INTERGOVERNMENTAL WORKING GROUP ON DROUGHT

TASK GROUP # 2

VULNERABILITY ASSESSMENT
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ACRONYMS

ANVCC: Atlas Nacional de Vulnerabilidad al Cambio Climático
CAR: Central African Republic
CAPRA: Central American Probabilistic Risk Analysis
CEE: Central and Eastern Europe (CEE)
CEPREDENAC: Center for Coordination of Natural Disaster Prevention in Central America
CoP: Conference of Parties
CRIC: Committee for the Review of the Implementation of the Convention
CSO: Civil Society Organizations
DEWS: Drought Early Warning System
DLDD: Desertification, Land Degradation and Drought
DVA: Drought Vulnerability Analysis
ECA: Economics of Climate Adaptation
EDC: European Drought Centre
EDO: European Drought Observatory
EU: European Union
GWP: Global Water Partnership
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>IADB:</td>
<td>Inter-American Development Bank</td>
</tr>
<tr>
<td>ICCD</td>
<td>(ICCD/COP (13)/19) Convention to Combat Desertification Committee for the Review of the Implementation of the Convention</td>
</tr>
<tr>
<td>IDMP</td>
<td>Integrated Drought Management Programme</td>
</tr>
<tr>
<td>IWG</td>
<td>The Intergovernmental Working Group</td>
</tr>
<tr>
<td>IWMI</td>
<td>International Water Management Institute</td>
</tr>
<tr>
<td>IWRM</td>
<td>Integrated Water Resources Management</td>
</tr>
<tr>
<td>NAP:</td>
<td>National Action Programme</td>
</tr>
<tr>
<td>NDMC:</td>
<td>US National Drought Management Center</td>
</tr>
<tr>
<td>NDMPs:</td>
<td>National Drought Management Policies</td>
</tr>
<tr>
<td>NFP:</td>
<td>National Focal Points</td>
</tr>
<tr>
<td>RAP:</td>
<td>Regional Action Programmes</td>
</tr>
<tr>
<td>SA DMS</td>
<td>Drought Monitor System for South Asia</td>
</tr>
<tr>
<td>SLM:</td>
<td>Drought and Sustainable Land Management</td>
</tr>
<tr>
<td>SRAPs</td>
<td>Subregional Action Programmes</td>
</tr>
<tr>
<td>UNCCD</td>
<td>United Nations Convention to Combat Desertification</td>
</tr>
<tr>
<td>UN-ISDR:</td>
<td>United Nations International Strategy for Disaster Reduction</td>
</tr>
<tr>
<td>WB</td>
<td>World Bank</td>
</tr>
<tr>
<td>WMO:</td>
<td>World Meteorological Organization</td>
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</table>
1. INTRODUCTION

1.1 Preamble

The COP (Dec 23/COP 14, Para 11a) invited Parties, international organizations, and stakeholders to make submissions on (i) Policy, implementation, and institutional coordination frameworks and implementation measures for addressing drought under the convention; and (ii) Barriers, challenges and opportunities in preparing for, responding to and recovering from drought. In accordance, the UNCCD has established the Intergovernmental Working Group (IWG) with representatives from national focal points and international experts. The IWG members contribute directly to delivering the outputs drawing from a range of resources including, but not limited to, UNCCD background documents and other resource materials. In scaling up its activities to support countries in drought preparedness and capacity development, the UNCCD had formed the Intergovernmental Working Group (IWG) consisting of 30 members. The working structure consists of an IWG Coordination Committee and four task groups. The four Task Groups (TGs) build and share a global vision to trigger international and regional cooperation on drought risk management. The four TGs worked on the following topics - (1) Implementing drought monitoring and early warning systems, (2) Assessing impacts, vulnerability and risk of drought, (3) Drought risk mitigation and response measures - Economic tools, financing instruments, and related physical risk mitigation approaches, and (4) Drought risk mitigation and response measures - Policy and related physical risk mitigation approaches. Each TG reviewed the state of the art, identify the Instruments such as technical, policy, financing, and legal instruments [COP 14 document], identify gaps and challenges, map the connectors of drought with
other sectors such as land, water, health, energy, etc., and the benefits of action vs. costs of inaction. These will be substantiated with case studies and evidence. The TGs will utilize existing literature and work with relevant organizations and professionals to produce an info-graph and ensure regional, sub-regional, and country perspectives are reflected in the work of the IWG. The IWG Coordination Committee brought these TG reports together as a comprehensive and coherent document.

This report is an outcome from the TG2, which is led by Sara-Jade Govia, and the co-leader Abduvokgid Zakhadullaev. Other members are Caroline King-Okumu, Andries Jordaan, Stephen Muwaya, Jose Fidel Pérez, Marijana Solomun, Suruchi Bhadwal, Abdolhoseni Mohsen, Maher Salman and Andries Jordaan. The group is assisted by Daniel Tsegai and Saravanan Subramanian from the UNCCD secretariat. Stephen Adaawen later replaced Saravanan Subramanian in his role as the group coordinator.

TG2 report analyzes and discusses the topic of drought vulnerability and impact assessment which will be presented in the regional consultation workshops to be held in 2021. The report is outlined as follows:

This initial chapter is an introduction to explain the purposes of the survey, and the countries that participated or responded to the survey. Then there are four chapters to treat each of the four questions in successive order. The second chapter of that report focuses on assessing impacts, vulnerability, and risk of drought, and how “to help countries assess - in a comprehensive manner- the extent of potential damage or loss in the event of a drought, and how to reduce vulnerability to droughts”. One of the strategic objectives of the UNCCD is precisely that of “reducing vulnerability to drought for ecosystems and population”. That second chapter contains relevant case studies. The third chapter brings the summary and interpretation of the answer to the second question of how countries are doing to reduce the impacts of drought. The fourth chapter deal with the identification of barriers and the definition of the challenges in drought management. Chapter five discusses policy research findings. The final, sixth chapter summarizes the statements that Task Group Two wants to take to the Intergovernmental Working Group (IWG).
1.2 The Countries

The TG2 conducted the survey with national focal points (NFPs) on four major questions that were developed by the group in discussion with the UNCCD. The questionnaire was administered through the UNCCD’s regional coordination units across the five world regions, also referred to as Annexes, are Africa, Asia, Latin America and the Caribbean (LAC), Northern Mediterranean (N-MED), Central and Eastern Europe (CEE).

A total of 46 responses were received, coming from 40 (NFPs) and 5 civil society organizations (CSO). An additional response was received from South Africa to make it a total of 46 responses (Table 1).

Table 1: Number of countries that responded to the survey

<table>
<thead>
<tr>
<th>Region</th>
<th>Countries</th>
<th>World Representation</th>
<th>Number of Countries with Responses</th>
<th>Regional Representation</th>
<th>% out of total responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Annex I: Africa</td>
<td>54</td>
<td>27.55%</td>
<td>18</td>
<td>33.33%</td>
<td>45.00%</td>
</tr>
<tr>
<td>2 Annex II: Asia</td>
<td>54</td>
<td>27.55%</td>
<td>5</td>
<td>9.26%</td>
<td>12.50%</td>
</tr>
<tr>
<td>3 Annex III: Latin America and the Caribbean (LAC)</td>
<td>33</td>
<td>16.84%</td>
<td>6</td>
<td>18.18%</td>
<td>15.00%</td>
</tr>
<tr>
<td>4 Annex IV: Northern Mediterranean (N-MED)</td>
<td>12</td>
<td>6.12%</td>
<td>5</td>
<td>41.67%</td>
<td>12.50%</td>
</tr>
<tr>
<td>5 Annex V: Central and Eastern Europe (CEE)</td>
<td>15</td>
<td>7.65%</td>
<td>6</td>
<td>40.00%</td>
<td>15.00%</td>
</tr>
<tr>
<td>6</td>
<td>Countries not belonging to a regional implementation annex</td>
<td>28</td>
<td>14.29%</td>
<td>0</td>
<td>0.00%</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>196</td>
<td>100.00%</td>
<td>40</td>
<td>100.00%</td>
</tr>
</tbody>
</table>
By far, countries from Annex 1, Africa had most of the responses with 45% of the total number of responses (18/40), followed by Latin America And Caribbean (LAC) and Central and Eastern Europe each with 15% of the total number of responses as seen in the last column of Table 1. The North Mediterranean and Asia Regions had 12.5% each. Annexes four (N-MED) and five (CEE) had the higher regional representation with 41.67% and 40% of the countries in those regions responding to the survey; followed by Africa with a third of the countries in that region responding to the survey. This can be seen in the second to last column in Table 1 with the heading “regional representation”.

1.3 The context of some of the countries

In many of the responses, the NFP pointed out their country-specific context, making reference to the geographic, environmental, and socioeconomic and even political situation of those countries. Before going into the barriers and challenges, it is worth
taking a look at those contexts to have a better understanding of their perspectives on the issues related to drought vulnerability.

1.3.1 Weather, Climate and Water Resources

Weather variability and climate change were mentioned to be the main driver of drought in several territories, like for instance in Cambodia, where “several regional drought events of 2004 to 2005, 2009 to 2010, and most recently 2015 to 2016” resulted in critical low flows & little rainfall in the Low Mekong Basin. The concern and perception there is that “drought events have increased in frequency and severity in the past decades”, at the same time, there is an “increased demands on water use in different sectors for the continuous population growth, and industrialization and urbanization are on the increasing trends. Temperature is projected to increase, under several climate change scenarios in Cambodia as well as the “number of dry days, and more severe low flow in the region for the next 30, 60, and 90-year’ periods.

Countries are experiencing droughts of great magnitude in recent years. Belarus had the five most extensive and intense droughts (1992, 1999, 2002, 2010, 2015, 2018) occurring in the past thirty years. India has a drought every nine years and experiences water stress conditions every seven years. Countries in Central America and the Caribbean see interannual and decadal climate variations changes, and intense droughts usually coincide with the occurrence of the El Niño phenomenon. Panama reported having that situation. The national average rainfall in El Salvador for July 2014 was the lowest on record for the past 44 years. Malta has “limited availability of freshwater resources and ranks amongst the highest in the list of European countries that are most heavily affected by water scarcity. Under semi-arid conditions which lead to permanent water scarcity”. Ghana also pointed out the “uncertainties in climate change/variation”. Turkey’s concern is that not only the amount of rain will change but also the rainfall distribution due to the climate change effect. Turkey has quite low “rainfall amounts” and “sometimes it rains only once a year”. The same seems to hold for Greece. Burkina Faso mentioned “the rainfall irregularity”.

6
The chain of effects goes deep into the hydrologic cycle, like in Angola, which has an “extremely complex geology in some of the affected areas by drought with deep aquifers and fossilized saltwater”.

In other places like Sudan, there are frequent natural disasters including “floods and prolonged droughts”. Greece is experiencing longer summer droughts, and it is expected to increase, even more, putting pressures on water resources in areas with already increased vulnerability. South Africa is a “water-scarce country where demand will soon outstrip supply”.

1.3.2 Impact on sectors of the economy

Prolonged periods with rainfall deficits have a strong impact on the availability and quality of water, both surface and underground, directly affecting the different uses of the resource, especially human consumption and ecosystems, agricultural production, electricity generation, with consequent losses in the economy.

Climate variability has become an important threat that is affecting the national economic sectors in Panama. Droughts in El Salvador have caused the greatest damage to the country’s agricultural production, and droughts are having severe impacts on health, agriculture, and the ecosystem. The 2014 and 2015 drought in El Salvador caused losses in agriculture of almost 4% of the gross domestic product and affected 3.5 million people.

Droughts in Cambodia are leading to severe agricultural losses, and the same holds true for other countries as varied such as Spain, Belarus, Italy, and India. Agriculture in the Po district generates important part of Italy’s gross domestic product, with about 200,000 active companies. A slight reduction in water availability causes significant economic losses, and damages to the social-productive system. India, vulnerable to droughts, is primarily an agrarian society mainly depending on agriculture and allied activities.

In Serbia, losses related to the droughts after 2000, exceed 5 billion euros, and more than 70% of material loss and damage resulting from the impact of climate change are
associated with droughts. Macedonia struggles to cope with the damage to economies, health, property, infrastructure, and security.

1.3.3 Soils, Forests, Land Use and Land Degradation

Guinea’s concern is the “low level of fertility of arable land”, which puts them at odds in terms of food security. Sudan sees a “deteriorating soil fertility” and therefore sustainably low crop productivity; with high postharvest losses, widespread pests and diseases and use of genetically poor crop/tree germplasm, another of the concerns in Sudan is the “wide varieties of diseases and pests”. Burkina Faso also sees a “decline in soil fertility” as a key factor affecting their situation. Panama has important areas with degraded soils, extensive livestock, and water supply problems, and the situation is worsened with the droughts.

Forests are disappearing at an alarming rate and land is being degraded in the Democratic Republic of Congo. This gradual and uncontrolled destruction of its forests is going to have a great impact on the lives of millions of people, animals, insects and plants that depend on these forests. Forest fires are on the rise as a result of droughts in Spain, where land desertification and aridification are very important environmental issues.

Venezuela, struggling to come out of an economic crisis, is seen the effect of droughts in food production, hydroelectric generation, drinking water supply.

1.3.3 Socioeconomic and Political Situation

The ambitious development goals of eradicating poverty and reaching “zero hunger” would seem unattainable in the near future in several of the countries that responded to the survey. **Burkina Faso** points out the “poverty of the rural population”, specific to women who constitute the most affected and stable layer, food insecurity in that country, related to
rainfall anomalies and land degradation. The extreme poverty of most rural communities in Guinea puts “pressures on natural resources and drought vulnerabilities”. Other countries like the Central African Republic have a unique situation. The CAR “is a post-conflict country and its economy is very febrile and does not allow it to mobilize internal funds”, so “it relies on the support of development partners”. The meteorological centers have been destroyed by military-political conflicts and need to be rehabilitated. Sudan made a reference to their “poor basic infrastructure” and the “political unrest between and within affected communities”. Sudan uncontrolled free ranch management, use poor animal breeds, unimproved production system. Angola experiences “temporary displacement of populations” due to the economic situation, also see poor infrastructure as one of their limitations. Refugee crises have taken place either due to conflict situations or due to famines and shortage of food. This is a difficult context for drought management initiatives to be operable.

1.4 The survey

The survey consisted of four questions. The TG2 divided themselves into four subgroups (Table 2), with each of them examining one question from the survey. Each subgroup summarized the responses from the parties, which is presented as different chapters in this report.

*Table 2: Questionnaire and TG2 members assigned*

<table>
<thead>
<tr>
<th>#</th>
<th>Question</th>
<th>Synthesis of Analysis Elaborated by:</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Are there any specific assessments that you have developed or are using to understand and reduce drought effects?</td>
<td>Sara-Jade Govia and Fidel Perez</td>
</tr>
<tr>
<td>2</td>
<td>What are the needs to reduce the drought impacts and vulnerability in your country? (please give details and provide links to or copies of reports, where possible)</td>
<td>Abduvokhid Zakhadullaev and Suruchi Bhadwal</td>
</tr>
</tbody>
</table>
Two comments the reader should bear in mind. The first is that the report shows the summaries of responses to these questions by the National Focal Points (NFP). But in general, when discussing or showing the comments, these are referred to as “the countries”; assuming the NFP’s opinions are accurately describing the country’s situation. The second thing is that comments of the CSO are ascribed to the country the CSO is in or is applicable to where the CSO operates.

2. VULNERABILITY ASSESSMENT METHODOLOGIES

2.1 Analysis of Responses to Question One

Table 3 summarizes the information gathered from responses to question #1 of the survey. The question was meant to find the drought vulnerability assessment being carried out in the countries and what methods and tools were applied to conduct this assessment. There were a total of 37 responses to this question; 30 coming from the countries and 7 responses from the CSOs. One-third (33%) of the countries did mention conducting a vulnerability assessment. Six other countries said something that could implicitly mean there is a DVA study that has been done in the past, or that there are tools to carry out the assessment, and 14 countries did not give any response to this question.
### Table 3: Indications of drought vulnerability assessment by the countries and CSO

<table>
<thead>
<tr>
<th></th>
<th>Number of Countries</th>
<th>%</th>
<th>Number of CSO</th>
<th>%</th>
<th>Total Responses</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicitly stated</td>
<td>8</td>
<td>20.00%</td>
<td>1</td>
<td>20.00%</td>
<td>9</td>
<td>20.00%</td>
</tr>
<tr>
<td>Stated</td>
<td>11</td>
<td>27.50%</td>
<td>2</td>
<td>40.00%</td>
<td>13</td>
<td>28.89%</td>
</tr>
<tr>
<td>Implied</td>
<td>7</td>
<td>17.50%</td>
<td>1</td>
<td>20.00%</td>
<td>8</td>
<td>17.78%</td>
</tr>
<tr>
<td>No information or no DVA</td>
<td>14</td>
<td>35.00%</td>
<td>1</td>
<td>20.00%</td>
<td>15</td>
<td>33.33%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>40</td>
<td>100.00%</td>
<td>5</td>
<td>100.00%</td>
<td>45</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

A careful review of the responses shows that many of the respondents did not address DVA assessments, but answered the question indicating other activities such as drought monitoring, drought early warning systems (DEWS), national action plans (NAP) or national drought plans or a Strategy, climate change studies and resources, or some other type of study. Other respondents did mention DVA or a diagnostic study to make an assessment.

The more detailed information is shown in Table 4, where country by country responses are classified into these categories:

- **Countries** and their Annex / Region identified (a total of 40 countries and 5 CSO). See columns 1 and 2 of Table 4.
- **Drought Monitoring (watch):** 31 countries have it, as marked in column 3 of Table 4. It is possible that other countries may also have their monitoring systems, as well, but there was no information in the report. When reference was made to a climate monitoring system, this was interpreted to mean also applicable to drought monitoring.
- **Drought Early Warning Systems (forecast):** Some 21 countries have gone from monitoring to actually produce operational forecasts or predictions. See column 4.
- **Index-Based applications:** Some of the responses mentioned specific drought monitoring indexes used in their drought monitoring and assessment. See column 5. The indexes mentioned are these:
o The one index with the most mentions is the Standardized Precipitation Index (SPI); mentioned in responses from Bosnia & Herzegovina; Ivory Coast; Nicaragua, Serbia, Turkey, Uzbekistan.

o Other indexes used are Palmer Drought Severity Index, Z-index, PNI, NDVI.

o In the case of Macedonia these were listed: deciles, percent of normal, Palmer Drought Index, Palmer Z Index, Palmer Drought Severity Index, Palmer Hydrological Drought Index, Modified Palfai’s Aridity Index, Standardized Precipitation Index.

o Kenya uses an interesting, combined index, called the normalized difference drought Index (NDDI) which is a combination of the normalized difference vegetation index (NDVI) and the normalized difference water index (NDWI).

o Montenegro uses the SPI index (i.e. standardized precipitation index) at different time intervals (30 days, 60 days, month, season, year) and monthly display of FVC and LAI indices.

o **Community Based Assessment:** This mark goes in column 6 for only one country that mentioned this. Burkina-Faso uses a community participatory diagnostic method that is very unique among the response to this survey. Communities use analyzes of previous and current situations, internal and external causes, immediate and future consequences. This method allows communities to become aware of the seriousness of the situation and to propose actions to mitigate the effects of drought in the absence of more appropriate large-scale interventions.

o **National Drought Plans or Strategy:** Eleven (11) countries responded that they have a national drought plan or a national strategy or a drought framework. See column 7.

o **Climate Change Studies and Vulnerability Assessments:** Seven (7) countries said to have done climate change studies. These are Ghana, Guinea, Hungary, Greece, Kirgizstan, Macedonia and Venezuela. See column 8. More on this topic is found in section 2.4.

o **Drought Impact Assessment:** Several responses mentioned some form of impact assessments being used to monitor the effects of droughts or drought
itself. In some of these responses, DVA is implied since the impact is part of the estimation process for vulnerability. But in some of the responses, impact assessment is referred to as an end product in itself. Montenegro uses a network of reporters on the field who make “observations on the state of the soil, vegetation or even loss of yield on their specific location, throughout the season of the year”. South Africa uses remote sensing products to assess the impact of droughts. Greece has established a Climate Change Impact Study Committee (CCISC). Uzbekistan assesses vulnerability, impact and development of measures to prevent, mitigate and adapt to drought risks. CSO-Parma-Italy has implemented the Drought Impacts and Vulnerability Assessment (DIVA), for the Po River Basin. Other countries said that the effect on crops and agricultural activity is monitored such as Belarus, Suriname, and CSO-Congo. See column 9.

- **Other types of studies:** Many of the responses mentioned other types of studies that are being done in the countries, which have some relation to the drought problem. Malta and Turkey mentioned the implementation of integrated water management studies. Uzbekistan mentioned studies of adaptive measures to prevent, mitigate and adapt to drought risks. Angola and the Central African Republic, do the same in their responses, as well as Guinea, Ghana, Greece, and South Africa. See column 10.

- **Drought Vulnerability Assessments and Diagnostic Assessment:** ten countries explicitly said to have DVA. These are Angola, Botswana, Burkina Faso, Cambodia, Central African Republic, China, Eritrea, Ghana, South Africa and Venezuela. The CSO indicated DVA studies, these are CSO- SAF-Teso-Uganda; CSO-SARO-Mali; CSO-Grameen Vikas Samiti-India, CSO-Parma-Italy (See column 11 of Table 4). Unfortunately, there is no detailed description for most of the countries of the methodologies used in these DVAs. A detailed discussion on methodologies for DVA studies is found in section 2.4.

- **Drought Risk Assessment:** Cambodia, China, Kenya, and Macedonia have said that they have a drought risk assessment. See column 12.

- **Drought Platforms:** Some of the countries said in the response that they have online or web platforms for VA or drought monitoring. These were: Cambodia,
China, Montenegro. More is said about these platforms in section 2.3 of this report. See column 13.

- **Vulnerability Assessment in Publications**: In order to provide a comprehensive picture of drought vulnerability assessments, the last column in Table 4 was added to indicate DVA studies found in the literature. It is possible that the NFPs are not fully aware or up to date on DVA in his or her country. The other possibility is that what is found in literature is an independent academic exercise, totally disconnected from what is the ministries or institutions are doing in a country. So, this last column 14 could represent a country capacity which the survey did not collect.
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<tr>
<td>CSO-Action Lever-Congo</td>
<td>1 AFRICA</td>
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<td>O&lt;sup&gt;14&lt;/sup&gt;</td>
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<tr>
<td>Annex / Region</td>
<td>Table 4: Actions identified in responses to question 1. Country</td>
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<tr>
<td>CSO- SAF- Teso- Uganda</td>
<td>1</td>
<td>AFRICA</td>
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<tr>
<td>CSO-SARO- Mali</td>
<td>1</td>
<td>AFRICA</td>
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<tr>
<td>CSO-Grameen Vikas Samiti- India</td>
<td>2</td>
<td>ASIA</td>
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<td>S implied</td>
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<tr>
<td>CSO-Parma- Italy</td>
<td>4</td>
<td>N MED</td>
<td>S</td>
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</tbody>
</table>

Note: S means information obtained from the responses to the survey. O: means Other sources found in publications.
Table 5 shows a list of twenty other countries, that did not respond to the survey but are known to have drought monitoring systems, early warning systems, DVA studies, or DVA platforms. The information is found in literature or on the web.

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Drought Monitoring System</th>
<th>Drought Early Warning Systems</th>
<th>Drought Vulnerability Assessments</th>
<th>DVA Platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ARGENTINA *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;15&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>2 AUSTRALIA *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;16&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>3 BANGLADESH *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;17&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>4 BOLIVIA</td>
<td>O</td>
<td>O</td>
<td>O&lt;sup&gt;18&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>5 BRAZIL *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;19&lt;/sup&gt;, O&lt;sup&gt;20&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>6 CHILE*</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;21&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td>8 COLOMBIA *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;22&lt;/sup&gt;</td>
<td>O&lt;sup&gt;23&lt;/sup&gt;</td>
</tr>
<tr>
<td>9 COSTA RICA *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;24&lt;/sup&gt;</td>
<td>O</td>
</tr>
<tr>
<td>10 GUATEMALA *</td>
<td></td>
<td></td>
<td>O</td>
<td></td>
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<tr>
<td>11 EL SALVADOR</td>
<td></td>
<td></td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>12 HONDURAS *</td>
<td></td>
<td></td>
<td>O&lt;sup&gt;25&lt;/sup&gt;</td>
<td>O</td>
</tr>
</tbody>
</table>
To build the table from Table 5, there were 37 publications found and reviewed. This additional information brings to 48 countries that have been identified as having already conducting DVA. The geographic distribution of countries with some DVA study is that Africa has 37.5% of the total, and Asia has 20.8%, making up for 58.3% together in those two regions is shown in Table 6:

*Table 6: Geographic distribution of countries with DVA studies as reported in scientific publications*

<table>
<thead>
<tr>
<th>REGIONS</th>
<th>Number of countries with DVA studies</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Africa</td>
<td>18</td>
<td>37.5%</td>
</tr>
<tr>
<td>2 Asia</td>
<td>10</td>
<td>20.8%</td>
</tr>
<tr>
<td>3 Eastern Europe</td>
<td>2</td>
<td>4.2%</td>
</tr>
</tbody>
</table>
2.2 State of the Art of DVA methodologies

A good article that shows an evaluation of different vulnerability methodologies across the world has been published recently with the title “Drought vulnerability and risk assessments: state of the art, persistent gaps, and research agenda” (Hagenlocher, M., et al, 2019). The authors carried out and found out that there is “a multitude of conceptual foundations and methodological approaches”.

It is interesting to see that some of the findings from this systematic literature review of more than two thousand articles paint a similar picture as that of the situation as expressed by the survey responses and the review done to build table 6. The authors say that: “more than 60% do not explicitly specify the type of drought hazard that is addressed, and 42% do not provide a clear definition of drought risk”. Looking back at the last column of Table 3, only 35.14% of respondents explicitly stated there is a DVA, 18.92% only implied there is one, and 45.95% seem not to have any knowledge of DVA studies done in their country. According to the authors of the cited article, most assessments were conducted in Asia (46%) and Africa (29%), which is similar to the situation reported for the literature review of TG2.
Table 7: Geographic Distribution of DVA studies

<table>
<thead>
<tr>
<th>#</th>
<th>REGIONS</th>
<th>According to Review of TG2 (table 6)</th>
<th>According to more extensive reviews by Authors cited</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>number of countries</td>
<td>percentage</td>
</tr>
<tr>
<td>1</td>
<td>Africa</td>
<td>18</td>
<td>37.5%</td>
</tr>
<tr>
<td>2</td>
<td>Asia</td>
<td>10</td>
<td>20.8%</td>
</tr>
<tr>
<td>3</td>
<td>Eastern Europe and Western Europe</td>
<td>6</td>
<td>12.5%</td>
</tr>
<tr>
<td>4</td>
<td>South America (LA&amp;C)</td>
<td>14</td>
<td>29.2%</td>
</tr>
<tr>
<td>5</td>
<td>North America</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>6</td>
<td>Australia</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td>48</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The authors (Hagenlocher et al., 2019) highlighted several findings which can be of interest to complement the assessment of TG2:

1. There is great ambiguity in the conceptual definition of vulnerability and risk.
2. The majority of articles apply the methodologies recommended by the IPCC.
3. Since the Fifth Assessment (AR5) report by IPCC, there is a shift in concepts but diversity persistent in the definitions.
4. 34% of the articles consider sensitivity, 25% consider adaptive capacities and only 14% consider coping capacity as sub-components of vulnerability.
5. 11% of all papers include drought hazard characteristics and 14% include exposure as part of vulnerability.

6. Drought-index-based approaches are applied in 62% of the DVA studies.

7. The weighting methods for the components of vulnerability are not specified in 57% of the DVA studies.

8. Validation is done in only 11% of the studies.

9. “Future scenarios of drought risk” are considered in only 10% of the DVA studies.

10. Only about 40% of the assessments establish a direct link to drought risk reduction or adaptation strategies/solutions.

2.3 Case Stories of Countries with Online Platforms for DVA

It is worthwhile mentioning that there are resources and capacities not reported in the submissions or answers to the survey, like the online tools for drought vulnerability analysis that already exist in some regions. A bit surprisingly, none of these are reported in the submission or the NFPs of those countries involved did not even reply to the survey.

Two good examples or case stories are found in the Latin American and Caribbean (LAC) region. Mexico has shown a good level of expertise with the development of an online tool for vulnerability mapping called the Atlas Nacional de Vulnerabilidad al Cambio Climático (ANVCC). The second case is the “Central American Probabilistic Risk Analysis” (CAPRA) developed by the University of Andes in Colombia that helps vulnerability assessment, and probabilistic risk assessment. The CAPRA initiative was created in partnership with the Center for Coordination of Natural Disaster Prevention in Central America (CEPREDENAC), the United Nations International Strategy for Disaster Reduction (UN ISDR), the Inter-American Development Bank (IADB) and The World Bank. CAPRA provides countries in Central America tools to assist them with analysis of the risk from adverse natural events and has been handed over to the UniAndes. The methodologies and software are being recommended for projects of disaster risk assessment, with funding by IDB and World Bank. CAPRA analysis multiple hazards and
climate change, including Geologic Hazards (Earthquake, Tsunami, Volcano, Hydrogeological hazards (drought, flood, hurricane, landslides, precipitation). CAPRA could very well be the most developed and complete freely available platform for vulnerability and risk analysis.

The Integrated Drought Management Program (IDMP) “supports the Global Water Partnership (GWP) in South Asia and the International Water Management Institute (IWMI) to develop a regional drought monitor for South Asia (SA DMS) covering Bangladesh, Bhutan, India, Nepal, Pakistan and Sri Lanka. It involves the national authorities, the Country Water Partnership and other interested partners”.

The European Union (EU) is supporting climate observation systems and the European Drought Observatory (EDO)\(^1\). Several other regions are assisted through this program.

Global Water Partnership (GWP) and the World Meteorological Organization (WMO) launched a joint Integrated Drought Management Programme (IDMP) in 2013 to improve monitoring and prevention of drought in various parts of the world – among them also in Central and Eastern Europe (CEE), which is seriously vulnerable to drought. Regional centers can assist smaller or less developed countries with VA studies and mapping projects. And it would be even better if the regional or global centers can conduct capacity-building workshops.

The survey picked up one good example. In the response by Montenegro, of a regional center which is the DMCSEE\(^2\) (Center for Drought Management for the Region of Southeast Europe, which is “co-financed by the European Union through the Southeast European Cooperation Program”.

\(^1\) Drought Projects - European Drought Observatory - JRC European Commission (europa.eu)

\(^2\) www.dmcsee.org, www.dmcsee.eu
2.4 The Concepts and Methodologies for Vulnerability Assessments

Given that no specific description of the methodology for DVA was found in the responses, and given also that few countries indicated that they have done DVA studies, some key concepts and reference to methodologies are mentioned in this section.

The first comment to be made about is that there are more than thirty different formulas about vulnerability and risk as applied to natural disasters. This could represent some degree of confusion for countries interested in conducting DVA studies, when trying to discover which method to use, specially more so since not all these conceptual approaches carry with them a step-by-step guide.

Fortunately, the UNCCD Drought Tool Box offers help and useful resources. One of these resources that serve as an example of how countries can do their DVA is the Drought Risk Visualization tool found in the UNCDD Knowledge Hub site. This work was done by the Joint Research Centre of the European Commission, that ‘developed the Global Drought Observatory for the entire world” with data for the period 2000-2018 (Vogt, et al., 2018). The conceptual approach applied in this work is that drought risk is a function of these three components: the severity and the probability of occurrence of a certain drought event. (2) the exposed assets and/or people, and (3) their intrinsic vulnerability or capacity to cope with the hazard. The formula in the visualization tool is see (https://maps.unccd.int/drought).

\[
\text{Risk} = (\text{Hazard} \times \text{Exposure} \times \text{Vulnerability})^{1/3}
\]
This formula is saying that drought risk is the geometric mean of the three components. The full report\(^3\) by Vogt et al. shows details on the indicators of reach component, and how the layers were developed for hazard exposure and vulnerability.

Other vulnerability and risk visualization platform seem to follow the same approach as the One such example is the CAPRA\(^4\) GIS software for vulnerability and risk. CAPRA is mentioned in the afore section 2.3.

The same formula is found also in the UNCCD Knowledge Hub\(^5\), but written a bit different:

\[
\text{Drought risk} = \text{Vulnerability} \times \text{Hazard} \times \text{Exposure}
\]

Notice, that the difference lays in that this equation does not have the exponent (1/3),

In the UNCCD Drought Tool Box, there is another useful guide with the title “Guidelines and Background Documents for Development of National Drought Plan” (UNCCD, 2018). This document offers a detailed step-by-step guide to help users carry out the DVA studies with information given on choice of indicators. The methodology here is similar, but slightly different, to the previous source of the JRC, expressing vulnerability as a function of exposure, sensitivity and adaptive capacity. The model drought plan is followed with an annex of the Drought Resilience, Adaptation and Management Policy (DRAMP)\(^6\) report (Crossman, 2018) where the formula is written on page 42 in this way:

\[^4\] https://ecapra.org/topics/er-m-vulnerability
\[^5\] https://knowledge.unccd.int/drought-toolbox/page/read-more-vulnerability-and-risk-assessment
\[^6\] https://knowledge.unccd.int/publication/drought-resilience-adaptation-and-management-policy-dramp-framework

This is actually the same formula recommended in the Third (AR3), Fourth (AR4) and Fifth (AR5) Assessment Report (AR5) of the IPCC, for climate change vulnerability assessment. It is possible to find more countries following this approach to calculate vulnerability assessment since climate change studies are very popular. This is mainly due to the attention brought about by the strong political climate change advocacy, and the role of governments committed to doing such studies under the CC convention. Greece, for instance, made reference to the Intergovernmental Panel on Climate Change (IPCC) and the 4th Assessment Report (AR4). This has been replaced by the fifth assessment report (AR5) that has a Representative Concentration Pathways (RCP). This AR5 recommends the same methodology for vulnerability assessment as in previous reports such as AR3 and AR4 which expresses vulnerability (V) as a function of exposure (E), sensibility (S) and adaptive capacity (AC), by this formula \( V = \frac{E \times S}{AC} \). This same method is found in several countries to be used in drought vulnerability assessments.

I should be noted however, that the first formula refers to risk and the second one to vulnerability. The calculation of risk is one step further in the assessment since risk (R) is a function of vulnerability (V) or the product of vulnerability times the probability (P) of occurrence; i.e. \( R = V \times P \), whereas, in the IPCC method, vulnerability is a function of exposure, along with sensitivity and adaptive capacity.
3. REDUCING DROUGHT IMPACTS AND VULNERABILITY

3.1 Analysis of Responses to Question Two

Question Two of the Survey was stated in this way: “What are the needs to reduce the drought impacts and vulnerability in your country? (please give details and provide links to or copies of reports, where possible)”.

The second question of the survey was answered by 40 countries and five CSOs. It was conceived in this way: “What are the needs to reduce the drought impacts and vulnerability in your country? (please give details and provide links to or copies of reports, where possible)”.

Twenty of the forty countries (50%) explained their mechanism to reducing drought impacts and vulnerability in their country (see Table 8). Fifteen of the forty countries (37.5%) described the problems of drought impacts and vulnerability but did not describe nor gave details on their solutions at the state level. The remaining 5 countries (12.5%) have only reported general problems. The comments of these countries did not provide a precise methodological answer and gave little information on how to solve the problems.

Table 8: Indications of reduction of drought impact and vulnerability by the countries and CSO

<table>
<thead>
<tr>
<th>Countries</th>
<th>%</th>
<th>CSO</th>
<th>%</th>
<th>Total Responses</th>
<th>%</th>
</tr>
</thead>
</table>
The feedback and suggestions are explicitly stated

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<tr>
<th></th>
<th>20</th>
<th>50.0%</th>
<th>3</th>
<th>60.0%</th>
<th>23</th>
<th>51.1%</th>
</tr>
</thead>
</table>

Feedback and suggestions are moderately described

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<tr>
<th></th>
<th>15</th>
<th>37.5%</th>
<th>2</th>
<th>40.0%</th>
<th>17</th>
<th>37.8%</th>
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</thead>
</table>

The answer is not well done

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<tr>
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<th>5</th>
<th>12.5%</th>
<th>0</th>
<th>0.0%</th>
<th>5</th>
<th>11.1%</th>
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<th>40</th>
<th>100.0%</th>
<th>5</th>
<th>100.0%</th>
<th>45</th>
<th>100.0%</th>
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</table>

The country-by-country synopsis of the responses is shown in Table 9, where the area classified in the three categories according to the extent to which the responses offered details about what is done to reduce drought impacts and vulnerability in the country.

**Table 9: Responses from countries to question 2 of the survey**

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Monitoring network, Early Warning Systems, Forecasting</th>
<th>Assessments</th>
<th>Plannings</th>
<th>Institutional &amp; Legal Framework</th>
<th>Financing programs</th>
<th>Policies</th>
<th>Participation of Communities and CSO</th>
<th>Drought Management</th>
<th>Capacity building</th>
<th>Hydraulic infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Algeria</td>
<td>X</td>
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<tr>
<td>2 Angola</td>
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<td>X</td>
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<td>X</td>
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<td>X</td>
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<tr>
<td>3 Belarus</td>
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<td>4 Bosnia &amp; Herzegovina</td>
<td>X</td>
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<td>X</td>
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<td></td>
<td>X</td>
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<tr>
<td>5 Botswana</td>
<td></td>
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<td>X</td>
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<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>6 Burkina Faso</td>
<td></td>
<td>X</td>
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<td>X</td>
<td>X</td>
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<tr>
<td>7 Cambodia</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>8 Central African Republic</td>
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<td>9 Chad</td>
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<tr>
<td>10 China</td>
<td>X</td>
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<tr>
<td>11 Ivory Coast</td>
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<td></td>
<td>X</td>
<td>X</td>
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<td>12 Ecuador</td>
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<td>13 EL Salvador</td>
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<td>14 Eritrea</td>
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<td>15 Ghana</td>
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<tr>
<td>Greece</td>
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<td>Guinea</td>
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<td>Hungary</td>
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<td>Kenya</td>
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<td>Kyrgyzstan</td>
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Examination of the responses led to the understanding that some countries actually said, in their answer to this question. This is a summary of what the countries need in order to reduce drought vulnerability. There is a vast array of answers that converge around the following groups of needs.

![Figure 3: Needs to reduce drought vulnerability and impact in the countries](image)

### 3.3 The most commented needs

The comments about needs are very varied as seen in the responses to this question. Some countries gave detailed answers while others gave more general descriptions. In some cases, like Kyrgyzstan, have documented the “needs to reduce the impact of drought and vulnerability” in the National Report. Other countries have more work to do to define those needs like Guinea, that stated that “the country has not yet put in place a needs identification strategy to reduce the effects of drought and vulnerability”. But whether they have defined or not, all agree that the needs are many. To put it in the phrase of the response by Sudan: “There are many needs for reducing the drought impacts and vulnerability”.

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The following sections describe what are needs are to reduce the impacts of drought and vulnerability. They are framed according to distinct needs that are more committed in the responses.

3.3.1 Drought monitoring, forecast and early warning systems

Eighteen of the forty countries (45%) marked drought monitoring, early warning, and forecast as one of the needs. This was the second most mentioned need. Some spoke about monitoring, others about warning systems and there were cases mentioning forecasting.

Thirteen (13) countries specifically referred to the need to either installing, rehabilitating, or improving the network of climate and hydrological stations that would allow effective and reliable drought monitoring. **Algeria** said they need to “strengthen the weather network and the agro-meteorological network”, while **Bosnia & Herzegovina**, wrote about the “establishment of drought monitoring system”. **Angola** also said they need to “improve the hydro-meteorological monitoring network”. **Ecuador** added that their monitoring meteorological stations “do not have the suitable instruments or the necessary personnel to provide follow-up and efficient monitoring of atmospheric conditions that allow to measure, evaluate monitor, and forecast drought-related events”.

It could be assumed that these countries do have hydrometeorological networks and what is meant is that the network, or part of that network, needs to be specialized or operated for the purposes of drought monitoring. The comment made by **Ghana** is there is a need to “support in terms of tools and equipment” for monitoring droughts. And Mali’s comment is that there are “weaknesses of the agrometeorological and hydrological data collection network”.

Eleven countries said one of the main needs is to have drought early warning systems (DEWS). **Bosnia & Herzegovina** commented that this should be “targeted as a priority”. **Angola, Bosnia & Herzegovina, the Central African Republic, Guinea, and Nigeria**
said there is a need of establishing or “creating a reliable early warning system, capable of providing timely warnings about actual drought status in real-time”. The response by Sudan added that there is a need to develop “capacities for earth data collection and analysis for the establishment of early warning”. Guinea commented that early warning systems are needed at national levels and at the community level. In some of the countries where there are early warning systems, judging by the response, there is a need of strengthening these systems. Angola said there is a need to “improve and forecasting capacity to support DEWS at the provincial level. Some countries made comments about specific aspects of improving the existing DEWS. Ecuador referred specifically to the need of increasing the predictive capacity of the hydrometeorological monitoring system. More comments on improving predictive and forecasting capacities came from Nigeria, saying “forecasting the onset of drought as closely as possible”. An improvement that is needed for that purpose, as commented by Turkey, is having “more open-source high-resolution remote data for hazards studies like agricultural drought monitoring and wind erosion systems. China said they “urgently” need to improve “the accuracy of future precipitation forecasts, such as the total rainfall of the next 10-30 days, 60 days and 90 days”. Ecuador commented that improvements in DEWS should include technology management whereby DEWS can be on cellular devices). Macedonia and Montenegro are both in favor of advanced drought monitoring and early warning systems (Macedonia and Montenegro). Montenegro recommends using remote sensing data to monitor drought using meteorological and remote sensing data. There seems to be a common understanding that monitoring early warning plays a key role in preparedness for droughts. Hungary commented that timely information is needed on the onset and extent of drought; in order to “reduce damages in agriculture and other sectors”. Swaziland said these DEWS would allow “timely decision making”, adding that “farmers may have to reduce stock numbers if warned on time on the possibility of a drought”.

A CSO from India, that participated in the survey, also recommended the “development of early warning systems".
3.3.2 Drought vulnerability assessments

Seventeen countries (42.5%) expressed there is a need of having or making or improving drought vulnerability assessments and impact assessments. Since there is one question of the survey and a full chapter dedicated to vulnerability assessments, the comments here are oriented to describe what the countries feel is needed to improve assessments. These comments have been categorized in the three components of the more widely accepted conceptualization of vulnerability assessments: exposure, sensitivity, and adaptive capacity.

NEED, ORIENTATION, AND SECTORS: There were comments pointing out the need to conduct DVA for other sectors which are normally not considered, such as the health sector. Other comments stressed the importance of linking DVA to climate change and considering the land and water relationship.

- Need to conduct vulnerability assessment, impact assessment and adaptation measures and drought risk mitigation (Guinea).
- Need to combine drought impacts and vulnerability assessment (Cambodia).
- Importance of the identification of the most vulnerable regions inside of country (Bosnia & Herzegovina).
- DVA should also address the “impact of drought on the health and nutrition status of the affected populations” (Angola).
- Water supply and agriculture should be considered on the basis of the intensity of effects of these sectors (Greece).
- DVAs should be conducted on a regular basis (Kenya).
- DVA could serve for the purposes of timely effective reporting of land degradation neutrality (Sudan).
- Land and water resources analysis needs to be considered (Cambodia).
- The need to apply DVA on the entire social economy, such as the operation of cities and urban agglomerations, and ecosystems, such as wetlands and grasslands, because most of the current research focuses on the impact of drought
on a specific industry, such as agriculture, hydrology, or people, such as farmers (China).

- Assessing the reasons for vulnerability and the conditions that impact the resistance of a system to drought (Macedonia).
- Locate areas vulnerable to drought, through drought risk maps in order to receive knowledge about areas having a high probability of droughts and drought impacts; (Montenegro).

**IMPACTS:** There are several comments indicating that impact assessment is needed as an important part of the DVA process:

- Countries should develop an information database of damage and impact by geographic regions. (Greece)
- Damages are broken down by geographic region to provide an indication of each region’s vulnerability to climate change. (Ecuador)
- Economic assessment of the impacts of drought is missing. (Hungary)
- Recording drought impacts on vulnerable economic sectors, including rain-fed and irrigated agriculture, livestock, environment, energy, tourism and health sectors. (Macedonia)
- Assessing the degree or extent of potential damage or loss in the event of a drought. (Macedonia)
- Create a Drought impact archive which a systematic archive on the damages related to drought, using information from newspapers and media reports, reports of the agricultural producer, websites of state institutions, local governments, enterprises, and statistical yearbooks. (Montenegro)
- Montenegro made a point that drought impact assessment should identify both, direct and indirect, consequences of the drought on the local and national level, taking into consideration various impacts, such as the one on society, economy and environment.
- Direct impacts of the drought, such as reduced crop yields and final product quality, ground and surface water resources depletion, soil erosion, soil physic-chemical
properties deterioration, the occurrence of wildfires, endangerment of overall flora and fauna status, has to be discussed. (Montenegro)

- Indirect or secondary effects should be included, such as social effects. Understanding the effects of the past events should lead to understanding the overall impact of drought over a certain area or time period of interest, as well as possible risk assessment of drought events in the future. (Montenegro)

**SENSITIVITY:** This component needs to consider specific population groups when conducting or carrying out the exercise of DVA analysis.

- Specific solutions developed for migrant populations. (Angola)
- Consider the socio-economic aspects that exacerbate the population vulnerabilities in the livelihoods such as the resource-based conflicts on land, water and pasture and the literacy rates need to be addressed. (Kenya)
- DVA should consider specific populations and conditions that can become more vulnerable during a drought situation, such as places where there are issues with: weakened health conditions, population fully dependent on agricultural activity, problems with equity and gender violence, children and adolescents forced to work, groups with a low level of education, people with no previous or recent exposure to droughts. (Ecuador)
- Assessing the coping capacity of communities affected by drought. (Macedonia)
- Assessing sectors, population groups, and ecosystems most at risk and identifying appropriate and reasonable mitigation measures to address these risks. (Macedonia)

**EXPOSURE:** There were several comments related to the analysis of the component of exposure.

- Should consider “the use of soils most vulnerable to droughts”. (Belarus)
- Water demands and availability for crops and future scenarios. (Cambodia)
- Developing specific regional drought indexes, which have not yet been calibrated, and do not work well for all regions. (Turkey)
- Wind erosion needs to be considered in addition to climate variables because erosion contributes to loss of soils and desertification. (Turkey)
3.3.3 Planning tools

Different tools and types of planning were mentioned as one of the needs to reduce impact and vulnerability, and the need for strategies for the fight against drought. The following list is an attempt to put these plans in some order:

- National Action Plan to Combat Drought (Angola, Guinea, Nigeria)
- Drought risk management strategy and action plan (Cambodia)
- Provincial Plan to Combat Desertification
- Contingency Plan for the management of droughts
- Development Planning and Territorial Organization (Ecuador)
- Districts Assemblies emergency response plans (Ghana)
- Climate-resilient plans at the level of local communities and the Government (Angola and the Central African Republic)
- Climate change-focused plans such as Provincial Plans for Climate Change Adaptation
- Integrated Climate Change Adaptation Plan
- Preparation of medium- and long-term area-specific plans (CSO-G V S – India)
- Contingency and crisis management plans need to be drawn for short-term drought. (CSO-G V S – India)

Some countries commented on the process of the planning, recommending these ideas:

- “The national action plan will serve as a working basis for the national platform, and should reflect the different activities of ministries, UN agencies and other actors in the country in order to ensure better coordination and use of resources”. (Chad)
- There is a need to “ensure effective integration of DRR and CCA in the new UNDAF 2015-2020” in the planning process, and the evaluation of the “current level of national budget contribution to DRR activities in various sectors and ensure adequate and systematic funding to the national budget for DRR in the future 2016-2025 strategy”. (Chad)
Need to ‘improve the coordination and involvement of the institutions of the government’s institutions, private sector and academia” for the development of the plans. (Ecuador)

“The issue should be handled with more priority on the political level and should integrate drought issues into appropriate strategies”. (Hungary)

Improvement is needed “in water planning and management”. (Nicaragua)

The concerns of combating drought and desertification are poorly integrated into sectoral policies and strategies. (Togo)

Political will is required of the national and also the autonomous decentralized governments. (Togo)

Need to connect land use planning and drought management. (Angola, and Bosnia & Herzegovina, and Montenegro)

3.3.4 Capacity building

Capacity building was identified as a need mainly by the countries from Africa such as Angola, Central African Republic, Angola, Eritrea, Ghana, Guinea, Mali, Zimbabwe and Togo. The development of capacities that were mentioned are directed at other of the needs described above, like drought monitoring and early warning and drought vulnerability assessments. In general, they refer to providing assistance to the institutions in terms of material, financial, human, and technological resources, and improving capacities also at the community level and of the stakeholders. Here are the categories where there is a need to build more capacity:

Capacity building for better Drought Monitoring and Early Warning

Need to strengthen the institutional and technical capacities of the actors concerned in the analysis, interpretation and use of climatic, hydrological, agrometeorological data and the early warning system. (Guinea)
“Capacity building both institutional and human capacity for metrological and agrometorological data collection, analysis and interpretation and modeling for early warning”. (Eritrea)

Improving the in-house capacities in early warning and early actions regarding drought situation. (Angola)

Capacity building of the Departments of Metrology and Civil Protection on data collection, analysis interpretation, and modeling for early warning. This requires the provision of appropriate technology and technical support for use of the technology. Support on technology for data and information sharing real-time between the field workers and policymakers. (Zimbabwe)

Significant gaps in knowledge, surveillance, monitoring and control of drought indicators, etc. (Togo)

Capacity building for improved Drought Vulnerability Assessment

Support for building the capacities of diverse actors as part of a vulnerability assessment of countries linked to drought to provide information on vulnerability indicators. (CAR)

Capacity needs for drought assessments. (Cambodia)

The relevant technology and the professionals needed to join the relevant research team and receive relevant professional training. (China)

There is a need to compensate for the lack of scientific, reliable and up-to-date information relating to the vulnerability of vital development sectors to drought hazards. (Togo)

The preexistence of trained personnel in disaster risk management analysis. (Togo)

Capacity building for better Drought Management

Education on the possible occurrence of disaster and measures to prevent or reduce drought impacts. (Ghana)
• Capacity building on drought management for managers and communities. (Ghana)

• Build the capacities of stakeholders in the fight against desertification, sustainable land management, drought, Awareness, Training and Environmental Information (SFICE) of adaptation to climate change. (Guinea)

• Increased need for material, technical and financial support for research and popularization of improved agricultural and early market gardening seeds with short cycles. (Guinea)

• the integration of benchmarks, indicators and traditional knowledge (local knowledge and know-how) in the process of managing issues of natural disasters, in particular, drought. (Mali)

• The adoption of technologies developed in the framework of adaptation and/or mitigation of the effects of climate change, especially drought. (Mali)

• the integration of benchmarks, indicators and traditional knowledge (local knowledge and know-how) in the process of managing issues of natural disasters, in particular drought. (Mali)

• Technical support to the disaster management institutions “in terms of providing an expert in drought-related disaster management”. (Angola)

Capacity building for Research

• Financing of research programs/projects leading to better (Surinam)

• Studies of drought-resilient genetic material, cultivation techniques and systems (Surinam)

• Investment in new and innovative field machinery, observation & lab tools and knowledge and experience sharing. (Surinam)

Capacity building of Human Resources

• Capacity building of all the actors involved (local authorities, state technical services, the private sector, CSOs) while taking into account the specific gender
for the identification and distribution of roles and responsibilities of each (CSO-SARO-Mali).

- We need competent human resources in the field of setting up relevant projects and the mobilization of financial resources (CSO-SARO-Mali)

### 3.3.5 Institutional and Legal framework

Fifteen percent of the countries (6 out of 40) defined it as a need the legal and institutional frameworks. As well stated in the response by Togo, the countries need an adequate institutional framework to be able to "respond to the gaps and integrate risk and disaster reduction in general into development policies, plans, programs, and projects". Some countries, like Burkina Faso, already have the institutional, political, and legal frameworks that promote the fight against desertification. But even some of these countries commented on this need and its importance.

These are comments and recommendations made by the countries about the need to improve the legal framework:

- Establish a specific national legislative framework for DRR and disaster management, including emergency preparedness and response, which would at the same time make it possible to clearly define the roles of the various national institutions (Chad).
- At the same time, carry out a complete inventory of all sectoral laws in order to strengthen/update them on aspects of DRR including PRU. This can be done through support and training for/from certain jurists at the national level (Chad).
- Ensuring coherency in legislation concerning different sectors (Hungary).
- that involves all stakeholders involved, including actors from the public and private sectors, as well as appropriate legal instruments conducive to taking drought risk prevention into account as a national priority in terms of the country's economic development (Togo).
These other comments are in relation to institutional aspects:

- Leadership of institutions and decision-makers at all levels (particularly on the local level of the drought-affected regions/municipalities) (Bosnia & Herzegovina).
- Improving institutional arrangement for drought management (Botswana).
- Sectoral institutionalization of drought management at sector level in a proactive manner (Botswana).
- Carry out sensitization sessions on DRR at the highest level of the State, including parliamentarians, prefects and mayors, in order to sensitize them on the need to invest in DRR (Chad).
- For more efficiency in coordination and in order to have strong leadership, create a national unit/entity responsible for the coordination of DRR placed within the Prime Minister or the Ministry of Planning. It would also be desirable to have a focal point in this area within the planning unit of each ministry (Chad).
- Set up the national platform for DRR and provide training to its members on the role and responsibilities of such a structure (Chad).
- Actively support the various ministries in the preparation of the future National Development Plan 2016-2025 in collaboration with the Ministry of Planning and the Ministry of Finance, in order to ensure better integration of aspects of DRR (Chad).

3.4 Other needs: means and resources

These other four aspects were mentioned as needs in the countries:

1. Financial resources: eight countries (20%)
2. Policies: five countries (12.5%)
3. Infrastructure: six countries (15%)
4. Community participation: four countries (10%)
3.4.1 Financial resources

Financial resources are a means, not the end, for any possibility the countries might have to carry out the national drought plans and the many drought management measures. Just to put one example of the importance of having or not having financial resources, Algeria pointed out that they are unable to acquire equipment for the agro-meteorological network due to lack of funding. Another similar comment was made by Swaziland, which referred to the cost of water infrastructure which is very expensive for small economies. Spain commented that more resources, research, and innovation, policies, and strategies will be needed to mitigate the drought-related issues. Botswana said there is a need to determine the protocol for drought budget”. Guinea said there is a need to put in place an “appropriate financing mechanism to cope with the effects of the drought”.

Sudan suggested “advocacy and lobbying for resource mobilization and financial support to sustainably manage UNCCD related activities to achieve land degradation neutrality by 2030”.

The CSO of TESO-Uganda recommended funding to support several initiatives including climate technology solutions, opportunities for targeting innovative solutions, new market segments, development or adopting new technologies, business models, modal shifts and/or processes that will help to reduce the impacts of drought.

3.4.2 Policies

It is clear that drought policies are important for the countries dealing with drought problems (Mali). But some countries do not yet have adequate and effective policies in place, like Togo, which said that comment in the “non-existence or non-effectiveness of clearly-developed policies”.

The Central African Republic commented that there is a need to “support for the development of national public policies with a view to effectively combating the effects of drought”. And Greece said that the “adaptation policies needed for the “implementation
of appropriate actions must be planned in a timely manner, so as to mitigate the likely adverse impacts”.

Macedonia called for the “adoption of national drought policies that are focused on risk reduction and which are complemented by drought mitigation plans at various levels of government will have significant ripple effects across key sectors”. Macedonia also recommends the “adoption of policies supports the implementation of Sustainable Development Goal target 6 – “ensure availability and sustainable management of water and sanitation for all” – by promoting integrated water resources management.

3.4.3 Infrastructure

Several countries mentioned infrastructure as one of the needs to reduce drought vulnerability. The Central African Republic and Guinea were the countries that pointed this, and they referred to the following type of infrastructure: construction of agricultural and pastoral hydraulic infrastructures; modern boreholes and wells, ponds, and other water supply structures. This would include irrigation canals among the hydro-agricultural development. Fish farming stations were mentioned, as one of the investment needs. Kenya talked about infrastructure in a more general sense and included road networks that would give access to farmers’ lands, and thus crate more access to markets.

3.4.4 Community interventions and participation

Community participation and civil society organization (CSO) interventions at community levels were mentioned as another action needed in order to reduce drought vulnerability. Burkina-Faso said attention must be given to the “needs of grassroots communities” to reduce the effects of drought”. It was recommended to strengthen the operational capacities of the CSO that have a key role in the “fields of the environment and development”, and that CSO should implement multi-annual “financing of programs to
combat desertification and the effects of drought”. The aim of development actions at the community level should be: “(i) reducing the mobility of able-bodied arms due to poverty”. (ii) “reducing illiteracy in active and productive communities”.

3.6 Drought Management Measures

Drought management measures were the most commented category among the needs to reduce drought impact and vulnerability. Twenty-one of the forty countries (52.5%) identified several management measures.

Comprehensive measures are needed to reduce the impact of droughts on the environment, and these measures also contribute to attaining water security. From the responses, it was possible to distinguish the following four categories of measures. A “multipronged strategy is needed to reduce drought impacts which include appropriate water infrastructure management, demand, and supply management” (South Africa).

3.6.1 Measures oriented towards augmentation of water supply

The measures included in this category are aimed towards providing more water to meet the increasing demand by agriculture and food production, municipal water supply systems, and hydropower generation. The countries mentioned the following measures:

- “Investments in physical assets of irrigation infrastructures” (Greece).
- Temporary measures to be undertaken include the rehabilitation of existing boreholes and the drilling of wells (Angola).
- Physical works for water storage such as lagoons, small reservoirs (Ecuador).
- Water conduction works such as irrigation canals, at farm level narrow/shallow channels (Ecuador).
o Rainwater harvesting (Nigeria).
o Maintain strategic water reserves in order to meet the basic needs of the country’s population in case of large-scale extreme weather events, such as prolonged drought (Greece).
o Regulation, natural or artificial, of the water resource (Nicaragua).
o Harvest and store water during years of normal rain and release them during drought years (Swaziland).
o Medium to large scale dam can be constructed (Swaziland).
o Need to move from rainfed agriculture to irrigation farming which is more reliable (Swaziland).
o Water harvesting, protecting water sources against contamination (Macedonia).

o Developing water sources – such as micro dams, ponds and wells (Macedonia).
o Use of reserve sources of groundwater (Macedonia).
o Enhancing irrigation schemes (Macedonia).

3.6.2 Water demand management measures

o Actions oriented to water efficiency such as “Investments on water saving” (Greece).
o Reduce water losses in the agricultural sector, through the implementation of comprehensive parcel irrigation systems and sprinkler irrigation systems (Ecuador).
o Improve the efficiency and control of water resources with a view to mitigating the effects of drought (Panama).
o Reduce water limits during the growing season, adherence to water discipline (Uzbekistan).
o Ban water-intensive crops (like rice cultivation) in some regions (Uzbekistan).
o The reuse of water from drainage collectors for irrigation (Uzbekistan).
- Converting to pressurized irrigation systems will improve the uniformity of water application (Macedonia).
- Smart irrigation practices by homeowners, business owners and especially farmers (Macedonia).
- Water rationing/allocation (Macedonia).

### 3.6.3 Land and watershed management

As stated by South Africa, land use and land management practices are of relevance to the UNCCD and are important measures to protect water sources.

- Promote reforestation on a large scale and in major cities of the country (Central African Republic)
- Adopting sustainable land management, as a tool to combat drought and as an environmental work strategy regarding national sustainable development. (Panama)
- The need to promote the sustainable management of forest and wildlife ecosystems with a view to combating environmental problems, climate change, desertification and drought (Guinea).
- The need to strengthen the management of pastoral areas and transhumance (Guinea)
- Consolidate environmental activity through the management of hydrographic basins, resulting in sustainable management in areas affected by drought (Panama).
- Appropriate land use and land management practices and improved land use/land cover management (South Africa)
- Restoration programs of degraded lands with the aimed at “enhancing ecosystem services such as carbon sequestration, water regulation and purification, reducing the risk of natural disasters by improving the landscape, catchment stability and resilience” (South Africa National Parks).
Forest and environment restoration (Myanmar).
Boosting soil productivity (Macedonia).
Restoring forests that store water during rainy spells (Macedonia).
Changing our relationship with the land will reverse biodiversity and ecosystem decline.
Restoring land and habitats (Macedonia).
Adopting land-management practices that boost biodiversity, we create flourishing ecosystems (Macedonia).
Restoring pastures and balancing land and water resources (Macedonia).
Recovering the water holding capacity of soils through tree planting (including fruit trees) and the protection of riverbanks and wetlands (Macedonia).
Implementing Integrated Water Resources Management (IWRM), such as mitigating upstream-downstream user conflicts and coordinating between water users, communities and sectors (Macedonia).

3.6.4 Adaptation measures

Adaptation measures can comprise several other types of measures, but it is generally accepted to mean measures to undertake in order to adapt to risk and naturally occurring disasters. The countries suggested these measures:

- Need to strengthen the resilience of rural communities weakened by various shocks and disasters (floods, recurrent drought, perverse effects of climate change, etc.) (Guinea).
- Need to promote adaptation techniques to climate change in the agro-sylvo-pastoral sector (Guinea).
- Awareness-raising is necessary on every level (Hungary).
- Enhanced agriculture-based services that target agricultural production through support in breeding for pastoral, farm input subsidies (fertilizers, seeds, farm chemicals and farm mechanization especially in cultivation) to marginal, mixed and agropastoral communities (Kenya).
- Encouraging the planting of trees around the home (Nigeria).
- Tacitly mobilize the grass-root towards the anticipation of drought (Nigeria).
- Maintain strategic food reserves at the national level (Swaziland and Greece).
- Water resource development (Myanmar).
- Animal breeding (Myanmar).
- Drought-resistant agriculture (Myanmar).
- Water supplements for livestock (Ecuador).
- Desertification control technologies are widely popularized in the communities (Burkina Faso).
- Prevention of forest fires and fires in peatlands, which negatively affects the environment (Belarus).
- Control of invasive alien plants, soil degradation and bush encroachment control in strategic catchment areas (SANParks).
- Degradation and restoration framework is aligned with the Ecosystem-Based and Adaptation (SANParks).
- Irrigation supports for subsistence agriculture (CSO, Parma-Italy).
- Provide farmers with irrigation kits/materials for irrigating their plants during dry spell (CSO, TESO-Uganda).
- Training Community Drought Management Response Teams (CDMRTs) to conduct surveillance, training and Public Education and awareness-raising on climate change, environment protection and drought management. (CSO, TESO-Uganda).
- To secure and maintain food grain stocks to meet the growing population needs (CSO-G V S – India).
- To arrange protected drinking water even in hot summer months (CSO-G V S – India).
- Identification of susceptible areas i.e., drought-prone areas (CSO-G V S – India).
- Build the land’s resilience to disasters, and with it, resilience in the livelihoods of the most vulnerable households and communities (Macedonia).
- Diversifying rural livelihoods through social protection, cash-transfer programs (Macedonia).
Improving access to markets and rural services: Access to markets could help create alternative non-farm employment that could reduce the impacts of droughts (Macedonia).

Crop insurance (Macedonia).

Shifting to drought-tolerant crops (Macedonia).

Managing livestock production within the landscape, including the relocation of herds, nomadic migrations and use of special reserved areas (Macedonia).

3.7 Tools and Resources

3.7.1 The Drought ToolBox

The Drought Toolbox includes a recent rapid review of practices and policy recommendations for drought impact and vulnerability assessment “A Guide for Assessing Climate Change Risk”)\(^7\) which presents case studies from Brazil, Colombia, Ethiopia, India, Kenya and Mexico. It also includes a review of literature from various other countries. These case studies could also be developed further. The IWG members have identified additional methodological guidance and examples that can be added to the toolbox including a useful guide published by the Urban Land Institute (Drought impact and vulnerability assessment a rapid review of practices and policy recommendations\(^8\) and a US Climate Resilience Toolkit\(^9\), which offers additional insights. There is an opportunity to provide additional insights on how drought impact, vulnerability and risk assessments can more effectively guide economic decision-making. A global database


has been established for the assessment of drought impacts. The database contains reports on the impacts of droughts that occur around the world\(^\text{10}\).

The identification of likely drought impacts — described in the previous section — is an important part of a vulnerability assessment. Vulnerability analysis can then work backward from these impacts to uncover, explain and assess human, social, economic, political, physical and environmental factors that can exacerbate or mitigate the risks (UNISDR 2009, p.37)\(^\text{11}\). In drought-prone countries, the identification of likely drought impacts is often retrospective, drawing on the experience of past droughts. However, vulnerability assessments are seen as a way to inform actions that can reduce future drought risks.

### 3.7.2 Databases and Framework

Relevant databases have been established at the level of the European Drought Centre (EDC) Drought Impact Database and the US National Drought Management Center (NDMC) Drought Impact Reporter. Within the European Union (EU), there have been some efforts to coordinate methodologies that are used to collect and record data on disaster losses (EC 2010; Groeve 014)\(^\text{12} \ 13\). But these methods are still limited, and available databases vary in their level of completeness and detail. In addition, IT systems differ in purpose, complexity and openness.

Increasingly, the concept of vulnerability is nested within broader drought risk assessment frameworks for drought preparedness, as in the case of the DRAMP framework

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\(^{10}\) [https://www.emdat.be/](https://www.emdat.be/)


\(^{12}\) EC (2010) Risk Assessment and Mapping Guidelines for Disaster Management. EUROPEAN COMMISSION, Brussels

(ICCD/COP(13)/19). This defines vulnerability as an element related to but distinct from the nature of the drought hazard, and the system or population that is exposed to it. If these relationships are explicit and well-established, the vulnerability and risk factors can be quantified, hazard-vulnerability curves can be mapped (as in ECA 2009 and Figure 1)\textsuperscript{14} and quantitative predictions of the cost of droughts can be made.

Achievements toward the reduction or modification of the vulnerability factors could then be measured and a clear economic case presented for such interventions.

A recent application of an approach of this kind refers to cost curves that are used to predict a relationship between drought indices and effects on GDP in China (Su et al. 2018)\textsuperscript{15}.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{Representation of Drought Vulnerability and Impact}
\end{figure}


\textsuperscript{15} Su B et al. (2018) Drought losses in China might double between the 1.5 °c and 2.0 °c warming Proceedings of the National Academy of Sciences of the United States of America 115:10600-10605 doi:10.1073/pnas.1802129115
4 BARRIERS AND CHALLENGES

Question number 3 of the Survey reads: “What are the main barriers and challenges in addressing the vulnerabilities to drought?”.

A summary of the responses is first presented, followed by a description of the context of countries participating in the survey. Subsection three of this chapter deal with showing which are the barriers identified in the responses, and subsection four is about defining what are the actual challenges faced in drought management.

Responses to question three were very rich in content and provided all of the comments shown in this chapter. Fortunately, for the purposes of this report, it became very clear what are the main barriers as the majority of the countries coincided in those four barriers, in some way or the other, and many times expressing them with the same phrases. The definition of the challenges was a bit more difficult for two reasons. The first is that many times the two words, barriers and challenges, are used indistinctively to mean the same thing. The second reason is that they are not actually the same thing. That is explained in subsection four. So, to define the challenges it is necessary to put things in perspective and then synthesize the most salient points the responses are pointing at.

4.1 Summary of responses

The responses included comments on barriers relating to several issues and can be categorized into these four classes: (see Table 10).

1. Institutional, legal and regulatory framework, poor coordination between the institutions
2. Limited funding and little financial resources
3. Inadequate institutional capacity, human resources, and material Resources
4. Limited knowledge, low technology, little or no research, and problems with information or access to information.
### Table 10: Responses to Question 3 on Barriers and Challenges

<table>
<thead>
<tr>
<th>Country</th>
<th>Institutional, Legal and Regulatory Framework, Poor Coordination</th>
<th>Funding and financial resources</th>
<th>Inadequate Institutional Capacity, Human Resources and Material Resources</th>
<th>Limited Knowledge, Low Technology, Research, and Problems with Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Angola</td>
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<td>Belarus</td>
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<td></td>
<td>X</td>
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<tr>
<td>Bosnia &amp; Herzegovina</td>
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<td>X</td>
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<td>Botswana</td>
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<td>X</td>
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<td>Burkina Faso</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Cambodia</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Central African Rep.</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Chad</td>
<td>X</td>
<td>X</td>
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<td>China</td>
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<td>X</td>
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<tr>
<td>Ivory Coast</td>
<td>X</td>
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<tr>
<td>Ecuador</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>EL Salvador</td>
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<tr>
<td>Eritrea</td>
<td>X</td>
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<td>Ghana</td>
<td>X</td>
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<td>Greece</td>
<td>X</td>
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<td>Guinea</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>Hungary</td>
<td>X</td>
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<tr>
<td>Kenya</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Kyrgyzstan</td>
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<tr>
<td>Macedonia</td>
<td>X</td>
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<tr>
<td>Mali</td>
<td>X</td>
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<td>Malta</td>
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<td>X</td>
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<tr>
<td>Montenegro</td>
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<td>Myanmar</td>
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<tr>
<td>Nicaragua</td>
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<td></td>
<td>X</td>
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<tr>
<td>Nigeria</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Country</td>
<td>Institutional, Legal and Regulatory Framework, Poor Coordination</td>
<td>Funding and financial resources</td>
<td>Inadequate Institutional Capacity, Human Resources and Material Resources</td>
</tr>
<tr>
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<td>---------------------------------------------------------------</td>
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<td>------------------------------------------------------------------------</td>
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<tr>
<td>28</td>
<td>Panama</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>29</td>
<td>Serbia</td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>30</td>
<td>South Africa</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>31</td>
<td>Spain</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Sudan</td>
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<td>33</td>
<td>Suriname</td>
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<tr>
<td>34</td>
<td>Swaziland</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>35</td>
<td>Togo</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>36</td>
<td>Turkey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Ukraine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Uzbekistan</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>39</td>
<td>Venezuela</td>
<td>X</td>
<td></td>
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</tr>
<tr>
<td>40</td>
<td>Zimbabwe</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The four categories that were identified as barriers by at least half or more of the countries are:

- Limited knowledge, low technology, research, and problems with Information or access to information was commented on by 62.5% of the countries.
- Limitations with funding and financial resources were pointed out in 55% of the countries.
- The capacity barrier came after 55% of the countries facing issues with inadequate institutional capacity, not enough qualified human resources, or material resources.
- Institutional, legal and regulatory framework, poor coordination between institutions, was identified as a barrier by 50% of the countries.
The category of inadequate capacities bears close relation with the barrier of limited knowledge. In fact, the latter is the result of the former. But it is necessary to treat them separately in order to better capture what the responses are saying.

A weak policy framework is mentioned or suggested to be a “barrier” by only six of the forty responses, which represents 15% of the countries that participated in the survey. Policies in themselves should never become barriers unless they are wrongly formulated and implemented. To put it in other words, policies are not part of the problem, but part of the solution. It seems the countries are more concerned about the lack of policies or weak policies, rather than to wrongly crafted policies. It should be noted that there is a specific question on policy in the survey, question four, which addressed policy issues, and that is dealt with in the next chapter, not in this one. And for that question, the majority of countries gave details of policies implemented.

Table 11: Barriers and Challenges in the Countries

<table>
<thead>
<tr>
<th>BARRIERS</th>
<th>Number of countries that Indicated this barrier</th>
<th>Number of countries that did not indicate this barrier</th>
<th>Total Number of countries</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Institutional, Legal and Regulatory, Framework, Poor Coordination</td>
<td>20</td>
<td>22</td>
<td>40</td>
<td>50.00%</td>
</tr>
<tr>
<td>2 Funding and financial resources</td>
<td>22</td>
<td>23</td>
<td>40</td>
<td>55.00%</td>
</tr>
<tr>
<td>3 Inadequate Institutional Capacity, Human Resources and Material Resources</td>
<td>22</td>
<td>25</td>
<td>40</td>
<td>55.00%</td>
</tr>
<tr>
<td>4 Limited Knowledge, Know-how, Technology, Research, and Problems with Information</td>
<td>25</td>
<td>22</td>
<td>40</td>
<td>62.50%</td>
</tr>
</tbody>
</table>
4.2 **Barrier #1: Institutional issues**

The responses give a very good description of the main five barriers or obstacles the countries have in managing the vulnerability to drought and reducing the impacts of drought.

4.2.1 **Barrier #1: Institutional issues**

Barrier number one is the current institutional, legal and regulatory framework, which is evidenced by several of the following: in the poor coordination between the institutions, the overlap of functions and actions, no clear definition of the roles, lack of collaboration, the multiplicity of organizations doing work disconnected one from the other, or sometimes in competition among themselves. Of these, poor coordination of actions seems to be the main concern. The end result is that due to this lack of coordination, exactly **half of the responses (50%)** indicated institutional issues constitute the main
barrier in their country. While there are three other barriers with a slightly higher percentage, this is probably the biggest hurdle and most difficult to circumvent as institutions have mandates and laws, and also powers, they are not willing to concede or delegate. To put it in the actual words of the respondents, these are the summarized situation, country by country, in this aspect.

- **ANGOLA** said there is “poor intersectoral coordination and weak policy framework to respond to change risks”.
- **BOSNIA & HERZEGOVINA** said there is “insufficient institutional structure and leadership related to drought”, and there is “no clear inter-institutional scheme of responsibilities and determined communication flow between relevant stakeholders, which are necessary for adequate institutional response to drought”.
- **BURKINA FASO** sees “Insufficient supervision” of the civil society organizations (CSO) by the incumbent institutions.
- **THE CENTRAL AFRICAN REPUBLIC (CAR)** sees a barrier “the lack of a cross-sector coordination framework” to coordinate policy-defining and implementation actions, overlapping roles and responsibilities. The CAR mentioned the importance of defining “the roles and responsibilities of those involved in drought events”.
- **IVORY COAST** also noted that there is “poor coordination of actions” and “poor communication” among the institutions.
- **ECUADOR** identified the main barrier to be the lack of “inter-institutional coordination” due to “fight for power” between government institutions.
- **EL SALVADOR** said that one of the great “challenges” faced in achieving strategic drought management is to have a comprehensive regulatory framework for the management of water resources.
- **KYRGYZSTAN** sees that the coordination problem is also at the regional level, and a barrier to the “development of drought prevention measures”.
- **MALI** faces also “insufficient coordination” between the ministries involved in drought-related activities” and a barrier in “the multiplicity of bodies which all work on the subject without consultation”.


MACEDONIA's barrier is also “limited coordination” among the institutions that provide different types of drought early warning, risk management and risk reduction, that results from a national policy.

MONTENEGRO attributes the current situation regarding the treatment of drought is not adequate, to the lack of an “official institutional set up”. There are several “institutions whose responsibilities refer directly/indirectly to drought issues, but the main obstacle is that there is no clear inter-institutional scheme of responsibilities and determined communication flow between relevant stakeholders, which are necessary for adequate institutional response to drought. The establishment of institutional set up at official level should be is the first step for adequate addressing of drought, and a precondition for adequate institutional setup, relevant institutions responsible for drought-related issues and their role in drought management, has been identified in National Drought Management Plan.

HUNGARY reports that there is a “lack of legislation for operative measures”, and that “several drought strategies have been prepared so far, but there is no unified, comprehensive strategy or program adopted by the Government”. A call for “improvement of the organizational cooperation among the appropriate institutions” is needed.

KYRGYZSTAN said there is underdeveloped regional coordination for the development of drought prevention measures.

PANAMA cites insufficiencies in the framework of institutional coordination.

South Africa says there are “applicable regulatory frameworks”, but they are not implemented.

SPAIN also explains that “coordination between national, regional and local administrations”, stakeholders, public authorities competent in many different topics and the general population is required. This coordination is done in Spain within each river basin district by the so-called Confederaciones Hidrográficas.

SWAZILAND: There is a great need for international cooperation in awaiting appropriate technology possibly at a sub-regional level guided by international protocols or agreements to ensure sustainability and adequacy at its flow.
o TOGO’s point of view is civil society organizations involved in rural development and environmental management get weak support in drought management aspects. There is also “poor coordination and no collaboration of interventions in the field”.

o VENEZUELA sees the need for legislation and an international cooperation agenda.

The observations about institutional issues came on three different fronts. One is that of the cooperation among the government institutions with competence or in charge of drought management. And for that, there is plenty of institutional work to be done. While these institutions have shared objectives, there is no coordination in the field or in the actual work. Some of the countries indicated that they already have National Policy and the General Water Law, which is a great foundation, but there is a need to work more to improve the regulatory framework.

The second aspect is that the lack of coordination between the government institutions correlates to the non-governmental organizations or civil society organizations. Some responses indicated that there is no supervision of the CSO. This needs not to be attributed solely to the national agencies, but also to the "independent" nature of CSO; and sometimes, the fault is actually on the side of the CSO which tends to work on their own, without proper coordination with the incumbent institutions. Independence and isolation are not to be taken as synonyms. The agendas of the CSO need to have some relation to the institutional actions to avoid overlaps and empty gaps and inefficiencies at the communities and local levels where the CSO concentrates their work.

The third aspect here is the need for regional coordination. Drought is a phenomenon with regional coverage as its effects are manifested simultaneously in several countries.

Kyrgyzstan, for instance, mentioned the coordination problem at the regional level. This is where international cooperation should be playing one of its main roles. Regional blocks should work together sharing tools and resources.
4.2.2 Barrier #2: Knowledge gap

The second barrier that was identified in the responses to the survey is limited knowledge, which is direct to another one of the barriers that have to do with institutional capacities. This either barrier refers to the needs for capacity building in the institutions, its human resources, the tools, etc. By knowledge, it is meant that the body of knowledge needs to be improved about droughts in general, their impacts, the assessment of vulnerabilities, the analysis of the threats and the risks. The knowledge barrier of the knowledge gap is related to little or no research, lack of information, or problems of access to information. Issues with lack of data and limited research were included in this category since data and the analysis of the data is the basis for having knowledge of drought-related issues. With this concept in mind, there are 62.5% of the countries see this as a big issue. The words knowledge is present in the majority of the responses, in phrases such as lack of knowledge, low level of knowledge, poor or limited knowledge, etc. The same happened with words data or information and research. The following short excerpts of the responses attest to the lack of knowledge as a barrier:

Angola: “Limited knowledge and capacity to fully assess risks posed by climate change to disaster risks in the country”; and “the existence of an information deficit that makes the framing and assessment of situations critical”.

Burkina faso: The non-return of information on actions to combat desertification at the grassroots level (communities).

Cambodia: “We need further and stronger support for research and development activities to develop drought-proof technology and enhance its adoption by farmers. Poor knowledge and adaptive capacity of the local farming community making changes in practices difficult/slow”.

China: First, there are differences in perceptions of vulnerability. What is vulnerability? People in different industries or regions have completely different understandings of it, which will lead to completely different or even opposite assessment results of
vulnerability. However, it is reasonable and normal for people in different industries or regions to have different understandings of vulnerability. What we need is to have a unified understanding of vulnerability for a specific and specific industry or region.

**Ghana:** Inadequate knowledge and technical capacities in drought management.

**Mali:** the weak integration of benchmarks, indicators and traditional knowledge (local knowledge and know-how) in the process of managing natural disaster issues, in particular, drought; low adoption of technologies developed in the context of adaptation and / or mitigation of the effects of climate change, especially drought.

**Macedonia:** Existence of various definitions, methodologies for assessment. Challenge is to separately estimate groups of factors that define various aspects of vulnerability to drought - natural, (geophysical, climatological, environmental factors, and also the inclusion of socioeconomic factors (for example-managerial skills of the population/stakeholders/agriculture) to finally estimate overall vulnerability and to provide efficient risk management. As has been noted, *(Monnik, 2000, Pulwarty and Verdin, 2013)* the main constraints on early warning information system implementation include:; Inadequate social impact indicators to form part of a comprehensive early warning system and inform policy response.

**Malta:** Drought is a natural hazard, so its occurrence in any location and during a given time period could be evaluated by attaching probabilities depending on the biophysical and climatic characteristics of that location. However, drought impacts are strongly modulated by the socio-economic characteristics of affected areas, such as their vulnerability and resilience to drought, as well as their level of drought preparedness. The role of socio-economic factors in determining drought impacts is complex and relations are not linear. Drought vulnerability assessment needs to be done through a multidisciplinary/multilevel approach, as it is linked to geological, climatical, agricultural and socioeconomic and biophysical factors. Moreover, such assessment needs to be done at different levels, starting from micro (village-communities) to meso (state-district-country) and macro levels (region/country). To realize drought vulnerability and
understand the impacts at the aforementioned levels, it is necessary to explore the knowledge or information of these regions and estimate the direct and indirect consequences that contribute to vulnerability.

**Nigeria:** Lack of quantitative data on per capita water requirement in rural areas

**Panama:** Lack of knowledge, awareness, education and training for the inclusion of the issue at various levels of action.

**Serbia:** Over the last several years, this kind of shift from reactive to a proactive approach in the management of natural hazards has been driven by floods, so the current activities are mainly focused on floods, leading to the situation that in case of other hazards, such as drought, the whole process is still, to some extent, undeveloped.

**Suriname:** The need in support to reformulate the research project ideas for innovation and resilience development in more appropriate project dossiers to be able to find interested donors and at last receiving funding for the implementation.

**Turkey:** Call for more studies because the actual calculations cannot explain drought adequately. So, more knowledge is needed to “which indexes” accuracy is more meaningful for Turkey’s regions.

**Uzbekistan:** Low level of knowledge among local communities and lack of advisory support and services for the dissemination of best practices.

**Venezuela:** Create awareness in the population about drought as a socio-environmental problem. Increase our knowledge of drought and its impacts.

### 4.2.3 Barrier #3: Financing and funding issues

Limited funding and little financial resources result in budget cuts and investment restrictions so the desired drought management initiatives cannot be put into operation.
This affects the implementation of many of the measures that need to be taken in drought management. Drought monitoring and warning systems have been affected by limited financial resources. Action on the field to assist communities during severe droughts is limited as well. Twenty-two of the forty countries (55%) explicitly indicated that limitations of financial resources are a barrier. This is how and what respondents expressed:

**ANGOLA:** “Lack of financial support to cover immediate life-saving and key activities”.

**BURKINA FASO:** “Insufficient funding” for actions to combat desertification.

**CAR:** lack of funding to translate actions into action.

**CHAD:** Sectoral strategies exist... but they are not implemented due to a lack of resources.

**IVORY COAST:** Poor funding.

**ECUADOR:** Budget cuts have had a negative influence on the reduction in both quality and quantity of hydrometeorological information, creating a crisis in the national agencies in charge of the generation and dissemination of hydrometeorological information.

**GHANA:** Financial resources are limited.

**KYRGYZSTAN:** Slowdown of the insurance system due to the lack of financial capacity of the country's budget.

**MALI:** lack of funding; insufficient financial resources.

**GUINEA:** The low importance of resources (material and financial) devoted to the fight against Desertification, drought, sustainable land management and natural disasters.

**KENYA:** “Limited funding for county-and-national-based drought management makes it difficult to advance drought management”.

**NIGERIA:** “Lack of dedicated fund for drought management”.
PANAMA: “Limited access to financial sources to face the actions”.

SOUTH AFRICA: “Extreme dependence on government funding systems intended to respond to drought climate change variability”; and “lack of participation by private business”.

SUDAN: limited financial availability and accessibility.

SURINAME: A barrier in this country is “to find interested donors and at last receiving funding for the implementation”.

SWAZILAND: “Main barriers and challenges are finance and access to technology. Protocols to also include financing modalities for local-level mitigation programs”.

UZBEKISTAN: Low incomes of local communities in drought-affected areas.

TOGO: The national “organizations benefit very little from national financial resources” for the implementation of actions for the effective management of the environment. Most of their actions are often supported by external funding from various sources from technical and financial partners.

Many countries underlined the need for financial resources, and CSO trying to have access to funding. Some countries made interesting proposals to deal with this barrier. Nigeria and Kenya suggested a “national fund for drought management and drought contingency”, which already exists in one of those countries but it is currently “underfunded” and therefore it is “ineffective”.

The other input was made by South Africa, which first reflected on extreme dependence on government funding systems intended to respond to drought, and then pointed out the lack of participation by private business. This is a clear call for public-private participation which is an initiative promoted in several regions given.

Swaziland makes a call for international cooperation in awaiting appropriate technology possibly at the sub-regional level guided by international protocols, including financing modalities for local-level mitigation programs. Togo made reference to the financial
partners, and the need to involve in the management of drought crises the private actors that intervene in different sectors of activity including agriculture, forestry, exploitation of mineral resources, etc. These private actors are weakly involved.

### 4.2.4 Barrier #4: Capacity

The current institutional capacities are deemed as limited if not poor in 55% of the responses, be it stated in general terms as limited institutional capacity, or more specifically referring to limitations or lack of human resources and material resources. These are the responses of the countries in regard to this barrier:

**Algeria:** “In need of training of human resources or material specialists, also lack other resources”.

**Angola:** Lack of human and material resources to conduct regular work properly, including monitoring and emergency response; and low capacity to address and adapt to drought.

**Belarus:** There is a need for more capacity to modernize the forecast and predictions about droughts.

**Botswana:** Need more “institutional and technical capacity for drought assessment and management, and also for drought early warning”.

**Cambodia:** Limited institutional capacity to cope with drought (Physical resources, soft skills, financing, innovative technology).

**Bosnia & Herzegovina:** Shortage of drought monitoring system; and limited capacities for adaptation and mitigation of drought.
**Ghana:** There is a lack of availability of suitable drought assessment tools, given the inadequate knowledge and technical capacities in drought management; and not enough “human resources”.

**Kyrgyzstan:** Current capacity seems to result in “underestimation of the danger of drought, hence the slow deployment of early warning measures for drought”.

**Mali:** insufficient resources (human and financial) at the level of structures providing data and information required for forecasting, monitoring, and warning; The weakness of the agrometeorological and hydrological data collection network.

**Macedonia:** There is an increasing concern worldwide about the ineffectiveness of current drought management practices that are largely based on crisis management. These practices are reactive and, therefore, only treat the symptoms (impacts) of drought rather than the underlying causes for the vulnerabilities associated with impacts.

**Malta:** It is necessary to analyze regional and attained capacity to cope. The aforementioned complexities form the main barriers in addressing the vulnerabilities to drought.

**Nicaragua:** Definition of indicators of hydrological drought, which consider not only the natural resource but also the demands and regulation of the resource. Plans and protocols based on these indicators contemplate the necessary management measures to reduce the conditions associated with the shortage of water.

**Guinea:** The low importance of resources (material and financial) devoted to the fight against Desertification, drought, sustainable land management and natural disasters. The low level of institutional and technical capacity building of the actors involved in the analysis, interpretation and use of climatic, hydrological, agro-meteorological. The low level of training of actors in research techniques and the popularization of improved agricultural and early market gardening seeds with a short cycle; data and the early warning system.
Kenya: The barrier of access to information provided by the early warning systems about impending threats and the ability of government to act to reduce those threats. Limited technical knowledge on meteorological information at the local level for helping farmers cope with increasingly unpredictable weather conditions. Limited research for the supply of information for application in deriving homegrown approaches for drought management. The EWS is supposed to trigger support for the communities upon a given threshold. The support is to come from National Drought and Disaster contingency fund that is not very effective. Limited technologies to harness scarce and renewable resources like water, solar energy and wind.

Panama: Limited actions in environmental land use planning plans, addressing issues in the short term and responding to emergencies.

South Africa: Infrastructure maintenance/ vandalism, Inadequate capacity (technical capacity), Education and Awareness on drought.

Sudan: limited human and institutional capacities.

Togo: Most programs/projects have not integrated the improvement of technical skills related to drought control into their programming. A significant capacity-building component should therefore be foreseen, particularly in the area of mitigation measures for the effects of climate change and the impacts of drought.

Zimbabwe: Absence of water efficiency technology for all irrigated land, and absence of appropriate technology for fodder production.

4.3 The Actual Challenges

At this point it is necessary to define challenges and barriers, bringing definitions according to The Merriam-Webster dictionary. A barrier is an obstacle or anything that prevents movement or access, or something material that blocks passage. Barriers by
definition mean something that places a restraint or limitation on the amount of progress that can be achieved. It can be a natural formation or structure that prevents or hinders movement or action. A barrier is not exactly what needs to be done but what is the obstacle in the way to what needs to be done. The barriers are identified in section 4.3, and those are the issues with institutions, or lack of resources, capacities and knowledge.

A challenge, on the other hand, is ‘something that by its nature or character serves as a call to battle or special effort’. defines it as a stimulating task or problem, or a summons that is often threatening, provocative, stimulating, or inciting. So, this 4.4 section refers to the actual challenges. The barriers stand in the way to tackle these big challenges.

4.3.1 Increasing Production in Spite of the Vulnerabilities

Given the context, these countries are in, and their intrinsic vulnerabilities to drought, the biggest challenge is to maintain or to increase the production of food for a continually growing population, in spite of the conditions that make them vulnerable. That means both agricultural and livestock production.

Eritrea rightly defined that one of the main challenges in crop production and livestock. The challenge, taken from the response of Eritrea, in terms of crop production comprises several aspects: (i) to solve the “shortage of inputs; (ii) introduce more improved varieties and manage the multiplication of seeds; (ii) to reduce losses in harvesting vegetables that sometimes need cold storage facilities; insects pests and diseases affect the productivity of crops.

In terms of the challenge in addressing the vulnerabilities to drought in the livestock sector, taken also from the response by Eritrea, includes: (i) “shortages of animal feed; (ii) manage land to grow fodder; (iii) supply the capital; (iv) build more skills” among producers; (v) Implement vaccination and treatment of animal diseases. There are specific needs according to the type of livestock. “Poultry production suffers from a
shortage of feed and diseases”. “In honey production, the challenge consists of the following: (i) have an adequate supply of modern beehives and bee colonies; (ii) reduce the adverse effects on the use of pesticides and herbicides; and (iii) provide funding to operate the queen rearing centers”.

Somewhat hidden in livestock rearing and production is the issue of the water footprint of meat production. Animal products generally have a much larger water footprint per calorific value than crop products (Mekonnen & Hoekstra, 2012). And not only is the water footprint a factor to analyze, but also the land footprint. These footprints have been seen to increase in Kenya in all production systems due to the predominance of indirect use of water to support forage production (Bosire, J. O., Krol, de Leeuw, & Hoekstra, 2015).

4.3.2 Moving from a Reactive to a Proactive Approach

Several countries place with pinpoint accuracy the focus on the challenge of changing from a reactive to a proactive approach in drought risk management and to drought issues in general. The need for this paradigm shift cannot be overstated.

**Bosnia & Herzegovina** made a call of this challenge, saying one of the challenges is that there is “a reactive rather than a proactive approach.”

**Botswana** referred to the “lack of effective approaches/methods for early drought assessment for use at the local level to enable proactive drought management”.

**Hungary** kind of justified that there is a reactive approach because “in many cases, the approach of drought management is still reactive, due to the characteristics of droughts, since they have a slow onset, a creeping nature, and are difficult to estimate the exact impacts.

**Kenya** said that the country continued to take a reactive, crisis management approach rather than an anticipatory and preventive risk management approach
**Macedonia:** Drought management “practices are reactive and, therefore, only treat the symptoms (impacts) of drought rather than the underlying causes for the vulnerabilities associated with impacts”.

**Malta** argued that in order “to ensure proactive and inclusive drought risk mitigation, multiscale, systemic approaches to drought vulnerability and risk assessment should be further reinforced on a global level”. Furthermore, Malta also stated that “proactive policies and planning based on vulnerability and risk assessments, though, can reduce drought risk before the worst impacts occur”.

**Montenegro** attributed to the absence of a proactive approach to the slow or late “reactions” when drought impacts are already being felt.

**Serbia** said there has been a “shift from reactive to a proactive approach in the management of natural hazards” but mainly driven by and focused on floods, “leading to the situation that in case of other hazards, such as drought, the whole process is still, to some extent, undeveloped”.

### 4.3.3 Sustainability of Drought Monitoring and Improving Forecasts

Many of the countries made reference to drought monitoring, drought early warning systems and drought forecast, not only in this question three but also in other questions. While investments have been done in establishing such monitoring systems, the truth is that the very expensive technology is made a waste due to vandalism and poor maintenance as a result of budget cuts. The national meteorological services (NMS) and the national hydrological Service (NHS) are continual in tackling this challenge, at the same time they face obstacles like poor financing, lack of human and material resources, as well as knowledge gaps between the wealthy economies where the technology is generated and produced and the countries with “febrile” economies.
These are the comments by the countries on this challenge:

**Angola:** There is a lack of technology used in” forecasting and monitoring, and weather and hydrological stations to monitor… and assess the onset of drought”. There is a need for material resources to conduct regular work properly, including monitoring and emergency response.

**Belarus:** proposed the development of modern drought monitoring systems, “including the use of ground-based agrometeorological observations and satellite information and allowing to forecast the onset of droughts and the occurrence, intensity, duration of drought and the magnitude of a possible decrease in crop yields.”

**Bosnia & Herzegovina:** there is a “shortage of drought monitoring system”.

**Botswana:** There is a need to have the “downscaling of early warning outputs or reports to the end-users such as farmers, water managers in simple language and in a timely manner”.

**Cambodia:** “Drought early warning tools need to be developed in a more responsive and efficient way”.

**China:** speaking from its perspective of a bigger and more developed country with a vast amount of territory, argues that the most important to reduce drought vulnerability is improving “the accuracy of long-term climate forecasts, such as climate forecasts for the next 5, 10, and 50 years. Only based on accurate long-term forecast results can we adjust the industrial structure, change crop planting methods and types, adjust the global commodity supply chain, formulate ecological environmental protection measures, and develop a reasonable urban layout”.

**Ivory Coast:** listed “Drought monitoring mechanism” as a challenge.

**Ecuador:** pointed out that "it is necessary to identify the sustainability mechanisms for drought early warning, “whose administration and maintenance is through governments
sub-national and institutions in the territory”. This country also advocating for regional networks, like the South American observatories of degradation of soils, floods and drought.

**Guinea:** says the institutional and technical capacities are low in the “analysis, interpretation and use of climatic, hydrological, agro-meteorological data and the early warning system.”

**Kenya:** The barrier of access to information provided by the early warning systems about impending threats and the ability of government to act to reduce those threats.

**Kyrgyzstan:** “Underestimation of the danger of drought, hence the slow deployment of early warning measures for drought.”

**Macedonia:** There are constraints in the early warning information system.

**Mali** highlighted the current weakness of the agrometeorological and hydrological data collection network. Mali commented on the importance to build capacities in the agrometeorological and hydrological data collection networks, and improving the structures providing data and information required for forecasting, monitoring, and warning.

**Montenegro:** several institutions in charge of drought monitoring, and “the main obstacle is that there is no clear inter-institutional scheme of responsibilities and determined communication flow”.

**South Africa:** Improving local capacity in managing and monitoring water schemes, incapacitated drought warning systems, and the national monitoring network needs to be rehabilitated.

**Uzbekistan:** pointed out these two needs (i) strengthening and expanding the hydrometeorological monitoring system; (ii) providing early information.
Countries see barriers in attempting to develop drought early warning systems. The response by Macedonia brings into this in perspective by citing two publications: (Pulwarty & Verdin, 2013) and (Monnik, 2000). “The main constraints on early warning information system implementation include:

- Lack of a national and regional drought policy framework;
- Limited coordination between institutions that provide different types of drought early warning, risk management and risk reduction, that results from a national policy; and
- Inadequate social impact indicators to form part of a comprehensive early warning system and inform policy response.”

[This points to lack of knowledge or undeveloped body of knowledge]

4.3.4 Improved Drought Vulnerability Assessments

Drought vulnerability assessment (DVA) needs to be either implemented in several countries where it is not yet available and/or improved where there are already some DVA studies carried out. The enhancements in DVA proposed by the countries that participated in the survey center around making DVAs more comprehensive and holistic in the approach, by including environmental and socioeconomic factors. Put in words of one of the NFP the goal would be to achieve multiscale, multilevel, multisector drought vulnerability assessment.

These are the comments by the countries: **Angola**: “Existence of an information deficit that makes the framing and assessment of (drought) situations critical”.

**Botswana**: This country points out two issues. One is the “Lack of simple but effective approaches/methods for early drought assessment for use at the local level to enable proactive drought management”. The second statement indicates that one barrier is the lack of “Institutional and technical capacity for drought assessment and management”.


China: Says that “there are differences in perceptions of vulnerability; and that “different industries or regions have completely different understandings of it”, which “will lead to completely different or even opposite assessment results of vulnerability. A unified understanding is needed of vulnerability for a specific and specific industry or region.

Ghana: Says one of the challenges is the “availability of suitable drought assessment tools.”

Greece is in favor of integrating climate risk in agriculture, water management, and insurance policies is the main challenge in addressing the vulnerabilities to drought.

Macedonia: here are “various definitions, methodologies for assessment”; and that the “challenge is to separately estimate groups of factors that define various aspects of vulnerability to drought - natural, (geophysical, climatological, environmental factors, and also the inclusion of socioeconomic factors (for example-managerial skills of the population/stakeholders/agriculture) to finally estimate overall vulnerability and to provide efficient risk management”.

Malta calls for “global economic assessments often still fail to connect to holistic consideration of vulnerability at a local scale”. Malta’s response was extensive in commenting about “drought vulnerability assessment needs to be assessed through a multidisciplinary/multilevel approach, as it is linked to geological, climatical, agro socio-economical and biophysical factors. Moreover, such assessment needs to be done at different levels, starting from micro (village-communities) to meso (state-district-country) and macro levels (region/country).

To realize drought vulnerability and understand the impacts at the aforementioned levels, it is necessary to explore the knowledge or information of these regions and estimate the direct and indirect consequences that contribute to vulnerability. Furthermore, it is necessary to analyze regional and attained capacity to cope”. This kind of proactive and inclusive global drought vulnerability assessment approach could strengthen the capacities of responsible agencies in drought-affected countries to apply the available methods to vulnerability assessments of the most vulnerable communities. Malta
continued to call for the coordinated international process is needed to ensure that the available methods for drought vulnerability assessment are systematically applied, coordinated and improved, to achieve a thorough global understanding”.

**Mali:** to integrate benchmarks, indicators and traditional knowledge (local knowledge and know-how) in the process of managing natural disaster issues, in particular, drought and to combine this with extension work on technologies developed in the context of adaptation and/or mitigation of the effects of climate change, especially drought.

**South Africa:** Such data could feed into nationally relevant and validated risk indices and early warning systems.

**Uzbekistan:** specialized services for monitoring and assessing drought risks.

### 4.3.5 Challenge of Inclusion and Participation: plus the Gender issues

The statement by UNCCD Executive Secretary for this 2021-year International Women's Day calls for “equal future for women” 38, which means an equal access to land, and security of land tenure. In view of international support for women in the last decade, awareness of the inclusion of women seems to be well drilled in the minds of the survey participants that responded to the survey.

The challenge goes beyond just considering women. It is having more inclusion and participation in general, of communities, population groups, and stakeholders. The comments but the countries are these:

**Burkina Faso:** Points to the “poverty of the rural population, in particular, that specific to women who constitute the most affected and stable layer”.

**Congo:** There is “non-involvement of rural women in the management of natural resources”.

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**Ivory Coast:** said there is the challenge of poorly consideration of gender in the different strategies, and that there is “insufficient participation”.

**Ghana:** Proposes to bring the communities along as partners, is important or the sustainability of any drought-related project.

**Mali:** “the low level of representation of women in decision-making bodies and the poor consideration of gender in the design and implementation of projects and programs on drought”.

**Togo:** “The low involvement of women: Women play an essential role in several sectors of activity, notably forestry, throughout the production process (weeding, sowing, harvesting, transport, storage) and in food security (processing and marketing of products). Despite the significant contribution of women to agricultural production, they only derive 10% of the cash income derived from the fruit of their labor (National Population Policy Document, 1998.). Despite the improvement of the political and strategic framework relating to the consideration of women’s concerns in development decisions and actions, much remains to be done”.

**South Africa:** In a critique to the current state of affairs among organizations and the general approach, South Africa calls for more attention to vulnerable communities and the more affected, in particular to women in rural communities/areas. South Africa also added that there is a lack of participation by private business”.

**Togo:** Says there is “weak support to civil society organizations in drought management: Numerous civil society organizations (CSOs) and NGOs”. Togo proposes the representation of “grassroots communities, which are the community organizations of peasant organizations, associations/groups of women and young people”. In relation to women, there is still “low involvement of women, who “play a role lay an essential role” in production in several sectors and in food security”.
Venezuela: is working in the creation of articulation spaces for the preventive management of drought and mitigation of its impacts, and to increase the knowledge of drought and its impacts.

5. POLICIES TO COPE WITH DROUGHT

5.1 Summary report on Section 4: Policies to cope with Drought

Question #4 of the survey (What are the policies or practical measures undertaken recently to cope with drought in your country?) aimed at identifying eventual policies, frameworks and national strategies in place in the different countries as tools to cope with drought. The main scope of the survey was to evaluate the relevance of existing plans, assess gaps and challenges, identify effective cross-sectoral policy instruments, and map drought-relevant measures eventually embedded into broader programs.

A total of 36 countries and 5 CSOs from 4 continents responded to the question, as per list and table below:

Table 12: Countries and CSO that participated in the survey

<table>
<thead>
<tr>
<th>Countries</th>
<th>CSO</th>
</tr>
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<tbody>
<tr>
<td>Algeria, Angola, BiH, Botswana, Burkina Faso, Cambodia, CAR, Chad, China, Ivory Coast, Ecuador, El Salvador, Eritrea, Ghana, Greece, Guinea, Hungary, Kenya, Macedonia, Mali, Malta, Montenegro, Myanmar, Nigeria, Panama, South Africa, Spain, Sudan, Suriname, Swaziland, Togo, Turkey, Ukraine, Uzbekistan, Venezuela and Zimbabwe</td>
<td>Action Lever-Congo, CSO-Italy, SAF-TESO-Uganda, Saro-Mali, Grameen Vikas Samiti- India</td>
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<tr>
<td>Continent</td>
<td>Number</td>
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<tr>
<td>---------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>Africa</td>
<td>21</td>
</tr>
<tr>
<td>Asia</td>
<td>5</td>
</tr>
<tr>
<td>Western/Eastern Europe</td>
<td>10</td>
</tr>
<tr>
<td>South America (LAC)</td>
<td>5</td>
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</tbody>
</table>

The majority of feedback received, around 68%, were comprehensive or quite comprehensive, thus showing a significant level of commitment of interviewees to the topic and the recognition of a need for more effective policy measures, to be developed under the Convention. As for the relevance of received responses, around 58% of them resulted in line with the survey and provided a good overview, and in some cases, detailed indications, on the different instruments applied in the countries.

These figures, however, should be read together with the percentages that show the state of the art, which represents the number of interviewed countries with legislations already in place. As summarized in the below table, the number of countries with policies in place among respondents is quite low, according to the information provided by the NFP through the survey, and their relevance even lower. Moreover, among those who have indicated reference to existing policies, the largest majority also states the lack of recent and updated instruments.
Table 14: Number of countries with policies in place

<table>
<thead>
<tr>
<th></th>
<th>Policy in place (%)</th>
<th>Relevance of policies (%)</th>
<th>Recent (last 5 years) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>39</td>
<td>34</td>
<td>27</td>
</tr>
<tr>
<td>No</td>
<td>61</td>
<td>66</td>
<td>73</td>
</tr>
</tbody>
</table>

The impact of drought and the need to reduce the vulnerability of affected livelihoods is largely acknowledged by analyzed countries and drought management provisions are included in national policies in the vast majority of cases. Although only in a minor number of cases they are already formulated through dedicated strategies and plans (Botswana, Burkina Faso, Ghana, Mali, Montenegro, Panama, Spain, Togo), in a number of countries specific policies are currently under development (Central Africa Republic, China, Guinea, Malta, Swaziland, Venezuela). The key elements of developed and under-development plans generally follow the latest international approaches and display policies along main pillars such as predictions and early warning, preparation and mitigation, information dissemination, awareness and capacity building.

The majority of countries, in spite of acknowledging the growing phenomenon in respective territories, defines drought management and DRR measures through sectoral policies and law provisions. The case of Montenegro, where the National Drought Plan was developed with the support of UNCCD and set off a coordinated consultation process with relevant national stakeholders, could represent a best practice for developing integrated national plans based on existing data, project results and relevant legislation, as well as effective practical measures and applications (i.e. the Drought Watch Tool).

On a different term, the case of Turkey represents a specific model, as no national plan/program on drought is reported, but the General Directorate of Water Management (SYGM) is responsible for the preparation of watershed drought frameworks that include
monitoring, vulnerability assessments and future projects. In the planning, these regional studies will feed into the overall report for the country. Spain, indeed, adopted a similar approach and each river basin district is mandated to have Special Drought Plans, accounted for into the National Action Programme to Combat Desertification.

The lack of strategic national drought plans, it should be highlighted, is rarely the result of a lack of understanding or underestimation of the drought phenomenon (only Chad explicitly mentions a need for increased acknowledgment and poor mastering by institutional officials of drought). Rather, it is the plethora of law provisions in place and authorities in charge that increases the difficulty to establish effective coordination mechanisms and, ultimately, hampers national efforts to develop successful policies. In this respect, Ivory Coast proposes a three-level institutional structure, with a Steering Committee bringing together relevant ministries and responsible for the development of the National Strategic Plan (PNS); a Permanent Executive Secretariat, to ensure monitoring, control and implementation of the PNS; and a Drought Working Group to coordinate relevant government structures and non-governmental organizations and act as consultation center for prevention, response and recovery actions. Similar governance settings could be tailored to national contexts and promoted in those countries with similar challenges, in order to reduce the eventual overlapping of responsibilities and policies and facilitate the establishment of coordination mechanisms.

5.2 Policies and Policy Measures to cope with Drought

The survey proved an overview of the existing policies measures adopted in the countries and showed a number of different tools, from locally tailored interventions, often built on the experience of implemented projects (e.g. the project in the Cuvelai River basin in Angola), to national strategies, in some cases developed as outcomes of subscribed international frameworks (e.g. B&H and Montenegro, who started preparation of national drought plans as part of the UNCCD Drought Initiative).
The table below considers these different approaches and summarizes them to provide a more detailed overview. It should be noted that in the summary table above not all of these measures have been included as some of them do not appear integrated into comprehensive national strategies, but rather on-spot interventions, thus do not reflect the existence of relevant policy measures for drought management. Nevertheless, they are reported below to indicate showcases that could be potentially scaled out and eventually framed into more consistent national policies.

*Table 15: Interlinked approach to drought policy measures across Rio Conventions*

<table>
<thead>
<tr>
<th></th>
<th>Local interventions</th>
<th>Plans of action (National/Local)</th>
<th>Policy measures embedded</th>
<th>Drought dedicated national strategies</th>
<th>International Agreement subscribed</th>
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<tbody>
<tr>
<td>Algeria</td>
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<td>Angola</td>
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<td>X</td>
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<tr>
<td>Botswana</td>
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<td>X</td>
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<td>Burkina Faso</td>
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<td>Cambodia</td>
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<td>CAR</td>
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<td>Chad</td>
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<td>China</td>
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89
<table>
<thead>
<tr>
<th>Country</th>
<th>Local interventions</th>
<th>Plans of action (National/Local)</th>
<th>Policy measures embedded</th>
<th>Drought dedicated national strategies</th>
<th>International Agreement subscribed</th>
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<td>Ivory Coast</td>
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<td>El Salvador</td>
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<td>Eritrea</td>
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<td>Ghana</td>
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<td>Greece</td>
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<td>Guinea</td>
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<td>Hungary</td>
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<td>Kenya</td>
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<td>Macedonia</td>
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<td>Mali</td>
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<td>Malta</td>
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<td>Montenegro</td>
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<tr>
<td>Myanmar</td>
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<tr>
<td>Nicaragua</td>
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<td>X</td>
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</tbody>
</table>
It should be noted that in those cases where specific national strategies are missing, drought-coping measures are often nested within climate change adaptation policies,
generally formulated under the Paris Agreement, and/or are identified as part of complementary legislation (agriculture, forestry, land and water management). Commonly, they are framed within broader visions and frameworks for the fulfillment of the Sustainable Development Goals (SDGs). It is the case, for instance, of BHi, whereby drought instances are tackled through environmental and land degradation legislations, with reactive, rather than proactive approaches. As well as it is the case of Ecuador, which recognizes drought as an increasingly recurring natural phenomenon resulting from climate change and accordingly promotes the development of a National Strategy of Climate Change for 8 sectors, each of them including strategic lines to face drought. Similarly, Greece adopted 2016 the National Adaptation Strategy (NAS) that suggests potential adaptation actions for all environmental and socio-economic sectors likely to be significantly affected by climate change. With regard to droughts, the NAS suggests measures to increase the climate resilience of agriculture and water resources.

With regards to the policy measures most commonly undertaken to cope with drought, as mentioned earlier, they often fall within sectoral policies. Agriculture-related interventions to cope with drought in Eritrea, for instance, promote the improvement of water productivity and soil fertility, the implementation of water harvesting and conservation approaches, as well as the enhancing of livestock, pasture and health management and the employment of drought-resistant crops. In addition to these, Kenya also established a common approach for disease control, vaccination and deworming, to develop local livestock markets and protect pasture using traditional rules and range management approaches. In a water-scarce context as Nigeria, the promotion of sustainable water supplies and utilization of resources in dryland areas and wetlands is adopted as a drought management measure. Coastal protection through nature-based solutions, such as mangrove planting, is being applied in Suriname, while Uzbekistan is working towards the improvement of land use efficiency, reclamation of irrigated lands, and modernization of irrigation infrastructures. Crop contingency plans are amongst the practical measures implement by the Government of India to promote immediate relief to farmers, also through the provision of diesel and enhanced seed subsidies, the establishment of a State
Disaster Management Fund, and the implementation of additional fodder development schemes. Raising awareness, finally, is indicated as key policy measures by a number of countries, such as Zimbabwe, Ivory Coast, India and Eritrea.

The range of drought management solutions reported by Civil Society Organizations (CSOs) typically are identified within national frameworks and policies. Nevertheless, in those countries where strategic measures to control and prevent drought are not yet established, CSOs are promoting solutions at local and district levels to reduce the effects of climate change on affected populations and territories. A local NGO in South Kivu, Congo, is setting up a reforestation program to develop a total of 1,000 hectares, and a training program on the construction of improved stoves to reduce deforestation. The reforestation program takes into account the creation of a corridor of artificial forests and develops cultivable land by anti-erosion devices, accompanied by the technique of fertilizing fields with compost. In Mali, the Great Green Wall Initiative is the driver of drought-related interventions implemented by CSOs, as in the case of the implementation of the FLEUVE project (Local Environmental Front for a Green Union). The support of the international community could highly improve the results achieved by CSOs, particularly in those countries, such as Uganda, where these actors are committed to international agendas for drought management and promote climate change mitigation actions to empower rural communities and reduce drought effects.

5.3 Case studies: drought policy tools

In the framework of the DriDanube project, Montenegro developed the Drought Watch Tool (www.droughtwatch.eu), an open interactive web application that offers an insight into the development of drought conditions across the Danube region. The application gives a spatial and temporal view of the state of soil moisture and vegetation through various drought-related datasets: remote sensing products, modeled indices and static
products at the regional and national levels. It combines data from the satellites, meteorological stations and drought impact reports into ready-to-use drought information available to the public through a web-browser interface. Drought Watch is an innovative and interactive tool that enables more accurate and efficient drought monitoring and early warning for the entire Danube region. It offers diverse functionalities and displays various drought-related datasets. Drought indices in the tool are updated daily, weekly, or every 10 days. This way, they enable a harmonized view of changing drought conditions in near-real-time across the entire region. Results and data from Drought Watch Tool are used by IHMS.

In Italy, the institutional responsible body for water resources management is the High Institute for Environmental Protection and Research (Istituto Superiore per la Protezione e Ricerca Ambientale - ISPRA - [https://www.isprambiente.gov.it/it](https://www.isprambiente.gov.it/it)). In order to respond to the mandate of the EU Commission on drought and water scarcity, the institute developed a guideline on drought indicators, to be applied by the established permanent drought observatories: [https://www.isprambiente.gov.it/pre_meteo/ldro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WP1_con%20copertina_ec.pdf](https://www.isprambiente.gov.it/pre_meteo/ldro/Osservatori/Linee%20Guida%20Pubblicazione%20Finale%20L6WP1_con%20copertina_ec.pdf). The aim of the document is the definition of relevant indicators for the monitoring of drought events and of hydrological drought conditions, and it contains a protocol on the indicators to be adopted in each local observatory. As a result, the application of the indicators in the different hydrological districts can provide a homogeneous picture of drought conditions at the national scale.

### 5.3 Discussion

According to the feedback received through the survey, the number of countries with national drought policies in place is quite low (38%), and their relevance even lower (34%). Although these figures could be further investigated as they may have been only partially reported by NFPs due to different interpretations, the need to increase countries’
efforts towards the elaboration and implementation of comprehensive policy instruments on drought is evident. The international community and dedicated initiatives are best placed to increase awareness, develop capacities and, ultimately, support countries reaching this goal.

We have identified a range of regional platforms and policy frameworks that are helpful to countries to improve DVAs, and policies to reduce vulnerability.

In those countries where national measures are missing, however, the approach to be promoted should not necessarily be top-down, as there may be space, as it appears from the surveys’ reply, for the scaling-up of local and regional initiatives. Building on existing experiences, local interventions should be further investigated to evaluate their relevance and effectiveness at a larger scale, and, in such cases, could be considered as reference tools for the elaboration of national measures.

Additionally, a thorough policy mapping of sectoral policies may prove highly beneficial for countries where national strategies are not in place, in order to acquire a clearer and more comprehensive picture of available law provisions and define policy gaps and challenges. While some of the survey’s replies well-identified institutional responsibilities at the national level, the large majority of respondents highlighted the existence of scattered policy measures with potential relevance for the drought sector. The process of elaboration of national strategies would be significantly facilitated, and made more effective, if built on the full awareness of policies already in place, in order to avoid unnecessary overlaps and define drought-specific measures at the national level.
6. CONCLUSION

6.1 Drought Vulnerability Assessment

Many countries have done drought vulnerability assessments, but many others still need to do theirs. There is plenty of information found in the literature that attests to the fact that DVA studies have been done in many countries. There good case stories of some countries that even have online platforms to estimate drought vulnerability and display maps that show the more vulnerable areas.

A confusion persistent in many places is the proper understanding of the concepts of vulnerability and risk, which are not the same but are found often to be ‘equated” as if they were. The other difference that is important to distinguish, as seen in the responses of the countries, is that by assessment many countries are meaning the “evaluation of current situation” of a drought. That seems to apply more to drought monitoring and impact-based warning systems. The more accepted concept is that a drought vulnerability assessment is an evaluation of what the “average” situation is in terms of drought occurrences and where it is having more effects. The two concepts are that DVA would need to be varying in time, just as there is a spatial variation to it.

The fact that there are many methodologies that differ between themselves and that result in different results of the assessment, can explain also why there is not a unified understanding on the concept. Ideally, having a unified methodology would allow comparisons to be made of the assessment of the drought situation in different countries or regions within the same country. For Global analysis, the Global Drought Observatory is consistent within itself, and this does allow comparing vulnerabilities in different countries.
But eventually, even with different methods, the important thing is to see in the vulnerability assessment which are the territories deemed more vulnerable than others using one particular method.

The agricultural sector has taken the lead in drought assessments. It is also needed and sometimes done in other sectors, like the tourism sector which could be vital to a given country’s economic development. DVA should be multisectoral.

The challenge, in general, is to be able to have more holistic DVA, which are multisectoral, multi-industry, multilevel, multifactor, multiscale.

By multilevel it is meant that DVA can be done at continental, regional, national, provincial, and even community level. Some countries suggest doing DVA studies at different levels, starting from micro (village-communities) to meso (state-district-country) and macro levels (region/country).

By multifactor drought vulnerability assessments, it is meant that groups of factors need to be considered in the analysis which would include natural factors, like geophysical, climatological, environmental factors. But it should also include socioeconomic factors to finally estimate overall vulnerability. These two questions to be dealt with, one is which indicators to be used for exposure and which to consider for sensitivity for instance. The other point is which weight is to be given to each factor. Those questions can be tackled in research studies.

Since many factors need to be considered DVA studies should involve multidisciplinary teams with different expertise. But also it should be done in a participatory process with the presence of stakeholders, key players and even communities. A bottom-up participatory and inclusive approach can produce more consensus in the final results, as well as more confidence in those results.

Finally, some of the countries attribute the deficiencies of the absence of DVA studies to the lack of knowledge and know-how, and the low level of capacity of the institutions. This calls for more efforts on capacity-building and more research. International/regional organizations and research centers can collaborate with countries where those capacities
are not currently in place. Some of the countries ask for stronger support for research and development projects, and the international community can play a key role.

The CoP Decision called for outreach to the UN Regional Economic Commissions. They could play a greater role in DVA and strengthening proactive policies for drought preparedness.

6.2 Reducing drought impact and vulnerability

The countries indicated that the major needs to reduce drought vulnerability:

**Drought Monitoring and Forecast:** Establishment of reliable Drought Monitoring Systems and Early Warning Systems, capable to provide timely warnings about actual drought status in real-time. Improvement of the hydro-meteorological monitoring network and forecasting capacity; and strengthening the existing dissemination/response system in the affected areas by drought. Regional platforms are already helping with this.

**Drought vulnerability assessments:** Drought vulnerability assessments (DVA) and impact assessments, should be improved, conducted more often and need to consider all sectors of the economy and not only in the water supply and agriculture. Impacts on the health sector should be evaluated also and the nutrition status of the affected populations. Loses and damage databases need to be developed to provide information for the assessment process, especially for indicators to be used in the components of vulnerability. Case studies, and typologies are also useful, in case databases are not developed. Direct and indirect impacts must be taken into account. Regional platforms could do much more to help with this.

**Planning tools:** Development of a National Drought Plan, provincial Plans for Climate Change Adaptation; Integrated Climate Change Adaptation Plan; Provincial Plan to Combat Desertification; Contingency Plan for the management of droughts, Connect Land Use Planning and Drought Management. Drought risk management strategy and
action plan. Make better use of agroecological maps and hydrological models to integrate water footprint assessments? Use mobile technologies and online platforms to increase land and water user inputs to shaping and informing these tools.

**Drought Management:** Establishment of proactive instead of reactive response on drought, with communication protocols related to drought. Identification of the most vulnerable regions inside of the country. Improving institutional arrangement for drought management; Determine protocol for drought budget. Sectoral institutionalization of drought management at sector level in a proactive manner.

**Capacity building** was identified as a key need for institutions that monitor or manage or respond to droughts. (1) for better Drought Monitoring and Early Warning; (2) for improved Drought Vulnerability Assessment; (3) for better Drought Management; (4) for Research; and (5) to have more skilled human resources.

**Legal and institutional frameworks:** Countries need an adequate institutional framework to be able to develop policies, plans, programs and projects. Recommendations are: (1) Inventory of sectorial laws, (2) more coherence in legislation; and (3) having the appropriate legal instruments.

**Other needs are:** (1) Financial resources, (2) Policies; (3) Infrastructure, and (4) community participation.

**Drought risk mitigation measures:** Water harvesting, protecting water sources against contamination, developing water sources (micro dams, ponds and wells, use of reserve sources of groundwater and water rationing/allocation). Restoring pastures and balancing land and water resources. Recovering the water holding capacity of soils through tree planting (including fruit trees) and the protection of riverbanks and wetlands. Implementing Integrated Water Resources Management (IWRM), such as mitigating upstream-downstream user conflicts and coordinating between water users, communities and sectors. Enhancing irrigation schemes. Diversifying rural livelihoods through social protection, cash-transfer programs or improving access to markets and rural services: Access to markets could help create alternative non-farm employment that could reduce
the impacts of droughts. Crop insurance. Shifting to drought-tolerant crops. Managing livestock production within the landscape, including the relocation of herds, nomadic migrations and use of special reserved areas. Finance actions oriented to water efficiency. Investing in water saving. Temporary measures are undertaken of finding new sources of water like the rehabilitation of existing boreholes and the drilling of wells; Promote reforestation on a large scale and in major cities of the country.

**Infrastructure:** Construction of agricultural and pastoral hydraulic infrastructures; construction of hydraulic infrastructure (modern boreholes and wells).

The countries are implementing many actions to reduce drought impacts which can be classified in different ways. There is four classical way to define and group the different measures, and the four apply to describe the actions described by the countries in their response:

1. Structural measures and non-structural measures, which stem from the classical engineering view of water resources development;
2. Measures to increase water supply and measure to manage water demands; which stem from the classical integrated water resources management;
3. Mitigation and adaption measures, which is the climate change point of view.
4. Preparedness, mitigation and response measures, which come from the Disaster and Risk Management field

Most of the structural measures aimed at increasing the water supply or availability of water. This includes all forms of hydraulic infrastructure such as dams and reservoirs; ponds and artificial lagoons; construction of agricultural and pastoral hydraulic infrastructures; construction of hydraulic infrastructure (modern boreholes and wells); Storage tanks for municipalities. Adaptation measures, non-structural measures and managing water demand seem to go hand in hand, although are not the same.

Measures to reduce or manage the demand for water. This includes measures such as reduction of leaks in the distribution network; Installation of macro and micrometers; imposing water rates/tariffs to incentivize the rational use of water; installation of efficient
sanitary facilities; educational campaigns for the population. Reusing water; rain harvesting is part of this but was not mentioned by the countries that responded.

One area that needs a lot of improvement in the countries is institutional strengthening. These include measures aimed at achieving improvements in the legal and institutional framework. This includes drought planning and the drought policy framework.

Drought management measures were the most commented category among the needs to reduce drought impact and vulnerability. Comprehensive measures are needed to reduce the impact of droughts on the environment, and these measures also contribute to attaining water security.

<table>
<thead>
<tr>
<th>Type</th>
<th>Infrastructural measures</th>
<th>Non-structural measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures oriented towards augmentation of water supply</td>
<td>irrigation canals, medium to large dams and reservoirs, lagoons, boreholes and the drilling of wells</td>
<td>Water harvesting, protection of water sources, Watershed management</td>
</tr>
<tr>
<td>Water demand management measures, and water demand reduction</td>
<td>Improving efficiency by rehabilitation of canals linings and revetments, sprinkler irrigation; converting to pressurized irrigation systems</td>
<td>Banning water-intensive crops in some regions; Reuse of water from drainage collectors for irrigation, Smart irrigation practices; Water rationing/allocation; Reduce water limits during the growing season</td>
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</tbody>
</table>
**Table 17: Drought management measures from the point of view of climate change**

<table>
<thead>
<tr>
<th>Type</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land use and watershed management (mitigation measures)</td>
<td>Reforestation, sustainable management of forest and wildlife ecosystems; Restoration programs of degraded lands, forest and pastoral restoration, land management practices and improved land use/land cover management; improving landscape; Recovering the water holding capacity of soils through tree planting (including fruit trees) and the protection of riverbanks and wetlands; Integrated Water Resources Management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adaptation measures</th>
<th>Crop insurance; Shifting to drought-tolerant crops; relocation of herds, nomadic migrations and use of special reserved areas; Diversifying rural livelihoods through social protection, cash-transfer programs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Improving access to markets and rural services; Secure and maintain food grain stocks; protected drinking water; Water supplements for livestock; Irrigation supports for subsistence agriculture; Agriculture-based services; farm input subsidies; Maintain strategic food reserves at the national level</td>
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<tr>
<td></td>
<td>Training Communities; Education and awareness-raising</td>
</tr>
</tbody>
</table>

**Table 18: Drought management measures from the point of view of Disaster Risk Management**

<table>
<thead>
<tr>
<th>Type</th>
<th>Measures</th>
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</thead>
<tbody>
<tr>
<td>Preparedness</td>
<td>Drought monitoring and early warnings systems; Drought Vulnerability assessments; Drought planning, policies, and strategy; Capacity building; Institutional strengthening, legal frameworks</td>
</tr>
<tr>
<td>Mitigation</td>
<td>Water storage, food reserves, infrastructure; Augment water supply, water demand management and water reduction</td>
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</tbody>
</table>
6.3 Barriers and challenges

The four barriers and the challenges identified in the survey can be put into matrix format to show how the four barriers stand in the way of the efforts to face the challenges:

<table>
<thead>
<tr>
<th>THE CHALLENGES</th>
<th>THE BARRIERS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Limited Knowledge</td>
</tr>
<tr>
<td>Increasing or maintaining production in spite of the vulnerabilities to drought and amidst the risks</td>
<td>X</td>
</tr>
<tr>
<td>Moving from a Reactive to a Proactive Approach in drought management</td>
<td>X</td>
</tr>
<tr>
<td>Sustainability of Drought Monitoring and Improving Forecasts</td>
<td>X</td>
</tr>
<tr>
<td>Multilevel, Multiscale, Multisectoral, Multi-industry, and Holistic Drought Vulnerability Assessment</td>
<td>X</td>
</tr>
<tr>
<td>Inclusion and Participation: plus the Gender issues</td>
<td></td>
</tr>
</tbody>
</table>
Increasing or maintaining production: Droughts can have environmental, economic and social impacts. The changes in the weather or climate, and in the hydrologic cycle affect water supply to population, agricultural yield and production, and hydropower generation. Some countries are more vulnerable than others, given their geographic settings and the context they are in. But they still need to survive and keep production going in spite of the vulnerabilities to drought and amidst the risks. Drought contingency planning is needed not only at the country level but also at the regional and global level.

Proactive Drought Management: Drought assessment should move from a reactive to a proactive approach, as seen in the responses of the countries. This is basically the same statement of the UNCCD. Institutional coordination is a must-have requirement, and financing is of course needed. Coordination at all levels is important. Not only at the government or national level, but also at the regional level (above), and local level (below). It is also needed among government and CSO, which means the efforts should be unified.

Sustainability of Drought Monitoring: The challenge is not only to install weather and hydrological stations but also to make the operation of the networks sustainable. Identifying the mechanisms to make them sustainable could require several types of measures. Since these networks exist for different purposes and not only for drought monitoring, finding projects with funding to renew and rehabilitate stations, is not impossible. The challenge also refers to good data quality and access to that data. And finally, the use of prediction, forecast and drought early warning is desired in all the countries.

Holistic Drought Assessment: There are definitely many definitions, concepts and methodologies of what drought vulnerability assessment is. That is evident in technical literature and in reports of DVA. It is also clear that even at the top level there seems to be no agreement on this. The IPCC has one conceptual methodology and the UNCCD has another different one. Assuming the UNCCD should be the official one to use, there is still some more work to be done as countries rightly see that drought assessment should be Multilevel, Multiscale, Multisectoral, Multi-industry, and more Holistic. Some sectors, like agriculture, have taken the lead to assess vulnerability.
**Inclusive and Participatory Approach:** Drought initiatives and plans should be conceived in a participatory approach that is inclusive and brings actors at all levels. In several countries, there is still a low representation of local groups affected by rural communities and women, in spite of policies and international attention. Key players are not only those that device the strategy and the plans but those affected by the droughts and also by the consequences of policies, plans and strategies that may not be effective. Population groups should be considered, as mentioned by the countries, are women, young people, peasants. The private sector should also be considered as they can play a key role in making viable some of the initiatives through a public-private partnership. Although it is easier said than done, drought plans should include these groups from the very start and not only at the end of the process.

**6.4 Policies to cope with drought**

There are many countries with different existing policies measures, which can be classified in the following five categories:

1. Locally tailored interventions,
2. National strategies or Plans of action (National/Local),
3. Policy measures embedded,
4. Drought dedicated national strategies, and
5. International Agreement subscribed.

Some of the policy measures for drought management are not integrated into a comprehensive national strategy. In some cases where specific national strategies are missing, drought-coping measures are often nested within climate change adaptation policies. In some cases, the drought instances are tackled through environmental and land degradation legislations, with reactive, rather than proactive approaches.

The policy measures are most commonly undertaken to cope with drought often fall within sectoral policies, such as agriculture-related interventions. There is evidence of the need
that the elaboration and implementation of comprehensive policy instruments on drought. The approach to be promoted should not necessarily be top-down, and local initiatives can be scaled up to the national and/or regional level.

6.5 Putting the full picture together

In an attempt to bring all of these findings together, a fishbone diagram, or Ishikawa diagram, has been created to illustrate the cause-and-effect situation that would explain how all the shortcomings sendup resulting in droughts till found to cause more and more impacts.

The barriers identified in the survey are present in several of the factors at the same time, and explain the following causes:

1. Unsustainable drought monitoring systems and drought early warning systems. While the technology of data collection and transmission platforms are available and while such monitoring systems have been installed in many countries, the cost and the cost of maintenance, plus the reduction of stations due to vandalism and lack of proper maintenance make the networks unsustainable

2. Lack of drought vulnerability assessments, and different understanding and concepts

3. National plans that are not integrated or whose implementation is not well coordinated,

4. Reactive and crisis-driven drought management,

5. Weak or ineffective policies.

If all the five elements are reversed towards positive status, there will be a reduction of the impacts of droughts.
6.6 Recommendations for Drought Risk Reduction at National Level

6.6.1 Drought Monitoring and Early Warning Systems

Drought as a slow onset hazard, that develops from a mild dry period and potentially to an exceptional drought. It should be categorized according international thresholds, which is adopted by several best-case examples from a D0 to a D4 drought. The progression of drought from a D0 to D4 should be linked to implementation of drought contingency plans. Drought recovery is equally important and drought recovery contingency plans should assist communities to recover after a drought.
Thresholds for the different drought classes should be standardized and different indicators should be used to monitor drought eg.

- SPI / SPEI for meteorological drought
- NDVI, PASG, VCI, Soil moisture index etc, etc for rainfed agriculture
- Water supply / Water demand ratio in to water supply region for irrigation, domestic and industrial water use
- Stream flow, dam levels and groundwater level for hydrological drought
- The above to be supported with exposure and other socio-economic vulnerability and resilience indicators

It is important to have a single drought mitigation unit at national level. Different stakeholders / departments do monitoring but data should be analyzed and communicated from a central point or agency.
6.6.2 Vulnerability and Risk Assessments

The territorial unit of assessment should be linked to socio-economic-ecological boundary instead on administrative boundaries eg catchment level (as small as possible). However, since many top decision makers might not visualize watersheds or basins, it is advisable that once calculations are made, the resulting vulnerability maps should be out in administrative divisions which they do know well, such as estates, provinces, municipalities or counties. Another good reason for using both hydrographic divisions (basins, watersheds catchments) and political-administrative divisions is that the source of data for the socioeconomic indicators is provided for political boundaries.

Groundwater recharge area for groundwater users etc. In many cases irrigation water and water for domestic use the source of water is far away and, in such cases, the meteorological and hydrological indicators at the water source area became more important.

Vulnerability assessment, capacity to deal with drought, adaptation exposure should all be included in the risk analysis. Countries mentioned limited capacity and lack of knowledge as reasons for lack of these assessments. Maybe we should emphasize the need for proper training. The knowledge is globally available, the trained staff in many countries might not be available.

Following work done in the disaster framework in South Africa, as a good case study, a distinction can be made between analysis and assessment. Analysis is the first phase namely Risk = Vulnerability/Capacity X Exposure. Assessment is taking it further with scenario development, cost benefit analysis, prioritization, acceptable risk. Only then, should assessment can be addressed. The latest drought risk assessments in South Africa, sub-categorize the vulnerability/resistance indicators in 10 categories or capital groups namely (i) Human, (ii) Social, (iii) Cultural, (iv) Economical-financial, (v) Environmental-Ecological, (vi) Infrastructure, (vii) Technology, (viii) Institutional, (ix) Organisations, (x) Political ].
6.6.3 National Drought Plans

National Drought Plan should rather be a policy that provide guidance to line departments and different sectors to complete sector specific and region-specific drought plans. These plans should focus on drought risk reduction (mitigation, prevention, preparedness) as well as response (contingency plans).

6.6.4 Policy Frameworks

In setting the policy frameworks, the recommendation is that drought should not be treated as a disaster but rather an extreme event with extreme consequences if no preparation is made for the next drought. Australia is a good example of this. This is also part of a new drought discussion in South Africa. The contingency plans and drought categorization should replace the idea of a disaster drought. Disaster is something that one cannot manage without external support. With proper planning and timely activation of contingency plans, there is no need for even an extreme drought to develop into a disaster. This is a mind-shift and should be addressed in policy.

6.6.5 Drought Risk Management Measures

Most countries have drought risk plans in place but they call it different things. In most cases it is called climate change adaptation plans, Land Care programs, extension programs etc. An analysis of many of these programs in South Africa shows that most of these programs contain strong elements of drought risk reduction in spite of the fact that drought risk reduction is not explicitly mentioned. The same as the feedback from the country surveys. The recommendation therefore is that countries identify those programs with a drought risk reduction element and use it as source to create awareness.
6.7 Conclusions

All the causes mentioned highlight limited capacity and institutional issues, followed with lack of knowledge and low financing. Limited capacity is linked to lack of knowledge and possibly lack of capital in case of structural issues.

Limited capacity that is linked to lack of knowledge can be dealt with through training programs for key staff and decision makers. Experience indicates that the politicians and decision makers also need to understand the problem and the solution. Only then will they allocate funding or act when officials or experts make recommendations. Politicians and decision makers can agree to work together to share expertise and recommendations.

Institutional issues are in many cases the result of a silo-approach where different stakeholders focus on own line functions without understanding the bigger picture. Drought management affect all sectors and drought monitoring requires inputs and data from all sectors. The need for a coordinating body (committee, commission) is essential. All key stakeholders need to be coopted on this body. In countries where drought

To have a final statement made on this report, it is appropriate at this point to remind the reader that the UNCCD understand that “most countries, regions and communities use reactive and crisis-driven approaches to manage drought risk”\(^{39}\). The UNCCD advocates for a proactive, coordinated and holistic drought risk management based on three key pillars:

1. Early warning and monitoring systems
2. Vulnerability and impact assessment and
3. Drought risk mitigation measures
These three key pillars have been considered in the question of the survey, and in this report. At the same time, it seems the country representatives have the pillars in mind as the responses addressed those pillars.

Based on the above, we have identified recommended options to:

> Improve DVA by strengthening regional platforms.
> Establishing communications and data management protocols.
> Regional and/or national programmes to provide training to local government for use of mobile technologies.
> National and regional initiatives to review and enhance available maps of vulnerability including models of water demand and availability (stress) at the watershed level (which may be within or between countries).
> Simple guides to assessment of economic risks of drought to be discussed with RECs.
> Case studies and pilot testing to be done with national governments and local governments.
REFERENCES


23 https://ecapra.org/topics/vulnerability


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38 International Women's Day 2021 | UNCCD: https://www.unccd.int/news-events/international-womens-day-2021

39 Land and Drought | UNCCD: https://www.unccd.int/issues/land-and-drought