# Characterization of the TazekkaNational Park forests and their assessment dynamics between 1982 and 2008.

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**ABSTRACT:** In order to have a clear idea on what would be the future state of a forest, it is necessary to know precisely its past and its present. Our work has been on the study and mapping of forest stands and their evolution in the Park National de Tazekka (PNTZ), located in the Middle Atlas Oriental, on an area of 13 737 ha. For the characterization of forest stands, we worked to map forest stand types, based on the interpretation of aerial photographs, supplemented by checks on the ground. This company has enabled us to identify 26 types of stands including the holm oak (Quercusrotundifolia), and the oak Cork (Quercussuber) the core. Cedar (Cedrusatlantica) and oak (Quercuscanariensis) zeen make up a relatively small number.The study of the evolution of the cover between 1982 and 2008 showed a gradual change in the cedar forest on an area of 63, 12ha. However the training at base of Quercusrotundifolia, Quercussuber, Quercuscanariensis, and Quercuscoccifera regressed 390,42 HA; 186,88ha; 142,59ha; 36, 58ha, respectively.

**Key words:** mapping, Types of stands, evolution, Tazekkanational park, forest stands, aerial photographs.

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## INTRODUCTION

Tazekka National Park (PNZ) is the former 2nd National Park to the Morocco after the National Park of Toubkal (Laurent B., 2011). It was created on 11/07/1950 by order viziriel on an area of 680 hectares for the comprehensive protection of all natural resources at the top of the JbelTazekka, located in the Middle Atlas Oriental, in the South-West of the city of Taza, but more especially the forest of cedar (Cedrusatlantica) Atlas. It shows the old extension of Moroccan cedraies, either those of the Middle Atlas, or those of the Rif

**(DEFCS/BCEOM-SECA,1994**). The endogenous dynamics of forest ecosystem requires in general areas of the order of thousands of hectares to ensure ecological integrity (HCEFLCD, 2012). In that spirit, and following the natural extension of young Cedars outside the boundaries of the Park on the North and East of the JbelTazekka sides, this last has been cropping to reach an area of 13 737 ha, While respecting the recommendations of the national study of protected areas made by OHCHR to the waters and forests and the fight against Desertification in 1996. Currently, the park encompasses other forest formations of biological, ecological and economic interests compelling (decline of Bab Azhar, Chiker Holm oak forest, the Zenaie,.) (**AMINI T and al, 2016)**, pictures landscapes, the deepest abyss of the North Africa.

The Park has been the subject no study pointing in the direction of our work.

However, given the very particular interest currently granted to this protected area, a characterization of these stands as well as their evolution in time and space, rest of great utility, to fill the lack of precise and up-to-date knowledge about the spatial distribution of the different forest formations and conditions of development (natural regeneration, environmental conditions, State health, dynamic stands,...). It's as well as managers and scientists will be able to develop a model of development for these forest formations.

Map of forest stand types is a basic document for the development of a forest are the objectives. This document allows sufficiently faithful way, localization and visualization of the stands to their current state, and studying their evolution in time.It is in this sense, this study is interested in the characterization of the different forests of the PNZ and to study their changes between 1982 and 2008.

## MATERIAL AND METHODS

### 1. Study area

The TazekkaNational Park, object of this work, is created in 1950 680ha to preserve the cedar forest of Tazekka, is today by its extension to 13 737 ha in order to follow the evolution of this ecosystem, include other natural resources, and meet the international standards for the creation of national parks. In such site, conservation is undoubtedly the top priority. This "rational conservation of resources of the Earth is nothing else than the marriage of the former two principles: the need to prepare the management of resources on the basis of accurate inventories and the need to take measures to prevent exhaustion of resources" (IUCN, 1990). It is located in the northernmost part of the Middle Atlas where stands three geo-logical parts: primary Tazekka massif, the average causse tabular Atlasique from the secondary era, and the Middle Atlas pleated from the secondary era (DEFCS/BCEOM-SECA, 1994). It is a mountainous Park is currently divided between 1400 and 1980 m, which corresponds to the top of the Tazekka (Morin, 1955) (figure 1).

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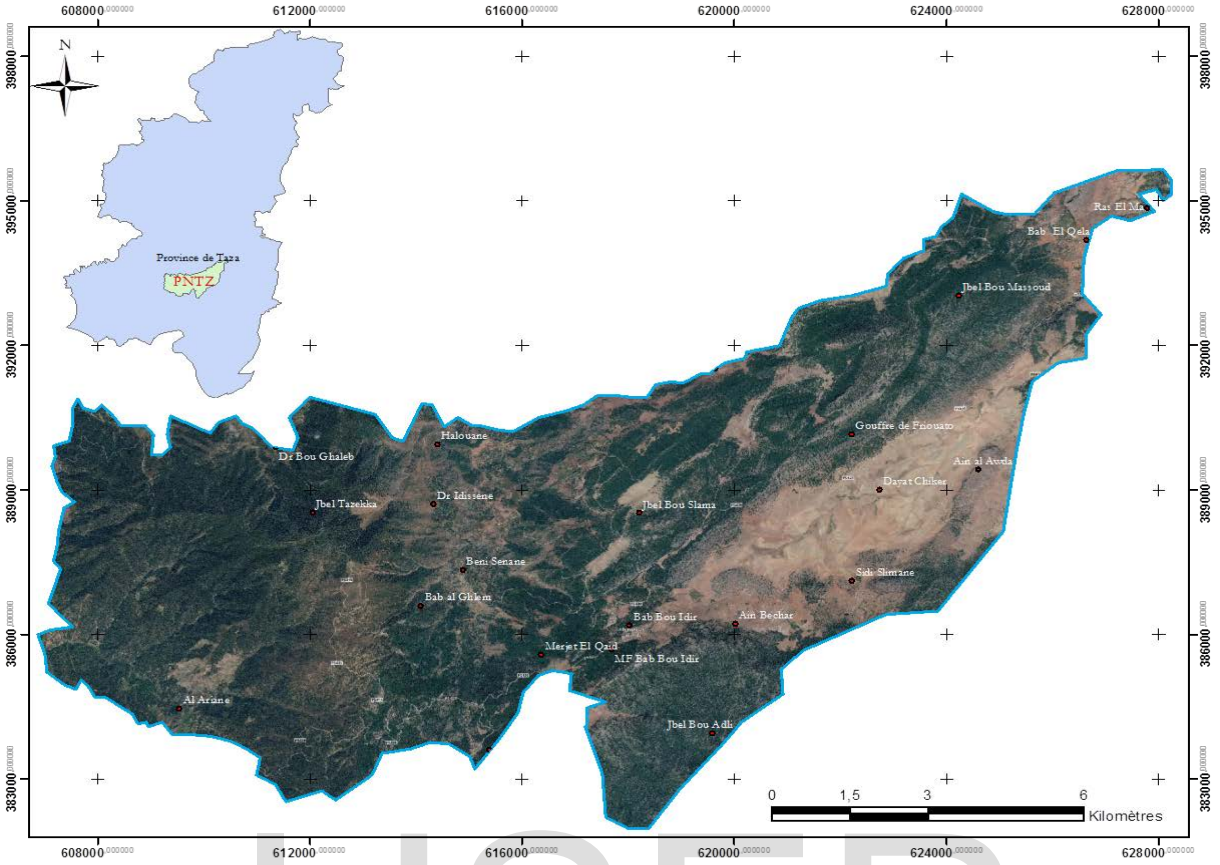


**Figure 1: Location of Tazekka National Park.**

The Park currently covers three key areas: a central core, an area of Oaks (Bab-Azhar) and a tourist area including forest Chiker (green Grove), the city Chiker, the abyss of Fox, the site of Bab-bird, the site of Ras-El-Maa, and Sidi-Mejbar (DEFCS/BCEOM-SECA, 1994).The interests of this protected area are multiple. They are botanical, wildlife, science, bioclimatic and morphological. His great wealth of landscapes and its ecological diversity gives it an exceptional heritage value.The climate of the PNZ is particular, its relief is a barrier to the moist westerly winds, allowing him to receive the bulk of the moisture they carry. In comparison with the neighbouring rainfall regimes, it is characterized by annual average rainfall ranging from 900 mm/year at Bab Azhar to 1500 mm per year to the Summit Tazekka and a relative humidity of the atmosphere significantly greater (El Mataouat S., 2009).Seasonal rainfall is of type HPAE. The bioclimate is semi-arid superior to Perhumide atmosphere. Thermal variations change according to altitudes between temperate and cold Variant (Fougrach, 1990).

In terms of land, four classes are identified with the dominance of the first two (AEFCS / BCEOM - SECA, 1994):

-Its iron quioxyde soil: they are the best represented, in particular, they occupy the dolomitic limestone plateaus of the

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eastern portion of the Park, and on dolomitic basalts or other volcanic rocks;

-Little advanced soil: cover large areas on schistose land, on land marno-limestone slopes and terraces West of main wadis;

-Calcimagnetics soils: are vulnerable to erosion, and occupy the eastern part;

-Brunifiés soils: they watch on more or less extended spikes in the Northwest of the Summit of the Tazekka;

**2. Mapping of stand types**

In its form as in its purpose, documents that propose to develop (map of stand types, and map of forest cover change) are trying to approach, as much as possible, States past and present forest cover in the Park, as well as its evolution. The development of these cards is based on operation at several stages of the aerial photographs covering the Park and taken in 1982 and 2008, at scales nominal 1/17500, and 1/20 000 respectively, according to a West-East direction. After the preparation stage of mapping which consists of a collection of different documents that interest first area of study and then the topic, was taken on a tour of exploration in the field. This visit allowed to see the various formations around the Summit Tazekka overall.

The confrontation of aerial photographs of the topographic map and each flight mission, helped to situate the study area on each flight plan covering the PNTZ.

The operation of stratification was performed inside floor space with a minimum of moving objects due to the terrain very rugged, and which constitutes the common part between a couple of photos of the same band and that of the adjacent bands (**Guellec, 1976**). For all the photos, the surface usually has a rectangular area that changes from one picture to the other according to the variation of recoveries.Examination under stereoscope, each pair of photographs based on stratification factors common to the texture, structure, tone, the reason... (HCEFLCD, 2007) has to do a first stratification. Then outputs of validation in the field have been made. The scanning operation was made using the system of Geographic Information (SGI) software. To this end, the georeferencing has been an essential step.

**3. Evolution of stand types mapping between 1982 and 2008**

Mapping of evolution is to follow the evolution of several aspects of an area over time, by comparison of photographic covers of various epochs. It is based on the exploitation of the planimetric data, either systematically or by sampling. It also requires a standardisation of the criteria of stratifications of the occupations to different dates for comparison

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(OuahidM., 1994). This method was adopted for the assessment of the dynamics of the types of stands at the level of the study area. It is based on a comparative mapping, with a systematic exploitation of the areas covered by each type of settlement dates from 1982 and 2008. It is so justified because of the existence of photographic documents on different dates (aerial photography missions 1982 and 2008).

## RESULTS AND DISCUSSION

Each stand type map is a document that gives a snapshot of the area in question. It is based on the results of this document will be based studies phyto-ecologic, estimates, and dendro-chronological which will be conducted later in the PNTZ. To allow a good read and easy use of this document, a right of the color choice. The skin consists of two parts: static and dynamic:-the dynamic part: constituted by the legend, the scale and the grid of the coordinates bar.

-no dynamic part includes all other possible accessories that we use to make the most convenient card for users to know arrow North, title...

The area is a national park of great importance internationally. The analysis includes a brief presentation of the plant Formations of the PNZ, as well as their evolution (progression or regression) during the period 1982-2008.

### 1. Mapping of stand types

### A. mapping of types of stands 2008

Map of the types of stands (mission 2008) helped identify 26 types of stands (table 2 and Figure 2). The size of the different formations is estimated at 13 453,12 ha (table 1). The Live Oak is the main formation in the study area, it represents 48.75% (6558, 46ha) of the total area mapped, followed by oak Cork on a surface of 2130,16ha (15,83%). The Atlas cedar is spread over an area of 492, 55ha, or 3.66% of the mapped area. Other programs, namely reforestation, the void and the other forest covers represent 31.76% of the total area.

**Table 1: Different forest formations in the PNTZ using aerial photographs, Mission 2008.**

| Type de peuplement | Area (ha) | % Area |
|---|---|---|
| *Quercus rotundifolia* | 6 558,46 | 48,75 |
| *Quercus suber* | 2 130,16 | 15,83 |
| *Quercus canariensis* | 537,69 | 4,00 |
| *Cedrusatlantica* | 492,55 | 3,66 |
| **Reboisement** | 465,23 | 3,46 |
| **Matorral** | 272,14 | 2,02 |
| *Juniperusoxycedrus* | 128,75 | 0,96 |
| **Not wooded.** | 2 868,14 | 21,32 |
| **TOTAL** | 13 453,12 | 100,00 |

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**Table 2: Different Types of stands in the PNTZ using aerial photographs, Mission 2008.**

| Stand type | Area (ha) |
|---|---|
| CaH1F | 391,69 |
| CaMH3 | 100,86 |
| JoM | 128,75 |
| Matorral Qc | 23,78 |
| Matorral Qcoc | 6,98 |
| Matorral QR | 241,38 |
| QcB | 57,15 |
| QcH1F | 113,15 |
| QcH2F | 31,75 |
| QcMH1 | 124,98 |
| QcMH2 | 133,38 |
| QcMH3 | 77,28 |
| QrB | 627,16 |
| QrH1T | 2 299,56 |
| QrH2T | 2 492,60 |
| QrH3T | 504,44 |
| QrH4T | 38,61 |
| QrMH1 | 228,84 |
| QrMH2 | 345,58 |
| QrMH3 | 21,66 |
| QsH1F | 1 169,61 |
| QsH2F | 60,82 |
| QsMH1 | 251,79 |
| QsMH2 | 591,67 |
| QsMH3 | 56,28 |
| Reforestation | 465,23 |
| TNB | 2 868,14 |
| **TOTAL** | **13 453,12** |

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CaH1F: Forest of dense high *Cedrusatlantica*, CaMH3: high **Cedrusatlantica** of average density in mixture with another species, JoM: *Juniperusoxycedrus* mixed with another species, Matorral Qc, Qcoc, or Qr: Matorral of *Quercuscanariensis, Quercuscoccifera,* or *Quercusrotundifolia*; QcB: *Quercuscanariensis* low, QcH1F: very dense forest of *Quercuscanariensis* haut,. QcH2F: forest of *Quercuscanariensis* dense, QcMH1: *Quercuscanariensis* high dense mixed with another species, QcMH2: *Quercuscanariensis* high dense mixed with another species, QcMH3: *Quercuscanariensis* high moderately dense mixed with another species, QrB: *Quercusrotundifolia* low. QrH1T: Coppice *Quercusrotundifolia* high dense, QrH2T: coppice of *Quercusrotundifolia* high dense, QrH3T: coppice of *Quercusrotundifolia* high moderately dense, QrH4T: coppice of *Quercusrotundifolia* high of faib density, QrMH1: *Quercusrotundifolia* very dense mixed with

another species. QrMH2: *Quercusrotundifolia* dense mixed with another species, QrMH3: *Quercusrotundifolia* moderately dense mixed with another species, QsH1F: forest of *Quercussuber* high dense, QsH2F: forest of *Quercussuber* high dense, QsMH1: *Quercussuber* high dense mixed with another species. QsMH2: *Quercussuber* high dense mixed with another species, QsMH3: *Quercussuber* high moderately dense mixed with another species, TNB: wooded lot no.

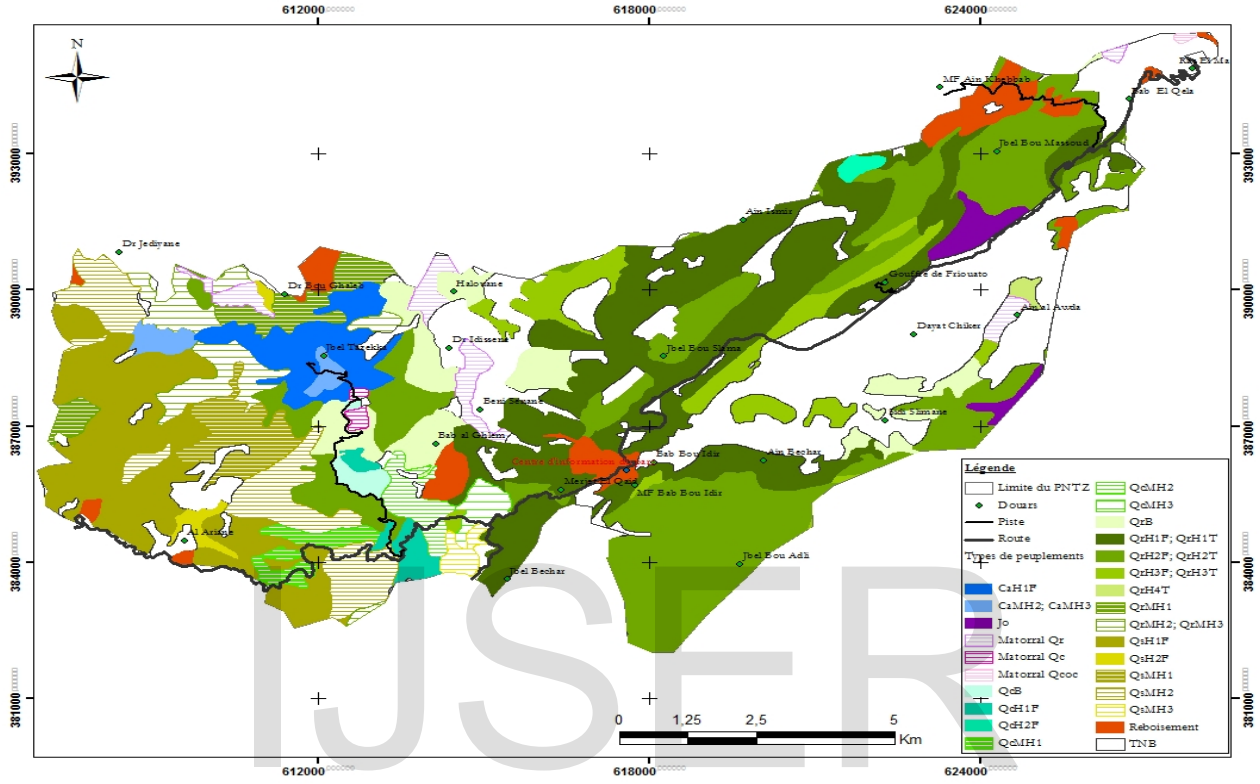


**Figure 2: Mapping of stand types in the PNZ using aerial photographs, Mission 2008**

CaH1F: Forest of dense high *Cedrusatlantica*, CaMH3: high *Cedrusatlantica* of average density in mixture with another species, JoM: *Juniperusoxycedrus* mixed with another species, Matorral Qc, Qcoc, or Qr: Matorral of *Quercuscanariensis*, *Quercuscoccifera*, or *Quercusrotundifolia*; QcB: *Quercuscanariensis* low, QcH1F: very dense forest of *Quercuscanariensis* haut,. QcH2F: forest of *Quercuscanariensis*denste, QcMH1: *Quercuscanariensis* high dense mixed with another species, QcMH2: *Quercuscanariensis* high dense mixed with another species, QcMH3: *Quercuscanariensis* high moderately dense mixed with another species, QrB: *Quercusrotundifolia* low. QrH1T: Coppice *Quercusrotundifolia* high dense, QrH2T: coppice of *Quercusrotundifolia* high dense, QrH3T: coppice of *Quercusrotundifolia* high moderately dense, QrH4T: coppice of *Quercusrotundifolia* high of faib density, QrMH1: Quercusrotundifolia very dense mixed with another species. QrMH2: *Quercusrotundifolia* dense mixed with another species, QrMH3: *Quercusrotundifolia* moderately dense mixed with another species, QsH1F: forest of *Quercussuber* high dense, QsH2F: forest of *Quercussuber* high dense, QsMH1: *Quercussuber* high dense mixed with another species. QsMH2: *Quercussuber*high dense mixed with another species, QsMH3: *Quercussuber* high moderately dense mixed with another species, TNB: wooded lot no.

The park stands are very varied and give rise to several cases. We attribute this diversity to the physical environment that offers a remarkable contrast. In fact, the distribution of the species is still more irregular than the structure of the physical environment in which they live (Ramade 1987).The majority of stands (Cork oak) and Holm oak are varied from the point of view of their structure, but less on the floristic plan. Those of zeen oak and cedar, on the contrary, are little diversified but rather rich. This is probably due to the pressure exerted on the first (collection of wood and route). The cedar forest and part of the zenaie in are relatively spared. Add to this the moisture conditions that are more favorable to the center of the Park.

**B. mapping of types of stands in 1982**

Analysis of table 3, below, shows that the green oak is the most widespread forestry training in the zone occupying an area of 6948, 88ha or 51.65% of the total area. Cork oak covers an area of 2317,04ha (17,22%). The Atlas cedar occupies an area of 429, 43ha, or 3.19% of the total area. The rest of the area is occupied by voids, reforestation, and other plant formations, which together 27,93% of the overall area. The main types of stands are illustrated in table 4 and figure 3.

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**Table 3: Different forest formations in the PNZ using aerial photographs, Mission 1982.**

| Stand type | Area (ha) | % Area |
|---|---|---|
| *Quercus rotundifolia* | 6 948,88 | 51,65 |
| *Quercus suber* | 2 317,04 | 17,22 |
| *Quercus canariensis* | 680,28 | 5,06 |
| *Reboisement* | 471,28 | 3,50 |
| *Cedrusatlantica* | 429,43 | 3,19 |
| *Quercus coccifera* | 36,58 | 0,27 |
| *Genistaquadriflora* | 29,13 | 0,22 |
| **Not wooded.** | 2 540,50 | 18,88 |
| **TOTAL** | 13 453,12 | 100,00 |

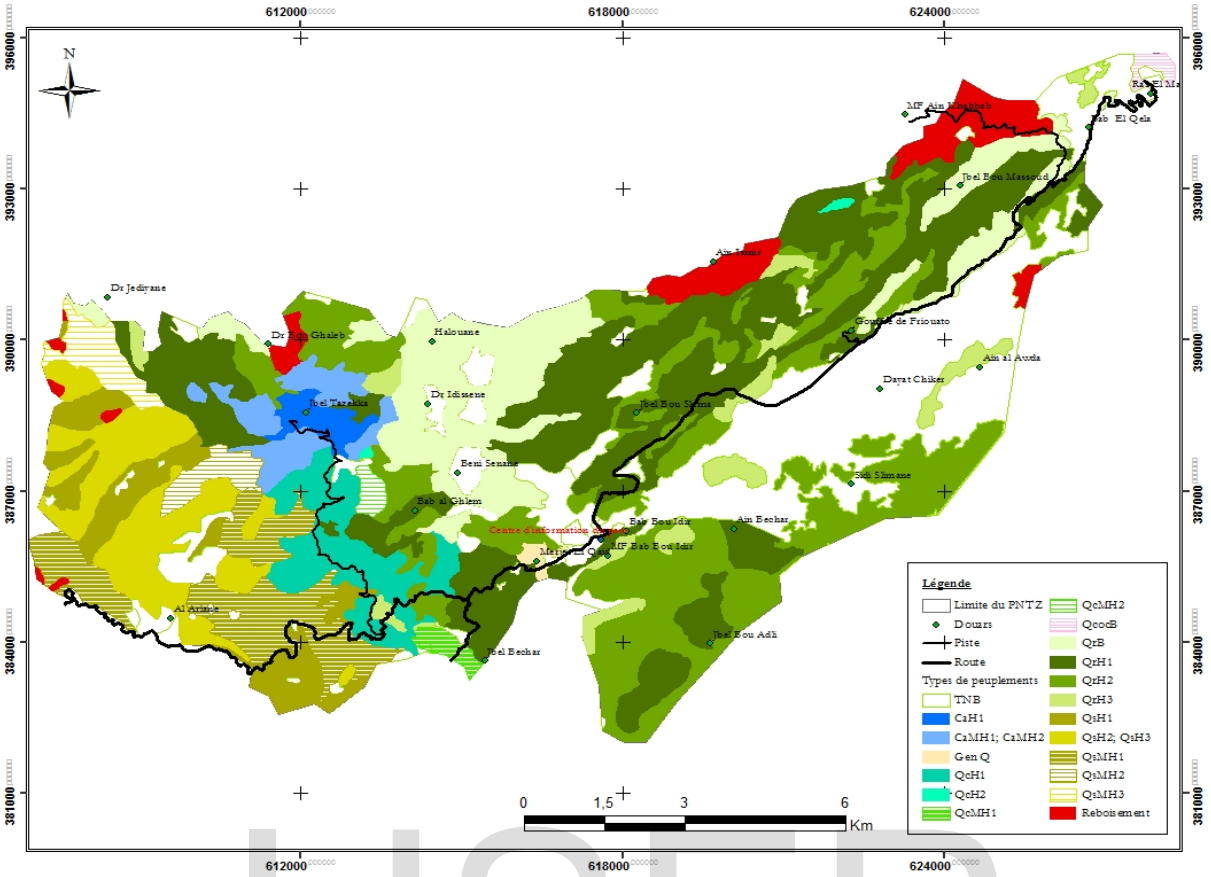


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**Table 4: Different Types of stands in the PNZ using aerial photographs, Mission 1982.**

| Stand type | Area (ha) |
|---|---|
| CAH1 | 122,55 |
| CAMH1 | 37,36 |
| CAMH2 | 269,52 |
| Gen Q | 29,13 |
| QCH1 | 546,25 |
| QCH2 | 22,18 |
| QCMH1 | 62,87 |
| QCMH2 | 48,98 |
| QCocB | 36,58 |
| QRB | 1 314,79 |
| QRH1 | 2 849,03 |
| QRH2 | 2 369,38 |
| QRH3 | 415,68 |
| QSH1 | 541,10 |
| QSH2 | 761,67 |
| QSH3 | 50,39 |
| QSMH1 | 685,79 |
| QSMH2 | 115,29 |
| QSMH3 | 162,80 |
| Reforestation | 471,28 |
| not wooded. | 2 540,50 |
| **TOTAL** | **13 453,12** |

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CaH1F: Forest of dense high *Cedrusatlantica*, CaMH3: high *Cedrusatlantica*of average density in mixture with another species, JoM: *Juniperusoxycedrus*mixed with another species, Matorral Qc, Qcoc, or Qr: Matorral of *Quercuscanariensis*, *Quercuscoccifera*, or*Quercusrotundifolia*; QcB: *Quercuscanariensis* low, QcH1F: very dense forest of *Quercuscanariensis* haut,. QcH2F: forest of *Quercuscanariensis* highdenste, QcMH1:

*Quercuscanariensis* high dense mixed with another species, QcMH2: *Quercuscanariensis* high dense mixed with another species, QcMH3: *Quercuscanariensis* high moderately dense mixed with another species, QrB: *Quercusrotundifolia* low. QrH1T: Coppice *Quercusrotundifolia* high dense, QrH2T: coppice of *Quercusrotundifolia* high dense, QrH3T: coppice of *Quercusrotundifolia* high moderately dense, QrH4T: coppice of *Quercusrotundifolia* high of faib density, QrMH1: *Quercusrotundifolia* high very dense mixed with another species. QrMH2: *Quercusrotundifolia* high dense mixed with another species, QrMH3: *Quercusrotundifolia*haut moderately dense mixed with another species, QsH1F: forest of *Quercussuber* high dense, QsH2F: forest of *Quercussuber* high dense, QsMH1: *Quercussuber* high dense mixed with another species. QsMH2: *Quercussuber* high dense mixed with another species, QsMH3: *Quercussuber* high moderately dense mixed with another species, TNB: lot no wooded.

## 2. Evolution of stand types mapping between 1982 and 2008

The cross of the layers of information related to the map files not generalized of elaborate maps from the inter-pretation of aerial photographs, taken at the same time in 1982 and 2008 helped to locate the various flows between forest vegetation and no woodlots. This operation, which was conducted using GISsoftware, has given birth to a new layer of so-called information "layer of evolution". This layer of information provides information about the State of evolution of the occupation of the soil of the area of study by training, distinguishing three main classes: regression of the forest, the forest training, and unchanged area increase. In order to meet the objective of the study, the evolution card must obey standards mapping to the number of classes covered by the map, the choice of colors that must be considered in such a way to visualize and distinguish the different classes considered.The results have produced a confusion matrix (table 5), which highlights the changes that have occurred during the periods 1982-2008. This is a table that allows giving an idea on the surface of an occupation transfer to another. It is an adequate method that allows you to detail and to deepen the phenomenon of transfer of surface between the different types of stands.The columns of the matrix give made entries in each type of settlement during the period considered, however lines indicate exits in each type of settlement. On the diagonal of the matrix, are recorded of each type of settlement areas which have not undergone change during the reporting period.

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**Table 5: Matrix of confusion of the period (1982-2008).**

| year | | 2008 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | forestforms | CA | Jo | Matorral | QC | QR | QS | reforested | No wooded | Total |
| 1982 | CA | 299,94 | - | 4,64 | - | 107,36 | 7,39 | - | 10,11 | 429,43 |
| | Gen Q | - | - | - | - | 29,13 | - | - | | 29,13 |
| | QC | 9,58 | - | 14,29 | 232,18 | 314,51 | 85,76 | 15,78 | 8,19 | 680,28 |
| | QCoc | - | - | 6,69 | - | - | - | 3,93 | 25,96 | 36,58 |
| | QR | 142,52 | 125,62 | 190,26 | 164,21 | 5 299,42 | 73,18 | 136,00 | 817,69 | 6 948,88 |
| | QS | 39,58 | - | - | 130,41 | 194,89 | 1 902,49 | 19,87 | 29,79 | 2 317,04 |
| | reforested | 0,93 | - | - | - | 226,76 | 24,62 | 181,86 | 37,10 | 471,28 |
| | No wooded | - | 3,14 | 56,27 | 10,90 | 386,38 | 36,72 | 107,79 | 1 939,30 | 2 540,50 |
| | Total | 492,55 | 128,75 | 272,14 | 537,69 | 6 558,46 | 2 130,16 | 465,23 | 2 868,14 | **13 453,12** |

Ca :*Cedrusatlantica,* Jo : *Juniperusoxycedrus,* Qc : *Quercus canariensis,* Qcoc : *Quercus coccifera*, Qr*Quercusrotundifolia,* Qs : *Quercus suber,* reb : Reboisement, Gen Q : *Genistaquadriflora*

### A. General changes to the occupations of the ground

The occupations of the soil changes have affected about 1583, 30ha, or 11.76% of the total area of the Park, against 9855,18ha of area which remains unchanged between 1982 and 2008.

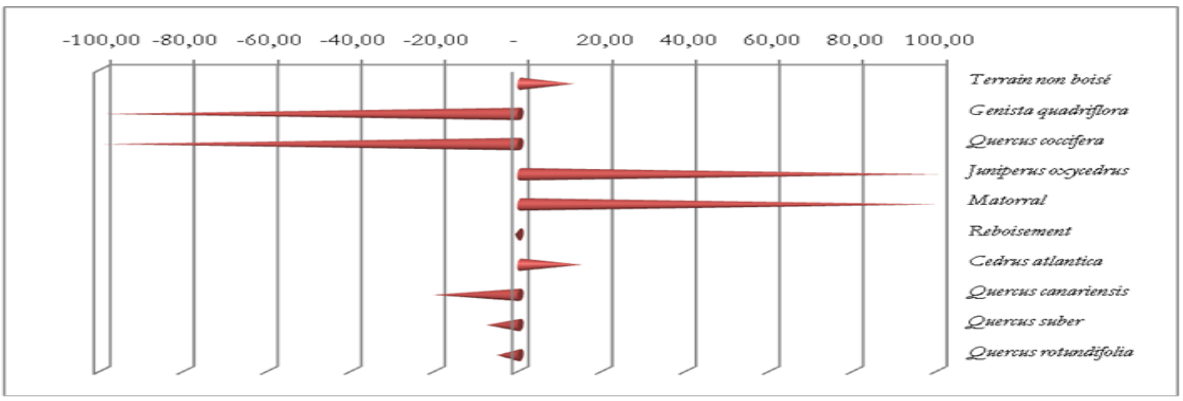


**Figure 4: Rhythm of the dynamics of the forest and per-forester formations in the PNZ between 1982 and 2008.**

As the shown in figure 4, the pace of change of the different forest and per-forester formations in the Park varies from one layer to another. This pace has higher values positively for forest training at base of *Cedrusatlantica* and not woodlots and negatively for training at base of *Quercuscanariensis*,

*Quercussuber* and *Quercusrotundifolia*.Data of planimetrage as well as the location of the different strata of dynamic occupations are given, respectively, in table 5 and figure 5.

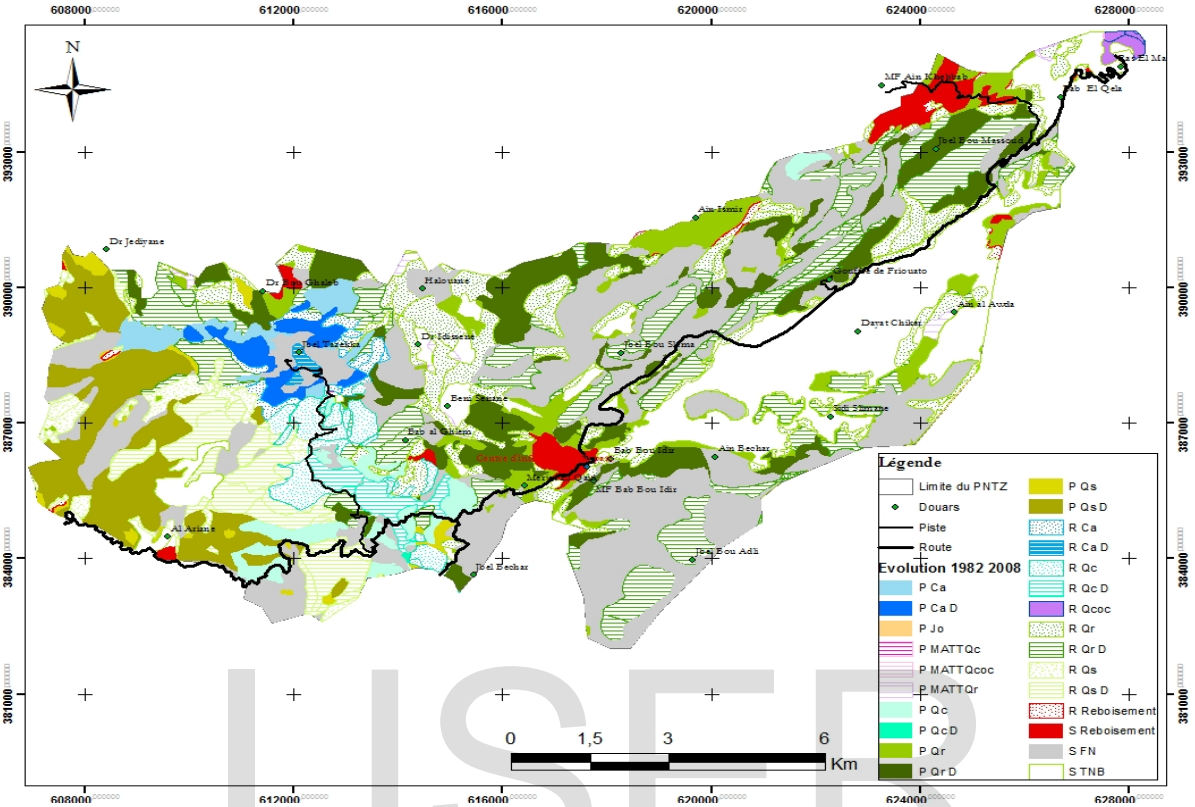


**Figure 5: Mapping changes in the types of stands in the PNZ between 1982 and 2008.**

P Ca: progression of Cedrusatlantica, P Ca D: progression of Cedrusatlantica density, P Jo: Progressio of Juniperusoxycedrus, P MATT Qc, Qcoc, or Qr: progress of the matorral of Quercuscanariensis, Quercuscoccifera, or Quercusrotundifolia, P Qc: Quercuscanariensis, P Qc D progression: increase in the density of Quercuscanariensis, P Qr: progression of Quercusrotundifolia,P Qr D: increase in the density of Quercusrotundifolia, P Qs: progression of Quercussuber, P Qs D: increase in the density of Quercussuber, R Ca: Cedrusatlantica regression, R Ca D: regression of the density of Cedrusatlantica, R Qc: Quercuscanariensis, R Qc D regression: regression of the density of Quercuscanariensis,R Qcoc: regression of Quercuscoccifera, R Qr: Quercusrotundifolia, R Qr D regression: regression of the density of Quercusrotundifolia, R Qs: Quercussuber, R Qs D regression: regression of the density of Quercussuber, R reforestation: regression of reforestation, S reforestation: stable reforestation, S FN: natural stable Formation, S TNB: wooded stable.

**B. analysis of the dynamics of the occupation of the ground**

**B.1. Regressive evolution**

The confusion matrix analysis to identify the following results (table 6):

**Table 6: Training regressed as a percentage for the period (1982-2008).**

| Year | | 2008 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Forest forms (%)** | CA | Jo | Matorral | QC | QR | QS | Reforestation | not wooded | **Total** |
| **1982** | CA | | - | 3,58 | - | 82,91 | 5,71 | - | 7,81 | **100,00** |
| | Gen Q | - | - | - | - | 100,00 | - | - | | **100,00** |
| | QC | 2,14 | - | 3,19 | | 70,19 | 19,14 | 3,52 | 1,83 | **100,00** |
| | QCocB | - | - | 18,28 | - | - | - | 10,74 | 70,98 | **100,00** |
| | QR | 8,64 | 7,62 | 11,53 | 9,96 | | 4,44 | 8,25 | 49,57 | **100,00** |
| | QS | 9,55 | - | - | 31,46 | 47,01 | | 4,79 | 7,19 | **100,00** |
| | not wooded | 0,32 | - | - | - | 78,35 | 8,51 | | 12,82 | **100,00** |
| | TNB | - | 0,52 | 9,36 | 1,81 | 64,27 | 6,11 | 17,93 | | **100,00** |

*It: Cedrusatlantica, Jo: Juniperusoxycedrus, Qc: Quercus canariensis, Qcoc: Quercus coccifera, QrQuercusrotundifolia, Qs: Quercus suber, reb: reforestation, Gen Q: Genistaquadriflora, TNB: wooded stable.*

During this period, the forest of Quercusrotundifolia-based training fell 390, 42 ha, or 5.6% of its area in 1982. This regression was at an annual average rate of 15ha, an average annual rate of decline of 0.2%. Indeed, the loss of forest area at base of green oak concerns areas near douarsBeniSenane, Idissene and Halwane, Al Awda, AïnBechar and Sidi Nick East and the inhabitants of dayatchiker to the West), because of the use of these trees as firewood.Forest training base of *Quercussuber* has experienced a decline in the order of 186,88 ha, or 8.07% of its area from 1982. This regression has been in favor of *Quercusrotundifolia* (47,01%) and *Quercuscanariensis* (31,46%). The average of this regression is equal to 7.19 ha; or an average annual rate of 0.3 percent. This decline is mainly due to climate change, which caused a migration of the training forest the edapho-climatic conditions.Forest forms base of *Quercuscanariensis* in turn suffered a regressive evolution of 142, 59ha or 20.96% of its area in 1982. The average of this regression is 5.48 hectares per year, or an average annual rate of decline of 0.80%. The largest share of regressed area was trans- formed into forest training at base of green oak, with a rate of 70,19%. The decline in density is more important in this case;

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it is explained by the lack of regeneration and climate variations that have fostered the development of young seedlings of green oak that have a striking plasticity at the expense of zeen oak. The formations dominated by *Quercuscoccifera* were almost missing and there are only a few specimens. Thus, the disappearance of the oak scale is not total, is found in the pre-forester State with feet that is barely dispositive. This regression covers an area of 36, 58ha, a rate of 100% of its area in 1982.This forms has been transformed in its big part in vacuum and matorral with a rate of 89,26%. The annual average rate of decline of oak scale is of the order of 1, 40ha.Reforestation also lost about 6.05 ha of area, which is a rate of 1.28% of its area in 1982. Most of this area has been exploited in the rational management of forest resources, and replaced by new perimeters of reforestation.

### B.2. Evolutionary development

The confusion matrix analysis identified the following findings (table 7):

**Table 7: forms progressed as a percentage for the period (1982-2008)**

| year | | 2008 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Forest forms (%)** | CA | Jo | Matorral | QC | QR | QS | Reforestation | not Wood |
| | CA | | - | 1,70 | - | 8,53 | 3,25 | - | 1,09 |
| | Gen Q | - | - | - | - | 2,31 | - | - | - |
| | QC | 4,97 | - | 5,25 | | 24,98 | 37,67 | 5,57 | 0,88 |
| **1982** | QCocB | - | - | 2,46 | - | - | - | 1,39 | 2,80 |
| | QR | 73,99 | 97,56 | 69,91 | 53,75 | | 32,14 | 47,99 | 88,03 |
| | QS | 20,55 | - | - | 42,68 | 15,48 | | 7,01 | 3,21 |
| | Reforestation | 0,48 | - | - | - | 18,01 | 10,81 | | 3,99 |
| | not wooded | - | 2,44 | 20,68 | 3,57 | 30,69 | 16,13 | 38,04 | |
| | **Total** | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 | 100,00 |

It: *Cedrusatlantica*, Jo: *Juniperusoxycedrus*, Qc: *Quercuscanariensis*, Qcoc: *Quercuscoccifera*, Qr*Quercusrotundifolia*, Qs: *Quercussuber*, reb: reforestation, Gen Q: *Genistaquadriflora*, TNB:not wooded stable.

During the period between 1982 and 2008, forestry training base of *Cedrusatlantica* rose 63.12 ha, or 14.70 percent compared to its size in 1982. Indeed, 73.99% of this growth expanded at the expense of green oak. The average of this extension is of the order of 2.43 ha; either an annual average rate of 0.56%. This increase is explained by putting resting place since the year 1950, date of creation of the PNZ, which has fostered a good momentum of regeneration to go lower on the North, something that allowed the settlement of evolve towards a felled structure,

characterized by the presence of all age classes.However, and during the same period, the forestry training at base of *Juniperusoxycedrus*, the shrubs, and land not wooded recorded increases of the order of 128,75 ha; 272,14ha; and 327,64ha; respectively. This is mainly due to overexploitation of the holm oak, which enabled Juniper masterpiece to individualize is in the form of pure bouquets (BabLemtiq example), or turn a low stands often giving way to some quite extensive shrubs formed feet of green oak stunted mixed with *Chamaeropshumilis*, which marks an advanced stage of degradation.

## CONCLUSION

The work we have done has concerned a protected, area formerly creates, and whose development began only just recently, after its expansion. The results are a fundamental tool for a proper decision-making, by officials of the development and management of the PNTZ.The mapping of types of stands of the PNTZ is a company quite long and laborious. However, she allowed us to several information and conclusions. Map of the types of stands established using photographs air (Missions 1982 and 2008), helped out a remarkable diversity (26 types of stands). The holm oak and cork oak hold the bulk of this diversity on the side portions. The cedar and the zeen oak show, at the Center, a relatively limited number of stand types. Oak scale is much localized on the limit of the North-East of the park with only one type.The study of the evolution of the cover between 1982 and 2008 shows a gradual change in the cedar forest on an area of 63, 12ha. However the training at base of *Quercusrotundifolia, Quercussuber, Quercuscanariensis,* and *Quercuscoccifera* regressed 390,42hA; 186,88ha; 142,59ha; 36, 58ha, respectively.

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## REFERENCES

**Amini T., BellaghmouchFZ.,Elharchli EH et Derraz K., 2016 :**Factorialanalysis of correspondences Application to phytoecologicalStudy in the Tazekka National Park (Morocco), International Journal of Scientific& Engineering Research, Volume 7, Issue 9, 1350-1362p.

**DEFCS/BCEOM-SECA, 1994 :** Parc National du Tazekka, Plan directeur d'aménagement et de gestion, volume 1 & 2, Rabat, Maroc.

**El Mataouat S. 2009 :** Evaluation de la Réintroduction du Cerf de Berbérie (Cervuselaphusbarbarus) dans le Parc

National de Tazekka: Impacts, Ressources Pastorales, Recensement et Gestion, Mémoire de troisième cycle, ENFI, Salé, 136p + annexes

**Fougrach H.,** 1990, Contribution à l'étude bioclimatique et écologique du massif du Tazekka, mémoire de 3ème cycle, Ecole Nationale Forestière d'Ingénieurs, Salé, Maroc.

**Guellec, 1976 :** Photointerprétation et cartographie, Revue Bois et Forêts des Tropiques n°170, 51-69p.

**HCEFLCD, 2007 :** Mise à jour des cartes de l'inventaire forestier national, Etude de base, Haut Commissariat aux Eaux et Forets et à la Lutte Contre la Désertification, 29p.

**HCEFLCD, 2012 :** Haut Commissariat aux Eaux et Forêts et à la Lutte contre la Désertification en collaboration avec Deutsche GesellschaftfürInternationaleZusammenarbeit (GIZ) GmbH ,Cadrage à l'horizon 2020 du Plan Directeur des Aires Protégées au Maroc, 22p.

**Laurent B., 2011 :** Évaluation partenariale des projets d'appui à la gestion deparcs nationaux au Maroc, Synthèse du rapport final, Série Évaluation et capitalisation, n°42, 56p.

**Morin Ph., 1955 :** Notice géologique : généralités sur le massif du Tazekka. Soc. Géol. Du Maroc, section Fès, 262

**Ouahid M., 1994 :** la dynamique de la végétation dans la partie méridionale du plateau central marocain au moyen d'une cartographie diachronique(la forêt de Bouhsousern). Thèse de Doc. Univ. De Poitiers, UFR es Scie. Hum., Géographie, 289.

**UICN, 1990 :** Aménagement et gestion des aires protégées Tropicales, Ateliers sur la Gestion des Aires Protégées Tropicales du Congrès Mondial des Parcs Nationaux, Bali, Indonésie, Octobre 1982, 289p.

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