, will include drought as one of 25 hazards, influenced by the recommendations from the FOCP in the latest version of the National Risk Analysis.¹⁰² In contrast to other cantonal hazard analyses, the Canton of Bern categorizes drought as a distinct hazard and not in association with heatwaves or wildfires. This inclusion reflects a growing awareness of the canton's limited experience with prolonged hazards, such as drought, in comparison to hazards with short-term exposure, including landslides and floods. Moreover, the recent occurrence of droughts in the canton has brought the issue of the hazard to the attention of the general public and vari-

In the Canton of Bern, the cantonal civil protection authorities provide a detailed drought risk scale for each municipality, empowering local governments to develop targeted responses and prioritize preparedness efforts.

The online platform *Trockenheit*,⁹⁹ launched by the Canton Basel-Landschaft, serves to enhance transparency and accessibility of drought regulations across different administrative levels.

ous sectors of society. This has led to a greater awareness of the necessity for public education and outreach campaigns, as outlined in Action Point 9 “Conduct community education and outreach programs”.

In the cantonal hazard analysis, the frequency of drought events is estimated to occur once every 10 to 100 years, affecting all the municipalities within the canton. The extent of a drought event is estimated to range from a relatively small occurrence of less than two million Swiss francs to a more significant event (with a projected cost of between 10–50 million Swiss francs) for municipalities of greater size. Furthermore, the cantonal hazard analysis also offers a specific drought risk assessment for each municipality. In the context of drought, these assessments concentrate on critical action priorities, such as “Unsecured water supply” and “Excessive groundwater abstraction.” To ensure local acceptance and implementation, these risk assessments are approved by the respective municipal authorities, fostering trust and collaboration between authorities.

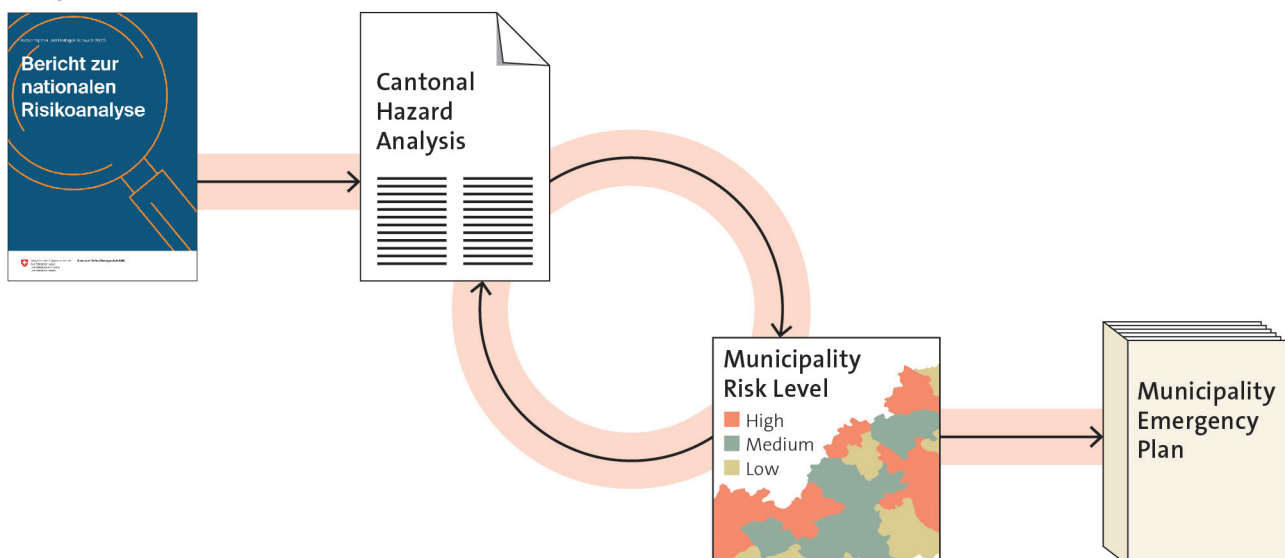
The case study of the Canton of Bern illustrates how the translation of risk from the national to the cantonal and local levels is necessary for local governments and communities to develop effective coping mechanisms for drought events.¹⁰³ An overview of this process is depicted in **Figure 6**.

In the Canton of Bern, the cantonal civil protection authorities disseminate risk information through the provision of a detailed drought risk scale for each municipality. This ensures that local communities are equipped with the necessary knowledge to understand the specific threats they face. This locally tailored information empowers and enables local authorities to develop targeted responses, such as water conservation measures, and to prioritize preparedness efforts, such as the drought exercise involving relevant local actors in Emmental, as outlined in Action Point 7 “Strengthen drought preparedness through exercises”. Moreover, it facilitates collaboration between municipalities with comparable risk profiles. For instance, in order to mitigate potential future vulnerabilities and ensure a reliable water supply, municipalities in the Canton of Bern are actively engaged in creating networks to secure water availability for smaller communities. This practice is being increasingly adopted in other cantons as well.¹⁰⁴

Furthermore, the Canton of Bern proactively involves local actors in the cantonal hazard analysis process, fostering a sense of ownership and accountability, which are pivotal elements for effective disaster risk reduction. This engagement is exemplified by the stipulation that municipal authorities approve their respective municipal risk assessment included in the cantonal haz-

Figure 6 illustrates the process of translating drought risk to local action

National Hazard Analysis



ard analysis. While the onus of developing emergency plans remains with the municipalities, this collaborative approach ensures that the process is not perceived as a top-down imposition but rather as a shared responsibility. It further demonstrates how robust accountability, manifested in the form of vertical steering by cantonal actors, can act as a bridge for coordination,¹⁰⁵ thereby enhancing the overall effectiveness of drought management efforts in the canton. Only an identified and communicated risk will allow for appropriate drought planning and management.

In conclusion, the case study of the Canton of Bern demonstrates the critical importance of translating drought risk from national to cantonal and local levels, enabling effective local response and preparedness. By providing detailed, municipality-specific drought risk assessments and involving local actors in the hazard analysis process, the canton fosters collaboration, accountability, and targeted action at the community level.



Action Point 5 – Develop a drought response plan

A well-structured drought response plan is an indispensable tool for any region preparing to address water scarcity. The plan serves as a dynamic framework that not only prepares for but also effectively responds to drought events. As a living document, it should be subject to periodic reviews and updates to ensure its continued relevance and effectiveness in the face of evolving conditions.

The goal of Action Point 5 is to demonstrate the necessity of a drought response plan and to offer assistance in preparing such a plan, with references to case studies from the cantons of Fribourg and Valais. A drought response plan should be developed in advance, based on thorough studies of the characteristics, impacts, and measures to alleviate drought while considering the social, political, and economic conditions of the area. Preparing the plan ahead of time allows for public feedback and input, ensuring that the responses align with the varying severity of water shortages.¹⁰⁶

At its core, a drought response plan provides a structured framework to address and manage drought conditions effectively. Such a framework accomplishes several critical objectives.¹⁰⁷ First, it equips the cantonal crisis management body with the necessary tasks within the civil protection mandate and allocates resources to coordinate and oversee the drought response efforts. This includes the establishment of clear lines of communication, the assembling of technical expertise, and securing adequate funding to implement response measures.

Second, the plan defines the roles and responsibilities of the stakeholders involved, ensuring that all parties are aware of their respective obligations, from government agencies and public service providers to individual citizens and businesses.

Third, the plan outlines a comprehensive communication strategy so that authorities and the public are kept informed about the evolving drought situation, the potential impacts, and the measures being taken to mitigate them. This bolsters public trust and cooperation during a crisis.

Fourth, the plan calls for collaboration and coordination among all levels of government, from the cantonal to the municipal level, as well as public service providers such as water utilities and power services. This directs different efforts to a unified response that leverages the strengths and resources of all involved parties.

Figure 7 outlines the key elements that should be included in a drought response plan, referencing the plans of the Canton of Fribourg and the Canton of Valais.

Drought response plan

✓ Fundamental information

Includes clear objectives, scope of the plan, relevant legal framework, and precise definitions of drought and heatwave to establish a common understanding and guide decision-making.

✓ Activation thresholds

Defines specific meteorological forecasts, such as temperature thresholds or precipitation deficits, that trigger different phases of the plan (e.g., pre-alert, alert, crisis) to ensure timely and appropriate action.

✓ Risk assessment

Identifies potential impacts of drought and heatwaves across various sectors, including health (heatstroke, dehydration), infrastructure (e.g., water supply, agriculture), and the environment (e.g., wildfires).

✓ Role definition

Clearly outlines the roles and responsibilities of all actors involved in drought response, from government agencies to community organizations, to ensure coordinated and effective action.

✓ Procedures

Provides detailed step-by-step procedures for decision-making, communication, coordination, and resource allocation during each phase of the plan, facilitating a streamlined and efficient response.

✓ Preparedness measures

Outlines proactive measures to mitigate the impact of drought, such as public awareness campaigns on water conservation, early warning systems, and pre-positioning of resources.

Fifth, the plan establishes strategies to contain and minimize the adverse effects of drought on various sectors and communities. This may involve water restrictions, conservation measures, and financial assistance programs to support those most impacted by the drought.

In Switzerland, the Cantons of Fribourg and Valais have each developed a drought contingency plan in response to the canton's hazard analysis and recent experiences with heat and drought. These plans, established by the cantonal crisis management bodies, share key elements to effectively address the challenges of drought, including activation thresholds, risk assessment, and role definition.

Sixth, the plan identifies and allocates the necessary resources, including personnel and material, to enable effective management of a drought. This could include the hiring of additional staff for the implementation of drought response activities, the procurement of equipment for the purpose of water conservation or distribution, and the stockpiling of emergency supplies.

Finally, the plan investigates and implements preventive measures to reduce a region's vulnerability to future droughts. Such measures may include the promotion of water conservation practices, the investment in drought-resistant infrastructure, or the diversification of water sources.

In Switzerland, the Cantons of Fribourg and Valais have each developed a drought response plan that is established by the cantonal crisis management body. These plans exhibit a number of key elements that collectively enable effective responses to the challenges of drought, as shown in **Figure 7**.

The development of a drought response plan in the Canton of Fribourg was prompted by the canton's hazard analysis (with the next update expected in 2025) and recent experiences with heat and drought events. Led by the cantonal crisis management body, the process fostered collaboration and integration between previously siloed departments and experts. A key achievement was the establishment of a competencies and responsibility matrix, which clarified specific actions, decision-making competency levels, and government involvement.

The plan institutionalizes the tasks of each involved cantonal office, including the highest executive authority in the canton, namely the Cantonal Council. It establishes a clear link between each action and the specific responsibility. Furthermore, the plan formalizes the tools utilized in response to drought, including the establishment of situational awareness with the support of soil moisture measuring stations. This, in turn, further contributes to an inter-cantonal and regional monitoring network. Additionally, the canton is currently in the process of establishing a Risk Observatory within the General Secretariat of the Security and Justice Department, with the objective of addressing drought and other risks.

To date, no event has triggered the implementation of the full plan. Nevertheless, certain elements

have been initiated, including water transport in alpine regions and the implementation of response activities, predominantly to address the elevated risks associated with wildfires and heatwaves. The lessons learned from these experiences, in conjunction with the insights gained from drought exercises as outlined in Action Point 7 “Strengthen drought preparedness through exercises”, could be used to refine and optimize the action plan in the future.

An important outcome of interactions with cantonal civil protection authorities is the realization that the most effective cantonal drought management strategies will not resolve water conflicts if municipalities are not inclusively involved, as described in Action Point 4 “Translate drought risk to local action”. This is particularly pertinent in instances where there is a necessity to curtail water usage during periods of drought, with the management of water being a key task at the municipal level. Therefore, the support from the cantonal level is always to be delivered in a subsidiary manner. Respecting political competencies and acting level-appropriately is key to ensuring that the federal structure in Switzerland prevails and needs to be considered when designing organizational structures and action plans.

Moreover, to further enhance drought management, it is advisable to inform and potentially consult non-governmental actors, such as the Swiss Farmers’ Association (*Schweizer Bauernverband*), to cultivate a broader understanding and support for drought mitigation efforts.

In conclusion, a well-structured drought response plan is not merely a static document but a dynamic tool for safeguarding a canton’s water security. The case studies of Fribourg and Valais illustrate that such plans must be comprehensive, clearly define roles and responsibilities, and be adaptable to evolving conditions. A successful plan involves collaboration across sectors and authorities, institutionalizes key tasks, and employs tools like monitoring networks and risk observatories. Importantly, it recognizes the critical role of municipalities and non-governmental actors in ensuring the plan’s operational effectiveness.



Action Point 6 – Appoint a drought task force

A well-defined drought response is the foundation for building drought resilience. Another critical component is the establishment of a dedicated drought task force responsible for coordinating a comprehensive response to drought conditions. This task force can bring together various stakeholders to ensure efficient management of resources and effective implementation of strategies to mitigate the impact of drought.¹⁰⁸ It is recommended that the task force not only operates during emergencies but also monitors conditions and promptly activates or advises on the activation of the response plan.

As evidenced by the survey results in Section 2.1, establishing a drought task force is a pivotal post-drought adaptation measure that has been widely adopted in many cantons after experiencing drought events. As of August 2024, 16 cantons have appointed a drought expert or task force. Action Point 6 emphasizes, therefore, the importance of establishing a drought task force, providing guidance on its roles and responsibilities, and highlighting its relevance through the case study of the Canton of Thurgau.

In order to effectively address the complex and multifaceted nature of drought and its impacts, the task force should comprise representatives from relevant departments and offices. Additionally, to expand the expertise and range of perspectives represented in the task force, members from the academic community (i.e., climatologists, policy specialists, planners), private sector actors, environmental organizations, and public interest groups should be included where possible, either as full members or as contributors to specialized working groups within the cantonal hazard analysis. It is to be expected that the composition of the task force will vary from one canton to another, mirroring each region’s social, political, and economic landscape.

The responsibilities of the drought task force extend beyond the immediate response to an event. As new research needs or institutional gaps emerge, the task force should compile a list of the issues in question and make recommendations to relevant agencies and legislatures on how to address them.¹⁰⁹ The degree of public visibility of the task force will also fluctuate in accordance with the recency and severity of drought events. Regardless of the level of public attention, the task force must include members with strong communi-

The case study on the Canton of Thurgau underlines the value of a drought task force led by the cantonal Office for Civil Protection and Military. This task force serves as an operational tool and a center of expertise in drought management. Other effective models include cantonal committees where civil protection collaborates (the Canton of Bern), orientation meetings held during the summer period (the Canton of Fribourg), and annual dialogue platforms (the Cantons of Basel-Stadt and Basel-Landschaft).

ation skills to either lead or support public communication, ensuring transparency, trust-building, and community engagement,¹¹⁰ as outlined in Action Point 9 “Embrace collaboration”.

Drought risk in the Canton of Thurgau has been an ongoing concern for over a decade, leading to the inclusion of drought in the cantonal hazard analysis since 2013. However, as early as 2006, the canton appointed a drought task force/specialist staff (*Fachstab Trockenheit*). This task force is constituted by relevant governmental actors and is responsible for the regular and continuous assessment of the drought situation in the canton. The task force is managed and coordinated by the Office for Civil Protection and Military, and its members include cantonal authorities responsible for the environment, water quality, water construction and hydrology, forestry, hunting and fishery, agriculture, public health, legal affairs, police, communications, and building insurance.¹¹¹

In more detail, the task force enables the authorities to exchange information, coordinate actions, and present a unified front when proposing measures to the executive government of the canton. Although the task force itself is not vested with the authority to make decisions, it ensures that each office provides information, measurements, and data drawn from its respective areas of expertise and responsibility. The diverse information is then collected and presented to the cantonal executive power. This multidisciplinary approach permits a comprehensive understanding and management of drought risks, as well as ensuring a cohesive, centralized, and unified communication to convey measures to the public.

Several advantages are observed by the creation and existence of a drought task force at a cantonal level, as emerged during the expert interviews with the cantonal authorities. One of the primary benefits of a cantonal task force is its capacity to harness and leverage local specificity and expertise. The impact of drought conditions can vary significantly across regions due to diverse environmental, economic, and social factors. By including representatives from various offices in the task force, it allows for the incorporation of local knowledge and tai-

lors strategies to address the unique characteristics of each region. In the Canton of Thurgau, for instance, the task force has recognized the importance of considering geographic and ecological patterns, such as watershed boundaries, soil types, and vegetation cover for drought management rather than relying solely on political boundaries such as cantonal or municipal borders.

Another key advantage lies in the facilitation of inter-cantonal collaboration. The Canton of Thurgau’s task force, for example, actively collaborates with neighboring cantons like St. Gallen and Zurich, with the objective of addressing shared challenges and developing solutions that are mutually beneficial.

The task force provides further value as an operational tool for drought response by serving as a platform where subject matter experts can collaborate, exchange knowledge, and translate their expertise into practical applications. This institutionalizes know-how and functions as a cohesive, whole-of-government body, legitimizing its decisions and proposals to the public.

In cases where a formal drought task force does not already exist or there are limited resources to create one, civil protection authorities leverage alternative approaches to address the issue. For example, the Canton of Bern has set up a drought working group within the cantonal Office for Water and Waste. Bern’s civil protection authorities can collaborate with this group to voice their perspectives and address challenges related to drought.

Another effective format has been observed in several cantons, whereby an orientation meeting is convened before or during the summer, where drought is discussed holistically with other hazards, such as heatwaves and wildfires. The Canton of Fribourg has adopted this approach, while the Canton of Basel-Stadt has expanded the concept to establish an annual dialogue platform with its neighboring Canton of Basel-Landschaft. This dialogue addresses concerns related to drought, wildfires, and fishery in the region.

At the federal level, the forthcoming crisis organization of the Federal Administration foresees having a dedicated specialist staff (*Fachstab Trockenheit*), as mentioned during the expert interviews outlined in Section 2.2. This development marks a notable political shift to distinguish drought from the existing natural hazard specialist staff (*Fachstab Naturgefahren*). This step recognizes the complexities of droughts that require a dedicated working group similar to other prolonged crises, such as migration, pandemics, or energy security.

The creation of a national drought specialist staff further improves the Federal Council’s capacity for crisis anticipation, also marked by the Capability Analysis for Civil Protection, and will position it better to deploy a cross-departmental crisis organization in a timely manner.¹¹² It is yet to be defined how the drought specialist staff, intended to be activated only during crises, will op-

erate and interface with other permanent Standing Core Units, and what role civil protection organizations will play at both the cantonal and federal levels.

In conclusion, Action Point 6 recommends the establishment of a drought task force or working group as a fundamental step in managing drought. This is corroborated by the multitude of cantons that formed such task forces following their own experiences with drought events. Whether implemented at the cantonal or federal level, these task forces serve as indispensable expert groups, advising on adequate measures and acting as mediators to resolve water conflicts.



Action Point 7 – Strengthen drought preparedness through exercises

One persistent issue in emergency response is the discrepancy between knowledge and action. Despite awareness of effective practices in emergency response, individuals and organizations may not necessarily translate this knowledge into behavioral change.^{113, 114} One effective method for addressing this challenge is the use of simulation exercises among crisis and emergency management organizations striving to close the gap between learning and action. This approach links informal and formal knowledge through action and experience.¹¹⁵ The diverse exercise programs for civil protection, as shown in **Figure 8**, prompt decision-makers, planners, and operational personnel to anticipate the potential progression of a drought and identify proactive measures to mitigate its impacts or cope with its effects.

Action Point 7 of the Drought Mitigation Toolkit sheds light on the importance of drought-related exercises in fostering organizational learning and addressing the learning-action gap. Exercises provide an invaluable instrument for assessing the strengths and weaknesses of existing structures and processes related to drought management, as well as for identifying potential avenues for improvement. Moreover, they serve as a venue for developing essential individual and collaborative skills, ultimately contributing to institutional knowledge.¹¹⁶ By actively engaging in exercises, civil protection organizations can effectively close the capability gap identified in Field of Action 3 of the Capability Analysis for Civil Protection that calls for joint exercises in civil protection (*Handlungsfeld 3: Verbundübungen im Bevölkerungsschutz*).¹¹⁷

The most well-developed drought management plans can be undermined if there is a lack of experience in implementing them. To this end, civil protection organizations should avail themselves of simulation exercises as a means to acquire the requisite experiences before an actual drought event. Disaster simulation exercises offer a controlled test environment to evaluate organizational arrangements and procedures.¹¹⁸ They may involve senior management at the strategic level but also personnel on the operational and tactical levels of the organizations. The value of conducting these exercises is considered high among crisis practitioners, as they provide arenas for learning and knowledge sharing.¹¹⁹ They help to internalize drought management plans, as outlined in Action Point 5 “Develop a drought response

Although exercises for drought within Swiss civil protection organizations are still rare, notable examples are paving the way. At the regional level, the exercise conducted by the regional crisis management body in Langnau in the Canton of Bern demonstrated the successful testing of civil protection responses to a drought scenario. The exercise Odescalchi 2022, with its cross-border component, yielded institutional benefits beyond immediate water shortage management. Additionally, the tabletop exercise “Drought” seeks to bring together representatives from cantonal and federal civil protection organizations to enhance preparedness for future extreme events.

plan”, into organizational practices. Moreover, exercises deepen relationships and cooperation among participants (municipalities, cantons, or even countries), emphasizing the importance of Action Point 10 “Embrace collaboration”.

In the domain of crisis and emergency management, operation-based exercises, including drills, functional exercises, and full-scale exercises, are regularly employed for the purpose of training response teams and testing the coordination and interoperability of resources and personnel.¹²⁰ In Switzerland, operation-based exercises related to drought are rare, as reported by civil protection authorities in question 15 of the survey in Section 2. This is despite the fact that civil protection authorities expressed interest in such exercises during the expert interviews. If exercises are conducted, they often involve only one civil protection partner organization within a single canton. One example is given by the Canton of Graubünden where personnel from the civil Defense exercise the operation of new heavy equipment for drinking water supply during an emergency scenario, as reported during the expert engagement process.

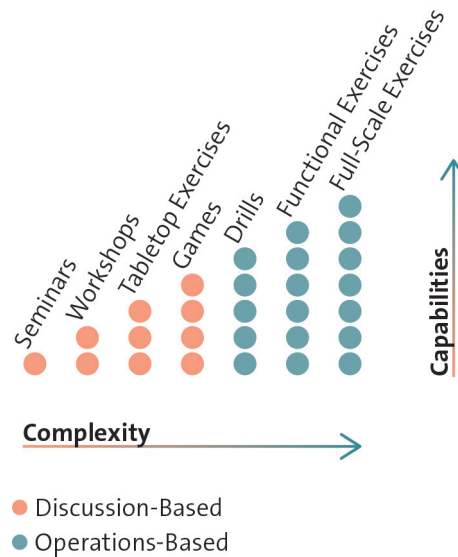
In other instances, these exercises are limited to a specific region, such as the exercise carried out by the regional crisis management body (*regionales Führungsortgane, RFO*) Langnau in the Canton of Bern, which tested the preparedness of local civil protection organizations for an extreme drought scenario in Emmental.¹²¹ In this example, the involvement of different civil protection organizations, even though tested at a local scale, proved successful in responding holistically to a drought scenario impacting several sectors of the region.

Large-scale exercises involving different civil protection partner organizations and multiple cantons targeting drought remain relatively uncommon, mainly due to their inherent complexity and resource demands. Larger exercises also tend to be logistically demanding, requiring collaboration and deployment of personnel

Figure 8 provides an overview of exercise programs applicable to civil protection and emergency management

Graph inspired from [Emergency Management Program from Massachusetts Institute of Technology](#), and [Emergency Management Institute of the US Federal Emergency Management Agency-FEMA](#)

Continuum of Exercises



from various institutional organizations. In light of their considerable expense and time-consuming nature, these exercises are reserved for addressing the most critical hazards and functions. Nevertheless, a noteworthy example of a drought-related full-scale exercise occurred in 2022 in the Canton of Ticino within the realm of “Odescalchi 2022.”¹²² This exercise entailed a significant mobilization of personnel and resources, reinforcing cross-border collaboration and mutual aid. This was achieved through the implementation of a new memorandum of understanding between the Cantons of Ticino, Valais, Graubünden, and the Italian border provinces.¹²³ Odescalchi 2022 included civil protection partner organizations from the Canton of Ticino and military personnel working in cooperation with their Italian counterparts to refine skills and mutual understanding in military and civil assistance in the event of a disaster. The first of the eight scenarios tested during the exercise addressed a drinking water shortage in Mendrisiotto (the southernmost district of the Canton of Ticino and Switzerland), where a prolonged drought prevented the authorities from supplying the population district with drinking water. The simulation exposed challenges in the distribution aqueduct, prompting industrial companies in Mendrisio to seek aid from the cantonal civil protection authorities. In response, civil protection partner organizations, in collaboration with the military, intervened by collecting water

from the nearby Lake Ceresio, transporting it to Mendrisio, and purifying it for consumption via the deployment of mobile water filtration treatment plants. These mobile water treatment plants, provided by the Canton of Basel-Stadt, are frequently deployed to address drinking water shortages during emergencies such as water shortage, water pollution, or industrial accidents. The sharing of assets occurred through the Federal Resource Management Mechanism (*Ressourcenmanagement Bund-ResMaB*), reiterating the importance of collaboration and resource sharing during crises.

The main aspects of the exercise were linked to technical and operational methods for responding to emergencies. However, the exercise remains a successful attempt to test institutional and operational drought preparedness. It allowed for the identification of areas for improvement in the domain of crisis response, testing of new assets, such as mobile water filtration treatment plants, and different forms of collaboration. This includes cross-cantonal collaboration for the purpose of resource sharing, international collaboration to refine mutual support, and civil-military collaboration to enhance mutual understanding of crises and emergencies.

An alternative to operation-based exercises is discussion-based exercises, which include seminars, workshops, and tabletop exercises.¹²⁴ Specifically, tabletop exercises entail the convening of relevant stakeholders to deliberate and rehearse their assigned duties in the face of a hypothetical scenario, with facilitators guiding the discussion. Tabletop exercises are often employed to familiarize the participants with plans, policies, and procedures or even to discuss or develop new ones.¹²⁵ Tabletop exercises have proven to be a helpful method to address complex emergencies and to improve communication and information flow, as well as to provide a venue for conflict resolution between the involved organizations.¹²⁶

Although the literature on tabletop exercises targeting drought is limited, notable exceptions exist, primarily in the United States. For example, the South Carolina Drought Tabletop exercise, developed by the South Carolina Emergency Operations Center in 2019, gathered participants from national emergency response teams to local water managers and Federal Agencies to learn about roles and responsibilities in drought response and to exercise drought preparedness and response actions.¹²⁷

In Switzerland, a tabletop exercise titled “Drought”¹²⁸ is scheduled for November 20, 2024. This exercise is designed to evaluate the readiness of the Swiss civil protection system in managing multi-year drought events. During the event, members of civil protection partner organizations will be exposed to hypothetical yet realistic extreme drought scenarios developed by the FOCP, the WSL Extremes program, and the Center for Security Studies at ETH Zurich. This approach allows for a

comprehensive examination of existing structures, processes, and resources at the cantonal and federal levels, encompassing both operational and strategic components to enhance preparedness for future extreme events.

This tabletop exercise aims to challenge participants to think more comprehensively and clearly about the consequences of drought and the responses to it. By bringing together different domains of Swiss civil protection organizations, the exercise seeks to further raise awareness of drought exposure and generate innovative ideas for improving drought planning and response strategies before the next drought occurs.

In conclusion, bridging the gap between knowledge and action is essential for enhancing drought preparedness within Switzerland’s civil protection system. Whether operation-based or discussion-based, simulation exercises provide invaluable platforms for testing response strategies, refining procedures, and fostering collaboration among stakeholders. These exercises not only build experience and confidence in implementing drought management plans but also highlight areas for improvement. As drought hazards continue to grow in significance, expanding the scope and frequency of such exercises will be crucial in strengthening the resilience of civil protection organizations and ensuring they are well-equipped to manage future challenges.



Action Point 8 – Participate in knowledge exchange

One of the striking findings from the survey of cantonal civil protection authorities in Section 2 was their expressed interest in participating in a national knowledge exchange program focused on drought management and resilience. In light of this interest, Action Point 8 explores the creation of a national knowledge exchange platform and its prospective benefits for improving drought resilience in Switzerland. This Action Point also postulates the essential role of incorporating academic expertise into the platform, ensuring scientific advice for drought management.

A national platform can strengthen and unify the efforts of the various stakeholders engaged in drought management and resilience. By functioning as a central nexus for practitioners, decision-makers, academics, and other relevant parties, it consolidates diverse perspectives and expertise.¹²⁹ Given the varying perceptions of drought and its impacts on individual interests, experiences, and contexts, the platform's initial objective is to integrate these multiple forms of knowledge and perspectives on drought.¹³⁰ This integration is intended to create a repository of innovative ideas and applications, facilitate joint exercises, as outlined in Action Point 7 "Strengthen drought preparedness through exercises", and overcome potential barriers to knowledge generation and resilience development that may arise from differing understandings of drought risk.

In addition to sharing knowledge, the platform would promote networking initiatives to facilitate discussions and the exchange of experiences. This aspect is of particular importance, as the expert interviews with cantonal authorities have revealed a lack of awareness regarding drought management measures implemented in other cantons. Active participation in the platform's networks would enable cantons to gain a broader understanding of drought challenges and solutions that extend beyond their individual borders, thereby improving their capacity to respond to drought events. The existing platform Conference of Cantonal Authorities for the Military, Civil Protection, and Civil Defense (*Konferenz der kantonalen Verantwortlichen für Militär, Bevölkerungsschutz und Zivilschutz*)¹³¹ demonstrates the effectiveness of inter-cantonal collaborative discussions within the civil protection domain.

The knowledge exchange program could be integrated into existing forums or established as a stand-

Cantonal civil protection authorities' expressed interest in knowledge sharing highlights the need for a platform that facilitates discussions, joint exercises, and innovative solutions. This corroborates informed and effective drought response strategies. Action Point 8 highlights the importance of a national knowledge exchange platform for drought management, unifying efforts and integrating scientific expertise with practical experience to enhance resilience across Switzerland.

alone entity. Regardless of its format, the platform's success hinges on the active participation of scientific actors whose research and expertise would complement the practical knowledge of practitioners and decision-makers. By incorporating scientific insights into every phase of the integrated risk management cycle,¹³² from planning and event documentation to post-drought evaluation, the platform would foster informed decision-making and effective response to future drought challenges.¹³³

This collaborative approach, where drought researchers and planners work together at the interface of science and policy, aligns with the core goals and methodology of this report and mirrors the Federal Council's vision for the upcoming dedicated drought specialist staff (*Fachstab Trockenheit*) outlined in Action Point 6 "Appoint a drought task force". The resulting synergy between theory and practice would ensure that drought management strategies are evidence-based and grounded in real-world experience, maximizing their effectiveness and impact.

One of the principal areas where science and civil protection practitioners intersect is in the documentation process during and after drought events. In Switzerland, the Federal Government is expected to introduce a cantonal reporting obligation in the event of drought conditions.¹³⁴ This reporting would elaborate on observed water deficits and conflicts and protective measures for ecosystems. They would also present an analysis of the potential implications of future drought events, including the number of exceptional authorizations granted for emergency water use. However, an independent study conducted in 2022 and commissioned by FOEN revealed that 19 cantons do not have an established procedure for systematically collecting information on water uses and protection during drought periods.¹³⁵ The application of scientific knowledge can address this gap by developing standardized protocols and methodologies for the collection and analysis of data, ensuring consistency and comparability across cantons. Such data, when integrated with post-drought evaluations, can inform evidence-based decision-making and support the implementation of targeted interventions.

The undertaking of post-drought evaluations is fundamental for civil protection. Such evaluations serve to preserve institutional memory and facilitate the process of learning from past successes and mistakes. These evaluations should analyze the climatic and environmental aspects of the drought, its economic and social consequences, and the effectiveness of pre-drought planning, relief efforts, and recovery initiatives.¹³⁶ Crucially, they should identify both the weaknesses and the strengths in drought-coping mechanisms, highlighting areas where societies exhibited resilience and not just failures. To support an unbiased assessment, the responsibility for post-drought evaluation and societal responses can be delegated to independent institutions, such as universities and specialized research institutes.¹³⁷

Although civil protection organizations are not directly involved, examples of comprehensive post-drought evaluation reports from the Cantons of Aargau¹³⁸ and Zurich¹³⁹ demonstrate the value of detailed insights and recommendations for future improvements in drought management.

In conclusion, the establishment of a national knowledge exchange platform is endorsed by cantonal civil protection authorities and represents a promising avenue for enhancing Switzerland's drought resilience. This collaborative forum, combined with proactive measures outlined in previous Action Points, has the potential to markedly enhance Switzerland's resilience to drought and its associated impacts and consequences.



Action Point 9 – Conduct community education and outreach programs

Droughts impact communities in multifaceted ways based on their severity, duration, and spatial extent.¹⁴⁰ The goal of Action Point 9 is to build drought resilience through consistent education and outreach programs. It is important to recognize that resilience does not imply immunity to drought, but rather, it signifies the capacity to mitigate its impact through early action. Raising awareness and managing knowledge about drought is essential for reducing its risks. Civil protection organizations, which have traditionally been geared towards immediate disaster response, need to expand their role to address slow-onset, complex, and prolonged crises like drought. This requires a modification in communication strategies, particularly when attempting to disseminate information regarding the intricacies of droughts in contrast to short-term weather events like heavy rainfall and flash floods.¹⁴¹

A significant increase in public awareness of drought has been observed in Switzerland, as evidenced by the expert interviews in Section 2.2. This awareness has been noted across the general public and various sectors and is largely attributable to recent drought events as well as ongoing efforts and initiatives to combat climate change. Despite this awareness, past drought events have shown that cantonal civil protection authorities still face challenges in navigating the complex discussions with communities about the rationalization and prioritization of water use, especially in the event of disputes.^{142, 143} While Switzerland does not currently face an acute water scarcity crisis, brief periods of water shortage have highlighted how prioritization of water use remains a critical issue. For instance, in emergencies, including prolonged droughts, cantons may adjust the minimum residual flow rates to allow for temporary water withdrawals, especially for drinking water supplies, as stipulated in Art. 32 (d) of the Water Protection Act.¹⁴⁴ The law, however, does not specify the relative priorities between using water for cooling and other industrial applications, firefighting, or agricultural irrigation, leading to conflicts in some municipalities. The Capability Analysis for Civil Protection identifies conflicts over water arising from rationing or prioritization issues as a gap in civil protection capabilities in Switzerland's civil protection capabilities for managing droughts (*Trockenheitsfähigkeiten 103*).¹⁴⁵

Engaging with the public ensures acceptance and compliance with water restriction measures, which are crucial for effective drought management. Action Point 9 emphasizes that public drought information, such as the cantonal drought bulletins in St. Gallen and Graubünden, and engagement activities, like the walking tours in Basel-Landschaft, are instrumental in building drought resilience. These initiatives equip communities with the knowledge and tools needed to face drought with preparedness and adaptability rather than crisis.

Disputes arise not only in relation to the allocation of water among different stakeholders but also in instances where restrictions are imposed in one administrative division but not in the neighboring ones.^{146,147}

Additionally, response strategies implemented by civil protection authorities or the cantonal and regional crisis management bodies, often with the support of other actors, can be contentious. A recurring challenge involves the deployment of the federally anchored capacity of the armed forces to transport water to sustain alpine communities. This practice is intended for emergencies and should only occur if the cantons' assets and resources, including the ones of the private sector, are exhausted and the criteria of subsidiarity are fulfilled. However, this intervention has become more frequent in the past. For instance, at the end of summer 2022, the armed forces transported 585,000 liters of water via helicopter to alpine farms.¹⁴⁸

To address these disputes and conflicts, year-round community engagement and outreach campaigns from cantonal and federal authorities are necessary to raise awareness about the various impacts of drought and dispel common misconceptions surrounding the issue.

Public outreach campaigns often focus narrowly on providing information on how to reduce water usage.¹⁴⁹ For example, communication measures during the summer drought of 2022 were largely limited mainly to appeal to the population by individual municipalities or water suppliers to reduce drinking water consumption.¹⁵⁰ However, effective community engagement and educational programs must address a broader range of information. Comprehensive educational programs should inform the public about the sources of their water, who uses it, the historical and potential future impacts of drought on their community, and the benefits of proactive drought planning.¹⁵¹ Greater understanding is likely to lead to greater compliance when citizens are requested to comply with water consumption restrictions in response to drought. The survey results in Section 2.1 revealed that cantonal civil protection authorities encounter challenges in engaging the public in water conservation

efforts. When individuals are involved in the decision-making process or are provided with clear and transparent information about the necessity of restrictions, they are more likely to perceive the measures as fair and necessary, reducing resistance and promoting voluntary cooperation.¹⁵² Moreover, it is also likely that individuals will begin to place more value on the long-term steps the community can take to be better prepared for the next drought.

Furthermore, engaging with the community helps to better capture and compare the variety of perceptions on drought phenomena and to gather insights from various stakeholders to understand diverse perspectives on drought and its impacts.¹⁵³ Because drought is challenging to recognize until it manifests through location- and sector-specific impacts,¹⁵⁴ different actors understand it in different ways. Capturing what drought means for different individuals, organizations, and sectors and mapping how this understanding evolves, including if stakeholders are prepared for it, are key components of risk management to reduce drought impacts. For instance, when developing the national monitoring and EWS outlined in Action Point 1 “Establish and incorporate a national drought early warning system”, the responsible federal offices initially conducted surveys and targeted interviews with a variety of users across different cantons. These endeavors tailored and shaped the development of the system based on the real needs of users.

Proactive communication and information sharing are essential in keeping the public informed on an evolving drought situation. For example, the Cantons of St. Gallen¹⁵⁵ or Graubünden¹⁵⁶ provide regular updates on the current drought situation through bulletins referencing parameters such as temperature, precipitation, surface water runoff, and groundwater level. This transparency helps to build trust and fosters a shared understanding of the challenges posed by drought, encouraging greater community participation in conservation efforts.

Beyond public communication, proactive engagement also extends to key stakeholders. For instance, the Canton of Thurgau offers a detailed checklist for water suppliers,¹⁵⁷ guiding their preparation for and response to increased water demands during droughts, particularly from the agricultural sector. This targeted approach ensures that water resources are managed effectively and equitably during periods of scarcity.

Finally, community outreach through excursions or guided walks to drought-affected areas and water infrastructure sites (e.g., reservoirs or treatment plants) can be an effective method for the co-production of knowledge and public education.¹⁵⁸ The underlying premise is that these experiences evoke personal memories and shared narratives by establishing connections between people and places, enriching knowledge exchange and collabora-

tive problem-solving. These activities promote informal dialogue and collaboration among a diverse range of stakeholders, including scientists, policymakers, farmers, and community members. For example, the excursion in the Riehen-Bettingen forest organized by Canton of Basel-Landschaft¹⁵⁹ is a primary initiative that offers a unique opportunity to discuss and explore solutions for water efficiency and conservation, promoting public social norms that value water as a precious resource.

In conclusion, fostering open dialogue, public awareness, and education empowers communities to not only withstand the effects of drought but also to mitigate its impact. Action Point 9 demonstrates that public engagement and outreach are key to building resilience to drought and paving the way for a future where drought is met not with crisis but with preparedness and adaptability.



Action Point 10 – Embrace collaboration

Droughts transcend political borders, often escalating from local to national and even international levels. However, the regulations and resources available to address them – such as time, personnel, and assets – are limited and confined within geographical boundaries. While water scarcity can lead to conflicts across different sectors, organizations, and communities, Action Point 10 champions collaboration as an effective means to mitigate drought risk across society. By breaking down silos, facilitating information exchange, and pooling resources, collaboration enables a more coordinated and effective response across sectors and communities.

A collaborative approach extends across all levels of government, civil society, and the private sector. It transcends mere cooperation or resource sharing and involves the concerted efforts of diverse entities working together to overcome organizational boundaries, levels of authority, and sectoral divisions.¹⁶⁰ The overarching objective is to collectively prepare for, respond to, and recover from drought events.

The necessity for collaboration in the context of drought management is evident at various levels. The findings of the survey and the expert interviews with cantonal civil protection authorities reveal a lack of cross-border collaboration, limiting engagement between Swiss cantons as well as with neighboring European countries. In fact, the cross-border management of shared water resources often leads to controversy and tensions, underscoring the need for collaborative solutions.^{161, 162} This need also extends to the local level. In the Canton of Lucerne, the absence of a collaborative approach has resulted in fragmented water supply systems and a lack of cantonal oversight,¹⁶³ an issue mirrored in other cantons as well. Additionally, recent drought events and water conflicts in the Canton of Aargau have emphasized the importance of regional cooperation in water supply planning, highlighting the necessity for cross-sectoral collaboration.¹⁶⁴

Rather than a constraint, collaboration should be viewed as an enabling mechanism, as it offers a multitude of benefits. First, it saves costs by pooling resources and avoiding duplication of efforts. Second, the long-term protection of people and nature is becoming increasingly complex, and the burden of addressing these challenges alone is overwhelming for individual entities. Third, effective solutions require a collective approach that goes be-

Drought transcends political boundaries, necessitating collaborative solutions across all levels of government, civil society, and the private sector to effectively prepare for, respond to, and recover from drought events. Action Point 10 emphasizes the need for collaboration within the civil protection system as a strategic necessity for mitigating the impacts of drought, pooling resources, and fostering a shared responsibility for water resource management.

yond the interests of individual stakeholder groups, ensuring that all perspectives are represented and incorporated into the planning and response procedures. This inclusive approach can foster a sense of shared responsibility and ownership over water resources, leading to more sustainable and equitable outcomes.

Moreover, collaboration with academic institutions – through what is often referred to as transdisciplinary approaches – ensures that societal and scientific stakeholders can co-create knowledge.¹⁶⁵ This means that research, for example, supports drought risk assessments and provides valuable insights into possible future scenarios, taking into account local conditions provided by local experts (e.g., emergency managers for natural hazards). This, in turn, helps the relevant authorities (e.g., civil protection) to define appropriate crisis management plans for effective preparation and response, as well as for recovery capacities. An example of this process, is the Research Program Extremes, which fosters inter- and transdisciplinary research to equip Swiss stakeholders with appropriate decision-making tools and coping strategies to address future extremes, including drought.¹⁶⁶

While the need for collaboration is evident and there is a strong desire for it across all levels, as shown by the willingness of most survey respondents to engage in both inter-cantonal and international cooperation, initiating and maintaining effective partnerships can be challenging. Diverse organizational structures, hierarchical levels, and different responsibilities create a complex web of demands that can be hard to navigate. However, several initiatives are underway to overcome these challenges.

The Canton of Basel-Landschaft's new Water Strategy, for example, provides a model that specifies the responsibilities of each level and office of the cantonal government in implementing water measures.¹⁶⁷ The model is intended as a guide for the canton and its municipalities to build trust (through transparent communication, shared goals, and mutual respect), define roles and responsibilities (to prevent overlaps and ensure accountability), develop joint protocols, and invest in capacity building.

Additionally, a new initiative consisting of workshops brings together researchers, members of the Federal Administration, including FOCP, and the insurance industry to explore synergies in drought management, fostering a multi-disciplinary approach to drought risk assessment and mitigation.¹⁶⁸ Another example of a permeable government collaboration is given by the Canton of Bern. Its risk assessments for the municipalities described in Action Point 4 "Translate drought risk to local action" were calculated based on data and statistics from several organizations other than civil protection.

Furthermore, Switzerland actively participates in international collaborations on disaster management. This includes engagement within the UNDRR, the UN's central coordinating body for disaster risk reduction, and active membership in the High-level Meeting on National Drought Policy (HMNDP) held in Geneva. The HMNDP encourages national governments to adopt policies that foster cooperation and coordination at all levels to enhance their capacity to cope with drought-induced water scarcity.¹⁶⁹

On a more localized level, the International Lake Constance Conference serves as a central hub for cross-border cooperation between Swiss cantons and the neighboring regions of Germany, Austria, and Lichtenstein, facilitating dialogue and joint action among stakeholders, decision-makers, and practitioners, including civil protection authorities.¹⁷⁰

For cantonal civil protection authorities, collaboration can take the form of joint exercises to simulate drought scenarios and test response mechanisms, as described in Action Point 7 "Strengthen drought preparedness through exercises". It can also involve the sharing of assets, the exchange of knowledge and expertise through different existing platforms, or the establishment of new dedicated forums, as illustrated in Action Point 8 "Participate in knowledge exchange".

In conclusion, droughts often occur during periods of elevated demand for water, thereby testing the capacity of individual communities to respond effectively. The deployment of limited resources, including time, personnel, and specialized equipment, can be rapidly exceeded in the event of a drought. Action Point 10 concludes the presentation of the Drought Toolkit, emphasizing that from a civil protection perspective, collaboration is not just a desirable option but a strategic necessity for mitigating the impacts of drought.

4 Concluding Remarks

Switzerland is often referred to as Europe's water tower, but it is not immune to the growing risk of drought. Droughts are extreme weather events with far-reaching and often devastating consequences for people, infrastructure, the economy, and ecosystems. Unlike many other natural hazards, their effects unfold gradually, impacting diverse areas such as agriculture, human health, energy security, and public safety. They disrupt the hydrological cycle and ecosystem functions, materializing over weeks, months, or even years. However, this gradual onset offers a window of opportunity for early intervention and the development of adaptation strategies.

Civil protection organizations are key to building resilience to such slow-onset crises. Their mandate to protect the population and its livelihoods extends beyond immediate emergencies and encompasses long-term risk reduction. The Drought Mitigation Toolkit presented in this report provides a roadmap for transitioning the Swiss civil protection system from emergency management to risk reduction in the context of drought. Grounded in research and expert insights, this toolkit offers 10 Action Points that form a framework for developing regional drought management policies and preparedness plans. It provides guidance rather than rigid prescriptions, encouraging reflection and discussion even if full implementation is not immediately feasible. After all, fostering dialogue about drought's relevance to civil protection is a core objective of this report. While tailored to the Swiss context, the toolkit's methodology can be adapted to various levels of government worldwide.

The diverse case studies highlighted in the toolkit reveal numerous ongoing drought mitigation initiatives across Switzerland. However, these efforts often remain isolated within their respective institutions or geographic areas. This report aims to connect these disparate initiatives by showcasing them and providing contact points for knowledge exchange and collaboration. The fragmented nature of current drought management practices further underscores the need for a national drought plan, one that harmonizes efforts, facilitates information sharing, and ensures a cohesive response across cantons or local administrations. If implemented, Switzerland would follow suit with other European countries that have national drought plans or are in the process of developing them.¹⁷¹

Though this report primarily focuses on strategic and structural aspects of drought management within the Swiss civil protection system, it is important to acknowledge that political decisions regarding water allocation and resource management will ultimately determine the success of these efforts. Addressing the complex challenges of drought requires not only technical solutions or operational actions but also a willingness to

make difficult choices and prioritize long-term sustainability over short-term gains.

Looking ahead, drought will continue to be a pressing concern for Switzerland and the journey towards drought resilience is ongoing. This report serves as a call to encourage discussions and exchanges among civil protection authorities, decision-makers, and communities in Switzerland regarding their vulnerability to drought and its potential impact on people, infrastructure, sectors, ecosystems, and institutional systems.

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