

LAND USE / COVER CHANGE AND WATER RESOURCES

NATIONAL PROFILE

The Algerian territory extends on 2.4 million km². It offers North to the South, three contrasted sets separated, by the relief and morphology, starting from the cuts which constitute transversely, the Tell chain with the littoral and the Atlas chain which borders the High Plains more in the South. Beyond the Atlas chain extends Saharan space. The climatic conditions allied with this organisation in relief determine the agriculture and water potentialities of the country.

NATIONAL STATISTIQUES ON AREAL CHANGES OF ARABLE, FOREST, RANGELAND AND AFFORESTED LAND

The national statistics come from the Ministry of agriculture and give data on

- arable land as useful agricultural area;
- forested land;
- pasture land;
- Alfa land.

Year	Arable land	Forested land	Pasture land	Alfa land
1980	7,510,340	4,384,370	31,660,980	4,660,600
1981	7,510,080	4,384,370	31,661,240	4,660,600
1982	7,508,740	4,384,370	31,598,370	4,660,600
1983	7,231,350	4,579,000	32,050,910	4,720,000
1984	7,509,730	4,583,020	31,771,200	4,521,920
1985	7,510,350	4,586,150	31,540,250	4,568,950
1986	7,533,740	4,252,200	31,154,580	4,463,250
1987	7,623,670	4,217,150	31,104,800	4,203,560
1988	7,635,230	4,141,610	31,151,650	4,204,570
1989	7,675,500	4,084,860	31,053,430	4,166,150
1990	7,661,380	4,061,000	31,015,280	3,641,000
1991	7,840,990	3,982,000	30,780,870	3,525,500
1992	8,126,040	3,924,780	30,738,690	3,493,990
1993	8,095,670	3,970,610	30,765,230	3,426,020
1994	8,042,610	3,950,000	31,596,770	3,351,550
1995	8,069,230	3,900,000	31,620,110	3,100,000
1996	8,081,000	3,855,000	31,525,000	2,865,000
1997	8,201,720	3,835,500	31,531,470	2,830,000
1998	8,215,730	3,900,000	34,466,850	2,920,000
<i>Mean of 1980-1998 period</i>	<i>7,767,532</i>	<i>4,156,631</i>	<i>31,515,141</i>	<i>3,893,856</i>

Table 1 - Area changes of arable, forest, pasture and Alfa Land (ha)

One can note, according to table 1, that the surface of forest and the Alfa lands decreased during the 1980-1998 period. The Alfa land undergo a strong degradation caused by an intense process of desertification. This phenomenon is presented in the paper by Aidoud in the present newsletter.

The specifications of the main agricultural policies and their launching dates

Since the independence of Algeria, the following policies have been implemented:

- the ordinance of August 24, 1962 and the decree of March 1963 gave rise to the committees charged to manage the lands given up by the former colonists. These committees were composed of workers who have been employed before in these lands and a manager appointed by the central administration of agriculture;
- the ordinance 71-73 of November 8, 1971 instituted the agrarian revolution. This ordinance abolishes any form of trade on the water resources of agricultural use;
- the Law 73-87 of July 17, 1973 fixed on a national scale the maximum and minimum surfaces of the agricultural properties or at agricultural vocation;
- the Law 87-19 of December 8, 1987 modifies the modes of management of the public lands and transfers them to the collective and individual farms of private statute;
- the Law 88-70 of September 1988 relating one to the new statute of the co-operation, restores the key principles of the co-operation based on free and voluntary adhesion, free and autonomous management while devoting the withdrawal of the official institutions in the control and the co-operative system management created in 1972;
- the Law 90-25 of November 18, 1990 completed the legal building and restores the traditional categories which governed the land right in the past. This law implies the privatisation of the land;
- the Law 90-30 of December 1990 relating one to the national field, introduces the distinction between the private and the public domain of the State. From this date, the national domain lands were classified as the private field and governed by the private rules.

NATIONAL STATISTICS ON ANNUAL WATER BALANCES AT THE COUNTRY LEVEL AND MAIN BASINS

Introduction

In Algeria, the systematic inventory of water resources, in spite of many studies carried out during the last century, is not completed yet, but its broad outline is known. These resources are not well distributed, in space, quantity and nature (surface or underground). The major part of the country (87%) corresponds to a desert where precipitations are quasi null but which conceals important fossil underground water resources. The Northern part of the country is characterised by a Mediterranean climate, with renewable surface and underground water resources. 90% of the surface water is located in the Tell area which cover about 7% of the territory. Another characteristic is the strong disparity between the West and East of the country. Plains are reaching on the poorly sprinkled Western area The Eastern part of the country is a mountainous area where the principal rivers run out. The Western basins receive only 10% of the flow with a surface representing the third of that of the North of the country. Those of the East drain 40% with only 20% of the total surface and the Centre basins drain 50% of the flows with 50% of the remainder of the surface. One estimates nearly 1,6 billion the volume regularised by year. The number of dams reach 115 of which 45 have a capacity higher than 10 million m³ and 65 of lower capacity. The number of dams in construction is 16 and 20 new are programmed at horizon 2010. For the future, 17 other dams are on study.

The total of surface and underground water resources are estimated at 19.2 billion of m³ with the distribution indicated in table2.

Zone	Surface water	Underground water	Total
North area	12 410	1 760	14 170
Sahara	-	4 950	4 950
total	12 410	6 710	19 120

A.N.R.H 1986

Table 2 - Water resource potential (in Hm³)

Surface water resources

The surface water in Algeria interest primarily the Northern part which has nearly 330,000 km² and located to the north of the axe formed by Béchar - Laghouat - Biskra. These surface water is subject to many constraints related to the physical environmental factors. The topography structure and the nature of the land determine the layout of the hydrographic network. The unity of hydrological basin is very weak and, between the source to the mouth, is made of a succession of modest rivers, slightly connected with each other in a disproportionate valley which they borrow in heritage of wetter periods. These rivers, on short distances, present contrasts between zones of strong erosion and active deposits. No large rivers can be found in the Northern part of the country since chains parallel to the shore do not allow it.

Area	Surface water	Underground water
ORANAIS	645	200
CHELIFF	1.660	207
ALGEROIS	3.010	412
SOUMMAM	700	122
CONSTANTINOIS	3.000	174
COTIERS-ANNABA	1.340	44
CHOTT CHERGUI	220	69
ZAHREZ-SERSOU	290	153
CHOTT-HODNA	280	133
MEDJERDA-MELLEGUE	645	75
AURES-NEMEMCHAS	300	145
SUD- ATLAS	70	20
SAHARA	250	4.950
TOTAL	12410	6.710

A.N.R.H 1986

Table 3 - Potential distribution by basins (in Hm³)

Importance of solid transport

The rivers often drain hills and mountains areas of the marno-argillaceous. The streaming achieves a multiform erosion work emerging with the formation of deep and hierarchical ravines of bad lands type. In Algeria The specific erosion rate reaches the most important values of North Africa. The elements of quantification related to the rates of specific erosion and to the concentrations, drawn from work of Demmak A (1982) and Heusch B (1982), give figures going from 20 to 500 ton/km²/an, with a turbidity ranging between 0,1 and 9g/l, and figures exceeding the 2000 ton/Km²/an with a turbidity ranging between 16 and 28g/l. The specific erosion rate reaches 5000 T/Km²/an on Agrioun river basin which feeds the dam of Ighil Emda (Bejaia). A quantity of 120 million tons of sediments is rejected annually in the sea. This phenomenon causes leads to a fast silting of many dams reserves. In 1957, the Algerian dams which counted a total capacity of 900 H m³, accumulated nearly 200 Hm³ of vase. The irregularity of the climate influences directly the flows, marked by:

- the seasonal and inter-annual irregularity of the water inflow;
- the violence and speed of the floods: we can have flows of more than 4200 m³/s on the Cheliff river;
- the severity and duration of the low water levels.

The overall estimate of the surface water potential is 12,410 per annum H m³, which were distributed as follow:

- basins tributary of the Mediterranean 11.105 H m³ (89%);
- endoreic Basins (76 000 Km²) 685 H m³ (6 %);
- Saharan Basins (67 000 Km²) 620 H m³ (5%).

The closed basins of the High Plains and the southernmost side of the Saharan Atlas drain only 11% of the surface flows.

In the Sahara, the possibilities of surface water mobilisation are quasi null (sporadic spreading of swellings like the sole case of Djorf Torba dam on the Guir river).

The measurement of the flows, ensured by the ANRH (the National Agency of the Water Resources) relates to 11 basins tributary of the Mediterranean (Tafna, Macta, Côtiers Oranais, Cheliff, Côtiers Algérois, Isser, Soummam, Côtiers constantinois, Kebir-Rhummel, Seybouse et Mejerda) and 4 endoreic basins (Chott Chergui, Chott Zahrez, Chott Hodna et Hauts Plateaux Constantinois).

Underground water resources

In Algeria, underground water is an essential capital in regard to the water reserves. The repeated dryness of these last decades clearly put forward the weaknesses of balance between need and resources regarding the surface water. The advantages of underground water, as a resource, result from the characters of their occurrence, their distribution and their regime in the natural environment. One can say:

- underground water does not require installations similar to regulating equipment and surface water transfer;
- underground water is often accessible and exploitable using simple means without requiring an excessive investment, in wide territories;
- underground water often offers natural characteristics in conformity with the standards required by many uses, in particular the drinking water.

Taking into account the diversity of the formations and geological structures as well as the importance of feeding the underground water reserves, all types of aquifers are represented in Algeria. It results from this point of view that the underground water potentialities and their exploitation could be radically different. A classification based on geological and morphological criteria made it possible to determine levels of very diversified resource and their exploitation. The strong potentialities allowing an intensive exploitation are localised in two principal types of aquifers:

- the large karstic, free or captive aquifers: mounts of Tlemcen, tableland of Saida, karst of Zibans;
- the large plains formed by subsidence and filled by an important alluvial filling, well fed as well by precipitated as by the rivers which cross them: plains of Sidi Bel Abbes, Mitidja, Mascara, Annaba;
- the rate of renewal of these aquifers is rather appreciable. Considering the geological environment and particular climatic conditions, one can say that in many areas of Algeria, the use of the underground water resource is limited by various factors:

- the parcelling out and the partitioning of the reservoirs as well by erosion as by tectonics,
- the morphology accentuated on a large part of the North (strong slopes supporting the streaming instead of infiltration),
- the limited power of the aquifers is a real constraint for intensive exploitation,
- the weakness of the unit flows of drillings which involves a number exaggerated of drills.

To this quantitative limitation of the reserves available, one can add the deterioration of the chemical quality of water. This is particularly true in the aquifers coastal (plain of Andalouses, Mitidja Eastern, plain of Annaba-Bouteldja, ... and the aquifers of the semi-arid areas, in particular those in the vicinity of the closed depressions (Chotts and Sebkhass). Excessive extraction from these aquifers often involve a fast increase in the water mineralisation. For these reasons, real and direct exploitable volumes of underground water, by well and drillings, can differ notably from the values of the annually infiltrated water.

Water use

The table 4 gives the water volume shared between the drinking water, industry and agriculture.

Type of activity	Underground water (hm ³)		Surface Water (hm ³)	Total (hm ³)	In %
	Northern	Southern			
Drinking water and Industrie	1000	200	300	1500	35,3
Agriculture					
Large perimeters	-	-	150	150	3,5
small perimeters	900	-	200	1100	25,9
Sud	-	1300	-	1300	30,6
Energy	-	-	200	200	4,7
Total	1900	1500	850	4250	
Percentage	44,7	35,3	20,0	100,0	100,0

(REE 1998)

Table 4 - Use of surface and underground water by each type of activity

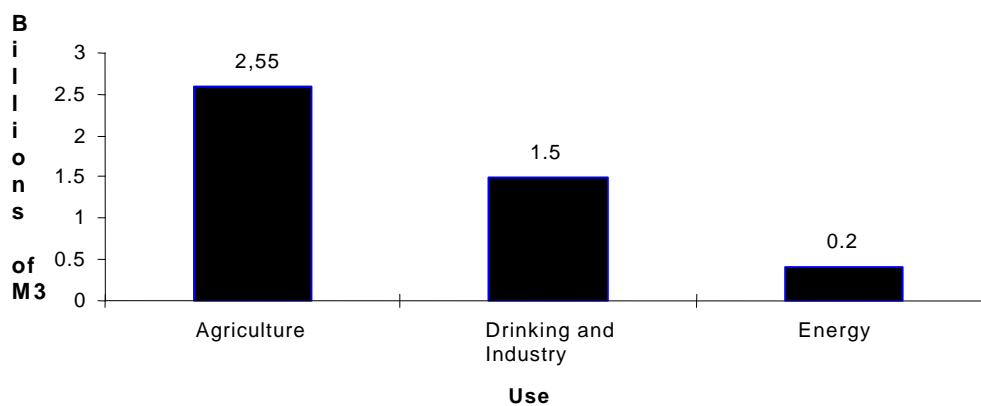


Figure 1 - Distribution of water between users
In billion of M3

Synthesis on water resources

In Algeria, even when not taking global climatic change into account, water scarcity is an important problem with acuity in many areas of the country. Since the Seventies, dryness prevails in an intense and persistent way. The impact on the water resource already appeared through, the reduction in the rivers flow, the low level of filling dams and the global fall of the piezometric level of the principal country aquifers. In the future, the current deficits of the water resources will increase. This will lead to obvious problems of management and strategy to ensure a durable development for the country.

The existing climatic change models deliver results mitigated enough with regard to the Maghreb area. There is not yet reliable estimates of modifications at the regional scale, which could affect some basic climatic parameters such as the annual and seasonal variability of precipitation, the temperature, the moisture of the ground, the frequency of the dryness, the floods, etc...

CHANGES ON ENCROACHMENT AND RELEASE OF AGRICULTURE ON RANGELANDS - CHANGES OF LIVESTOCK MANAGEMENT AND GRAZING PRESSURES

The changes which occurred in the rangelands, forest and Alfa lands, are primarily due to socio-economic reasons. The climatic fluctuations are a factor of aggravation. Some regulations, decided without involving the implied populations, caused a disrupt of traditional management systems of arid and semi-arid areas causing an accelerated land degradation.

Changes driven by climatic fluctuations

The climate of Algeria, as for many Mediterranean countries, is a climate characterised by an annual and inter annual variability which results in the occurrence of very dry, dry, normal and seldom wet years causing an important drop of the vegetable production. The rain events occur mainly from October to April and the water rain is often concentrated in few days or some hours. The quantity of annual rain is generally below 400 mm.

(a) Temperature - In general, the temperature, is relatively high leading to large value of evapotranspiration. Since 1970, the minimal and the maximal mean temperatures increase in the whole country and this tendency is still persisting. During the last two decades, the maximum temperature is increasing more rapidly comparatively to the minimum one and the increase reaches about 2°Celsius. The consequence of this temperature increase is reflected, in a rather clear way, on the number of snow days which passed, in certain areas, on average 26 days per year in the 1971-1980 period to 6 days for the 1981-1990 period.

(b) Rain - During the last two decades, the general tendency of the annual rain is still decreasing with more intensity in the western part than the other parts of the country. The ratio between the annual wet year and dry year rain can reach a value of 8. The inter-annual variability of the rain increases with the aridity of the area.

The climate variability constitutes a permanent stress on the ecosystems in general and on the dry cultures in particular. The variability increases while going towards the Southern latitudes. During the dry years, the rangelands, steppe and forest are degraded under the influence of the livestock due to over-grazing. The rangelands and steppe decreased because their plant covers could not regenerate and the fires devastate the forests. The recent fluctuations of the climate and the more frequent droughts during the three last decades accentuated the phenomenon of land degradation leading to a desertification of the vulnerable area as the steppe and the high plains.

The warming processes due to climatic changes would lead to more aridity inducing an exacerbation of the ecosystems degradation and more important destruction of the forests as a result of higher frequency fire. The successive records of temperature during the 1990-2000 period caused tremendous losses of forests. The actual tendency of flood intensification could lead to more soil erosion and degradation.

(c) Droughts - The table 5 gives the statistical values of the annual rain during the normal, dry and very dry years at the Oran station for the Western part of the country, Algiers station for the Centre, Annaba for the East and Biskra for the Northern part of the Sahara.

The normal year is defined as the average of the annual rain during 1961-1990 period.

The dry year is defined as a year of a return cycle of 5 years.

The very dry year as a year of a return cycle of 10 years.

One can see that the drought is more pronounced in the West part than the East. The severe drought occurred in 1945, 1961 and 1994 years.

Station	Périod	Normal year	Dry year and the % of normal year	Very dry year and the % of normal year
Oran	1961-1990	372 mm	288 mm (77%)	239 mm (64%)
	1927-1995			
Alger	1961-1990	686 mm	511 mm (74%)	436 mm (63%)
	1936-1995			
Annaba	1961-1990	615 mm	507 mm (82%)	441 mm (71%)
	1945-1995			
Biskra	1961-1990	135 mm	54 mm (40%)	12 mm (9%)
	1968-1995			

Tableau 5 - Normal, dry, very dry years at Oran, Alger, Annaba and Biskra stations

Changes driven by socio-economic factors

The demographic growth induced more important food needs and a stronger pressure on the land leading to forest clearing for agriculture purpose. The demographic growth rate was particularly important in the high plains and steppe. The result was:

- an over-exploitation of the natural resources;
- an environmental damage;
- an increasingly large deforestation.

This situation led to an imbalance between the biological increase of the rangelands and the pastoral activity. The steppe is exploited in a " mining " way for the benefit of a plethoric livestock maintained in survival by external contributions of food subsidised by the State. This speculative attitude is considered as an out-land activity and induced a land desertification.

The variability of the market follows climatic variability. In dry year, the agriculture production decreases and the prices go up.

Changes driven by policies

Many policies taken by the State felt and their effect was negligible on the ground. These policies were taken without participation of the local populations. The administrative management of the land led to the stockbreeders opposition who obey a mining logic of the natural resources whose rarefaction generated a desertification and in certain cases a rupture between the man, the animal and the plant. One can review the following measurements:

- the subsidies given by the State to the stockbreeders induced the degradation process of the steppe;
- the system of administrative organisation based on an aggregation of geographical and imposed entities did not respect the traditional organisation articulated around a precise knowledge of the space limits and the people rights for each type of land occupation; each traditional community had its own territory of which it ensured its management, its exploitation and its protection , the grounds being a collective inalienable ownership;
- the anarchistic accession to the land property and the introduction of mechanised means as tractors led to an extension of the cereals cultivation on a land surface of about 3.000.000 hectares which proved unsuitable to agriculture and sensitive to erosion; itinerant agriculture delivers important surfaces to the wind erosion which impoverishes them in fertilising elements.

CHANGES ON WATER BALANCE (GROUND WATER RECHARGE, QUICK RUNOFF AND FLOOD HAZARD)

In the semi-arid and arid areas, the watersheds are sensitive to small variations of the climatic characteristics. Little changes in the temperature and rain can have important effects on the surface water runoff. The rain reduction influences directly the quantities of water reaching the land surface. The distribution of surface waters between the streaming and the infiltration is a function of the nature of the soils (topography, permeability and vegetable cover) on which the rain fall.

Changes on water surface

The change in water surface storage is due to silting and runoff reduction.

(a) Silting - The erosion phenomenon represents a true wound for Algeria. Nature and morphology of the sloping lands, the brittleness of the vegetable land cover, the lack of afforestation and the urbanisation upstream of the dams lead to an intense erosion which reduce the storage dam capacity by 2 to 3 % each year due to the silting caused by the transport and the deposition of sediments by rainwater.

(b) Relation between the surface rains and quick runoff - Concerning the runoff, the monthly and annual analysis of the mean stream, made in 1993 by ANRH, showed a chronological evolution similar to that of rain. The report of a systematic reduction in the contributions of surface water by runoff is real. The weak flows do

not allow a sufficient refill of the existing dams and create great disturbances in the supply water of several agglomerations. The most affected rivers by this reduction are the Tafna and Hammam rivers which saw since the seventies, their flows to drop by 40% compared to the inter-annual averages. Studies carried out these last years on certain dams, through the country, evidenced a reduction of regularised volumes which varies from an area to another. Table 6 gives the evolution of the average rain measured near the principal dams sites and the surface flows by comparing two periods 1974-1992 (18 years) and 1932-1992 (60 years).

Area	Mean rain deficit in % between the inter-annual means for 18 years and 60 years periods	Mean runoff deficit in % between the inter-annual means for 18 years and 60 years periods
West part	21	43
Centre	13	22
East	10	17

Source : ANRH, 1993

Tableau 6 - The inter-annual mean trend for rain and runoff between 1974-1992 and 1932-1992 periods

Changes on underground water

The rain reduction as a result of the droughts since the seventies, led to the constant thinning down of the underground water reserves of the principal aquifers in the Northern part of the country. This caused a drop in the major sources flow draining the low deep aquifers. In much of the country plains, the piezometric level of the ground water and captive fall already reaching alarming proportions (>20 m), with all the inherent effects like the soil compression, increase in exploitation costs, conflicts between owners, etc... The drought aggravation combined with the overexploitation of the underground water resources led to the mineralisation of the unsaturated zone in the low deep aquifers of the semi-arid areas as the Oran plateau and occidental high plains, ...). If the mean use rate of the underground water is 79% in the North, it reaches and exceeds sometimes 90% in certain areas.

In the coastal zones, the fall of piezometric levels allows already the sea water invasion in the sweet fresh water reserves of the coastal aquifers of the Mitidja, Oran, Terga and Annaba. The water scrubbing and intrusions alter the underground water quality for domestic and agricultural uses.

The surface and underground waters undergo a strong pollution due to the manure use, phyto-sanitary products and industrial rejections. This pollution reaches limiting thresholds in certain areas of the country. On 72 controlled pumping stations, 22 have nitrate rates higher than the WHO standard (50 mg/litre).

In the Sahara area, a new degradation phenomenon of the underground resources appeared as a consequence of important waste water discharges into the aquifers. The waste water is saturating the soils, polluting the surface sheet and choking the oasis vegetation and palm plantations.

Floods hazard

The floods in Algeria are seldom caused by large scale weather disturbances and the main cause is the localised stormy formations. The storms are often accompanied by strong downpours which do not last a long time but can be extremely violent causing important floods by rising the rivers water level. However, in a country which suffers especially from droughts, the floods are sometimes regarded as saving because they feed the aquifers and the spreading zones. As an indication, we give in table 7, the number of floods recorded in Algeria, from 1989 to 1992. On average, one can record more than 30 flood cases by year. These floods can occur in any part of the country and during any month of the year.

Year	1989	1990	1991	1992
flood cases recorded	23	65	37	34

Tableau 7 - Flood cases recorded between 1989 and 1992

SUMMARIES OF DOCUMENTED CASE HISTORIES

Green barrier

The program "green barrier" conceived in 1972 to combat desertification envisaged an afforestation going from the Moroccan border to the Tunisian border, over 20 kms broad width along the Saharan Atlas. On the 160,000 of hectares envisaged, 123,000 were carried out with 42% of success. The afforestation in Ale pine constitutes 86%, the pastoral improvement 12% and the fruit-bearing plantations 0.5%. Part of the plantations in Alep pine was destroyed by the action of the processionary caterpillar and the "pine twister". The bad results are also due mainly to lack of follow-up, pastoral practices and lack of participation from bordering populations.

Floods cases

The floods can prove to be as harmful as the droughts. Indeed, recurring floods often occur, one can quote:

- the floods of the exceptional autumn of the year 1969 during which there were 50 dead persons, 23,000 destroyed houses, 62,000 persons without shelter, 10,000 sheep and 500 dromedaries drowned, 300 destroyed wells and 4000 hectares of flooded cultivated soils; during this period, it was recorded during the day of 28 September 1969, a rain intensity of 208 mm per 24 hours which exceed that of a wet tropical country like Martinique;
- the floods of the period from the 25 to 31 Mars 1974 were among the most serious of the last century when the majority of the rain records were beaten; the maximum rains of 24 hours ranged between 80 and 224 mm; it was recorded that 45 dead persons, 11 disappeared, 11 were wounded, 20,000 were without shelter. Moreover, 2000 animals were drowned, 7000 dwellings were destroyed, 154 villages were evacuated or isolated, 16 bridges were destroyed, arable lands flooded, landslide; 14 national roads and 34 minor roads were damaged; 23 schools and many flooded infrastructures (electricity, telecommunications, works hydraulic, dispensaries of health, of many destroyed etc.) were destroyed.

ADAPTATION MEASURES

Adaptation measures have been taken for arid and semi-arid areas, forest, Steppe, desertification, and water resources

Arid and semi-arid areas

The national action plan defined by the Ministry of Agriculture lies on a adaptation program which relates to the arid and semi-arid regions and those subject to the aridity, currently reserved for cereals or left in fallow and which are threatened of irreversible degradation. The adaptation will be made with profitable trees growing, vine growing, breeding and other adapted activities. It is a question of concentrating the cereals' production in the favourable zones. The purpose of this plan is also to improve the income of the farmer and to carry out the durable development by an optimal use of the natural resources. It lies on the population adhesion to the recommended actions of the farming systems adaptation. It inaugurates a specific step of drought and reduction of the fallow in the Northern zones.

Forests

Within the framework of the protection and valorisation of the forest potentialities, some actions were undertaken to protect the forests against fires and clearings. One can quote:

- leading forestry work and installation for a rational wood exploitation;
- afforestation with the species appropriate to the soil, most productive and with fast growth (rustic pine, poplar, fruit trees);
- installation of national parks and natural reserves;
- regeneration of burnt or degraded forest surfaces;

- protection and fight against the processionary caterpillar;
- setting up programs for information and sensitising programs related to forests.

Steppe

Measures were taken to organise steppes and rationalise pasture lands. This led to the creation, in 1981, of the High Commission for the Development of Steppe (HCDS) in the Djelfa zone. To combat steppe degradation, a program was set up in 1994 by the government through HCDS for:

- regenerating the pastoral land of 700.000 hectares;
- developing the pasture by the plantation of 100.000 hectares;
- improving small pastoral hydraulics by the creation or the repair of 350 wells distributed on the steppe;
- rehabilitating the steppe palm plantation in 7 wilayas.

Desertification

The meeting of ten Algerian NGO's for fighting desertification was held in October 1996 at Taghit (Béchar), the creation of the National Committee of the Algerian network (CNOA) affiliated with RIOD and the installation of Algerian focal points. This network will constitute an important support for the future actions (diagnoses, choice of solutions, decisions). A project FEM was worked out by the CNOA/RIOD for the biological diversity safeguard and fight against land degradation.

Water resources

To face the water resources problems and in a preoccupation with a better management, it was adopted an integrated approach of protection and rational use of the water resources by:

- the creation of the Water National Council and five watershed agencies was adopted, whose statute specifies that the agencies manage the contributions of all nature granted by the State and intended to promote and support the projects and actions aiming at the water economy, the safeguard of its quality and the protection of the receiving mediums against the pollutant emissions; the five agencies are: - Oranie - Chott Chergui, Chélif - Zahrez, Algiers zone - Hodna - Soummam, Constantinois - Seybouse - Mellègue and the Sahara;
- the creation of the watershed committees at the level of the five agencies made up of the representatives of the State, the local authorities and the users; they have role of formulating opinions on all the questions related to water and in particular about:
 - the appropriateness of projects and installations under consideration of the level of the influence zone of the watershed,
 - the contention related to water that can occur between the local authorities whose watershed includes the territory,
 - the distribution of the water resource mobilised between the various potential users,
 - the intervention programmes of the watershed agency,
 - the revision and adoption of a new water code,
 - the realisation of new stations for waste water treatment to protect water quality,
 - the establishment of the national quality chart of the surface waters,
 - the establishment of a cleansing tax fixed at 20 % of the invoice of consumption out of drinking water and industrial,
 - the institution of a royalty of saving water whose rate varies from 2 to 4% depending on the areas,
 - the creation of national funds for integrated management of water resources

NEW APPROACH, MAIN RESEARCH AND INFORMATION GAPS

New approach

Till now, the pasture management and agriculture sector have been under a sectoral logic implying only the Ministry of Agriculture and Fishing (MAP). This logic showed its limits by the insufficiency of the results obtained on the ground. The new approach must be multisectoral and integrate the MAP, the Ministry for the Water Resources (MRE), the Ministry of Territorial Planning and the Environment (MATE), the watershed Agencies, the local Authorities and populations. This approach will make it possible to avoid the conflicts of authority and the contradictory decision-makings between the various actors who are likely to limit the impact of actions on the ground. Each Agency basin must work out the precise inventory of the water resources and establish their assessment "demand -resources". They must adopt a rigorous management plan of the basins implying the measures against erosion, the afforestation of surfaces upstream of the dams, the protection of surface water against pollution and an underground water monitoring. The existence of geographical areas with insufficient water resources must give place to a programme of water transfer coming from the surplus areas. As regarding the pasture use, one must define a strategy which answer the following concerns:

- fixing of the population of the ovine according to the natural zones to ensure balance between the need of the livestock and the pastures production capacities;
- sedentarisation of the wandering stockbreeders to stop the movement (Achaba) towards the cereal zones which starts with the harvest season and finishes with the autumn sowing;
- limitation and management of deficits as regards of the barley importation and stop the exploitation "out soil" due to an important contribution of barley and fodder;
- reinforcement of the pasture infrastructure by the construction of shelters for the livestock, as well as for the watering and sanitary centres for livestock;
- creation of an insurance system against the effects of drought on the breeding;
- reinforcement of High Commissariat for the Steppe Development (HCDS) to diffuse the gained experience and to reinforce the actions as regards pasture improvement;
- development of sanctions against the irresponsible behaviour of stockbreeders which cause strong degradation of the natural resources.

Main research

Among the researches that are needed, one can propose :

- fight against the desertification of steppe (regenerating of the vegetal cover, protection of the sensible surfaces, etc.);
- choice of species adapted to soil and livestock;
- integration schema between steppe and high plains;
- inventory and optimal use of the water resources;
- creation of a system for drought monitoring and alert using satellite data.

Information

The information and sensitising of the stockbreeders are essential to support the strategic choices regarding the soil protection and the pasture exploitation. Some actions must be taken as:

- data inventory about the studies already done in the country and related to pasture;
- creation of a documentary centre devoted to the steppe;
- creation of local zones for experimentation to demonstrate the new techniques and technology applicable to pastures.

LIST OF RESEARCH PROJECTS FOR THE LAST FIVE YEARS

Many projects have been realised in connection with the pasture preoccupations. The list given is a selected one:

- the geographic information system and agro-ecological zoning for arid zone identification and application to the North of Algeria by Cadi A. from the Technical Institute of Large Cultures (ITGC- Algeria) and Deli G. from the Agronomic Institute of Out sea of Florence (IAO-Italia), the funding was provided by Algeria and IAO;
- the interest use of the geographic information system for monitoring the agro-climatic environment :
 - application to semi arid and high plains of the Eastern part of Algeria, by Smadhi D. from National Institute of Agriculture Research on Arid Zones INRAA)- Algiers, the funding was provided by Algeria,
 - the impact of hydric stress on morphological, physiological and biochemical parameters of two Atriplex species, by Bouchnak F. from the Blida university; the funding was provided by Algeria,
 - the seasonal rain forecasting for the West of Algeria, by Benachata L from the National Meteorological Office, the funding was provided by Algeria, Tiaret;
- the drought of the West part of Algeria and its impact by Matari A. from the hydrometeorological Institute for training and research - Oran the funding was provided by Algeria;
- the Graminées green of the steppe near the chotts in the Southern part of El Aricha – by benabadji N from the Tlemcen University the funding was provided by Algeria;
- the fodder interest of some plants of steppe by Adem L from Tiaret University- the funding was provided by Algeria;
- the actual state of the Stipa Tenacissima of the steppe at the South of Sebdou by Bouzza M from Tlemcen University, the funding was provided by Algeria;
- the physiological response of Atriplex to high salt concentration at the germination stade- from belkhodja M from Oran Es Senia University, the funding was provided by Algeria;
- the V& A study related to impact of climatic change on water resource in Algeria at the 2020 Horizon, by Tabet-Aoul M. from the Association for Research on the Environment and Climate (ARCE), Oran, the funding was provided by the FEM project RAB/94/G31;
- the application of three linear models for rain analysis of the Macta watershed by Guedjal A from the National Agency of Water Resources (ANRH)-Algiers;
- the fitting up schema for the Algiers watershed by Meddi M from the National High School of hydraulic – Blida, the funding was provided by Algeria;
- the estimation of reserves and water resources of a semi-arid area by Mebrouk N – Oran Es Senia university, , the funding was provided by Algeria;
- the contribution of the geographic information system to characterise the watershed by Chikh from National Centre for satellite technology (CNTS) Arzew, the funding was provided by Algeria;
- the dam silting in Algeria by Bengueddach B –Ministry of equipment Algiers, the funding was provided by Algeria. ◆

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- National Institute for Research on Arid Agriculture (INRAA) Algiers
- National Institute of Agriculture (INA) Algiers
- Technical Institute of large Culture (ITGC) Algiers
- The High Commissariat for the Steppe Development (HCDS)- Djelfa
- Ministry of the Soil Management and Environment (MATE)- Algiers
- National Institute of Soils, Irrigation and draining (INSID) - Algiers
- Universities of Algiers, Annaba, Tiaret, Oran, Tlemcen, Sidi Bel Abbes
- Centre for Scientific and technical Research on Arid Areas (CRSTRA)- Biskra
- General Direction of forests (DGF) Algiers