

**Lima Adaptation Knowledge Initiative**

**Workshop on Priority Setting For North Africa Sub Region**

**19- 21 September 2017**

**Bibliotheca Alexandria**

**Workshop Report**

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## 1. Introduction

Adaptation knowledge gaps have been repeatedly identified as a barrier to widespread and successful adaptation actions. The persistence and recurrent mention of such gaps, in spite of the growing body of adaptation knowledge, suggests the need for a better alignment of the supply of and demand for adaptation knowledge, and for efforts to respond to adaptation knowledge gaps.

In support of the Nairobi work programme's evolving role as a knowledge hub on adaptation under the Convention, the Lima Adaptation Knowledge Initiative (LAKI), a collaborative effort between the Nairobi work programme under the United Nations Framework Convention on Climate Change (UNFCCC) and the UN Environment (UNEP) through its Global Adaptation Network (GAN), aims to remove knowledge barriers that impede the implementation and scaling-up of adaptation action, through an iterative process of knowledge gap prioritisation and subsequent implementation of response actions in the context of various sub regions and thematic domains (e.g. different sectors and areas of vulnerabilities).<sup>1</sup>

The LAKI was endorsed and launched by the COP 20 President as a component of a set of actions to further address adaptation to climate change under the UNFCCC. The Subsidiary Body for Scientific and Technical Advice to the UNFCCC, at its 41st session, welcomed the LAKI and encouraged its replication in a variety of subregions, particularly in vulnerable developing countries such as the least developed countries, small island developing states and in Africa. Five priority setting workshops have been conducted for the implementation of LAKI. These included a) in Quito , Ecuador for the Andean Sub region; b) Abu Dhabi, United Arab Emirates for Gulf cooperation sub region; c) Johannesburg , South Africa for the Southern African sub region; d) Colombo Sri Lanka for both Indian Ocean countries sub region and e) Hindu Kush Himalaya ( HKH) sub region. The final one is for the North Africa Sub region to reach six priority setting workshops.

North Africa is an economically prosperous area, generating one-third of Africa's total GDP. Oil production is high in Libya. Geographically, the region intersects the Arab World and Africa. North Africa is very diverse from the Western Sahara to Egypt. This area is made up of coastal agriculture grasslands, desert, mountains, highlands, valleys, basins, rivers, lakes and seas. One major defining characteristic is the lack of precipitation, which is why it is called, "The Dry World". This area is made up of humid desert flatlands. Morocco, Tunisia and Algeria, which are the Maghreb countries, have the Atlas Mountains running through them. Because of the Atlas Mountain in these areas, this brings precipitation that is why there are coastal grasslands. In the coastal grassland area, these lands are some of the only places in North Africa where agriculture succeeds.<sup>2</sup>

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<sup>1</sup> Further details on the LAKI are available at

<http://www4.unfccc.int/sites/NWP/Pages/Item.aspx?ListItemId=23181&ListUrl=/sites/nwp/Lists/MainDB>>

<sup>2</sup> [http://maps.unomaha.edu/peterson/geog1000/Notes/Notes\\_Exam2/NA.html](http://maps.unomaha.edu/peterson/geog1000/Notes/Notes_Exam2/NA.html)

## 2. Workshop Participants

Bibliotheca Alexandria as the sub regional coordinating entity for LAKI in North Africa? (Is this agreed? I guess yes,) has organized with the UNFCCC and UNEP the LAKI priority setting workshop from 19-21 September, 2017 in the premises of Bibliotheca Alexandria. The Participants were selected based on the Criteria identified in LAKI background document to ensure technical expertise and diversified experience of the Multi Stakeholder Group (MSG) that fits within the four thematic areas identified in the scoping paper. The four thematic areas are as follows: Water, Coastal, and Agriculture and Desertification. The workshop also included resource persons who are either experts in climate finance or Adaptation Knowledge gaps. List of participants is in Annex II.

### 3. Key results

The workshop was conducted over the period of two and half days. Workshop Agenda is in Annex I. The key results are shown in the table 1 below

**Table 1, Response Actions Template**

**Adaptation Knowledge Gaps in North Africa  
(Lima Adaptation Knowledge Initiative)**

	<b>Priority Knowledge Gaps</b>	<b>Knowledge Users</b>	<b>Barriers/additional information</b>	<b>Potential Response Action to close the Gap</b>	<b>Best Placed Institution/s</b>
<b>G 6</b>	Limited access to available data on water quality and quantity	<b>Water Sector managers and policy makers</b>		- <b>Need institutional tools/reforms that can be adapted nationally and regionally but need to sustain to address many of the gaps</b>	
<b>G24</b>	Lack of access to data related to rainfed agriculture and irrigated agriculture	Researchers, Scholars	Not able to share this openly Need to identify areas of irrigated land, still face challenges of validating this information, need to develop a map	<ul style="list-style-type: none"> <li>- Develop a map of rainfed agriculture and irrigated agriculture; continuously update the map on the regional portal; a regional organization to coordinate between regional organization and national organizations/agencies</li> <li>- review of available data at national and regional levels through multi-stakeholder dialogues</li> <li>- course modules for this topic</li> <li>- Establish sub- regional on line observatory (open access to data)</li> <li>- link regional and national institutions</li> </ul>	<ul style="list-style-type: none"> <li>- An academic board in each country that gathers scientists.</li> <li>- Agriculture/data/desertification/ water research centers in all countries</li> <li>- In Egypt, institutions such as Agriculture Research Center and Desert Research Center, CEDARE can support on this</li> <li>- <i>Watershed agency in Morocco</i></li> <li>- FAO (at the international level)</li> <li>- Regional organizations</li> </ul>

	Priority Knowledge Gaps	Knowledge Users	Barriers/additional information	Potential Response Action to close the Gap	Best Placed Institution/s
G11	Lack of accessible information on climate change impacts on the water resources	Water sector managers and Policy makers		<ul style="list-style-type: none"> <li>- compile and repackage climate change impact studies in policy briefs</li> <li>- knowledge portal</li> <li>- conduct training and convene workshops</li> </ul>	<ul style="list-style-type: none"> <li>- National institutions in charge of water, regional body to coordinate national information (<i>CEDARE</i>)</li> <li>- Water and Agriculture ministries</li> <li>- National Meteorological Organizations</li> <li>- Arab Water Council</li> </ul>
G10	Limited understanding of climate variability and trends, including placing current observations into historical context	Water infrastructure designers		<ul style="list-style-type: none"> <li>- facilitate access to remote sensing data and tools for interpretation</li> <li>- compile historical weather data and interpret</li> <li>- research trends (research in different disciplines),</li> <li>- share at regional level</li> <li>-</li> </ul>	<ul style="list-style-type: none"> <li>- IMO ,</li> <li>- Ministries of Agriculture,</li> <li>- <i>CEDARE</i>,</li> <li>- Council of Ministers in charge of meteorological work.</li> </ul>
G1	Insufficient knowledge on rainfall historical data, trends and projections	Water resource planners	Records are available in Egypt (150 years ago) but Met office in Cairo does not release data with a payment	<ul style="list-style-type: none"> <li>- Prepare Policy brief from government to allow availability of the data to researchers</li> <li>- Establish MoUs between MET offices and Ministries of water, agriculture</li> <li>- Prepare outputs of projection models and</li> <li>- share on knowledge hub at national level (MET offices) and also at regional level</li> </ul>	<ul style="list-style-type: none"> <li>- Meteorological offices</li> <li>- Regional organization (<i>CEDARE</i>)</li> <li>- Global Water Partnership for Africa(tbc)</li> <li>- IUCN (tbc)</li> <li>- Sahara and Sahel Observatory</li> <li>- Competence Center for Climate change in Morocco (4 C)</li> </ul>
G41	Insufficient knowledge and information sharing on solutions/ good practices and lessons learned to combat desertification	Ministries of Agriculture Ministries of Water	CEDARE, IUCN, Al Saadi University has published a book on this topic and available on the website but challenges with sustainable financing Gap in communicating existing information	<ul style="list-style-type: none"> <li>- Involve the UNCCD focal points</li> <li>- a guide book on best available technologies</li> <li>- a database on technologies</li> <li>- Field visits demonstrating good practices</li> <li>- Taking stock and sharing of best practices and lessons learnt</li> <li>- Translating information from English to French and Arabic</li> </ul>	<ul style="list-style-type: none"> <li>- Research centers/universities</li> <li>- Arid Lands Institute</li> <li>- ICARDA</li> </ul>

	<b>Priority Knowledge Gaps</b>	<b>Knowledge Users</b>	<b>Barriers/additional information</b>	<b>Potential Response Action to close the Gap</b>	<b>Best Placed Institution/s</b>
G25	Lack of awareness on negative climate change impacts on yield	government, agricultural and rural advisory services providers		<ul style="list-style-type: none"> <li>- Evaluate perceptions on climate change impacts through awareness raising programmes/activities such as workshops/seminars</li> <li>- Conduct multi-stakeholder dialogue among municipalities, researchers on negative climate change impacts on yield, then share knowledge and information at subnational levels</li> </ul>	Civil Societies and NGOs Agriculture research Centers
G15	Lack of information for developing resilience strategies in urban planning in coastal zones	Decision makers, policy makers and planners	<ul style="list-style-type: none"> <li>- Urban planners and policy makers might not have an overview of what developing resilience strategies mean</li> <li>- legislative reforms are necessary</li> </ul>	<ul style="list-style-type: none"> <li>- success stories focusing on this topic that provide evidence (from and outside region) and organize workshops to disseminate the outcomes at national and subregional levels</li> <li>- campaign to disseminate these strategies in simple languages</li> <li>- training of urban planners on resilience strategies inclusion and review of urban development strategies (whether these include resilience strategies)</li> <li>- developing a regional integrated resilient coastal plan</li> </ul>	Agriculture and water research centers
G2	Lack of accurate information on water resources status (i.e. water availability, consumption patterns, water quality)	River basin agencies, environmental institutions, and water resource planners	<ul style="list-style-type: none"> <li>- CEDARE prepared state of water report with indicators, now preparing Arab State of Water report (CEDARE and Arab Council) and developing also an online database</li> <li>- ESCWA is launching a new model for this</li> </ul>	<ul style="list-style-type: none"> <li>- Support to the continuous development of the ongoing work of status report – which provides accurate information on water resources status</li> <li>- Establish/ Strengthen Online database of information on water resource status at national and regional levels (CEDARE has an online database which can be shared)</li> </ul>	AMCOW, CEDARE with water ministries (focal points for countries) ESCWA

	Priority Knowledge Gaps	Knowledge Users	Barriers/additional information	Potential Response Action to close the Gap	Best Placed Institution/s
G26	Lack of awareness on negative climate change impacts on livelihoods	Farmers organizations, local authorities	Egypt is divided into 9 agro-ecological regions. Workshops in these four regions are different. Same in NA countries, similar regions	<ul style="list-style-type: none"> <li>- workshops and group discussions, meetings for local farmer groups and co-operatives, including seminar for policy makers to address this gap</li> <li>- conduct subregional workshops need to take into specificity of agro-ecological zones)</li> <li>- use of <i>media</i> to communicate message to farmers</li> <li>- analyze available data on climate change impacts on livelihoods and socio-economic aspects, socio-ecological surveys from research centers</li> </ul>	<ul style="list-style-type: none"> <li>- Agriculture research centers and regional universities such as Arid Lands Institute, Ain Shams University</li> <li>- Desert Research centers</li> </ul>
G43	Insufficient information and knowledge about interconnections between desertification and socio-economic development	Central authorities of demographic statistics	Only reports from Egypt to the UNCCD but the task to disseminate information	<ul style="list-style-type: none"> <li>- Need to exchange and disseminate information either top down or bottom up</li> </ul>	
G31	Limited information and knowledge sharing on interlinkages with other sectors	Ministry of Agriculture	Multiple independent research/studies but not shared Existing institutions, universities should be responsible to disseminate information focusing on multiple sectors	<ul style="list-style-type: none"> <li>- Establish platform / network for interlinkage between agriculture and other sectors such as Ministry of Environment should be linked with information centers in other ministries, including Ministry of Agriculture</li> <li>- Organize seminar with different stakeholders</li> <li>- Develop a policy brief and online sharing of information on interlinkages between agriculture and other sectors and impacts on climate change</li> </ul>	<ul style="list-style-type: none"> <li>- Universities,</li> <li>- Ministries (Ministry of Environment, irrigation, water) and</li> <li>- Initiatives within the subregion such as Africa Agriculture Adaptation</li> </ul>



	<b>Priority Knowledge Gaps</b>	<b>Knowledge Users</b>	<b>Barriers/additional information</b>	<b>Potential Response Action to close the Gap</b>	<b>Best Placed Institution/s</b>
G20	Limited knowledge on the benefits of integration of coastal management and protection into national development plans and priorities	policy makers and planners		<ul style="list-style-type: none"> <li>- Support inter-ministerial committee and develop integrated coastal development plan</li> <li>- Conduct workshop on the benefits of ICZM and its added value</li> </ul>	
G21	Need for improved information regarding population dynamics within SLR models	Policy makers and planners		<ul style="list-style-type: none"> <li>- Develop SLR models regarding population dynamics at national and subregional levels</li> <li>- Develop GIS to update subnational and coastal zones (plus areas that are affected by salinity), and make this available through a web portal (CEDARE)</li> </ul>	<ul style="list-style-type: none"> <li>- Central Authority of Demographics Statistics</li> <li>- CEDARE</li> </ul>
G19	Lack of information on understanding of risks due to SLR among the different coastal zones	policy makers and planners	Right translation of information is missing	<ul style="list-style-type: none"> <li>- Prepare Summary/policy brief</li> </ul>	<ul style="list-style-type: none"> <li>- CEDARE</li> </ul>
G22	Need for improved information on technologies to protect coastal cities against SLR.	Technology providers, coastal planners at sub-national level, practitioners and Civil society organizations.	Resistance to change. Part of the action is also to showcase benefits (cost-effectiveness of the technologies)	<ul style="list-style-type: none"> <li>- Prepare Showcases on benefits of ICZM</li> <li>- Compile impacts of different appropriate (<i>socio-economic-environment appropriate</i>) technologies for coastal protection and share through a regional hub</li> </ul>	<ul style="list-style-type: none"> <li>- Combination of national and regional entities (CEDARE, UNDP), plus coastal protection authorities in different countries</li> <li>- GIZ (regional programme AQUA)</li> </ul>

	Priority Knowledge Gaps	Knowledge Users	Barriers/additional information	Potential Response Action to close the Gap	Best Placed Institution/s
G12	Limited knowledge on technologies and best practices to adapt to the impacts of climate change on water resources	Technology providers, water resource planners at sub-national level, practitioners and civil society organizations		<ul style="list-style-type: none"> <li>- Document, compile and disseminate information on technologies and best practices on Climate Change Impact on water resources. This could be further replicated</li> </ul>	<ul style="list-style-type: none"> <li>- Ministries of Environment, Water,</li> <li>- Regional institutions such as CEDARE, ESCWA</li> </ul>
G5	Lack of reliable data on water-quantity and quality, including accessibility to available reliable data and databases	Water sector managers and Policy makers	Water quality needs long time records. Ministries do not publish these information (could be sensitive as this has implications on health issues)	<ul style="list-style-type: none"> <li>- Review available data by organizing expert meetings to validate existing data on their reliability</li> <li>- Policy reforms are also needed to ensure the right to know ( beyond LAKI context)</li> </ul>	<ul style="list-style-type: none"> <li>- Arab Water Council, CEDARE in cooperation with relevant ministries in countries in particular Ministries of Water.</li> </ul>
G6	Limited access to available data on water- quantity and quality	Water sector managers and policy makers		<ul style="list-style-type: none"> <li>- Regional database but update existing regional database and <i>publish data</i> (for latter, political will is necessary)</li> <li>- Support the process for reporting including water portals and water reports</li> </ul>	<ul style="list-style-type: none"> <li>- Arab Water Council with CEDARE</li> </ul>

Abbreviations: **AMCOW**: African Minister's Council on Water, **CEDARE**: Centre for Environment and Development for the Arab Region and Europe, **ESCWA**: Economic and Social Commission for West Asia, **FAO**: Food and Agriculture Organization, **ICARDA**: The International Center for Agricultural Research in the Dry Areas **IMO**: International Meteorological Organization, **IUCN**: International Union for Conservation of Nature.

## 4. Methodology, process and results

### 4.1 Overall methodology

#### 4.1.1 Scoping paper

The LAKI process started with a scoping paper to identify the adaptation knowledge gaps in North Africa Sub region covering Algeria, Egypt, Libya, Morocco and Tunisia. This was based on literature review of available reports such as ,but not limited to, but were not limited to, National Communications reports, National Adaptation Strategies, National Adaptation Plans (NAPs), Intended Nationally Determined Contributions(INDCs). The Major Knowledge gaps were:

- Access to accurate and sufficient climate data and information
- Knowledge and Information on the impact of climate change on selected sectors
- Information and Knowledge on technologies and best practices
- Information on local indigenous knowledge
- Information on climate models
- Information and clarity of climate governance and its inter linkages with other sectors

The scoping paper identified 45 adaptation knowledge gaps that were categorized among four thematic areas as follows:

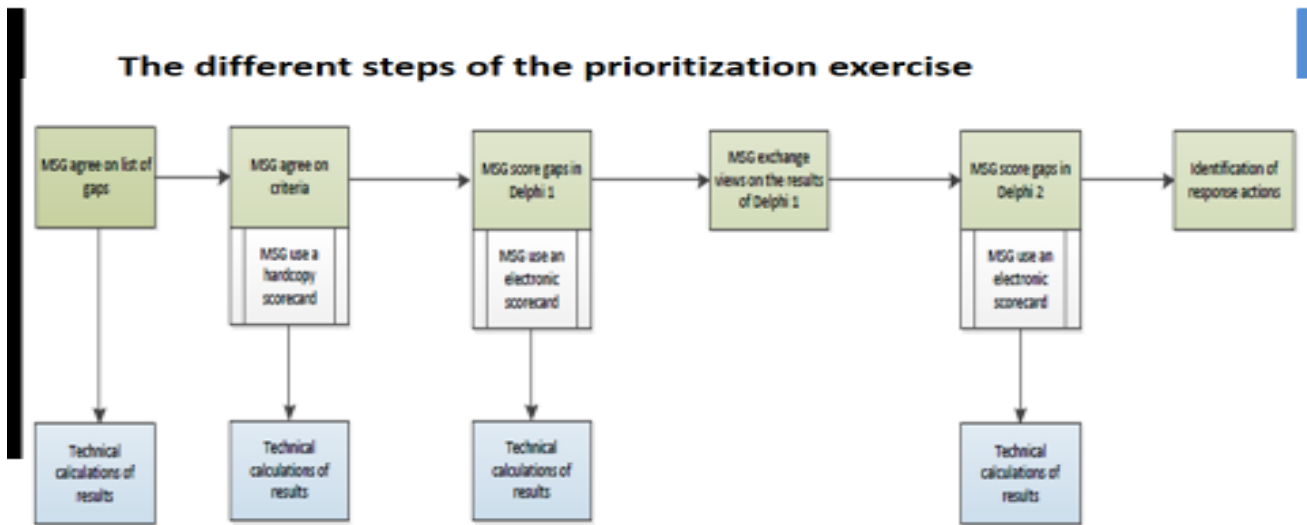
- Water ( 16 Adaptation Knowledge Gaps)
- Coastal ( 11 Adaptation Knowledge Gaps )
- Agriculture ( 11 Adaptation Knowledge Gaps)
- Desertification (7 Adaptation Knowledge Gaps )

#### 4.1.2 Priority Setting workshop

The priority setting workshop was conducted over the period of two and half days that included nine plenary session and four breakout sessions as shown in the programme in Annex I.

**On Day 1:** The workshop participants were provided a brief presentation on the scoping paper that has been drafted based on literature review. The participants were then divided into two groups; Group 1 on Water and Coastal and Group 2 on Agriculture and desertification. Each of the two group reviewed and discussed the gaps in the scoping paper, refined, added or deleted those gaps. The participants then reported back on their work in plenary. The refined knowledge gaps were then categorized into; a) Unavailable tools for processing data/ information, b) Inaccessible Data/ Knowledge c) Data/information not in the right format for intended audience

**On Day 2:** The participants discussed and agreed on the Criteria for prioritization of Knowledge gaps. Then, they prioritized the knowledge gaps through a quantitative process using two rounds of Delphi analysis.



**On Day 3:** The participants with the resource persons identified potential response actions and identified best placed institutions for losing the priory knowledge gaps.

#### 4.1.3 Follow up:

The last day of the workshop some members of the Multi stakeholder group expressed their interest to take over the responsibility of implementing some of the actions as it capitalize on their past or existing activities. The MSG with the resource persons agreed the need to establish a universal clearing house mechanism. This would even go beyond the sub region to overcome adaptation knowledge gap at large.

## 4.2 Discussion and refinement of Adaptation Knowledge Gaps

### 4.2.1 Integrating inputs from the Multi stakeholder group (MSG) and Resource persons

Table 2 shows the number of adaptation gaps before and after the refinement exercise conducted on the first day of the workshop

Table 2, Adaptation Knowledge Gaps per Thematic Area

#	Thematic Area	# of Adaptation knowledge Gaps prior to the workshop	# of Adaptation Knowledge Gaps after refinement exercise by MSG
1	Water	16	14
2	Coastal	11	9
3	Agriculture	11	13
4	Desertification	7	7
<b>Total</b>		<b>45</b>	<b>43</b>

#### 4.2.2 Defining category of gaps at the sub regional level

The MSG members carefully discussed the gaps identified in the scoping paper. Some of those gaps were removed as they were replicated. New gaps were added due to their importance as they were missing from the scoping paper. The added gaps are:

- 1- Lack of information on best practices on the use and costs of non-conventional water resources( eg. reuse of waste water)
- 2- Lack of information on the impacts of SLR on sea water intrusion into groundwater, rivers and estuaries
- 3- Lack of access to data related to rainfed agriculture and irrigated agriculture
- 4- Insufficient information and knowledge about interconnections between desertification and socio-economic development.

Other gaps were either merged together such as those of circulation model in water thematic area or divided into two due to their specific nature like differentiation between climate change impacts on ground water resources and groundwater dependent ecosystems

#### 4.2.3 Refining the gaps for specific target audience

The MSG used the Delphi analysis twice in day two to further refine and prioritize the knowledge gaps. In order to do so, the workshop facilitator has elaborated on the meaning and objective of each of the criteria. The participant discussed the criteria and wanted to add more but for the sake of time and quality of outputs, they considered only five which are; **a) urgency:** Closing the gaps addresses urgent adaptation needs (delay will entail additional cost) **b) sustainability:** Filling the knowledge gaps will help sustain benefit over the long term **c) scale of contribution to climate resilience:** Filling the knowledge gaps will increase the resilience to climate change **d) benefiting multiple sectors:** **e) Feasibility :** Filling the knowledge gaps is doable. Each member of MSG ranked the criteria from 1 to 4. All four criteria were of the same importance with similar weights ( Do you have the graph that came out of the ranking?)

## **4.3 Prioritization of Gaps**

### **4.3.1 Defining and ranking the scoring criteria**

The MSG members individually ranked the 43 knowledge gaps against the five agreed upon criteria. They used scoring matrix and ranked each gap, from value of 1 to 5. The higher the value, the more important the gap is to the chosen criterion

### **4.3.2 Scoring the knowledge gaps against criteria**

The two rounds of Delphi analysis used all the 43 knowledge gaps and this was furthered weighted individually by each member of the MSG until it reached the top 19 gaps that would require response actions.

## 5. Knowledge Gaps

**Table 3, 43 Adaptation knowledge gaps with their descriptions**

### 5.1. Water resources

Title	Description (including the reasons why it is considered a gap)	Knowledge users
<p><b>Gap 1:</b> Insufficient knowledge on rainfall historical data, trends and projections</p>	<p>The rainfall data obtained from the General Circulation models (GCMs) are not usually consistent both in direction and magnitude in Africa.</p> <p>Further more recent downscaling studies based on a single GCM and a pair of regional models showed contrasting results with future rainfall scenarios. This indicates the low level representation of factors governing the African rainfall in the GCMs and RCMs.</p>	<p>Water resource planners</p>
<p><b>Gap 2:</b> Lack of accurate information on water resources status (i.e. water availability, consumption patterns, water quality)</p>	<p>Lack of accurate local information on water resources situation, including water availability, assessments of consumption patterns, sources of pollution, appropriate technologies, water quality mapping.</p> <p>Further, policy and legislation require reviewing, updating and filling in of the gaps that have been overlooked in prior policy development.</p>	<p>River basin agencies, environmental institutions, and water resource planners</p>
<p><b>Gap 3:</b> Uncertainty in estimating the direction and magnitude of climate change impacts on water</p>	<p>There is a high uncertainty in estimating the direction and magnitude of climate change impacts on water including droughts and floods. This uncertainty could be due to the resolution of the input data and insufficient representation of relevant processes in the models.</p> <p>Most of the models do not show much of the population experiencing a decrease (or increase) in water stress with climate change.</p> <p>Downscaled climate change scenarios are important to study the impact of climate change on water resources in Africa.</p> <p>It is well known that local conditions may be very different from what we observe on the large scale.</p>	<p>policy makers, Water sector managers, Water resource planners</p>

Title	Description (including the reasons why it is considered a gap)	Knowledge users
	<p>There remains a scale mismatch between the large-scale climatic models and the catchment scale – the most important scale for water management. Higher-resolution climate models, with better land-surface properties and interactions, are therefore required to obtain information of more relevance to water management.</p>	
<p><b>Gap 4: Inappropriate data format for undertaking climate impact studies in which outputs of GCMs and RCMs are available</b></p>	<p>One of the principal obstacles in carrying out climate change impact studies by impact researchers in Africa and elsewhere is the data format in which outputs of GCMs and RCMs are available. As most of impact researchers are not climate scientists, they are not capable of using data based on the World Meteorological Organization (WMO) GRIB and the University Cooperation for Atmospheric Research (UCAR) NetCDF formats. Capacity building in using these data formats will increase the number of studies on impact of climate change on water resources and other sectors in Africa.</p>	<p>Water resources planners,</p>
<p><b>Gap 5: Lack of reliable data on water- quantity and quality, including accessibility to available reliable data and databases</b></p>	<p>In most African countries, however, only inadequate and inhomogeneous data is available on water quantity and quality. National data collection and knowledge about the interrelationships between human activities and the extent and timescale of water degradation is lacking. The pathways followed by contaminants to aquifers and from contaminant sources to potential receptors are often unknown. All of that leads to lack of reliable data ----- Also, There is wide acceptance that the hydrogeological conditions combined with climate (particularly rainfall, past and present) are the major controllers of water availability and sustainability. Lack of data on the physical extent, accessibility and development potential of aquifer systems combined with the vastness of the region is a severe constraint to development.</p>	<p>Water sector managers and Policy makers</p>



Title	Description (including the reasons why it is considered a gap)	Knowledge users
	Hydrogeological maps provide an invaluable tool to better understand the resource and to provide guidance on its management as well as on where to focus efforts in a first step that would include more detailed local-scale assessments.	
<b>Gap 6: Limited access to available data on water-quantity and quality</b>		Water sector managers and Policy makers
<b>Gap 7: Lack of quantitative information on climate change impacts on groundwater resources</b>	Groundwater has always enabled communities across Africa to adapt to seasonal or perennial shortages in surface water by providing water for drinking, watering livestock, and more recently for irrigation. As groundwater abstraction intensifies it is not clear whether intensive groundwater abstraction to meet the increasing demand for domestic and agricultural water is viable or sustainable. While the impacts of climate change on groundwater resources in Africa continue to be reported in literature a quantitative understanding of the impact of climate change on groundwater resources remains poorly defined.	Policy makers,
<b>Gap 8: Lack of quantitative information on climate change impacts on groundwater-dependent ecosystems</b>		Policy makers
<b>Gap 9: Lack of information on the existing and potential uses of transboundary groundwater resources such as in agriculture</b>	The degree of knowledge on transboundary aquifers is largely a function of the climatic conditions and surface water availability of the area. The more arid countries with little surface water resources tend to invest most in studies to assess the existing and potential of transboundary groundwater to meet various demands such as agriculture. While some aquifer systems have been studied extensively, a great lack of knowledge on transboundary aquifers still exists.	Policy makers, Water sector managers, Water resource planners

Title	Description (including the reasons why it is considered a gap	Knowledge users
<b>Gap 10: Limited understanding of climate variability and trends, including placing current observations into historical context</b>		Water infrastructure designers
<b>Gap 11: Lack of accessible information on climate change impacts on the water resources</b>	<p>Communication and knowledge sharing of climate change impact on the water resources at policy makers and field level will have a paramount effect on establishing a policy framework to adapt to climate change impact and on the implementation of proposed adaptation measures.</p> <p>It is considered as gap because There are few knowledge sharing projects on the impact of climate change on the water resources of Africa; Also, Barriers to access climate change knowledge on the water resources of Africa such as language, infrastructure and technology</p>	Water sector managers and Policy makers
<b>Gap 12: Limited knowledge on technologies and best practises to adapt to the impacts of climate change on water resources</b>	<p>With changing climate and increasing risks, the communities need technologies to adapt to the new conditions through various means, ranging from basic fundamentals to the use of state-of-the-art technologies.</p> <p>In this manner, systems are set up for adaptation to potential climate changes, namely temperature increase and water scarcity, and the adverse expectations on the increase and decrease of precipitation and sea level rise</p> <p>-----</p> <p>Extension and irrigation staff often have quite limited knowledge about various water-harvesting techniques and the associated socioeconomic implications</p>	Technology providers, water resource planners at sub-national level, practitioners and civil society organizations.
<b>Gap 13: Limited knowledge on technologies and best practices to adapt to the impacts of climate</b>		Communities, local authorities and farmers

Title	Description (including the reasons why it is considered a gap)	Knowledge users
change on water resources		
<b>Gap 14:</b> <b>Lack of information on best practices on the use and costs of non conventional water resources (e.g reuse of waste water,)</b>	It is very important to know how to overcome major obstacles to non-conventional water resources development such as the high costs of desalination and limited understanding of non-conventional resources that currently restrict their development.	Water planners and policy makers

## 5.2. Coastal Zones

Title	Description (including the reasons why it is considered a gap)	Knowledge users
<b>Gap 15:</b> <b>Lack of information for developing resilience strategies in urban planning in coastal zones</b>	Lack of <b>resilience strategies</b> in urban planning development in the Northern Coast of Nile Delta, which is considered as a highly threatened zone by SLR impacts, specifically floods	Decision makers, policy makers and planners
<b>Gap 16:</b> <b>Lack of clarity on the roles of various stakeholders and responsibilities regarding the reduction of the</b>	Lack of clarity on stakeholder roles and responsibilities regarding the reduction of the impacts of SLR on this affected zone and absence of coordination, lead to difficulty in identifying their role in increasing the resilience of the affected community by SLR	Decision makers and policy makers

impacts of SLR on affected zones(e.g. the Nile Delta)		
<b>Gap 17:</b> Lack of information on impacts of SLR on sea water intrusion into groundwater, rivers and estuaries.	There is no clear information on how the river flow will be affected by SLR, due to uncertainty in projected rainfall patterns in the basin and the influence of complex water management and water governance structures	policy makers and planners
<b>Gap 18:</b> Lack of access to tide gauges data to assess rates of SLR and land subsidence rates.	Establishing strong coastal monitoring and assessment, hence identifying and protecting vulnerable areas. In addition to promoting awareness and community resilience, and creating new opportunities at safe areas	Planners
<b>Gap 19:</b> Lack of information on understanding of risks due to SLR among the different coastal zones	Due to the different environmental characteristics of the coastal areas in the region, there needs to be a differentiation of the risks among them. A qualitative assessment of the risks with regard to the consequences of sea level rise indicates that there are definite geographical differences	policy makers and planners
<b>Gap 20:</b> Limited knowledge on the benefits of integration of coastal management and protection into national development plans and priorities	It is not clear how the importance of coastal protection will <b>rank</b> among the priorities of other development challenges to be addressed by the administrations in the coming years. Furthermore, it is traditionally not easy to implement plans for coastal protection as they require a substantial increase in awareness of the expected problems that will arise in conjunction with sea level rise.	policy makers and planners
<b>Gap 21:</b> Need for improved information regarding population dynamics within SLR models	Need for improved understanding of population dynamics within SLR models to identify critical hotspots, and develop a spatial vulnerability index.	Policy makers and planners
<b>Gap 22:</b> Need for improved information on		Technology providers, coastal planners at sub-national level,

<b>technologies to protect coastal cities against SLR.</b>		practitioners and Civil society organizations.
<b>Gap 23: Need for improved information on technologies to protect coastal cities against SLR.</b>		Communities, local authorities and farmers

### 5.3. Agriculture

<b>Title</b>	<b>Description (including the reasons why it is considered a gap)</b>	<b>Knowledge users</b>
<b>Gap 24 Lack of access to data related torainfed agriculture and irrigated agriculture</b>	There is a lack of reliable basic information on the effect of climate change on agriculture. Higher temperatures will reduce yields of some key crops, while a decrease in water supplies could threaten the availability of irrigation. This will result in more food imports and higher food prices. At the regional level, AFED Report 2009 stated that "no concerted data gathering and research efforts could be traced regarding the impacts of climate change on health, infrastructure, biodiversity, tourism, water and food production. The economic impact seems to be totally ignored. Reliable records on climate patterns in the region barely exist" (Cited in Drine 2011 Page 1).	Researchers, Scholars
<b>Gap 25 Lack of awareness on negative climate change impacts on yield</b>		government, agricultural and rural advisory services providers
<b>Gap 26 Lack of awareness on negative climate change impacts on livelihoods</b>		Farmers organizations, local authorities

<b>Gap 27</b> <b>Limited access to information on weather and seasonal forecasting to assist farm production operations and value chain processes</b>	<p>There is no locally usable information on weather or seasonal forecasts to assist in decision making regarding timing of planting, harvesting and ... (to be added by Hala).</p>	<p>Farmers</p>
<b>Gap 28</b> <b>Limited access to information on weather and seasonal forecasting to assist farm production operations and value chain processes</b>		<p>Ministry of Agriculture and other policy makers</p>
<b>Gap 29</b> <b>Insufficient information on pest damage to agroecosystems due to uncertainty about the impacts of climate change and climate variability on agro ecosystems (pests, diseases and water)</b>	<p>Agricultural losses from pests are most severe in the subtropics and tropics because of warmer temperatures, and longer growing seasons. However, it is difficult to accurately quantify the potential impacts of climate change on pest damage because of the complex and highly variable response of pests and their hosts to what could potentially be multiple and interactive shifts in environmental conditions. Conditions include elevated CO<sub>2</sub>, ozone, and temperature; changes in relative humidity and cloudiness; shifts in rainfall distribution and wind patterns; and land-cover and land-use change in response to climatic and non-climatic signals. Consequently, climate change is expected to affect the distribution, prevalence and life cycle of several infections diseases. This scenario is relevant to Morocco since the country is considered by many IPCC assessments reports as a climate change hotspot with a high vulnerability to many expected impacts</p>	<p>Ministry of Agriculture</p>
<b>Gap 30</b> <b>Limited information and knowledge sharing on climate change across agro-relevant sectors</b>		<p>Ministry of Agriculture</p>
<b>Gap 31</b> <b>Limited information and knowledge sharing on</b>	<p>Lack of a comprehensive framework leads to absence of sharing knowledge concerning agriculture sector. such framework is imperative for agriculture planning for adaptation - that pulls together and integrates what is known about</p>	<p>Ministry of Agriculture</p>

<p><b>interlinkages with other sectors</b></p>	<p>the climate system, the way it may change in the future, and the associated impacts on agro ecosystems, the livelihoods of those who depend on them, and food security. This specific gap can be seen as follow:</p> <ul style="list-style-type: none"> <li>- <b>Limited information and knowledge for the researchers</b> is a serious gap to identify a problem and test possible solutions to be given to the policy makers. In other words, the researchers, carrying out adaptation-related research in agriculture sector, require interaction among themselves and with modelers to understand the time scale, severity and extent of climate change. Such process envisaged will also make use of Geographic Information Systems (GIS) to take advantage of the spatial relationships among topography, development and climate. Identifying vulnerable assets is important for identifying which assets require adaptation and identifying vulnerable locations is important for locating assets and development to proactively minimize future risks on agriculture sector.</li> <li>- <b>Limited information and knowledge for policy makers</b> (ministry of agriculture) is a serious gap, as such information is imperative for decision makers to decide on the best course of action. In Algeria, in terms of data availability. Some shortcomings and deficiencies exist with inefficiency in data exchange among different sectors.</li> </ul>	
<p><b>Gap 32 Lack of advanced climate information services in agriculture (e.g. crop varieties, irrigation system)</b></p>	<p>This is illustrated in the form of lack of public database on climate-adopted crop varieties, crop rotation, intercropping, economic practices as well as irrigation system. This specific gap exists due to lack of IT infrastructure which is critical for generating robust climate information, efficient communication platforms which are essential for dissemination and, knowledge of how to package up the information ready for use</p> <p>In Algeria, network needs rehabilitation and support for equipment upgrade, in addition to very poor understanding of the added value of climate related data</p>	<p>Farmers, policy makers and private sector</p>

<p><b>Gap 33</b>  <b>Limited awareness about traditional knowledge, information and practices on climate change adaptation for agriculture sector/rural areas</b></p>	<p>Lack of information related to best and good practices on agriculture adaptation does not allow passing the lessons learned between generations, which is imperative to combat climate change and disperse its potential impacts on agriculture and food security.</p> <p>In the southern region of Morocco, global warming is causing the expansion of the Saharan desert. This is proving problematic to local farmers, the reason being the aridity of the land. With existing factors such as extreme heat and extremely low precipitation rates already in place, agriculture suffers more as the land becomes less fertile due to increased desertification. This, along with decreased rates of yearly precipitation, is putting a stress on water availability. More water is needed but less is available. These conditions make it difficult for farmers to keep their crops alive, thus decreasing their crop quality and yields. With less and lower quality product to sell, farmers are receiving a lower income, putting them in financial stress. With a decrease in water supply in some areas, some communities are being forced to tap into their groundwater resources, however, without the proper knowledge on how to do so, these communities are both taking too much and polluting what is left.</p> <p>Libya also lacks of long-term reliable data or technical capacity to analyse the data</p>	<p>Agricultural Extension workers, Farmers, policy makers, gene bank institutions, local organizations</p>
<p><b>Gap 34</b>  <b>Lack of knowledge on how climate change will affect livestock systems, poultry and fisheries, and related livelihoods of populations</b></p>	<p>Livestock are key assets held by poor people, providing multiple economic, social, and risk management functions. Livestock are a crucial coping mechanism in variable environments, and as this variability increases they will become more important.</p> <p>Livestock development issues raised by climate change can perhaps be best characterised as highly intertwined and complex. Some of the possible impacts at broad scales are reasonably well-researched while others are not, and currently many of the agricultural and other impacts at local scales are simply not known. How these impacts may combine to affect household vulnerability, and how adaptive capacity may be most effectively increased, are critical issues that need considerable attention.</p> <p>In Egypt, the impacts of climate change on animals' health and production under Egyptian conditions are not yet covered by scientific research.</p> <p>There is always lack of dissemination of new knowledge in rangeland ecology and a holistic understanding of pastoral resource management.</p>	<p>Farmers, policy institutions and agro pastoral communities</p>



<p><b>Gap 35</b>  <b>Insufficient knowledge, information and studies on the pastoral sector and rangelands</b></p>	<p>Rangelands are already under severe pressure because of land degradation and the increasing human and livestock populations. To develop appropriate interventions and policies, it is necessary to obtain information on increasing CO2 levels arising from (changes in) the primary productivity of species, their distribution and the carrying capacity of the rangelands.</p> <p>Information is mainly available for the 3 Maghreb countries. Very little information had been found for Libya and Egypt.</p> <p>Livestock studies in the region concentrate on specific species (ovine, goat) but not on specific agroecosystems (as the rangelands/steppe). Also, very little is known about the contribution of pastoral products to the sectors (meat, milk, wool, skins). However, little attention is given to rangelands</p>	<p>Local communities and agropastoral communities</p>
<p><b>Gap 36</b>  <b>Insufficient translation of climate related data analysis and results</b></p>	<p>Insufficient here means weak, unclear, inconvenient.</p> <p>In the MENA region, there remains a large gap in the scientific capacity to analyse data, interpret results and develop models and tools that fit stakeholder's needs and improve productivity</p> <p>Despite many scientific findings, methods and data are well documented and are available at very low effective costs, their implementation is still far from optimal in many countries</p> <p>Furthermore, there is still a gap between the scientific community and extension workers that are in charge of transferring climate change information to stakeholders and help in implementing adaptation strategies. One of the main reasons is the lack of effective national governance in promoting the use of climate information for coping with climate change issues.</p>	<p>Decision makers at local, national and sub-regional level, media</p>

#### 5.4. Desertification

Title	Description (including the reasons why it is considered a gap)	Knowledge users
<p><b>Gap 37</b>  <b>Large gaps in information on climate and</b></p>	<p>A first comparative study on climate change and migration in the Middle East and North Africa region indicates that environmental factors likely contributed to more mobility in Morocco, in particular temporary migration, both internally and cross-border. Emigration rates are expected to remain high in the near future, especially</p>	<p>Ministry responsible for demographic statistics</p>

Title	Description (including the reasons why it is considered a gap)	Knowledge users
<b>environment linked migration projections</b>	originating from rural areas affected by drought episodes that impact agricultural production.	Ministry of Agriculture Research Institutes
<b>Gap 38 Insufficient knowledge concerning the impact of climate change on land degradation, desertification, drylands and related livelihoods</b>	The region lacks of information and methods for mapping of productive lands, to improve science-policy communication and knowledge management and to identify land degradation hotspots, as well as to take advantage of advances in information technologies, such as geographic information systems mapping, methods for mapping different land types. The area also lacks of methods for assessing land-use trade-offs, more generally, to improve decision-making and provide ex-ante criteria for local decision-makers and international development project funders.	Decision makers
<b>Gap 39 Insufficient access to data in the subregion concerning land degradation</b>	In Egypt, though many institutions are engaged in addressing environmental issues in general and land degradation in particular, yet their research works are dispersed in different ministries and agencies, (e.g. MWRI, MALR, MSEA, ASRT Universities....etc) and in most cases, are overlapped and duplicated in efforts and funds. Under these conditions, the accessibility of accurate data and knowledge gained in any project is very limited. Lack of institutional coordination mechanisms between public organizations	Ministries of Agriculture Ministries of Water
<b>Gap 40 Insufficient monitoring and evaluation systems to understand the dynamics of drought and desertification</b>	There is weak linkage between research and policymaking, as well as an absence of national indicator systems for evaluating and monitoring programmes and activities for combating desertification. The main gaps in Egyptian and Morocco are drought management mitigation plans are mainly for emergency and not updated regularly lack of monitoring and early warning system. However, it should be stated that this a confirmed regional gap.	Ministries of Agriculture Ministries of Water Policy makers
<b>Gap 41 Insufficient knowledge and information sharing on solutions/ good</b>	This was clearly stated in the Review of Available Knowledge on Land Degradation in Morocco, taking into consideration that the major concern of the National Action Plan is on ways and means to promote the dissemination and sharing of information on combating desertification	Ministries of Agriculture Ministries of Water

Title	Description (including the reasons why it is considered a gap)	Knowledge users
<b>practices and lessons learned to combat desertification</b>		
<b>Gap 42 Insufficient baseline and subsequent information to understand desertification trends at national or sub-regional levels</b>	<p>This gap exists because there is no appropriate way of measuring and tracking the success of efforts in combating desertification. This gap presents a serious constraint on priority setting and impact assessment of actions.</p> <p>Through the National Action Programmes to Combat Desertification – in the cases of Algeria, Morocco and Tunisia, there is an underlined need to observe the status of desertification regularly and to monitor and evaluate the national action programmes mainly on the basis of the information systems implemented.</p>	Ministries of Agriculture
<b>Gap 43: Insufficient information and knowledge about interconnections between desertification and socio-economic development</b>		Central authorities of demographic statistics

#### 4.4 Identification of possible response actions

By the end of day 2, the participants were given the identified 19 knowledge gaps in order to individually identify potential response actions to close the gaps and then return next day to discuss it in plenary. At the outset of the third day, the MSG listened to a presentation from Climate finance expert who emphasized on the importance of hindering the barriers of Adaptation knowledge gaps and think broader not only within the Sub region but at the worldwide. **He advised to have a decision from the COP on Adaptation knowledge gaps where there is a call for the Green Climate Fund, Global Environment Facility and Adaptation Fund to work together to close Adaptation Knowledge Gaps.** This has to be covered through establishment of clearing house hub to function at the global, regional and sub-regional levels where all UN entities coordinate their efforts to support this hub.

#### 5- Identification of next steps

#### 6- Concluding Remarks:

Dr. Youssef Nassef from UNFCCC thanked the participants for their commitment and dedication and BA for hosting this workshop as well as Dr. El Arini for inspiring the discussion of response actions. He is looking forward for implementation of response actions to close the identified gaps especially that they serve more than one sector. He stressed that NAP preparations funded by the GCF is an opportunity that should be utilized to contribute to closing the identified adaptation knowledge gaps. Dr. Barney Dickson from UNEP also thanked the MSG for their active participation that provided life to the whole process. Dr. Salah Soliman from BA thanked the UNEP and UNFCCC for selecting BA to host this workshop. He further indicated the programmes that BA is leading in Africa. These include; African Networks for Agriculture, environment and Global Health. BA programme for Environment and Sustainable Development., BA initiative to build scientific capacity of young journalist. He has proposed a selection of body to gather all the information and knowledge and coordinate the identified response action. Accordingly, he proposed BA to act and carry this responsibility as Sub regional coordinating entity for adaptation knowledge Gaps for North Africa sub region.

## Annex I Programme Agenda

### LAKI – The Priority-Setting Workshop for North African subregion

19–21 September, 2017, Alexandria- Bibliotheca Alexandrina

*Facilitators:*

**Dr. Mozaharul Alam**, Regional Coordinator - Climate Change, Asia and the Pacific Office, UN Environment

**Dr. Yasmine Fouad**, Consultant for the scoping paper

#### Tuesday 19 September 2017– Day 1

##### Opening and setting the scene

9:00–9:30 a.m.	Opening remarks: Dr. Barney Dickson, UN Environment Dr. Youssef Nassef, UNFCCC Dr. Mostafa El Fiky - Bibliotheca Alexandrina
9:30–9:45 a.m.	Introduction of the workshop participants (MSG members)
9:45–10:15 a.m.	Introduction of the workshop (Dr. Mozaharul Alam)
10:15–11:00 a.m.	Presentation of the results of the scoping paper and discussion on the knowledge gaps (Dr. Yasmine Fouad)
<i>Coffee break</i> 11:00–11:30 a.m.	

##### Refining and categorizing knowledge gaps

11:30 a.m.–2:00 p.m.	Discussion of the knowledge gaps by the MSG ( <i>thematic working groups to add, delete or refine knowledge gaps</i> )
<i>Lunch break</i> 2:00–3:00 p.m.	
3:00 – 4:30 p.m.	Reporting and discussion of the knowledge gaps ( <i>plenary session</i> )
<i>Coffee break</i> 4:30–5:00 p.m.	
5:00 – 6:00 p.m.	Agreement on finalized list of LAKI knowledge gaps ( <i>plenary session</i> ) Presentation on expectations for Day 2

#### Wednesday 20 September – Day 2: Prioritizing knowledge gaps

9:00–9:30 a.m.	Introduction to Day 2 activities
9:30–11:00 a.m.	Identification of criteria for prioritization of the knowledge gaps ( <i>plenary session</i> ) Assignment of weights to the different criteria ( <i>individual exercise by MSG members</i> ) Presentation of the weighted criteria ( <i>plenary session</i> )
<i>Coffee break</i> <i>11:00–11:30 a.m.</i>	
11:30 a.m.–12:30 p.m.	First Delphi round for scoring of gaps against criteria ( <i>individual exercise by MSG members</i> )
<i>Lunch break</i> <i>12:30–1:30p.m.</i>	
1:30–3:00 p.m.	Presentation and discussion of the scoring results ( <i>plenary session</i> )
3:00 – 4:00p.m.	Second Delphi round for scoring of the priority knowledge gaps ( <i>individual exercise by MSG members</i> )
<i>Coffee break</i> <i>4:00–4:30 p.m.</i>	
4:30–5:30 p.m.	Presentation of and discussion on the prioritized list of knowledge gaps ( <i>plenary session</i> )
5:30 – 5:45 p.m.	Presentation of the expectations for Day 3

#### Thursday 21 September – Day 3: Designing response actions

9:00–9:15 a.m.	Introduction to Day 3 activities
9:15–9:45 a.m.	Overview of possible funding opportunities to implement actions in closing knowledge gaps in North African subregion: Dr. Omar El-Arini, member of the Board of the Egyptian Environmental Affairs Agency and of the Green Climate Fund
9:45 a.m.–12:30 p.m. (incl coffee break)	Discussion of the response actions, possible deliverables and best placed organizations, including design of collaborative response actions to close the priority knowledge gaps
<i>Closing session</i>	
12:30–2:00 p.m.	Presentation of the key results and of the next steps Feedback from participants Closing remarks

## Annex II List of Participants

#	Name	Title and organization	Country
1	Lahcen TAIQUI	Professor, Department of Biology, Faculty of Sciences of Tetouan, Abdelmalek Essaadi University.	Morocco
2	Laila Mandi	National Centre for Studies and Research on Water and Energy(CNEREE), University of Cadi Ayyad, Avenue Abdelkrim El Kattabi, BP511, Marrakech, Morocco.	Morocco
3	Samia Grimida		Libya
4	Mohamed Chirgawi Brahim	Environmental Consultant Lecturer in university of Sabha. Former National Focal Point of UNFCCC(United Nation Framework convention for Climate Change). Assistant professor Department of environmental sciences/ Faculty of Engineering and Technology /University of Sebha	Libya
5	Ayman Farid <u>Abou-Hadid</u>	Emeritus Professor, Arid Lands Agricultural Studies and Research Institute, Faculty of Agriculture, Ain Shams University, Cairo, Egypt since 2010.	Egypt
6	Mohamed Aly	Water Resources modelling specialist	Egypt
7	Prof. Khaled AbuZeid	Civil Engineering, Water Management, Colorado State University, is a registered Professional Engineer.	Egypt
8	Hala Yousry	Head of Social Studies Department Desert Research Center, Egypt AFAAS Country Focal Point, North Africa Representative & Board Member	Egypt
9	Michael Menker Girma (PhD)	Former ACPC staff staff and one of the author of ACPC Knowledge Gaps and Needs	Resource Person
10	Omar Al Arini	Member of the Board of the Egyptian Environmental Affairs Agency and GCF Board member for Africa .	Resource person