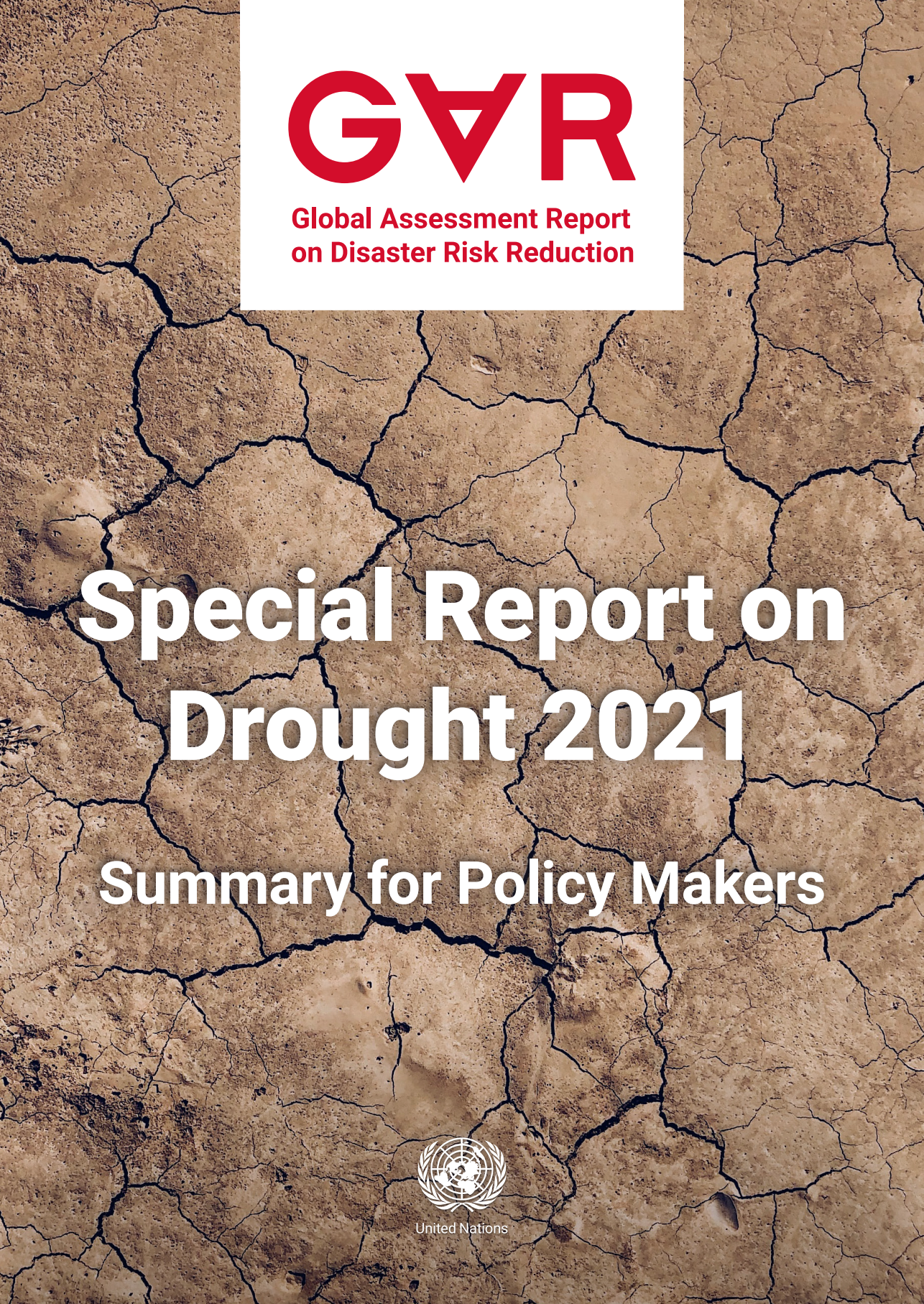
GAR
Global Assessment Report
on Disaster Risk Reduction
Special Report on
Drought 2021
Summary for Policy Makers
United Nations

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Introduction

Droughts have deep, widespread and underestimated impacts on societies, ecosystems and economies. They incur costs that are borne disproportionately by the most vulnerable people. The extensive impacts of drought are consistently underreported, even though they span large areas, cascade through systems and scales, and linger through time. They affect millions of people and many sectors and domains – such as agricultural production, public water supply, energy production, waterborne transportation, tourism, human health and biodiversity – contributing to food insecurity, poverty and inequality.

Climate change is increasing temperatures and disrupting rainfall patterns, thus increasing the frequency, severity and duration of droughts in many regions. As the world moves towards being 2°C warmer, urgent action is required to better understand and more effectively manage drought risk to reduce the devastating toll on human lives and livelihoods.

The GAR Special Report on Drought 2021 emphasizes that while drought poses a significant threat to achieving the Transforming our World: the 2030 Agenda for Sustainable Development (2030 Agenda) and the Sendai Framework for Disaster Risk Reduction 2015–2030 (Sendai Framework), this threat can be substantially reduced by applying prospective, proactive and innovative approaches to drought risk management. Drawing on lessons learned from case studies around the world, the report argues that with what we now know about drought and its risk to societies, economies and ecosystems, we can and must do better at managing it.

It calls for a sharper focus on prevention: shifting from reactive approaches to getting ahead of the curve by addressing the root drivers of drought and socioecological vulnerability, avoiding and minimizing risks. It shows that increasing greenhouse gas emissions, together with the vulnerability of populations and ecosystems exposed to drought, are important drivers of drought risk. Addressing these facets are central to reducing drought risk. At the same time, the report stresses that it is crucial to address the human activities that intensify and propagate the impacts of drought.

Prevention and mitigation of drought risk have a far lower cost than reaction and response. The report offers recommendations on how to achieve drought resilience by promoting holistic systemic approaches based on the lived experience. It calls for a transformation in drought risk governance and the actions, processes, traditions and institutions (formal and informal) by which collective decisions are reached and implemented. This would help society to be more able to copy with uncertainty, surprises and changes in systems over time.

The report recommends the establishment of new coordination and collaboration mechanisms to rapidly advance the understanding and management of drought risk. It calls for a new global mechanism that could support countries to: address the cascading and transboundary nature of drought risk; broaden collaborative partnerships; promote innovation, iterative learning and adaptive governance; share capacities and learning; and connect through communities, across scales and boundaries, and among existing regional entities and initiatives. It focuses on addressing the systemic aspects of drought risk creation while enhancing a better understanding of drought impacts.

The report also promotes the establishment of national drought resilience partnerships that would mobilize public, private and civil society partners and work to ensure a seamless link between national and local levels. These partnerships would serve to help eliminate the institutional silos that prevent a holistic approach to drought risk management, thus engaging a wide range of sectors and stakeholders to accelerate collective preventative action.

Structure of the GAR Special Report on Drought 2021

Chapter 1 presents the developing understanding of drought and describes the components of drought risk (hazard, exposure and vulnerability). The breadth and complexity of drought impacts are described within the context of growing risks posed by climate change.

Chapter 2 explores 17 case studies, which provide a cross section of the world's recent experiences of drought. The Annex to this summary for policymakers outlines the case studies, and full versions are available **here**.

Chapter 3 highlights the need to build drought resilience through systemic risk management approaches. It outlines the transformation needed in governance to match the diversity of actors and viewpoints with the widely varying nature of drought. It highlights key enablers, partnerships, capacities and strategies inherent in a systemic approach to drought risk management across scales.

Chapter 4 concludes the report with a call to action that applies to all stakeholders. The report highlights options to be explored and ways to navigate and negotiate through the complex damaging risk, although it does not claim to provide a single prescriptive solution to the challenge of drought.

Drought – an underestimated systemic challenge to lives, economies and ecosystems

Large and underestimated impacts

Droughts have always been part of the human experience, but the damage and costs resulting from them are usually seriously underestimated. This is due to widespread and cascading impacts that are often not explicitly attributed to drought. Reconstructive climatology suggests long dry periods across prehistory may have contributed to the demise of several ancient cultures. More recently, major droughts over the past century have highlighted the significant costs incurred by human society and the natural environment. The rapid evolution of human-induced climate change is further aggravating this risk in many regions of the world.

The direct and indirect impacts of drought across societies, economies and ecosystems are large and difficult to quantify in economic terms. They are therefore often underestimated.

Even so, the measurable impact of drought is considerable. Estimates of costs arising from drought impacts from 1998 to 2017 show droughts have affected at least 1.5 billion people and led to economic losses of at least $124 billion across the world. Estimates of some of the direct costs include annual losses in the United States of America of approximately $6.4 billion per annum, and some €9 billion in the European Union. The effect of severe droughts on India's gross domestic product is estimated at 2–5%. As a result of the Australian Millennium Drought, total factor agricultural productivity in Australia fell by 18% in the period 2002–2010. The costs of drought rise sharply as the length of drought increases and impacts cascade, and the effectiveness of initial plans becomes increasingly uncertain.

Global estimates of costs offer only partial accounts; case studies outlined in the report suggest multiplicative impacts and real losses many times the quantified costs. The harm resulting from droughts can be aggravated by compound events (such as heatwaves or wildfires) and cascading and widespread impacts.

Drought disproportionately affects the poor and marginalized across the world, for whom the cost of drought is measured in terms of lives, livelihoods and impoverishment. Beyond the large impacts on national economies (e.g. in India and sub-Saharan Africa and on the Iberian Peninsula), and the increasing and large costs in structural drought risk management measures and plans, there are less easily measured but substantial costs. These may be incurred from crop failure, livestock death, mass migration, hunger and health effects, disruption to food supply and markets, and, in vulnerable places, conflict and various forms of severe social disruption.

The climate change dimension

Climate change is an increasing driver of drought generation and is intensifying drought impacts, increasing the frequency, severity and duration in many regions of the world, even at the lower end of climate change projections. When not adequately managed, drought is one of the drivers of desertification and land degradation, thus increasing fragility of ecosystems and social instability, especially in rural communities. Drought hazard and human activities (e.g. land and water management) are strongly intertwined, such that these activities can exacerbate the drought hazard and increase the risk of severe socioeconomic and ecological impacts.

The size and nature of societies, economies and ecosystems exposed to drought are also changing. When drought is experienced for the first time, the skills, capacity and adaptive capabilities necessary to cope may be lacking or in decline. Human activities – also under pressure from climate change – drive risk and compound the impacts, which may result in water scarcity and feedback loops in the climate system that lead to further drought intensification and propagation.

A complex and dynamic risk

The report shows that drought is a complex, systemic risk that presents broad challenges for governance and management. Some elements can be modelled and quantified, some modelled and not quantified, and some remain unknown until experienced. Shocks in one or several parts of affected societies and ecosystems can ripple widely.

The dynamics of drought shed light on the characteristics and interactions of socioecological and technological systems that allow hazards to become

disasters, and how society's values, demands and attendant resource management affect ecosystems, human health and sustainable development.

A lack of a systems management approach to this complex risk lessens the ability to cope with uncertainty and surprises. This can be compounded by plans, interventions and investments that increase vulnerability or dependence. For example, irrigation and water supply dams may increase vulnerability by increasing demand or dependence on reservoir storage. The costs of drought rise sharply as the length of drought increases, and impacts cascade across sectors and scale. Many countries lack systematic quantitative knowledge on the environmental and socioeconomic costs of drought due to this complexity.

Prevention and preparedness

Inaction or poorly targeted action to address drought is leading to increased costs and impacts, which can be further compounded by a lack of adequate preparation to manage drought when it occurs. However, there are opportunities to act now to holistically manage drought risk.

Preventative action has far lower human and financial costs than reactive responses, and can stop communities being overwhelmed by the breadth, depth and longevity of drought impacts. This requires a shift from dealing with drought impacts, to getting ahead of the curve to address underlying risk drivers. Informed governance and societal choices can radically reduce drought impacts, by taking into account the root causes, spatial patterns and dynamics of drought, and socioecological vulnerabilities. However, key questions remain about characterizing and predicting drought events, understanding the nature of vulnerability and resilience, and what constitutes an effective response to the risk of drought.

Lessons from the lived experience

The case studies in this report emerge from damaging droughts across the world that have challenged existing drought policies, measures and responses, and which have led to new plans and strategies.

The wide range of direct and indirect impacts of drought test a nation's broader economic and institutional systems. The impact is greatest in those countries with high reliance on rural economies and with large vulnerable populations. Cascading impacts noted in the case studies range from food price increases due to crop failures, through to various forms of community health issues, and to devastating conflicts either arising from drought impacts or exacerbated by them. These impacts often also cross borders. Drought management is especially complex where many nations share water resources or other impacts of drought.

Drought effects are often felt initially at the landholder, farmer or grazier level. However, with time, the impacts propagate across communities, the economy and then beyond administrative or national borders. Vulnerability to the effects of drought is also unequal and follows a similar stratified pattern of severity. For example, in many African countries, a hierarchy of vulnerability is clear, with, for example, transhumance pastoralists being most affected, followed by rain-fed crop farmers, irrigation farmers, and then the broader community and economy. Within each of these groups, other forms of structural inequality, such as gender roles, also affect how vulnerable an individual is to the impacts of drought.

Adaptation to drought

Local adaptation to drought is occurring worldwide. Examples of adaptation from the ground up – sometimes supported by explicit government programmes – are clearly evident in the case studies. Examples include adapting crop variety or species choice, the

mix of enterprises, planting dates, planting densities, irrigation strategies, agro-pastoralism, livestock species and delivery mechanisms. The use of these tactics in drought risk adaptation is supported by private and public extension services in many countries.

Adaptation strategies based on traditional knowledge (e.g. West African water harvesting) are increasing in importance, as are community networks (e.g. in Australia). Land regeneration, green belts and reforestation are key adaptive and mitigation actions in some case studies, and are especially important in the Aral Sea area. Such adaptations suffer from a lack of sufficient information on the likelihood of drought or the status of existing droughts.

While many case studies highlight the need for empowered farmers and communities, and place an emphasis on preparedness tied into adequate early warning and monitoring, success is dependent on the effectiveness of policy support.

Policy support has myriad forms and includes drought funds, rebates and various tax measures, which are becoming more common. However, the use of risk transfer and related financial instruments is rare due to a lack of knowledge or research into financial risk products, poor choice within expensive financial products, and a small supplier pool and thus limited competition. Government-supported insurance schemes are in place in some countries (e.g. Islamic Republic of Iran), while government farm subsidies play out in vastly different ways across countries.

Drought risk management and governance

Drought impacts and drivers can disrupt day-to-day governance activities and test institutional arrangements for allocating and managing scarce resources. The case studies demonstrate that drought spurs policy action, and cycles of policy development, review and restructure emerge. These cycles reflect action when drought is severe and inaction when drought is no longer evident. While good examples exist in some parts of the world, many countries have been overwhelmed by the length and complexity of severe droughts, and measures are currently reactive only. Significantly, almost all case studies identify the need for national drought policies to support drought risk reduction and to avoid prevailing reactive models.

The case studies also show that countries' capacity to address drought varies. They highlight how increasing pressures due to population growth and industrial development, limited knowledge on possible impacts, poor assessments of vulnerabilities and costs, unclear and poorly defined roles and responsibilities across institutions, little coordination at national and local levels and lack of awareness of policy options are key impediments to effective drought risk management. Drought is not constrained by boundaries (internal, national or institutional), but such boundaries can hinder effective preventative action or response. The case studies also emphasize that international transboundary issues have additional complexities for governance. Conflict resolution and avoidance is a clear need, as water is becoming increasingly scarce and demand is growing.

In progressing beyond a reactive approach, some countries have adopted a three-pillar method to assess and respond to drought risk that includes: (a) monitoring, early warning and prediction, (b) vulnerability, resilience and impact assessment and (c) mitigation and response planning.

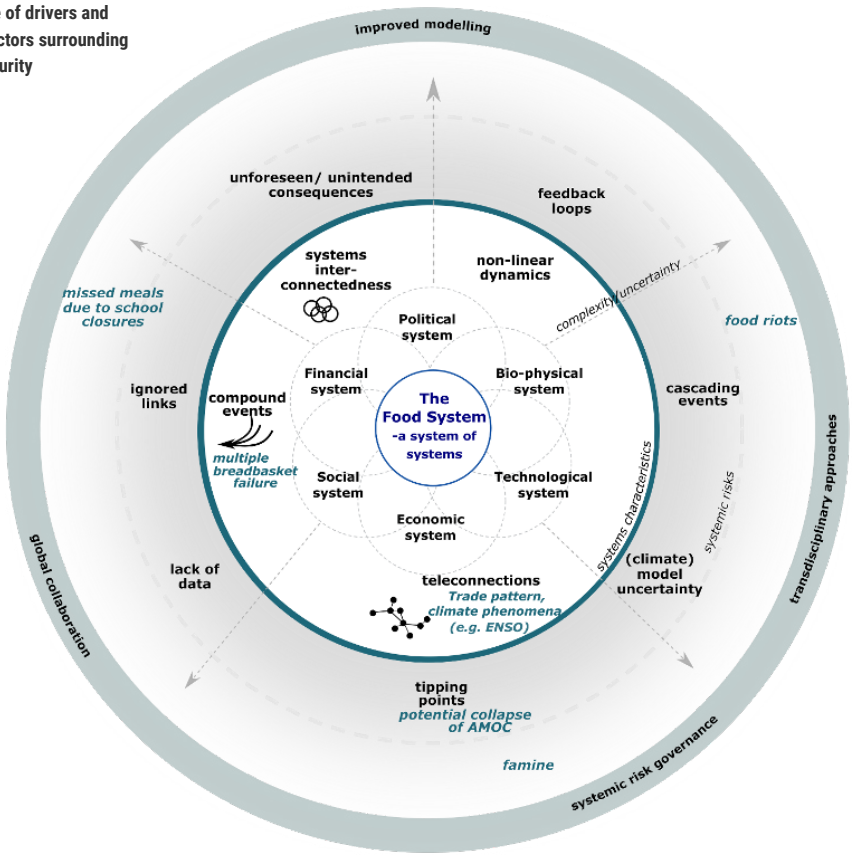
Many countries are now connecting meteorological services to early warning systems, seasonal weather forecasts and status reports with a focus on likely impacts on geographies and communities and livelihood / economic systems to improve targeting and support. There are opportunities to tie into and build monitoring systems that connect community "reporters" with remote-sensing technology and modelling (e.g. Drought Watch Danube Basin and DustWatch Australia). Such monitoring and modelling systems exhibit increased resilience due to distributed responsibilities and roles among, for example, landholders, academia, and public and private organizations.

Drought and food systems

Climate phenomena and other anomalies can interact to drive droughts, storms and floods. The systemic impacts of drought are interconnected and play out globally, including through global economic and trading systems via teleconnection. Drought impacts and drivers can be strikingly uneven across time and space. A wider co-occurrence of risks and system changes – including food price rises and health deterioration – can lead to fragility (rather than resilience), labour system deterioration and education failure. The vulnerabilities of the food, water and energy nexus are exposed by drought, and can spill over into a social vulnerability, stability and conflict nexus.

For example, the prices of the four main traded food crops of the world (wheat, maize, rice and soybeans), produced in breadbaskets like Argentina, Australia, Brazil, the United States of America and Europe, are vulnerable to almost simultaneous disruptions to production through drought. Failure in two or more of these production areas has, in recent decades, led to damaging food price spikes (in a wide range of foods due to the interconnections in the food system), food price riots and, arguably, disputes and conflicts. With climate change, there is a likelihood of increased water stress across these breadbaskets and increased pressure on the food system.

Complex nature of drivers and conditioning factors surrounding global food security



Note: AMOC: Atlantic meridional overturning circulation; ENSO: El Niño Southern Oscillation.

Source: This figure was published in One Earth, vol. 2, no. 6, Gaupp, F., Extreme events in a globalized food system, pp. 518–521, Copyright Elsevier (2020)

Complex, variable, dynamic, systemic – challenges for drought risk governance and management

Reducing the risk and impact of drought can positively contribute to achievement of the Sustainable Development Goals, in particular poverty reduction, zero hunger, good health and well-being, gender equality, clean water and sanitation, and sustainable cities and communities. Inadequate measures taken to address drought have significant costs to sustainability, stability and well-being. The better management of drought first requires a focus on identifying and measuring more completely the full costs of drought. In addition, knowledge-sharing in risk reduction is needed across all current and potential stakeholders to reinforce effective political and institutional action and response.

The shift to systems-based approaches

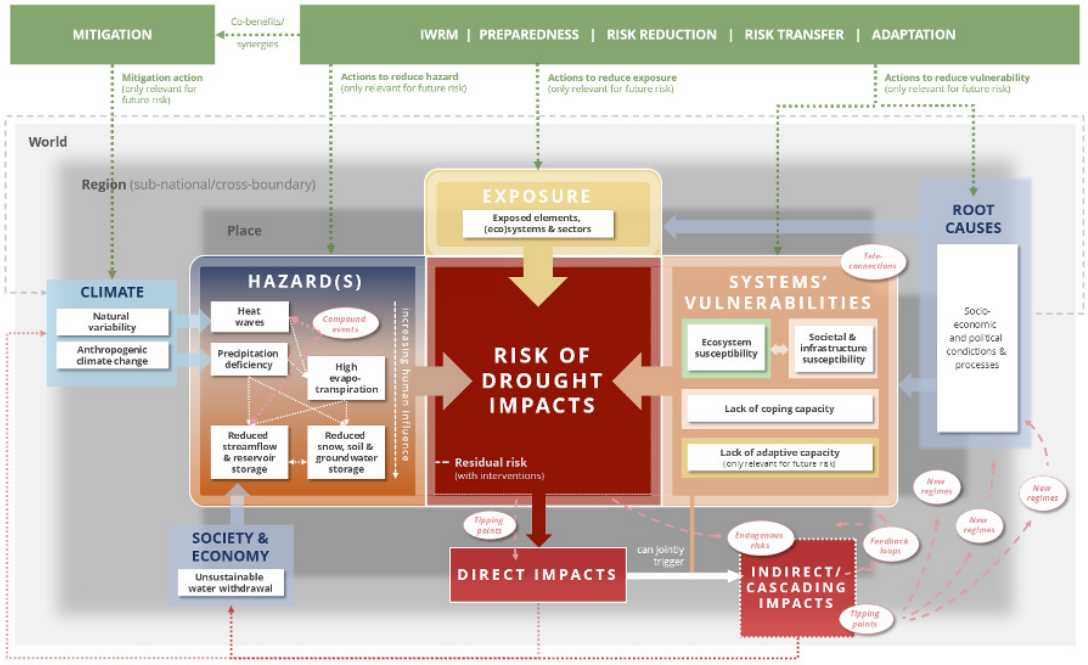
Drought risk governance and management requires integrated action across the three components of risk: hazard, exposure and vulnerability. Managing this complexity requires transdisciplinary and holistic approaches, often involving networking and partnerships across different scientific disciplines, policy-makers, practitioners and citizens, and tailored to and co-designed with specific users' needs. The root causes, spatial patterns and dynamics of exposure and vulnerability need to be considered alongside climate variability in an integrated and consistent manner. This requires new tools for risk-informed decision-making that allows human societies to live with the uncertainty associated with drought across the world.

Vertical and horizontal integration and inclusive novel partnerships

Governance and management of drought remains reactive and crisis focused in many regions. Responses include financial payments, provision of emergency water supplies, supply of fodder, construction of wells, and allowing access to land and infrastructure. This reactive approach is indicative of a lack of prioritization of risk preventative approaches, an inadequate level of preparedness and a lack of access to information about the current and likely state of drought.

The case studies also indicate that large investments in dams and related water infrastructure and irrigation schemes, which were designed to provide water security generally and during drought events, have not led to drought resilience. Some infrastructure measures can even have perverse impacts (e.g.

Characterizing the systemic nature of drought risk



Note: IWRM: integrated water resources management.

dam construction that encouraged unsustainable water-use practices, as observed in the Mediterranean Basin and Iberian Peninsula case studies).

In most case studies where severe droughts have been experienced, emergency funding has been short term and costly, emphasizing the need to move to drought resilience building. Successful integrated management requires a governance shift from reaction and bailout to risk reduction and resilience.

In the case studies, roles and responsibilities for drought management across agencies are divided, as evidenced in the planning, pre-drought and response stages. Coping with and understanding the broader systemic risks triggered by droughts require an effective systems approach by governments and affected communities, based on strengthened cooperation across stakeholders, experts and decision makers. In many countries, there is a need for a form of umbrella structure across individual departments and better coordination across weather, water, energy, agriculture, environment and infrastructure departments.

No case study in the report suggests that a single integrated solution to this complex and wide-reaching feature of the natural system has been found. However, the case studies do provide clear examples of how the lived experience can inform the shifts needed in governance, collaboration and decision-making. They also point to a clear need for greater investment in risk reduction and a shift to integrated, multi-hazard, systemic risk management approaches. In many cases, limitations to scaling, replicating or sustaining “successful” project-based approaches are exposed when overwhelmed by severe sustained drought events or cumulative impacts of sequences of smaller events.

The call to action

The report calls for bold and systemic action, because current structures and policies for managing drought fall far short of the need. Prospective and proactive drought risk management is required to reduce and, where possible, avoid future risks and to increase resilience to the changing drought hazard.

Hazards, especially drought, should not be considered in isolation. Shifting to integrated, multi-hazard and systemic risk management approaches is essential for prospective and proactive risk reduction, and will assist communities to better adapt to and through a changing environment.

Changes needed

The report calls for a move away from reactive and crisis management to a preventative, systems-based approach that recognizes the complexity and diversity of current and future drought risk. This will be partly based on improved knowledge of the climate mechanisms controlling the onset and termination of drought periods, other factors affecting drought initiation and cessation, and the level of vulnerability of exposed communities, industries and ecosystems. The case studies point to an urgent need for governance that is adaptive and sensitive to the inherent uncertainties and surprises. Such approaches to governance must promote and drive iterative learning, and more flexible and participatory planning and policymaking built around strengthened observation.

Adaptive governance allows communities to actively learn and adapt, while seeking to prevent and mitigate drought risk, and to adapt and respond to drought. Governance systems must commit to more iterative analytical deliberation and monitoring, and be open to new and varied approaches, collaboration and institutional arrangements. Deviation from the target should not be seen as failure but rather as an opportunity to learn and adjust.

Such approaches aim to garner inputs from a substantially higher diversity of actors and viewpoints – including indigenous wisdom and traditional knowledge – as more perspectives and visions may offer a broader portfolio of opportunities and solutions for problems, and promote mutual trust and the community's sense of ownership and self-confidence.

Innovation can be inspired through the effective use of scenarios and other exercises that do not predict future outcomes but guide choice among options by making likely trade-offs and synergies transparent. Future scenarios of drought risk need to consider the effects of adaptive or non-adaptive human behaviour and potential adaptation measures on future drought hazard, exposure and systems' vulnerabilities.

Increasingly adaptive governance can be enabled by a robust evidence and capability base that provides:

- Risk identification and mapping
- Participatory valuation and management of ecosystem services
- Mainstreaming of ecosystem approaches in drought risk management and reduction
- Social protection
- Social accountability
- Aligned goals and investment for financing drought-related systemic risk reduction

Existing capabilities and strategies can be realigned. For example, early warning systems can be expanded to include social processes where networks of organizations conduct collaborative situational assessments, which are central to adaptive governance. New indicators can be considered that help to identify when and where local capabilities, human agency and policy interventions are most needed.

Inclusive engagement and exploration

Enabling conditions are needed to:

- Allow new effective multi-stakeholder partnerships where iterative learning with those most affected by drought is central, and which embrace systemic change
- Promote collaboration, shared responsibility and confidence
- Support coordination, leadership and participatory learning

Working across sectors, governments and other traditionally "siloed" communities – building horizontal partnerships – can facilitate shared vision and be the foundation for participation and mainstream resilience-based approaches in drought risk management and reduction.

Multi-scale governance

Effective governance requires a process of systematic coordination from global to national, and national to local scales and back up the chain. It also requires collaboration across governments and intergovernmental organizations, the private sector, civil society organizations and citizens. Centralized and decentralized approaches can complement each other, especially when the actor network is broadened beyond a sender–receiver model of information communication.

National level

At the national level, effective governance requires:

- Policies and directives for drought risk reduction and climate change adaptation and mitigation that are integrated with local development plans
- Information and incentives for government agencies to share the responsibility for sustainability across portfolios
- Re-enforcement, amplification and extension of existing regulatory measures and incentives, such as the promotion of water-saving practices, enforcement of sustainable land and water management, and environmental protection
- Building on international policy momentum to bring domestic attention and resources to the reduction of climate-related disaster risks, and specifically risk prevention measures
- Creation of centres of excellence where drought-related technical resources and capacities can be pooled

These changes require high levels of public awareness and support.

Global level

At the global level, support for national and local risk reduction requires an effective framework to:

- Understand and engage countries and communities
- Develop international collaboration and dialogue on drivers of globally networked risks
- Develop thematic working groups including industry and civil society actors focused on feasibility, capacity and accountability

Convergence among and integration of strategies within international mechanisms – including disaster risk reduction (Sendai Framework), climate change adaptation and mitigation (Paris Agreement), reversing declining trends in biodiversity (Convention on Biological Diversity), combating drought and desertification (Convention to Combat Desertification) and sustainable development (2030 Agenda) – provide this essential framework. With their mix of slow and fast onsets, fluctuating intensities and duration even within the same event, droughts provide a useful analogue and practical experience for a much wider suite of complex and growing risks, including climate change.

Key recommendations

- Drought has extensive and pervasive costs to communities, economies and ecosystems. In many parts of the world and where vulnerability persists or grows, these costs continue to rise. Prevention has far lower human, financial and environmental costs than reaction and response.
- Complex risks like drought are daunting in their inherent uncertainty and unpredictability. In the past, this has limited the ability to reduce risk and prepare for impacts. But now the increased understanding of complex systemic risks and of forms of adaptive governance allows for effective action. With what we know, we must do better, and with what we learn, we must improve.
- Enabling conditions must be built for the transition to drought-related systemic risk governance. Drought resilience partnerships at the national and local levels can help create an enabling environment for more systemic risk governance that prioritizes iterative learning and innovation, bringing forth plans designed to be flexible and adapting to a changing context.
- A mechanism for drought management at the international and national levels could help address the complex and cascading nature of drought risk, and its impacts when realized. This can be based on shared values and responsibilities of stakeholders to mobilize and coordinate the needed financial resources and direct them to build systemic drought resilience.
- An effective global drought mechanism will develop international collaboration and dialogue on drivers of globally networked risks, promote shared learning and deployment of capabilities, develop thematic working groups – including industry and civil society actors – focused on feasibility, capacity and accountability, and develop processes for reducing systemic drought risk through adaptive governance that puts people first.
- Financial systems and services need to evolve to encourage cooperative approaches, to promote social protection mechanisms and to encourage risk transfer and contingent financing, so as to provide diversified adaptive support to drought risk management.
- New pathways are needed to encourage inclusion of indigenous and local knowledge, sharing of values and opportunities for realizing the benefits of effective adaptive governance, and effective sharing of drought risk management experiences across boundaries in their multiple forms.

As no two droughts are the same, no simple formula to manage them is sufficient. Continuous learning and adaptation to the variety of drought events and drivers, impacts, warnings and ongoing responses is essential.

Annex: Summary of case studies

Case study	Context	Description
Argentina	Agriculture in the Pampas regions of Argentina; relevant to similar landscapes and communities in neighbouring countries	Lessons learned from significant drought events in 2008–2009 and 2017–2018; complexities arising from food production and processing interdependencies; need for more proactive governance
Australia	General background to Australian droughts and progression in drought risk management	Millennium Drought 1997–2009; multiple and multiplicative impacts across all sectors and ecosystems; evolution in policy, governance and financial strategies (including risk transfer)
Brazil	North-eastern Brazil in the context of drought in the wider region	Compares governance and experience in the region with wider initiatives and potential solutions; institutional capacity issues; identifies required improvements in governance and preparedness
Canada	Flash droughts in the Canadian Prairies	Impact on agriculture and landscapes, particularly during the 2017 drought; cascading impacts including wildfires; clarity needed in roles across government and communities
Caribbean	Countries in the archipelago	Response to the impacts of the 2009–2010 drought and the level of preparedness for the 2014–2016 drought; describes successful risk management approaches credited in part to the effective operation of the Caribbean Drought and Precipitation Monitoring Network; novel collaborations needed in the development and integration of drought risk prevention
Central southern Africa	Drought risk in Angola, United Republic of Tanzania and Zambia	The 2010–2011 East African drought, a strong La Niña event aggravated by human actions; combined exploration of drought-affected populations in Angola; drought-induced crop yield losses in the United Republic of Tanzania; drought-related hydropower losses in Zambia
Danube River Basin (DRB)	19 European countries sharing the Danube River Basin	Explores and characterizes drought management in the Danube River Basin; Danube water supply connections, communities, irrigation, hydropower generation and industry, transportation, tourism and fishing; enhanced drought management model – the DriDanube project
East Africa	Principally in Intergovernmental Authority on Development countries	Comprehensive discussion of recent drought experience across countries of the region; drought resilience management often proves insufficient to protect lives; regional cooperation success stories are emerging
Euphrates–Tigris Basin	Drought impacts and risk throughout the Euphrates–Tigris Basin	Describes impacts and responses in areas shared by six countries exposed and highly vulnerable to drought; complexity grows from impacts on agriculture, through the whole economy and environment to turmoil and conflict; need for better coordination across the Euphrates–Tigris Basin but constrained by geopolitical realities
Horn of Africa	Drought risk over an area of 5.2 million km^2; 230 million people	Drought risk, impacts and increasing vulnerability – emphasis on arid and semi-arid lands; drought risk composed of complex and interacting components; need to increase equality in access to drought risk management opportunities
Iberian Peninsula	Guadiana River Basin that spans Portugal and Spain	Issues of sharing a river basin crucial to urban and rural water supply and irrigated agriculture; experience of implementing the European Union Water Framework Directive and European Union Drought Policy; different mechanisms for implementation and resultant tensions between countries

Case study	Context	Description
India	Deccan Plateau region (about 43% of southern and eastern India)	Impacts and risk governance; substantial variance in the quality of drought monitoring; exacerbation of pre-existing vulnerabilities during droughts
Mediterranean Basin	Lands typical of the Mediterranean bioclimate	Middle East and North Africa region, which is expected to be more severely affected in future projections; a 10-step drought mitigation approach is recommended, but not yet widely adopted; complexity due to competition for water among agriculture, energy and urban water supplies
Nile Basin	Blue Nile region	Diversity leads to substantially varying drought impacts; absence of transboundary drought management policies, plans or agreed legislation; need to strengthen institutional mechanisms for collaboration, data collection, monitoring and data sharing
United States of America	Flash droughts across agricultural areas	A shift in urgency for early warning and preparedness; Sub-seasonal Experiment, a Climate Test Bed project focused on improving subseasonal prediction
Uzbekistan	Drought risk management	Natural ecosystems of the country's arid and semi-arid regions; salinization, spread of moving sands, dust-storms and dry winds, exacerbated by lack of water resources; national action plan for drought management to be developed
West Africa	Recent drought experience in West African countries	Likely impacts from projected increased dryness; drought cascades to migration, conflict, deaths, hunger and malnutrition, and natural resources depletion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