



Royaume du Maroc

Strengthening National Capacities to Manage Water Scarcity
and Drought in West Asia and North Africa
Project 121C "ROA-207"



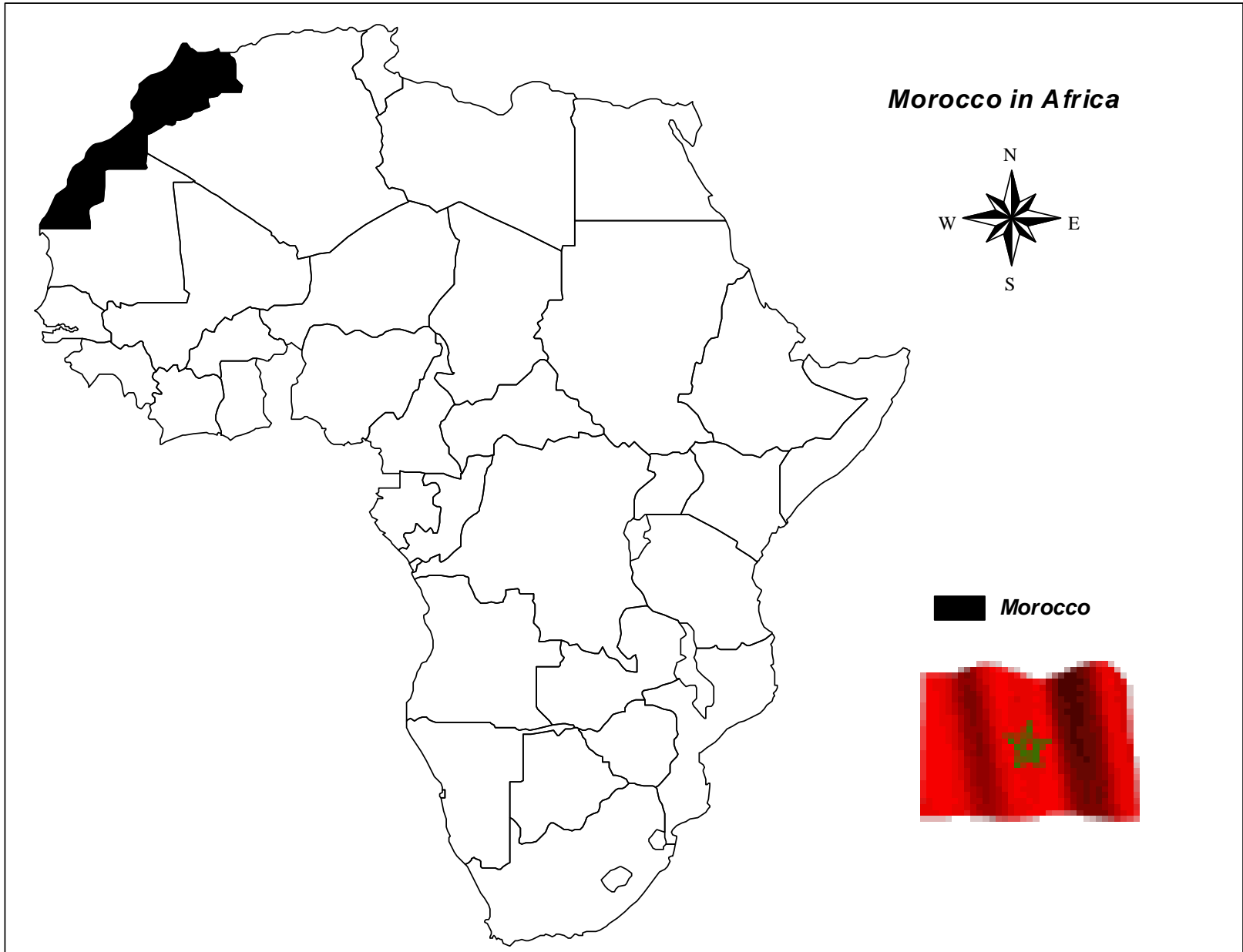
Drought Management in Morocco

National Capacity Development Training of Trainers (TOTs)
Workshop on Developing and Implementing Mitigation and Preparedness
Of Water Scarcity and Drought (WS&D) Management Plans
Zaragoza - Madrid, Spain, May 6-9, 2014

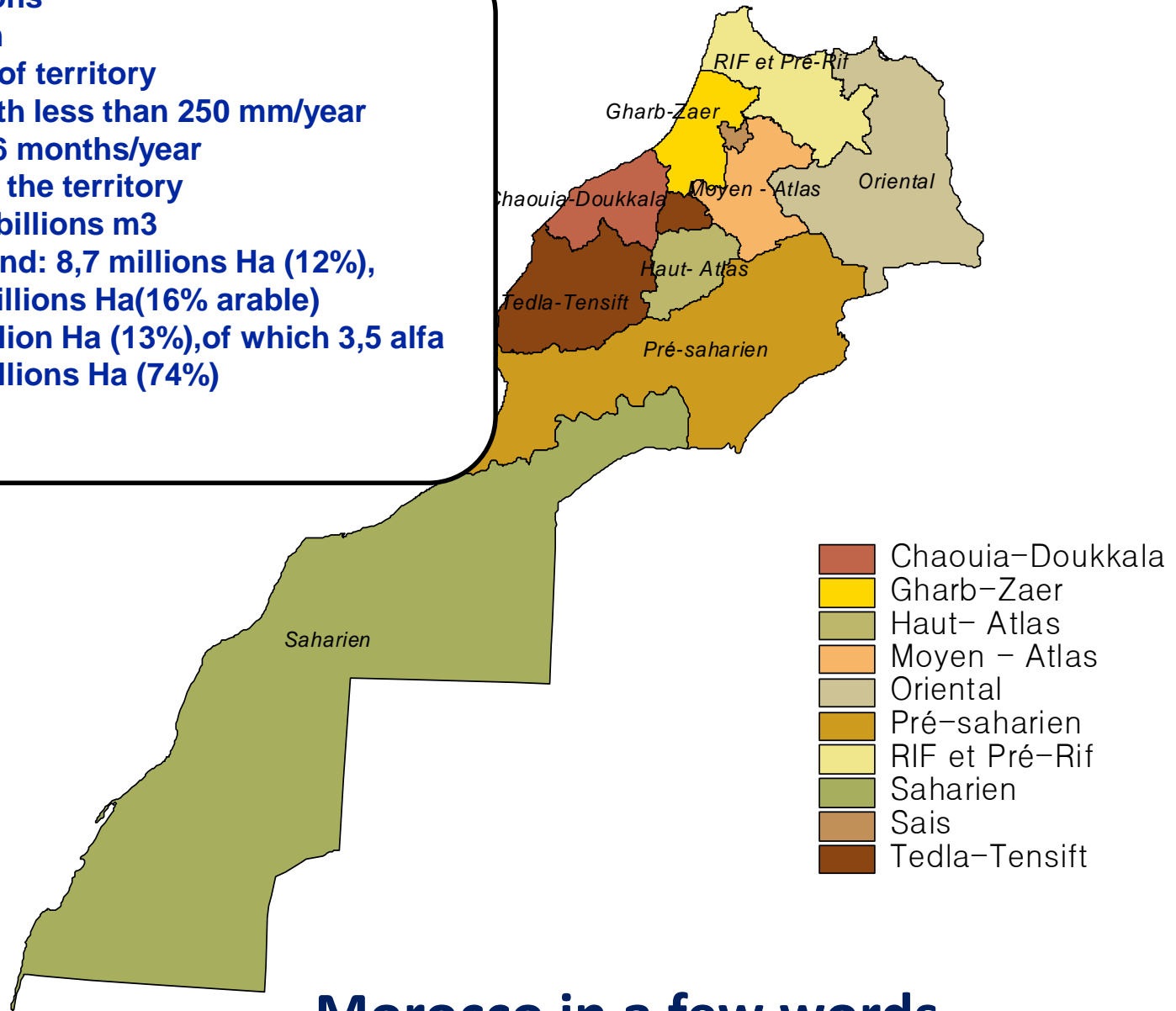
OUTLINE

- The national drought context:
 - Moroccan climat
 - Water resources
 - Historical droughts
 - Drought vulnerability
- Drought Impacts
- Institutionnal mapping
- Drought management strategies
- Constraints and further needs

Situation of Morocco : North-West of African Continent



- Population : 33 millions
- Area : 710,850 sq.km
- Arid area : 93% of territory
- Rainfall : 80% with less than 250 mm/year
- Dry season : 4 to 6 months/year
- Mountains : 26% of the territory
- Water resources: 22 billions m3
- Agricultural arable land: 8,7 millions Ha (12%),
- Irrigated area : 1,5 millions Ha(16% arable)
- Forest land : 9 million Ha (13%),of which 3,5 alfa
- Rangeland : 53 millions Ha (74%)

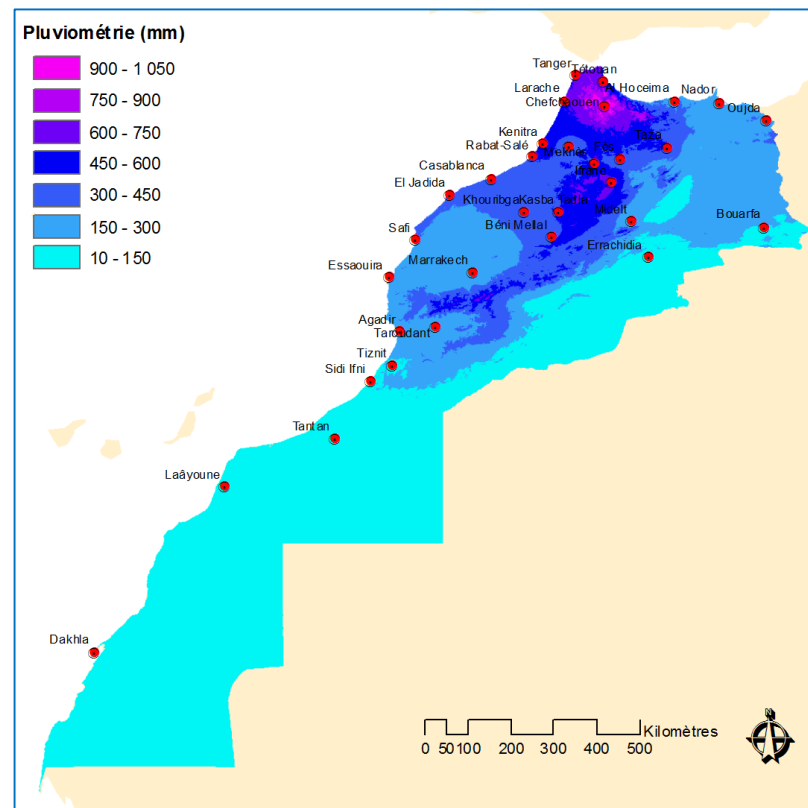


Morocco in a few words

Moroccan climate

Rainfall follows a decreasing gradient from north to south and from west to east, with an increase on the Rif and Atlas mountains

- Important intra and inter-annual variability;
- Important spatial variability



Moyenne de la pluviométrie cumulée de septembre à avril (Carte réalisée à partir des données www.worldclim.org ; Balaghi et al. 2012a ; Source de données : Hijmans et al., 2005). Les points en rouge indiquent les principales villes marocaines.

Water Resources Potential

Potential des ressources en eau

Précipitations: 140 Md m³

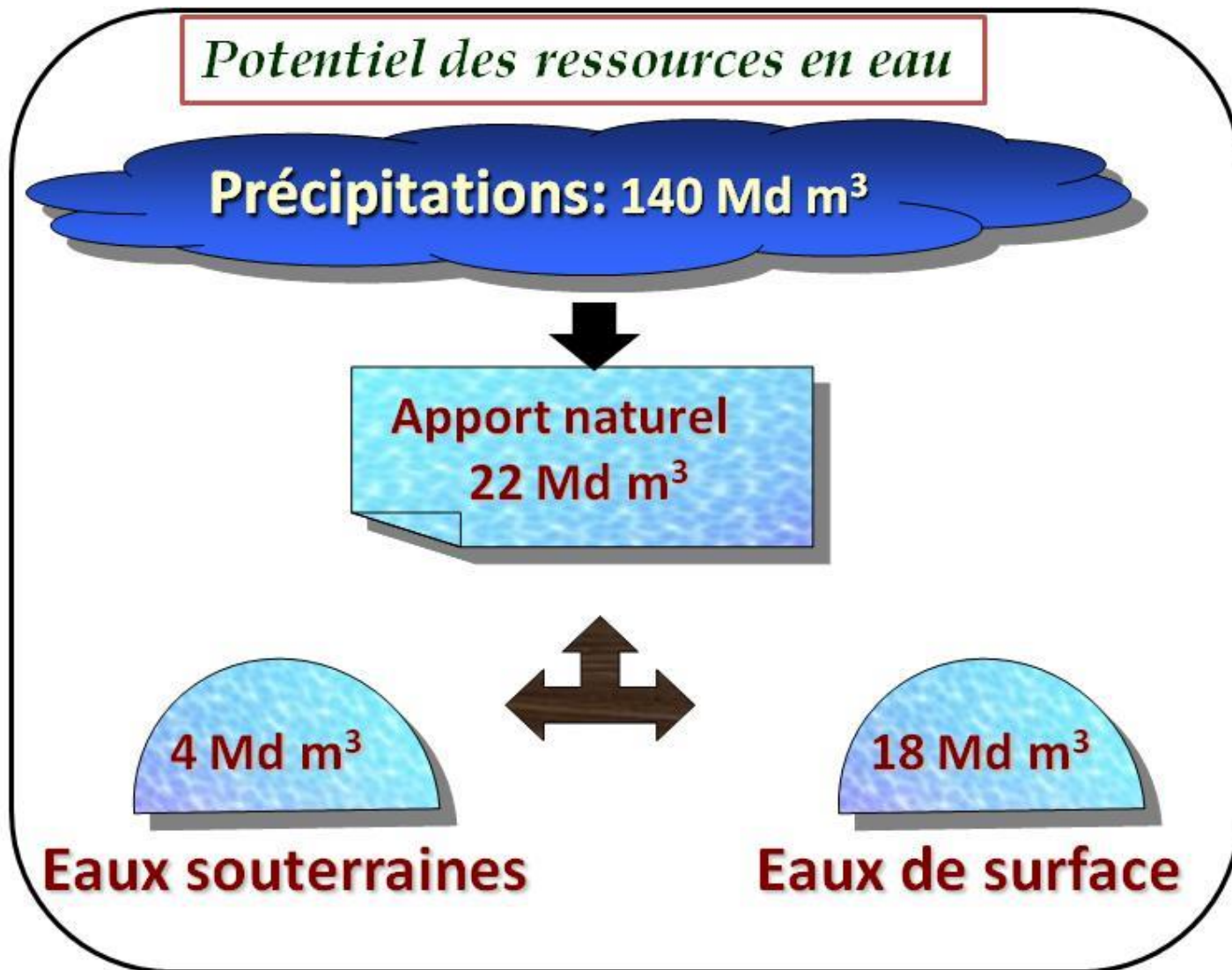
**Apport naturel
22 Md m³**

4 Md m³

Eaux souterraines

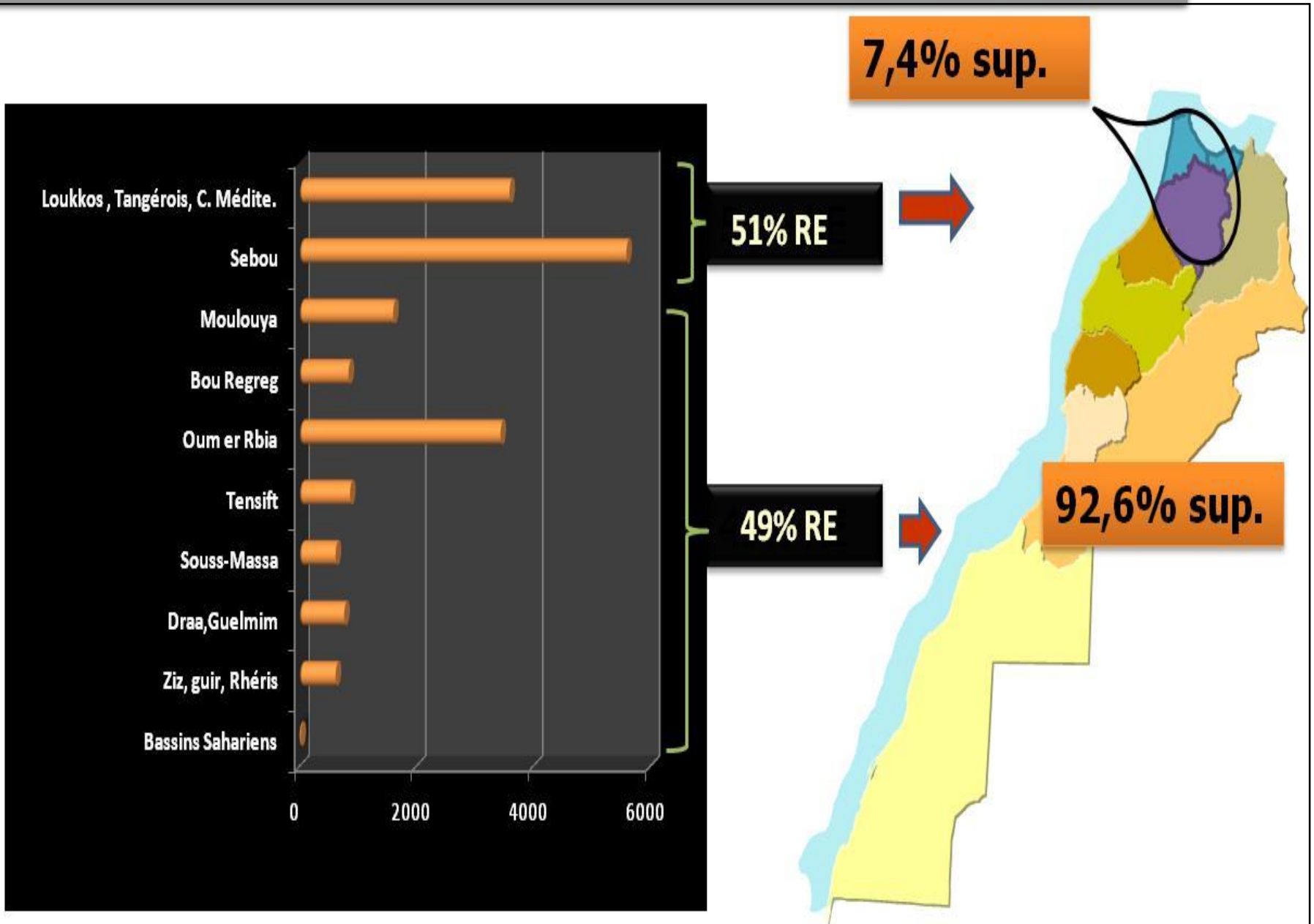
18 Md m³

Eaux de surface



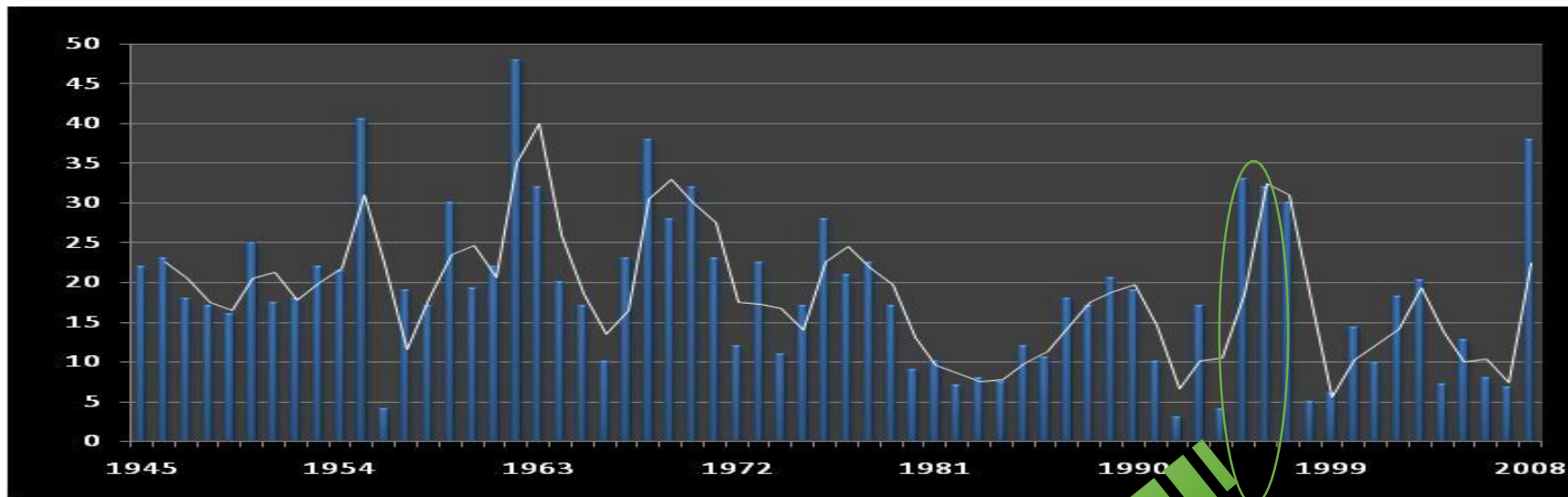
Water Ressources Potential

Surface water ressources: concentrated in the North-west

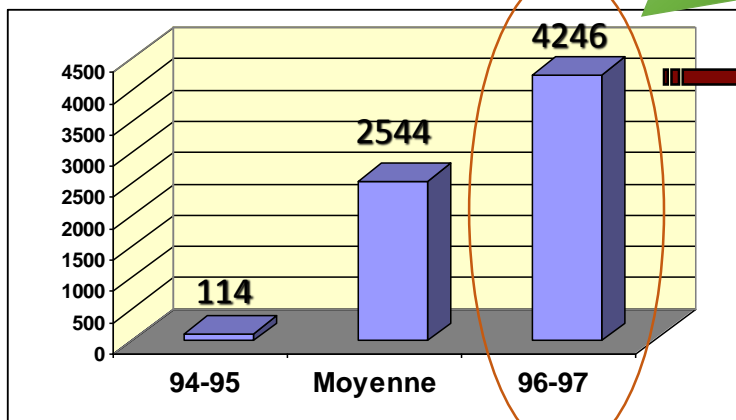
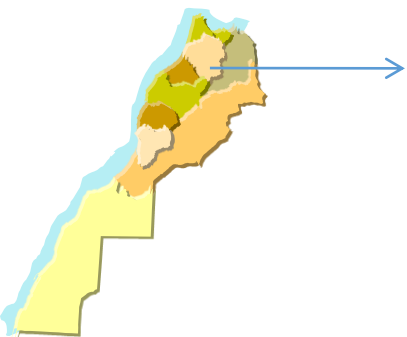


Water Resources

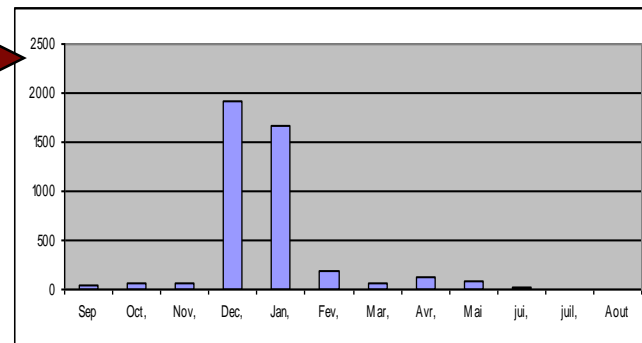
Surface water: Important inter-annual variability



Case of the Ouergha basin

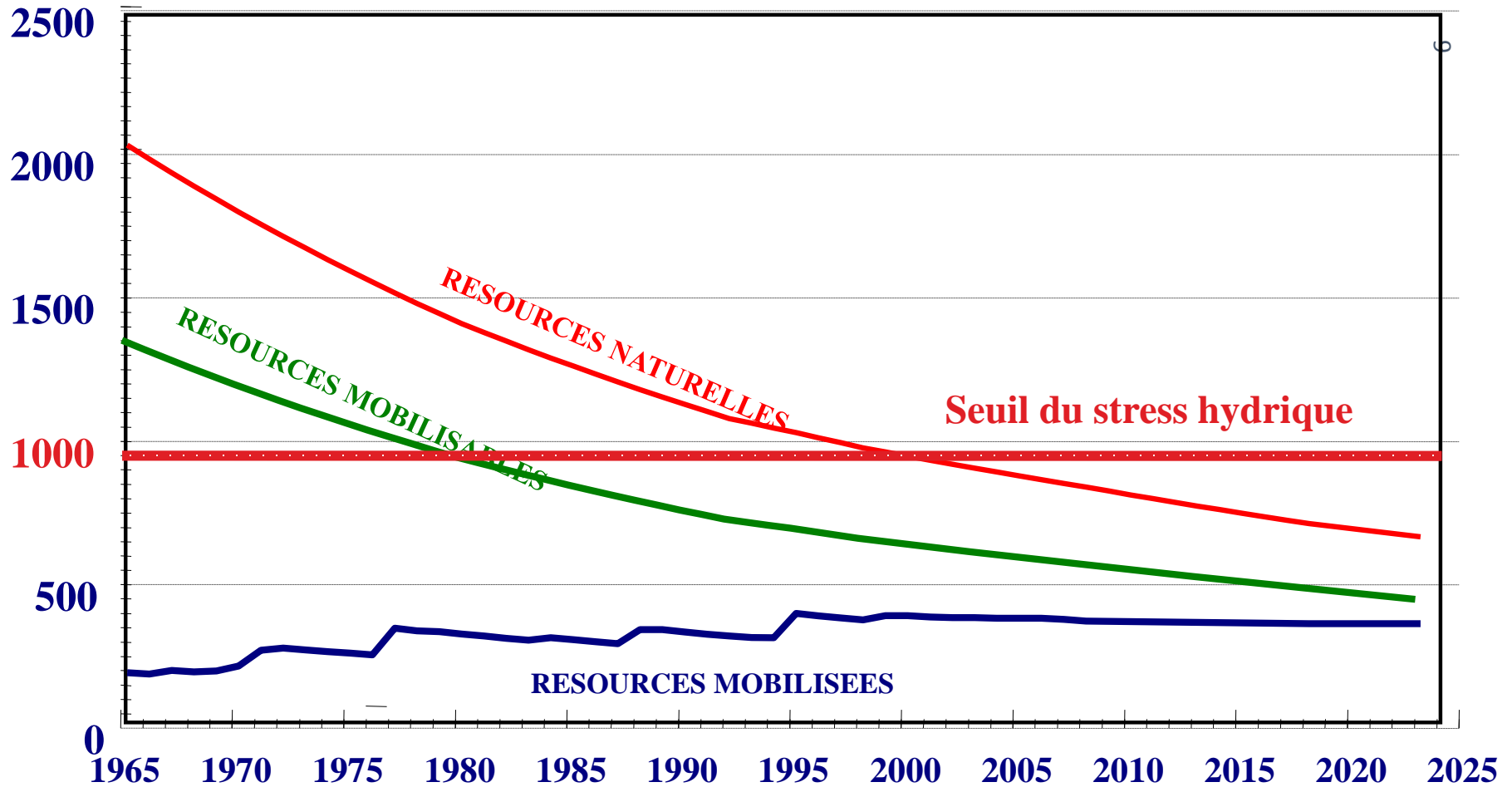


Wet year 1996 : 4.2 Mdm³



Evolution of the Water Ressources potential

m³/hab./an



.....The Rational:

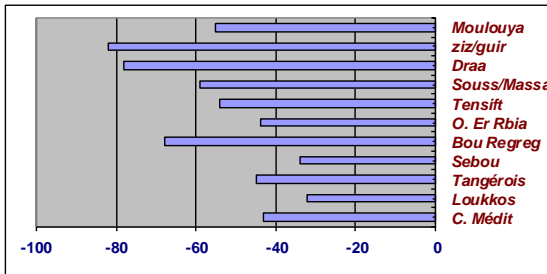
The Water Resources Potential is:

- Limited
- Inequally distributed in time and space
- Knows an important demand
- Threatens by climate change

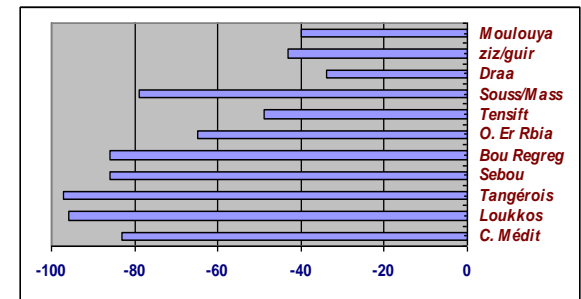
Frequent Drought periods

- During the last 40 years, more than 20 dry episodes were recorded
- Some of them were generalised to the whole country
 - Rainfall deficits sometimes exceed 60%
 - Long droughts can exceed 5 years

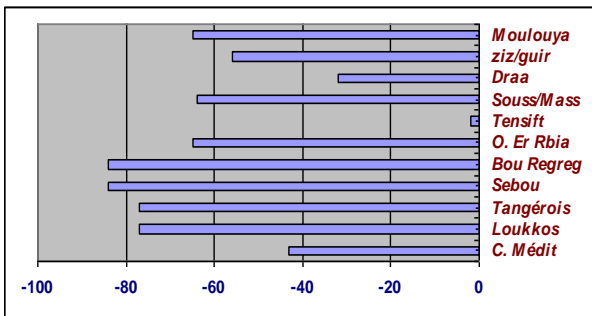
1982-1983



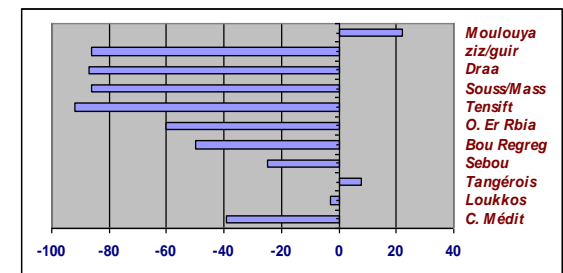
1994-1995



1999-2000



2000-2001



Droughts in Morocco

The frequency analysis of these drought episodes reveals that drought tends to become chronic in Morocco and that its frequency, severity and duration increase:

- 1940-1979: 5 dry years over 40 years (1/10)
- 1980-1995: 6 dry years over 16 years (3/10)
- 1996-2006: 4 dry years over 10 years (4/10)



Hydrological Droughts in Morocco

- Excédentaire
- Déficit < 50%
- Déficit > 50%

Increase of
drought
frequency
from the 80's

ANNEE	LOUKKOS	MOULOUYA	OUERGHA	BOUREGREG	EL ABID	N'FIS	ISSEN	DRAA	ZIZ
1950	49	41	108	21	55	6	-75	140	-6
1951	2	5	9	-23	-62	-42	-71	-47	-54
1952	-45	8	-37	-37	-37	2	-3	11	4
1953	-11	62	-40	36	105	75	2	15	58
1954	54	38	59	-7	8	-6	-11	60	-55
1955	135	94	96	162	145	143	185	140	108
1956	-58	-19	-73	-86	-49	-73	-79	-53	-22
1957	-9	-3	-16	-13	29	-25	-48	-21	-29
1958	-2	-3	37	-28	-12	-74	-81	-60	61
1959	91	115	116	70	46	-66	-55	-4	-11
1960	-20	-2	-39	8	-10	-87	-98	-66	69
1961	48	13	41	7	86	2	-2	-50	27
1962	153	104	194	262	169	217	289	57	134
1963	122	33	89	99	99	3	192	-56	329
1964	-6	26	3	-28	11	45	105	32	112
1965	15	-30	-8	-46	-32	2	-43	97	21
1966	-68	-44	-69	-66	-36	-20	9	-7	4
1967	-35	39	-21	44	26	156	170	216	-34
1968	160	61	131	202	69	1	116	117	18
1969	-40	53	141	15	21	25	77	31	-37
1970	55	48	65	117	104	102	109	74	-34
1971	29	26	-1	20	109	-17	-55	-42	28
1972	-67	2	-61	-62	-9	-55	-90	-49	48
1973	-20	5	4	57	53	4	29	-48	-40
1974	-64	54	-56	-79	-40	-80	-90	-76	39
1975	-38	40	-23	-61	-3	-50	-74	-73	85
1976	119	10	86	97	19	-66	-72	-55	3
1977	45	-33	34	-8	8	2	-14	15	-50
1978	52	-5	42	166	36	47	83	4	-29
1979	-68	3	-49	-34	-15	-13	-48	89	30
1980	-66	-62	-68	-75	-53	-41	-78	-51	-77
1981	-36	-36	-28	-52	-51	-66	-13	-72	-76
1982	-63	-61	-58	-83	-76	-86	-92	-89	-88
1983	13	-68	11	-78	-71	-56	-21	-91	-94
1984	-39	-69	-56	-68	-48	-41	-31	-74	-90
1985	27	-17	19	-37	-38	-67	-58	-77	-80
1986	-22	-22	-29	-50	-31	-71	-87	-79	-71
1987	-55	-53	-63	-25	-7	158	151	135	-54
1988	-52	-54	-65	-62	-13	100	83	118	44
1989	5	-12	-6	-28	-36	126	35	240	160
1990	-19	0	-17	9	-8	-32	-37	-7	13
1991	-75	-44	-82	-72	-55	71	-32	29	-51
1992	-83	-78	-90	-89	-64	-69	-96	-59	-83
1993	-50	35	-56	-36	-2	-4	-39	9	41
1994	-96	-36	-95	-84	-70	-49	-88	-28	-27
1995	99	90	8	135	80	164	301	89	138
1996	63	-11	67	110	-5	37	92	-30	-15
1997	67	-29	71	-6	-47	0	12	-12	-51
1998	-90	-74	-91	-65	-67	-80	-91	-81	-82
1999	-77	-79	-83	-83	-74	-2	-36	-30	-42
2000	1	7	-3	-47	-58	-93	-87	-90	-84
2001	-56	-30	-66	-41	-53	-57	-81	-60	-31
2002	24	-39	16	25	-45	-100	-61	-79	-80

Overview of the agricultural sector and elements of drought vulnerability

- Agricultural sector in Morocco accounts for
 - 14 to 20 percent of the GDP
 - 43 percent of all employment and 78 % of rural employment
- Only 15 percent of the country's lands are irrigated, while the rest are rain-fed crops.
- Uses about 80% of water resources
- Rural population mostly composed of small subsistent farmers whose production depends almost entirely on rainfall. They are therefore very sensitive to drought episodes that may dramatically affect their incomes

Drought Impacts

Impacts on water resources

- Impacts on inflows

Drought period	Mean Deficit of inflows
1980-1985	30 to 80 %
1991-1995	10 to 75 %
1998-2000	40 to 85 %

- Impacts on reservoirs levels

Drought period	Reservoir levels (% of total capacity)
1980-1985	Aroud 25 %
1991-1995	Around 30%

Impacts on drinking water

- Cities
 - ✓ Marrakech: Restrictions of 27% in 1983
 - ✓ Tetouan: Restrictions of 36% in 1995
 - ✓ Tangier: Restrictions of nearly 50% between 1993 and 1995.
This included the transportation of water using barges which cost nearly 300 million Dirhams (45 Dirhams per m³)
- Rural areas:
 - ✓ In 1994-1995, a water supply component brought clean drinking water to 196,000 rural people

Impacts on the agricultural sector

✓ Irrigation: Deficits in water allocations from main dams

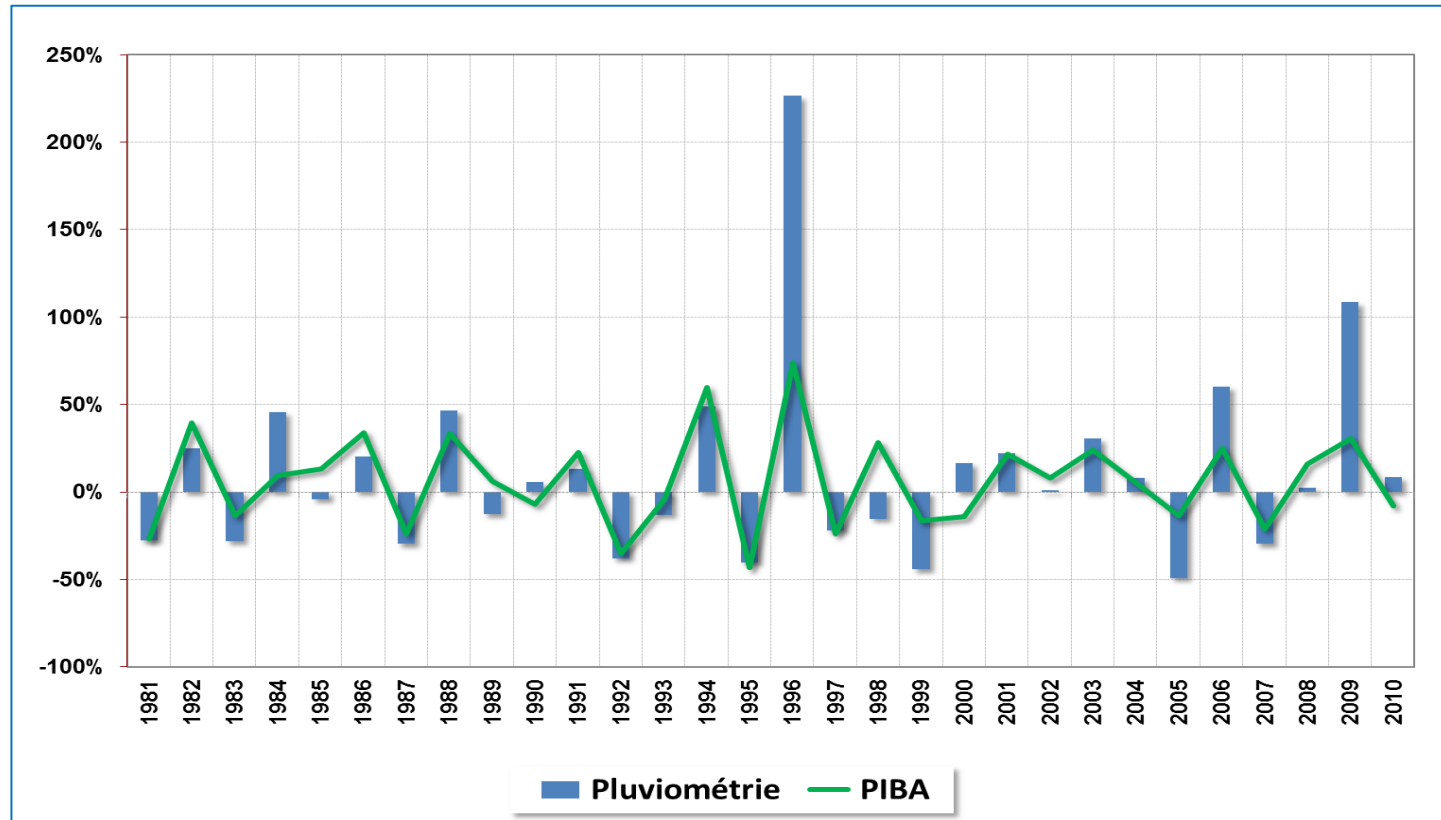
Drought periods	Deficits in water allocations
1980-1985	14 to 82%
1991-1995	10 to 69%
1994- 1995	16 to 90%

✓ Rainfed areas/Cereal production:

- Agricultural campaign 1994/1995: decrease of 82 % of the cereals production compared to 1993-1994
- Cereal production in Morocco varied from a high output of 10 million tons in a good season like 1996 to below 2 million tons in a dry year like 2000, giving a 'dry year : good year production ratio' of 1 to 5

Impacts of rainfall deficit on the Gross national Agricultural product

Due to the economic weight of the agricultural sector, each rainfall deficit immediately impacts the whole economy of the country



(Source : Bank Al Maghrib and MAPM)

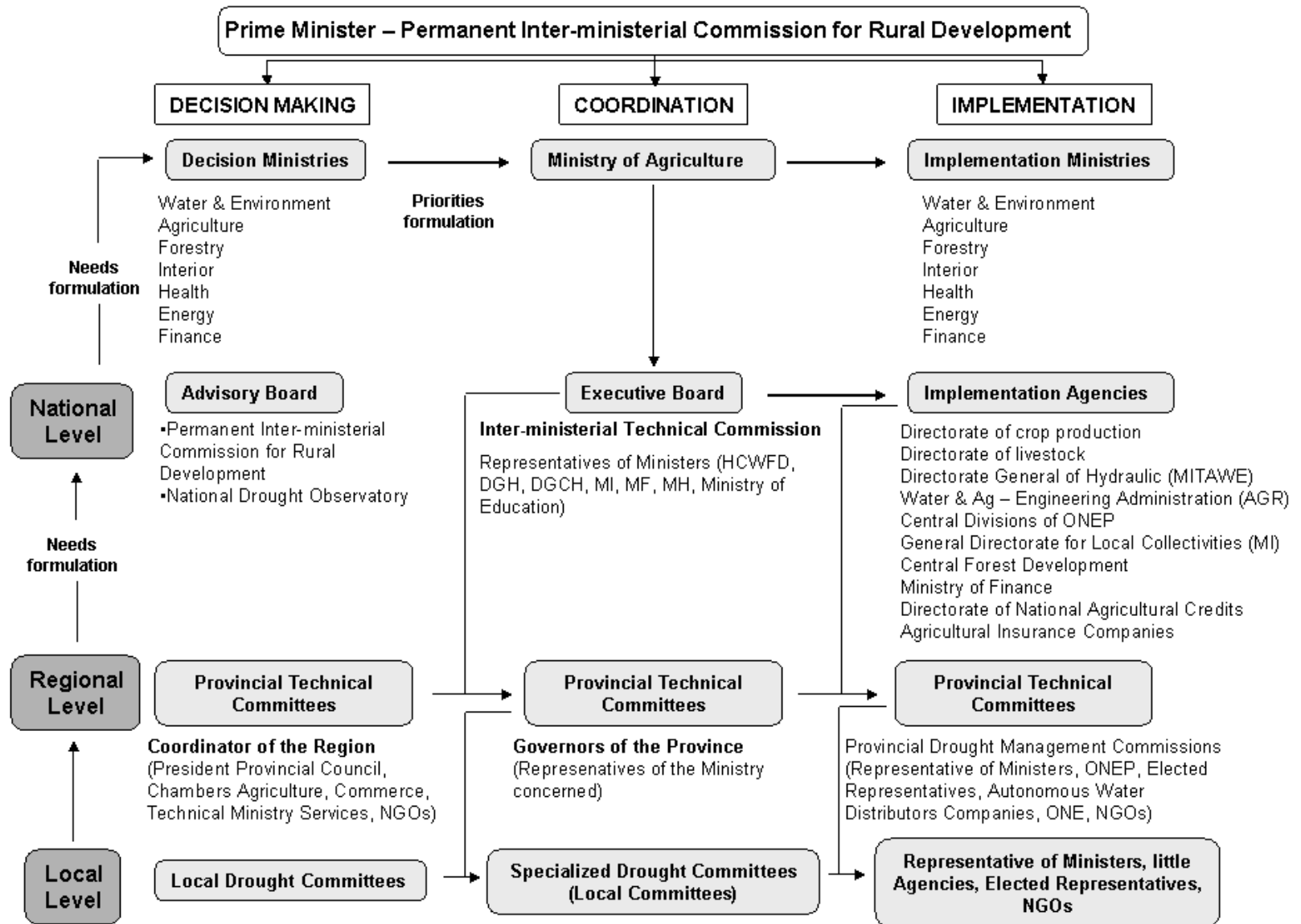
Impacts on Energy production and the Environment

- Energy sector: Deficit of the total energy production
 - ✓ Deficit of 46% during the 1980-1985 drought period
 - ✓ Deficit of 42% during the 1991-1995 drought period
- Environment: (Main impacts):
 - ✓ Biodiversity losses in ecosystems associated with water
 - ✓ Increase in number and severity of fires
 - ✓ Decrease in reservoirs and lakes levels
 - ✓ Ground water depletion
 - ✓ Increase in animal and plant diseases
 - ✓ Increased stress on endangered species

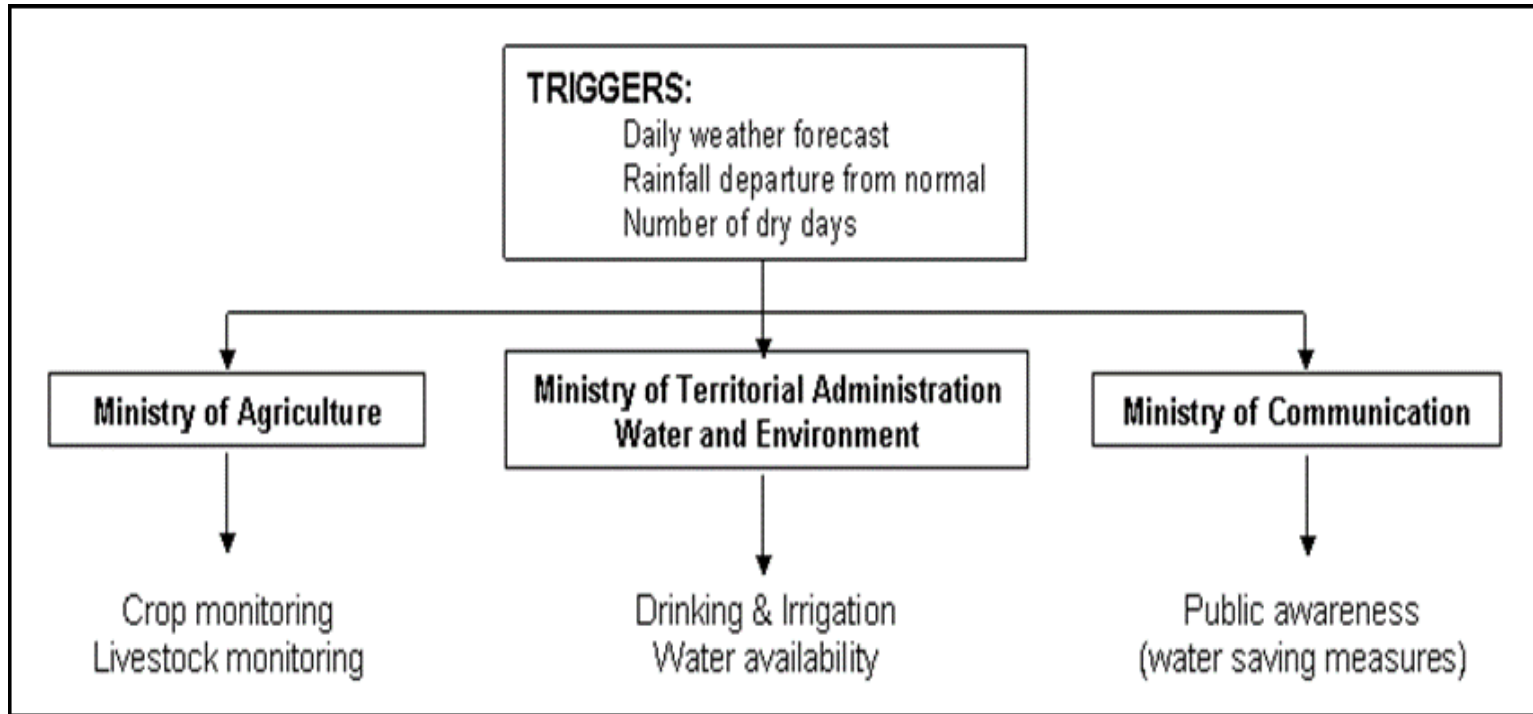
Drought management:

- Institutional Mapping
- Monitoring
- Mitigation & Adaptation strategies

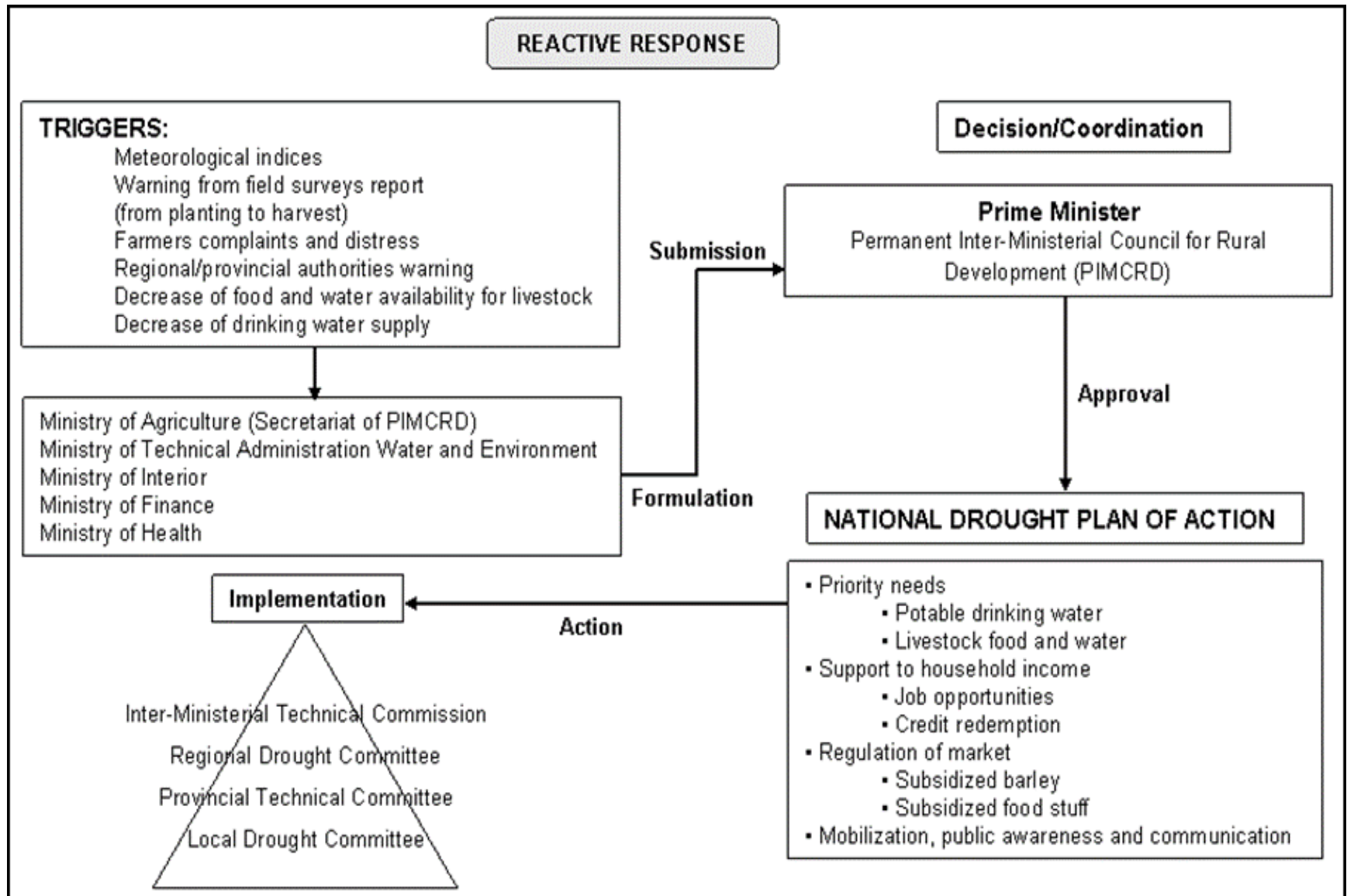
Overall schema of Drought management:



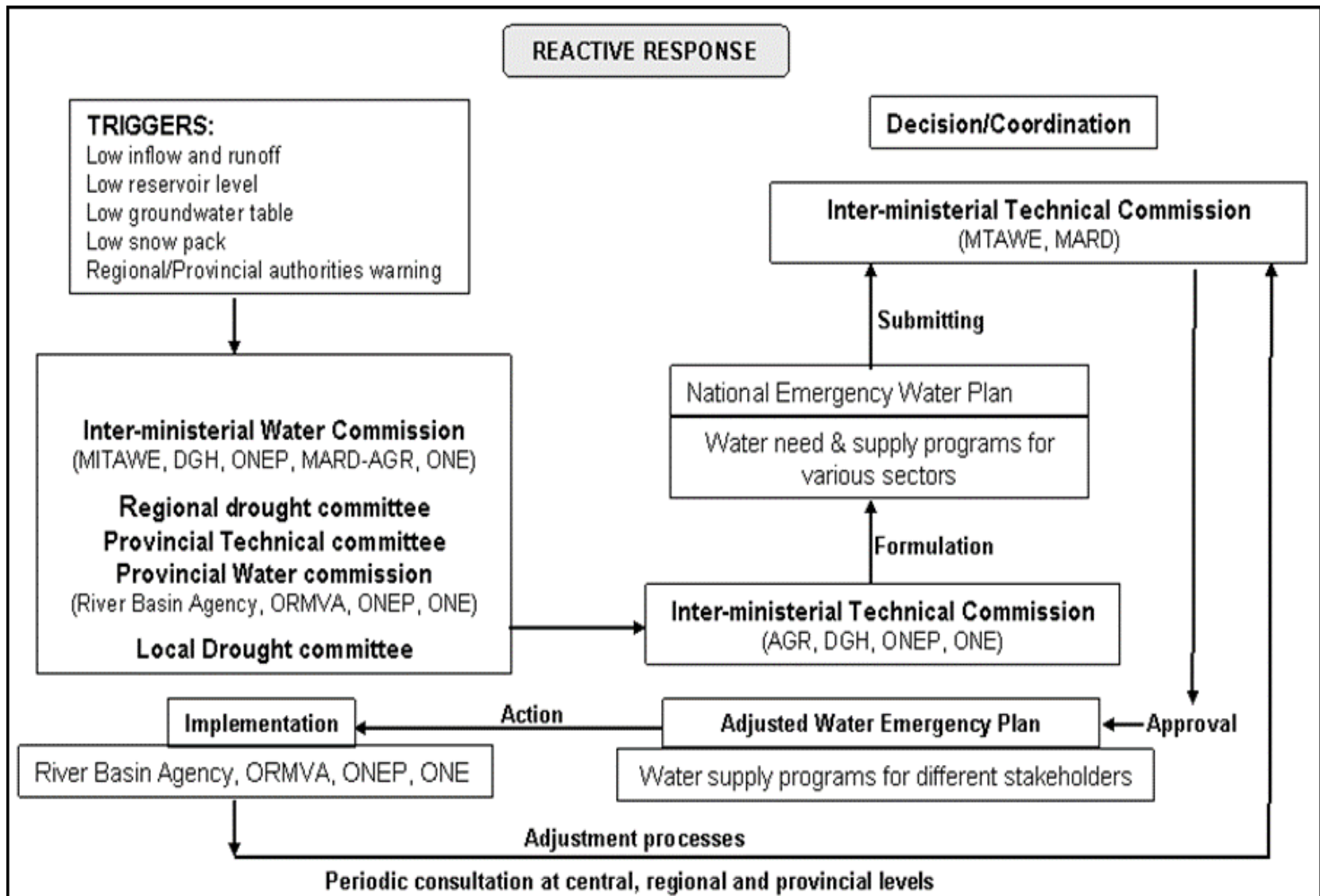
Meteorological drought:



Agricultural Drought



Hydrological Drought



Drought monitoring: Data and information systems

Category	Institutions	Type of data
Climate	DMN, CRTS, MAPM/DDFP/DIAEA HCEFLCD/Forestry, ORMVA, ABH/River Basin Agencies, DRA/DPA, CSEC	Meteorological
Water	MDE/DRPE, MAPM/DIAEA, DDFP, ONEE, CSEC, Autonomous state- controlled companies, ME/Environnement	Surface water, Groundwater, Water quality control Water use and allowances
Land	DDS, DIAEA, DDFP, ANCFCT, CRTS, MI, DCL, ME	Land use, topography, land census, administrative and ecological zoning
Agriculture	MAPM, DSS, DDFP, DIAEA, CGDA, CAM, MAMDA, ONICL, INRA, IAV, ENA, CRTS, ME, HCP	Agricultural census, statistics (area, type of farms, labor, production, prices, export and import), Research and development activities
Forestry	CFLD, DDF, DREF, ENFI, IAV, ENA ME/Environnement	Forestry (areas, products, prices)
Socioeconomic	DSS, MI, IAV, ENA, INRA, Universities and NGOs	Population, macroeconomic indicators, production costs
Energy & Mine	MEMEE, MC, ONEE, ME/Environment	Statistics by activity, energy consumption

Reactive Drought Mitigation plans

- Adoption in 1985 of a reactive action plan to mitigate the drought effects in the form of relief operations
- Plan monitored by an inter-government committee headed by the Ministry of Agriculture and Fisheries, in close collaboration with the Permanent Inter-ministerial Council for Rural Development under Prime Minister leadership
- Funds are made available to assist rural populations in solving the problems associated with Livestock protection, Drinking water, Jobs creation and Agricultural credit debt relief.
- Crisis-management oriented approach whose cost is tremendous in terms of public money investment, time and human resource needs

Proactive Drought Mitigation plans: Sectorial strategies

- In 1995, preliminary guidelines for a new approach to drought based on risk management principles provided the basis for a more proactive drought management approach in the country
- The National Program for Drought Mitigation has now two clear orientations:
 - (i) an operationally oriented short term reactive program with relief operations
 - (ii) a broad-based drought mitigation strategy, including long term forecasting programs, water conservation measures, new agricultural techniques and new crop varieties or species, a drought insurance program

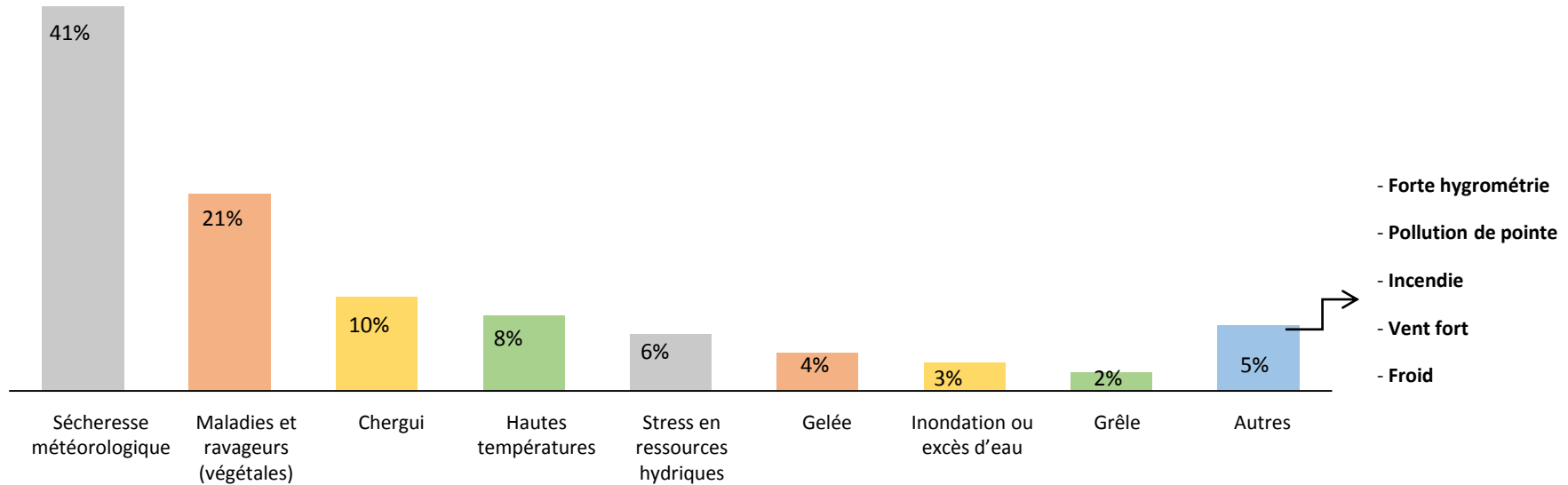
Sectorial Strategies: Water sector, IWRM

- Policy of control and mobilization of water resources through the construction of big reservoirs dams and works for water transfer since the 60's
- Law 10-95: new water law which consolidated the integrated, participatory and decentralized water resources management through the creation of river basin agencies and the introduction of financial mechanisms for the protection and preservation of water resources
- Strategic planification tools : national water plan , integrated river basin plans
- Development of non-conventional water resources
- Traditional and new water harvesting techniques

Sectorial Strategies: Agricultural sector

- The National Agriculture strategy Green Morocco Plan(Ex:Programme National d'Economie d'Eau d'Irrigation-PNEEI, Programme d'Extension de l'Irrigation-PEI, Desertification Plan, Pasture programme)
- Development of agronomic packages: dryland farming techniques
- Tarification of irrigation water
- Agricultural insurance

Agricultural insurance : Classification of agricultural hazards



Drought is the most important risk, followed by plant diseases (**21%**), **chergui** (**10%**) and high temperatures (**8%**).

The Multi-Risk agricultural insurance for Cereals and legumes: a new product

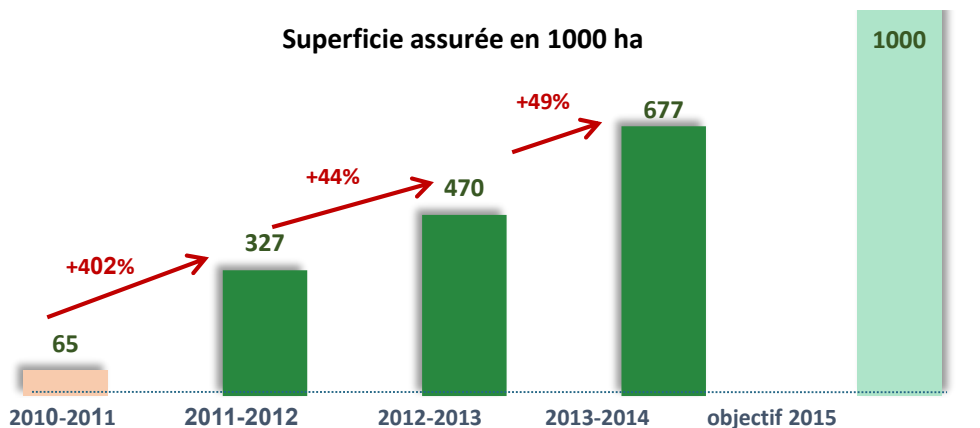


Technical characteristics

Covered risks	DROUGHT , Water excess, Hail, Frost, Strong winds and sand storms
Covered area	Objectif : One million ha by 2015
Insured crops	<ul style="list-style-type: none">•Cereals (durum wheat, bread wheat, barley and corn),•Food legumes.(fava bean, lentils, peas, chickpeas and beans)
Guaranteed capital	5 levels: : 600 / 900/ 1450 / 2900 and 4350 DH/ha
State Contribution	Subventions of 57% To 90%.
Compensation system	On the basis of communal yields

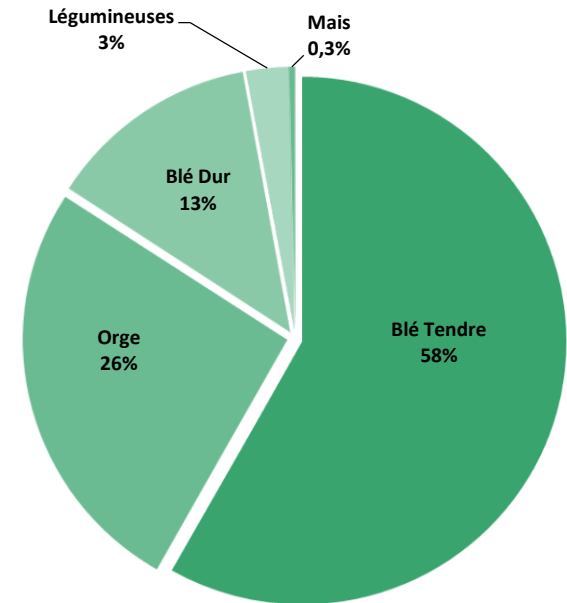
The Multi-Risk agricultural insurance for Cereals and legumes: a new product

Achievements



Former
Drought
Insurance

Climate Multi-Risks
Insurance



The Parametric insurance: a pilot project

A pilot project is launched in order to test the feasibility of a parametric insurance that would be a complement or even a substitut to the multi-risk insurance

Technical characteristics

Covered risks	Drought
Insured Crops	Cereals
Indices	Mixt indices : Climat indices (Rainfall, + ET0 + ...) + Remote data (NDVI from SPOT and MODIS)
Pilot areas	<ul style="list-style-type: none">•Chaouia - Ouardigha;•Meknès - Tafilalet•Fès - Boulemane
Lenght	•3 years starting from 2013-2014
Institutional involvement	MAPM ,INRA and DMN.



Constraints and further needs

Drought monitoring

Problematic:

- Limited coordination of information coming from different ministerial departments
- Lack of continuous drought indicators and defined thresholds
- No sustainable drought early warning system

Needs:

- Better cooperation among institutions
- Earlier drought detection
- Early warning system allowing data collection and diffusion of drought information at national level

Drought management

Problematic:

- Limited coordination between sectorial strategies
- Lack of implementation of legal framework on water scarcity
- No capitalisation on sustainable drought monitoring

Needs:

- Coordination mechanism
- Implementation of legal framework on water scarcity

Thanks for your attention!

