

**10th International Conference
Of
UNESCO Global Geoparks**

4 - 11 September 2023

Marrakesh - M'Goun Global Geopark Unesco

ABSTRACTS BOOK

PAGE	List of first authors in alphabetical order	PAGE	List of first authors in alphabetical order
2	Abdul Halim Sharina	51	Biswas Anil Kumar
3	Abelaez Juan Pablo	52	bloise luigi
4	Adisubroto Umar	53	Bourli Nicolina
5	Adjobi Paul-Andre	54	Boutakiout M. - Achbal D.
6	Affandi Mokhtar	55	Bouzekraoui Hicham
7	Agus	56	Boyle Michelle
8	Ait Oumchich Kamal	57	Br†steinand Espen
9	Ajayebi Kimiya Sadat	58	Brake Sacha
10	AL HARRAS MERIYAME	59	Brown Theodore
11	Aldosari Ali	60	Budiman Dana
12	Alejandra G. Guti,rrez-Alejandro	61	Bukhariand Azmil
13	Alexandru Andra	62	Burkhardt Heike 1
14	Alves Joao	63	Burkhardt Heike 2
15	Amaguar Fatima	64	Butel Emily
16	ANG Meliawati	65	BuxKhosol Rasool
17	Angeliki Pritenzi Maria	66	Calabrese Egidio 1
18	Ansori Chusni	67	Calabrese Egidio 2
19	AOYAMA Atsushi	68	Calder John
20	Ardislamov Faniz	69	Canet Carles
21	Arianna Nigeri	70	Casillas Ruiz Ramon
22	AYTAC Ahmet Serdar	71	Castro Emanuel de
23	Azman Norzaini	72	Chan Yu Nam
24	Azmil Munif Mohd Bukhari	73	CHATTOU Zoubir
25	Azrul Shah Mohamad	74	CHEN Runze
26	Bàch Vân Trần Nhị	75	choi cindy
27	Bajec Rupnik Urska	76	Chokkhun Suphunnee
28	Bajraktari Fadil	77	Chulepin Helga 1
29	Ballesteros Daniel	78	Chulepin Helga 2
30	BAO Jihong 1	79	Chulepin, Helga 3
31	BAO Jihong 2	80	Cortijo, I
32	baraas Abdillah	81	Costa Ferran Climent
33	Barrakad Imad	82	Costa Soraia
34	Barrera, J.M.	83	Cruz-Perez Miguel A.
35	Barriuso Leire	84	Cust†dio Salom, C.
36	Bartelletti Antonio	85	Cychowska-Nowak Monika 1
37	Bastos Susana	86	Cychowska-Nowak Monika 2
38	Batsi Anna	87	Da Prato Simone
39	Bechtel Arthur Philippe	88	Da Silva Marinho Thiago 1
40	Bellini Filippo 1	89	Da Silva Marinho Thiago 2
41	Bellini Filippo 2	90	De Luca Violetta
42	Ben Hassine Mohsen	91	Deenisa Rochadji and alii
43	Benhsain Wafaa	92	DELABY Serge
44	Benlakhdim mohamed	93	Deo Immanuel
45	Benlasri Mokhtar	94	Aguirre-Díaz, G.J.
46	Bensi Sara	95	Dietrich Katharina
47	Bergengren Anna	96	Dilari Vera
48	BERRED Sanae	97	Din Karl Michael
49	Bidondo Eugenio	98	Do Thi Yen Ngoc
50	Biot Vincent	99	Don Hoang Xuan
		100	dos Santos Costa Silas Samuel 1

PAGE	List of first authors in alphabetical order	PAGE	List of first authors in alphabetical order
101	dos Santos Costa Silas Samuel 2	151	Gulas-Woehri Oliver2
102	Duangkrayom Jaroon	152	Gumus Erdal
103	Duong Thi Hieu	153	Guo Jianeng
104	ECH-CHARAY Kawtar	154	GUTI RREZ Gustavo
105	Efe Recep	155	Hélou-Frugier Floriane
106	Einarsson Daniel	156	Haiyang Ding
107	El Baki yousra	157	Hakkarainen Veera
108	El KHalki yahia 1	158	Han Daik
109	El Khalki Yahia 2	159	Haraha Misbahib
110	Elena Storta	160	Hartmann Gerald
111	Eridani Selene	161	He Qingcheng
112	Etourki Hassan	162	Heikki Mäkipää
113	Eugenio Bidondo	163	Heinz liza
114	Eugenio Erika Lima de Melo	164	Hermansson Terttu
115	Fabjan Edi	165	Herrera Patricia
116	Fan Lin	166	Hilario Asier
117	Fan Zhang	167	Hoffmann Gosta
118	Fang CHEN	168	Huang He Qing
119	Farias, Cristian	169	HUANG Tao
120	FASSOULAS Charalampos 1	170	Huang Wen
121	FASSOULAS Charalampos 2	171	Huh Min
122	Fello Nuri Mohamed	172	Hultman Sofia
123	Ferreira Flavi L.F 2	173	Huong Pham,
124	Ferreira Flavi L F 1	174	laikarova Alia
125	Ferreira Jorge 1	175	Ide Akira
126	Ferreira Jorge 2	176	IIDA YOSHIHIKO
127	Fiestiandani Ipuk	177	Imperatori Fabjola M.
128	Fischer Tobias	178	Indra Amalla Rainita
129	Frey Maria-Luise	179	Irfan Dedy 1
130	Fukumura Seiya	180	Irfan Dedy 2
131	Garcja Jim,nez Antonio 1	181	Jaapar Abd Rasid
132	Garcja Jim,nez Antonio 2	182	James Patrick
133	Garcia L. F. 1	183	Jasim Anwar
134	Garcia L. F. 2	184	Javier Lopez
135	Garcia L. F. 3	185	Jaya Asri
136	Gardoň Luboš	186	Jikey Ndo
137	Gengyu Li	187	Jimenez Antonio Garcia
138	Gentilini Sara 2	188	Jingang Wu
139	Gentilini Sara 1	189	Jintasakul Pratueng
140	Gianoglio Fedra	190	JKim ung-hoon
141	GLEESON Carol	191	João Patrícia
142	Goran Radonic	192	José Ángel S. Fabian 1
143	Grant Caleb	193	José Ángel S. Fabian 2
144	GRAVAT HODAN Shona	194	Jung Jongyun et al.,
145	Groeger Martin	195	Jung Jongyun 1
146	Guerini Michele	196	Justice Sophie
147	GUIMARÇES E.S .1	197	Juying Meng
148	GUIMARÇES E.S. 2	198	Kakizaki Yoshihiro
149	GUIMARÇES E.S. 3	199	Kamil Amir
150	Gulas-Woehri Oliver 1	200	Kampolis Isidoros 1

PAGE	List of first authors in alphabetical order	PAGE	List of first authors in alphabetical order
201	Kampolis Isidoros 2	251	Lingling Wang
202	Kaneta Koki	252	Lippolis Elio 1
203	Kardatou Fani	253	Lippolis Elio 2
204	Karine Ana	254	Loureiro Fajbio
205	Karmakar Abhisek	255	Löwen Kersten
206	Katori Takuma	256	Lu Chunyu
207	Kavcic Mojca Gorjup	257	Lu Qinfei
208	Kazamia evi	258	Luciano Di Martino
209	Kejian Xu	259	Mahbubi Ahmad
210	Khaldoune Fatima	260	Mäkipää Heikki 1
211	Khamcha Chanchana	261	Mäkipää Heikki 2
212	khardali ismail	262	Mäkipää Heikki 3
213	Khasanova A.I.	263	Mampel L
214	Khoso Rasool Bux	264	Marquez-Rosado, L.B1
215	KIM HoGeun	265	Martina Pásková
216	Kim Jung-hoon	266	Martinez Jose A.
217	Kiuttu Mikko	267	Massias Melanie
218	KOHMOTO Daichi	268	Matheus Lisboa Nobre da Silva
219	Koivumäki Laura	269	May Susan
220	Koki Kaneta	270	Mc Glinchey Mauriri
221	KOLYA Andr, de Andrade	271	Megerle Heidi Elisabeth 1
222	Komoo Ibrahim	272	MegerleHeidi Elisabeth 2
223	Konstantina Bentana 1	273	Megyeri Balázs
224	Konstantina Bentana 2	274	Mendonca Jeanne Francisca
225	Konstantina Bentana 3	275	Meneses Salome
226	KORB LY Barnab s	276	Michael Din
227	Kottabi Salah Eddine 1	277	Michailidou Irene
228	Kottabi Salah Eddine 2	278	Miyeon Yoo
229	Kottabi Salah Eddine 3	279	Mohamad Dwi Sapari Hadian
230	Koumoutsou Eleni	280	Momene Tuwa Brigitte
231	Kruainok Parichat	281	Morais Antónia Maria 1
232	Kumar Biswas Anil	282	Morais Antónia Maria 2
233	Kummer Sabine	283	Moraiti Evgenia
234	Kunthasap Passkorn	284	Morimoto Taku
235	Laitila Annie 1	285	Nagata Koki 1
236	Laitila Annie 2	286	Nagata Koki 2
237	Lanery	287	Nagata Koki 3
238	Lansigu christophe	288	Nait Ouacha and Souhel
239	LAOUINA Abdellah	289	Nakada Setsuya 2
240	Lee Aejin	290	Nakada Setsuya 1
241	LEE Seungyeon	291	Nakamura Akifumi
242	Lee Yun-su	292	Nakase Hiroshi
243	LEGAL Stephane 1	293	Naomi Foster
244	LEGAL Stephane 2	294	Nedvěďická Blanka
245	Lemon Kirstin	295	Negri Arianna
246	Li Gengyu	296	Nenonen Jari
247	LI Yue	297	Neto Keynesmenio
248	Liang Shi	298	Neto Miguel de Castro
249	Lima Eva	299	Ngoc Thi Yen
250	Lin Wensheng	300	Nhị Bạch Vân Trần

PAGE	List of first authors in alphabetical order	PAGE	List of first authors in alphabetical order
301	Ningzhang Chen	351	Rocha Daniela
302	Nomikou Paraskevi	352	Rocha Daniela 2
303	Norhaya Ahmad	353	Rocha Daniela 3
304	Nowak Monika 1	354	Rodrigues Joana 2
305	Nowak Monika 2	355	Rodrigues Joana 1
306	Nunes João Carlos	356	Rodrigues Joana 3
307	Nyulas Judith	357	Roelfs Gretha
308	Obara Hokuto	358	Rolfe Rebecca 1
309	O'Connor, Gráinne 1	359	Rolfe Rebecca 2
310	O'Connor, Gráinne 2	360	Rollier Brigitte
311	O'Farrell Seán	361	RONG Miao
312	O'Grady Michelle	362	Roque-Melas Sophia
313	Ohno Marekazu	363	Rosado-González Emmaline
314	Oña Lisbeth	364	Rosana Mega Fatimah
315	Osada Mutsuki	365	Rule Roy
316	Papadopoulou Penelope 2	366	Ruschkowski Eick von
317	Papadopoulou Penelope	367	Sahli Fatima Zahra
318	Pardede Togu	368	SAKAMOTO Takaaki
319	Paskova Martina	369	Salom, Meneses
320	Paulo Dajlia	370	Salu Antony Thierry de Oliveira
321	Paz Alexandra	371	Samuel dos Santos Costa Silas
322	Paz Alexandra (2)	372	Samuel dos Santos Costa Silas ,
323	Pellicer Mir	373	Sanchez José, angel Fabian
324	Perakis Vangelis	374	Sanchez-Arredondo 2
325	Pereira Bruno Claro 1	375	Sanchez-Arredondo 1
326	Pereira Bruno Claro 2	376	Sanchez-Cortez Jos, Luis 1
327	Pereira Bruno Claro 3	377	Sanchez-Cortez Jos, Luis1 2
328	Petit Alain	378	Sanudo Pulgar.docx
329	Pimentel Nuno 2	379	sas abdillah
330	Pimentel Nuno 1	380	Sauer Nancy
331	Poros Michal	381	Sayedyounesi Soma
332	Pranita Diaz	382	Schmalzl Lilia .
333	Pratchayakup Phakasawan	383	Schmidt Lana
334	Prelec Filip	384	Schuller Andreas
335	Pritenzi Maria Angelika	385	Seghedi Antoneta
336	Probonas Michalis	386	Sell Jaciele 1
337	Ptochoulis Panagiotis	387	Sell Jaciele 1
338	Puras Guillem	388	Sell Jaciele 2
339	Putri Inasritaty	389	Sell Jaciele 3
340	Qiang (Jason) Li	390	Sen Yang
341	Qingzi Ye	391	Sengthongnalin Khamheng 2
342	Qiong Chen	392	Sengthongnalin Khamheng 1
343	Ramos Dulcinea	393	Seong Joo
344	Razak Januarani 1	394	Septiana Ana R
345	Razak Januarani 2	395	Sheibani Vesal Yahya
346	Razak Januarani 3	396	Shiba Hikari
347	Recep Efe & Soykan	397	Shires Claire
348	Ren Fang	398	Sigursveinsson Sigurður
349	Ren Fang 2	399	Silva Miguel Reis 1
350	Ristovsk Igor	400	Silva Miguel Reis 2

PAGE	List of first authors in alphabetical order	PAGE	List of first authors in alphabetical order
401	Singhwachiraworakul Pakkaporn	432	WANG Junbo
402	Sitdikov A.R	433	Wannapa Somta
403	Socratis Tsacos	434	Wansang Ryu
404	Storta Elena	435	Watanabe Yusuke
405	Stupar Martina	436	Weber Jutta
406	SUN Wenyan	437	Weissheimer de Borba Andr,
407	Tadoumamt Boujemaa	438	Wibowo Tri
408	Tallgren Vilma-Lotta	439	Wilkinson Malcolm
409	Talvitie Pasi	440	Williams Mark
410	Tantaatipanit Saengpet	441	Wilson Joanna and Wakita Koji
411	Taylor Greg	442	Wilson Joanna
412	Taylor Greg 2	443	Woloszyn Jagoda
413	Thjømøe Pål	444	Xiaoyuan Zhang
414	Thongdee Nattinee	445	Xu Kejian
415	Thu Thuy Ly Thi	446	YAN Luobin
416	Thùy, Vi Trần	447	Yang Lichao
417	Torres Peaquive Patricia	448	Yao Meng
418	Torrescusa Vega	449	Young Ng
419	TSUJI Shyuji	450	Young Ng 2
420	Tuncer Demir Ahmet	451	Yue Li
421	Unjah Tanot	452	Yusmadi Andrie
422	Utama Hari Wiki 2	453	Zahdi Ricetti JoÆo Henrique
423	Utama Hari Wiki	454	Zaini Mohamad Farid
424	Valiakos Ilias	455	ZHANG Linping
425	van de Koppel Johan	456	Zhanqian Lu
426	Vautrin Quentin	457	ZHAO Yueming
427	Vaz N.M.	458	Zhou Jianmin
428	Verdeny Esteve NÉria	459	Znari Mohammed
429	Verpaelst Pierre.docx	460	Zoumpouli Elena
430	Vidakis Nikolaos	461	Zouros Nikolaos
431	Wada Kaori		

CLIMATE CHANGE IMPACT ON GLOBAL GEOPARKS MANAGEMENT: EXPERIENCE SHARING FROM THE MASSIF DES BAUGES AND THE M'GOUN GEOPARKS.

Kottabi Salah Eddine^{1,2}, Benzidiya Khalid¹, El Khalki Yahia¹, Hobléa Fabien², Perrin-Malterre Clémence².

1. *DPRP, CNRST - University Sultan Moulay Slimane (Beni-Mellal, Morocco).*
2. *Edytem, CNRS-University Savoie Mont Blanc (Chambéry, France).*

kottabi.salaheddine.phd@usms.ac.ma

Today, according to various intergovernmental expert reports, there is no longer any doubt that climate change is accelerating and intensifying and the reason for that goes back to man-made activities. In the framework of a collaborative programme based on a comparative study, this presentation investigates the adaptation efforts of two territories, namely the Massif des Bauges UNESCO Geopark characterized by a cool, humid climate, and the M'Goun UNESCO Geopark with a dry, warm climate, in response to the impacts of climate change. Both territories experience hotter spells, drought periods, reduced snowfall, and water stress, impacting agriculture, natural environments, risk management and water resources. The focus of this presentation is on the strategies employed to mitigate and adapt to these changes, involving residents, elected representatives, and socio-economic partners in a transition process to limit the impact of climate change, including the future of winter tourism in the Massif des Bauges.

The main levers for mitigating the impact of climate change include reducing energy consumption from the highest-emitting sources (such as the residential and transport sectors), improving process efficiency, enhancing carbon storage, and promoting non-carbon-emitting renewable energies. Adaptation measures need to be implemented systematically and across the board, covering all possible areas. Both Geoparks are focusing on supporting the climate transition in different sectors of activity, mobilizing stakeholders and partners around this major issue. In the Massif des Bauges, the Geopark accompanies the ski resorts, imports understanding tools to better manage problems related to climate change. First retracement concerning 3 ski-resorts (Aillons-Margériaz; Le Semnoz; and La Sambuy ski resorts) are observed, after initiatives have been taken to diversify their tourist activities, and creating alternatives to winter tourism and promoting year-round tourism (concept "four seasons") beyond the winter season, The Geopark continuously work with the National Office of Forests and The National Forest Property Center, the departments and the region of Auvergne-Rhône-Alpes to promote and protect the capacity of forests to mitigate and adapt to climate change by participating in the Regional Strategic Plan and the Regional Plan for the wood sector 2023-2027, and within the framework of the European Agricultural Fund for Rural Development (EAFRD). In the M'Goun Geopark, the High Commission for Water and Forests, along with the Ministry of Agriculture and Maritime Fisheries, play significant roles in combating erosion, deforestation, and desertification. They develop and implement policies for conservation, sustainable development of forests, and sylvo-pastoral resources. Institutional mechanisms are established to coordinate policy formulation, execution, monitoring, and evaluation in combating desertification and contributing to rural development.

In addition, some strategic geosites are used or could be used as indicators and educational supports to record and show the effects of the climate change on natural processes and human activities.

Climate change impact on Global Geoparks management: experience sharing from the Massif des Bauges and the M'Goun Geoparks

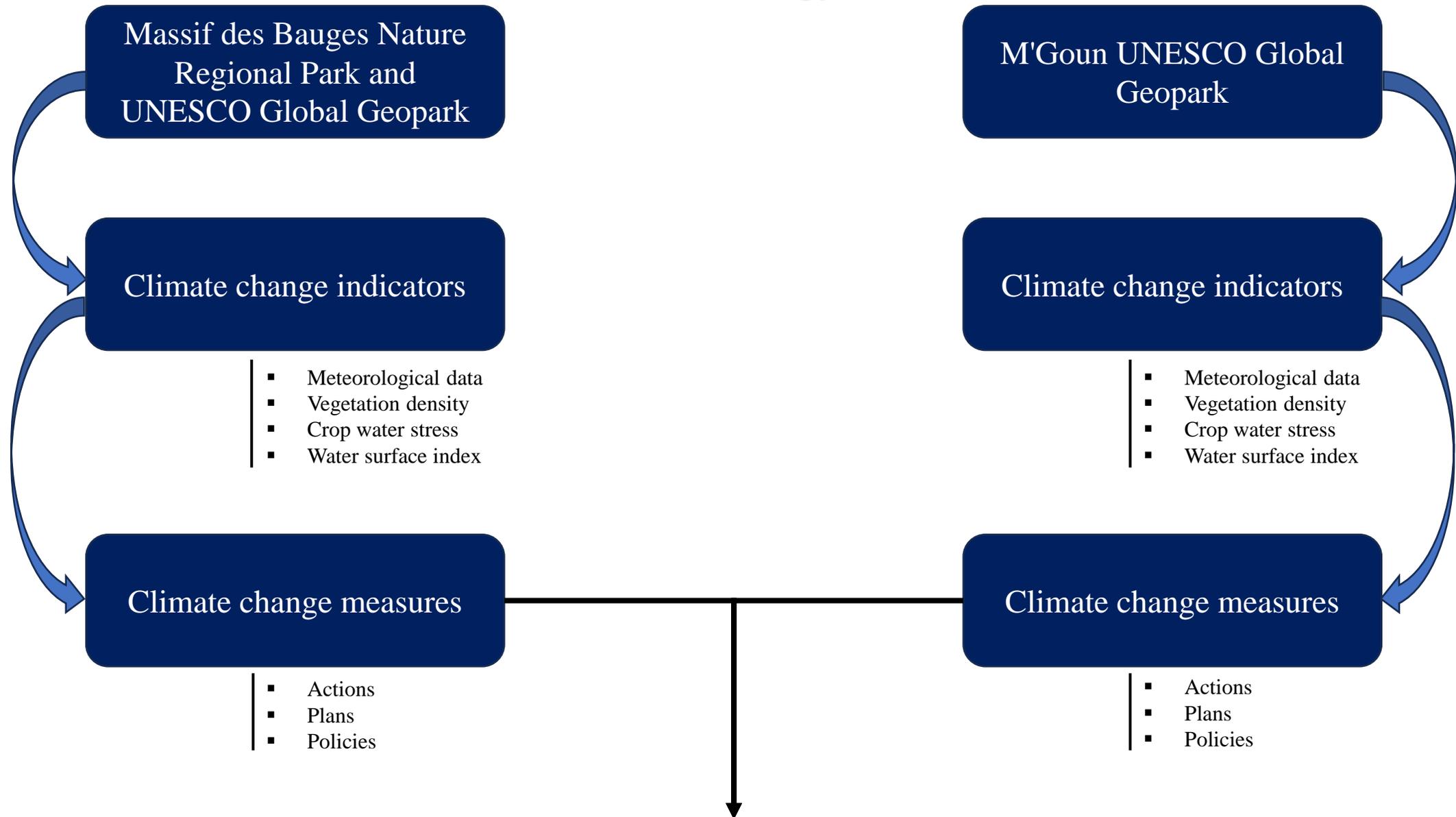


- *Kottabi Salah Eddine* ⁽¹⁾ ⁽²⁾
- *Benzidiya Khalid* ⁽¹⁾
- *El Khalki Yahia* ⁽¹⁾
- *Hobléa Fabien* ⁽²⁾
- *Perrin-Malterre Clémence* ⁽²⁾

Introduction :

- ❑ **Accelerating Climate Change:** Intergovernmental expert reports confirm the undeniable acceleration and intensification of climate change, primarily attributed to human activities.
- ❑ **Comparative Study Approach:** The presentation highlights a collaborative program centered on a comparative analysis. It investigates the adaptation strategies of two distinct territories: the Massif des Bauges UNESCO Geopark (cool and humid climate) and the M'Goun UNESCO Geopark (dry and warm climate).
- ❑ **Climate Impact:** Both Geoparks face shared challenges, including hotter spells, extended drought periods, reduced snowfall, and heightened water stress. These impacts have far-reaching consequences for agriculture, natural ecosystems, risk management, and water resources.
- ❑ **Adaptation Strategies:** The presentation emphasizes the adaptation strategies undertaken by these Geoparks. These efforts involve active participation from residents, elected officials, and socio-economic partners. The goal is to initiate a transition process that mitigates climate change impacts.

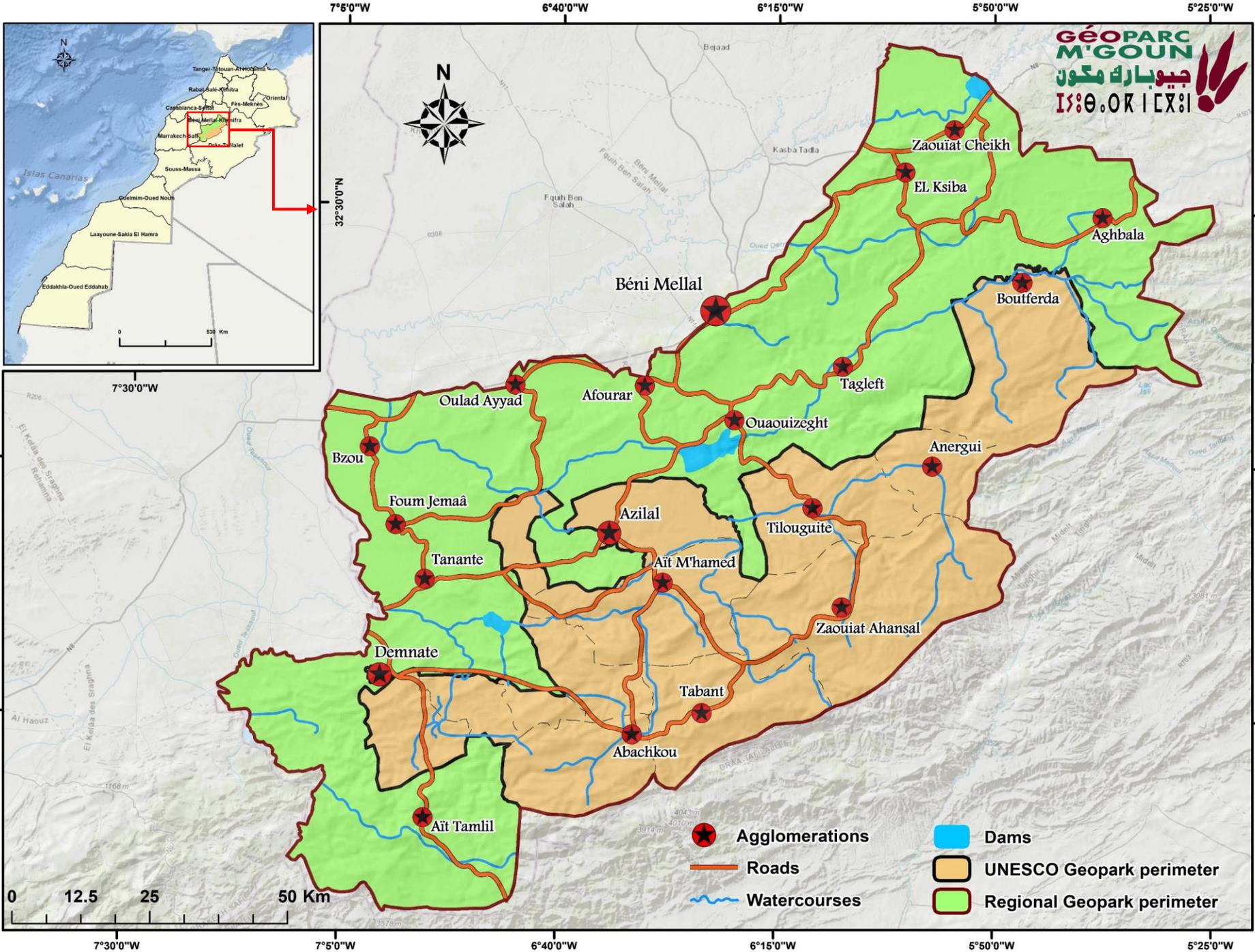
Methodology :



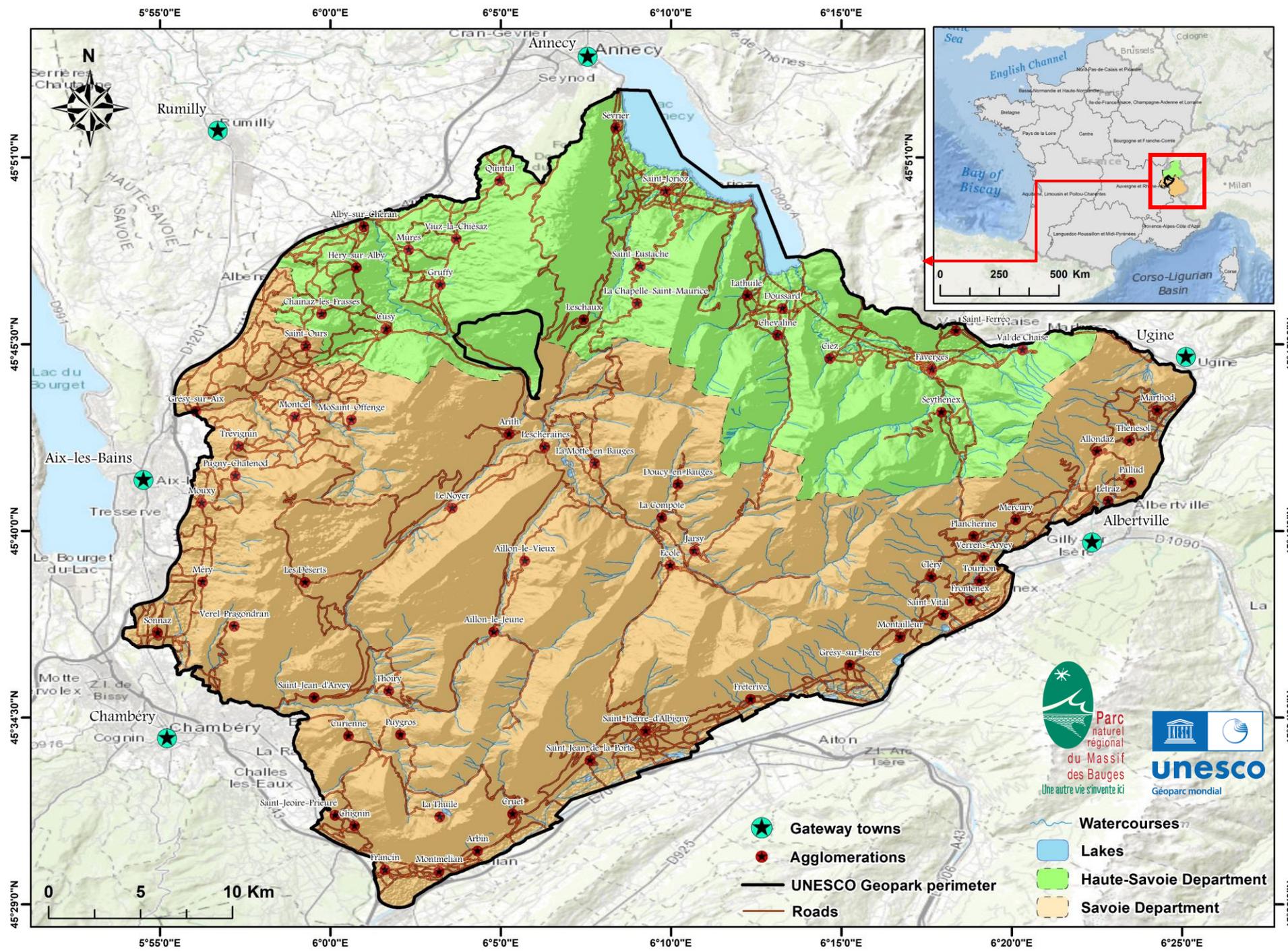
Comparison of measures and actions regarding climate change between the two UNESCO Geoparks



Exploring Two Geoparks: Study Area Locations & Context



- **Total area:**
Over 5 730 km²;
- **Region:**
Béni Mellal-Khénifra;
- **2 provinces:**
Azilal & Béni Mellal;
- **15 communes:**
2 urban & 13 rural;
- **Year of creation :**
2014.



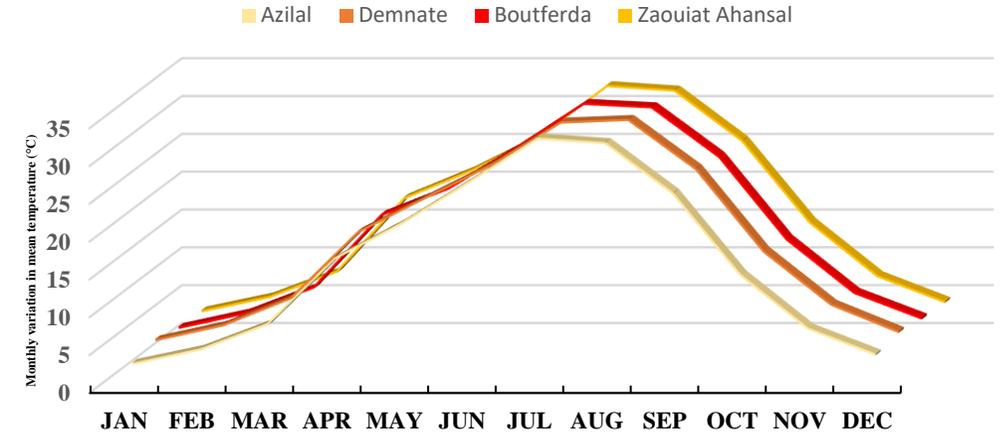
- **Total area:
Over 856 km²;**
- **Region:
Auvergne-Rhône-Alpes;**
- **2 départements:
Savoie & Haute-Savoie;**
- **67 communes + 6
Gateway Towns;**
- **Year of creation :
2011.**



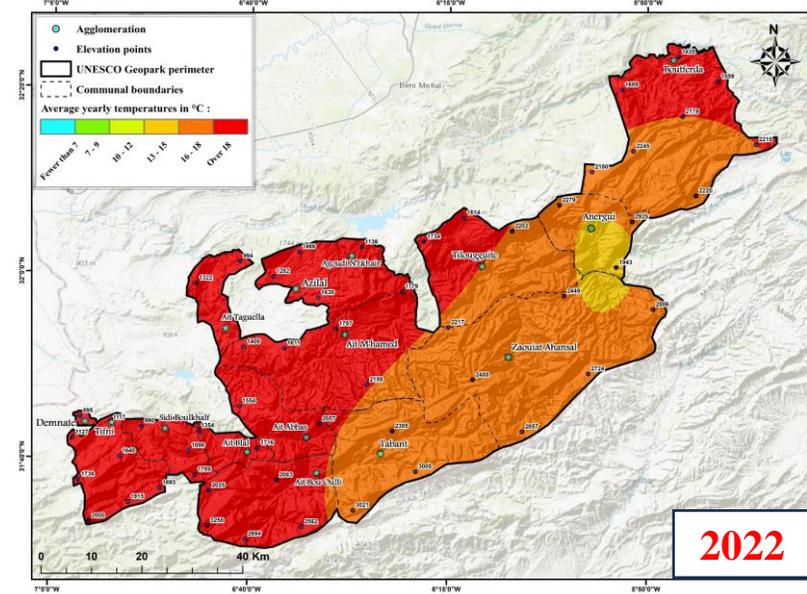
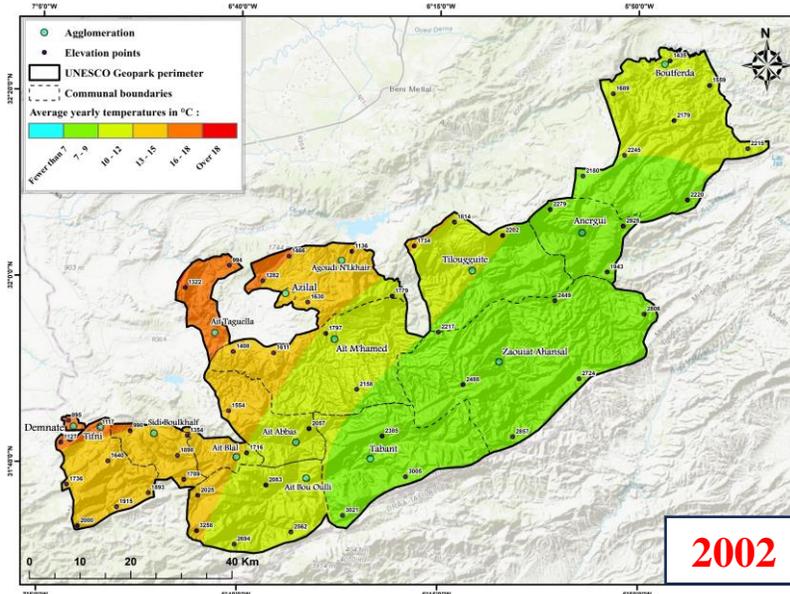
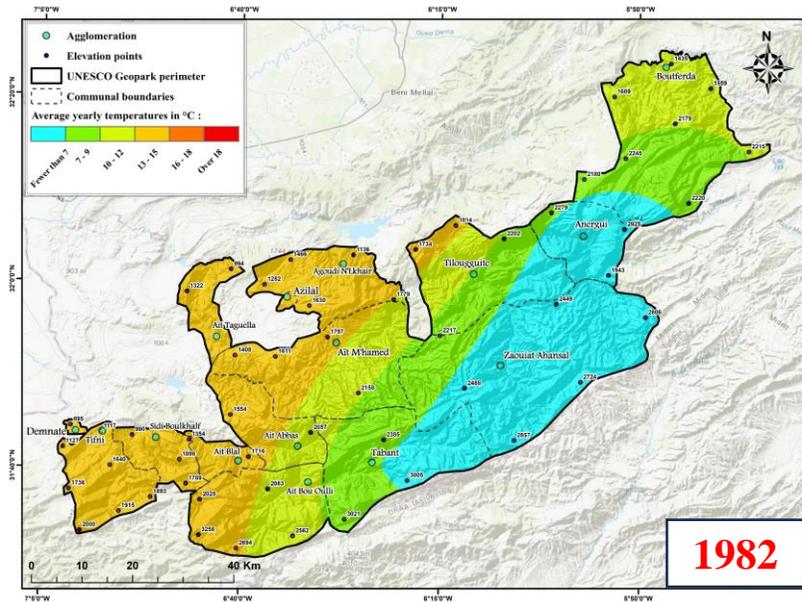
Climate change indicators :

Temperature :

- The climate is temperate and warm, characterized by a dry, arid season in summer and a cold, harsh winter.



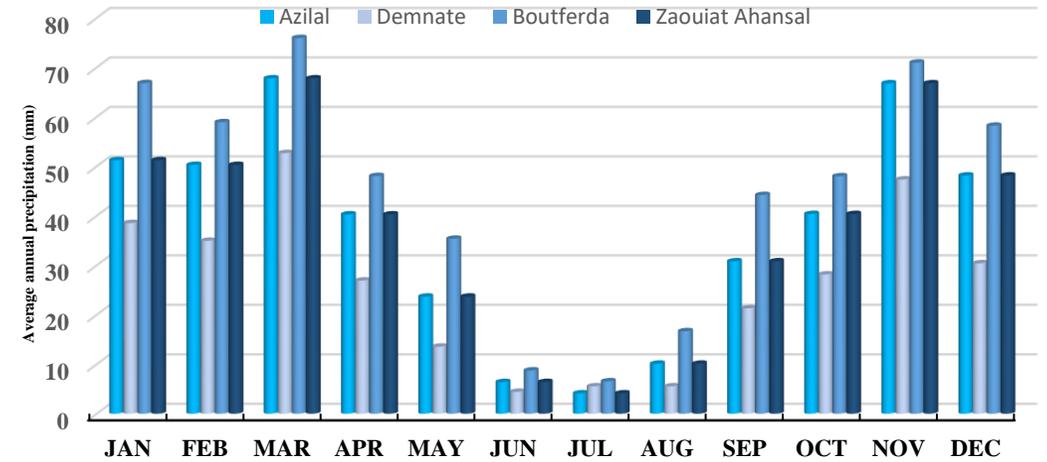
Source: NASA Langley Research Center (LaRC) (<https://power.larc.nasa.gov>).



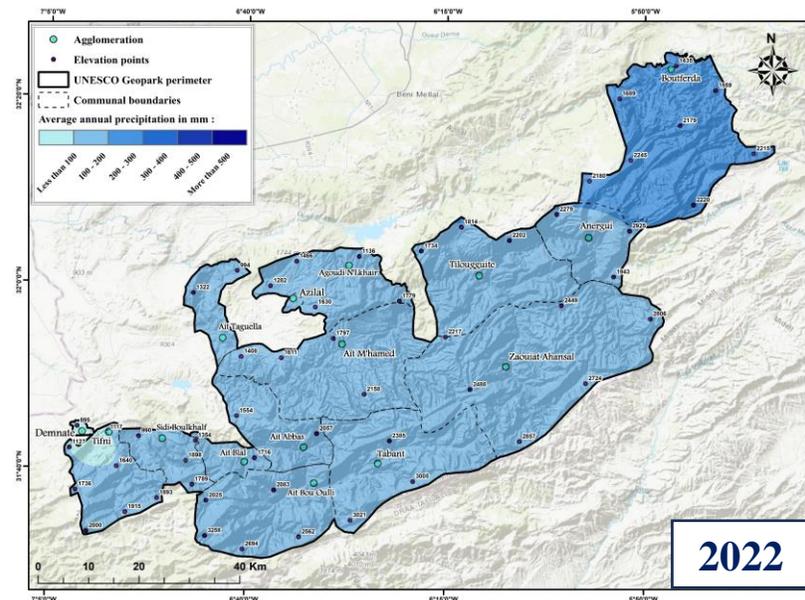
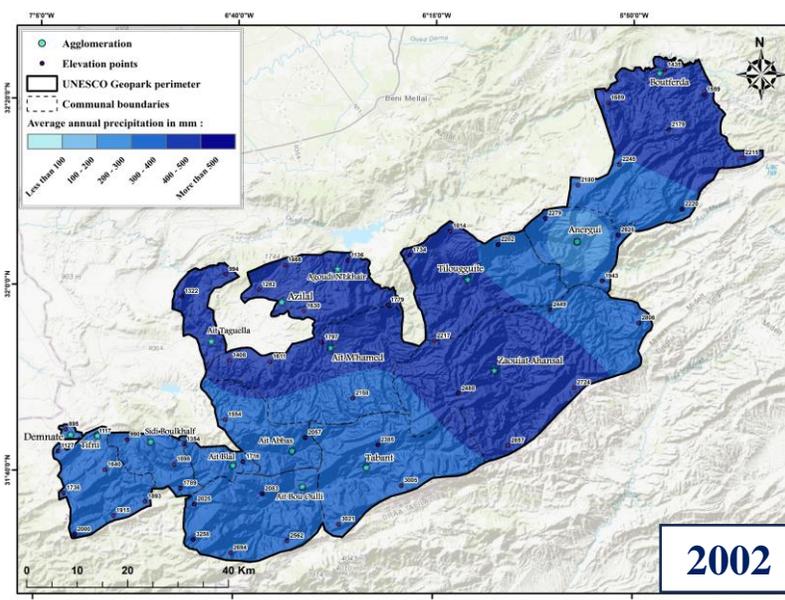
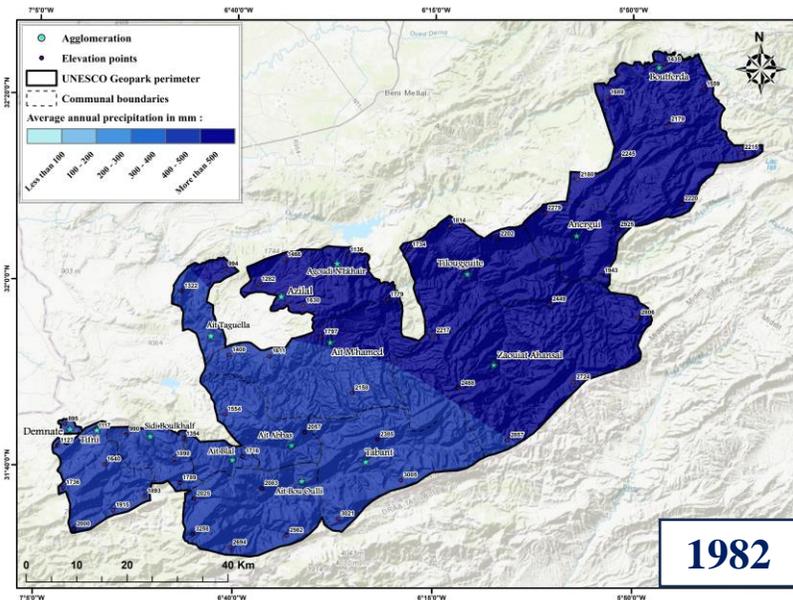
- Average yearly temperatures are steadily increasing, showcasing a distinct differentiation between the colder mountain areas and the warmer Piedmont regions.

Rainfall :

- During winter, snow contributes significantly to mountainous precipitation, comprising between 20% to 30% of the total.



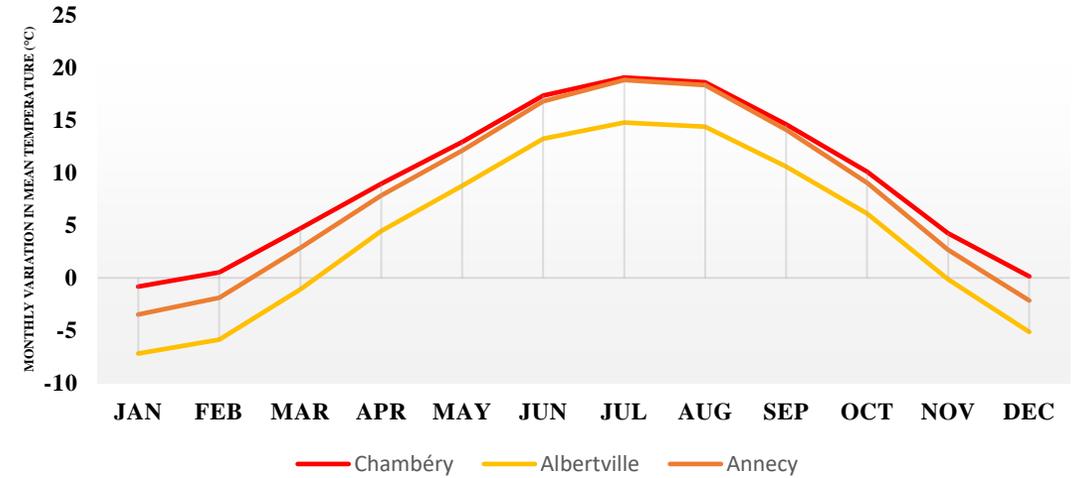
Source: NASA Langley Research Center (LaRC) (<https://power.larc.nasa.gov>).



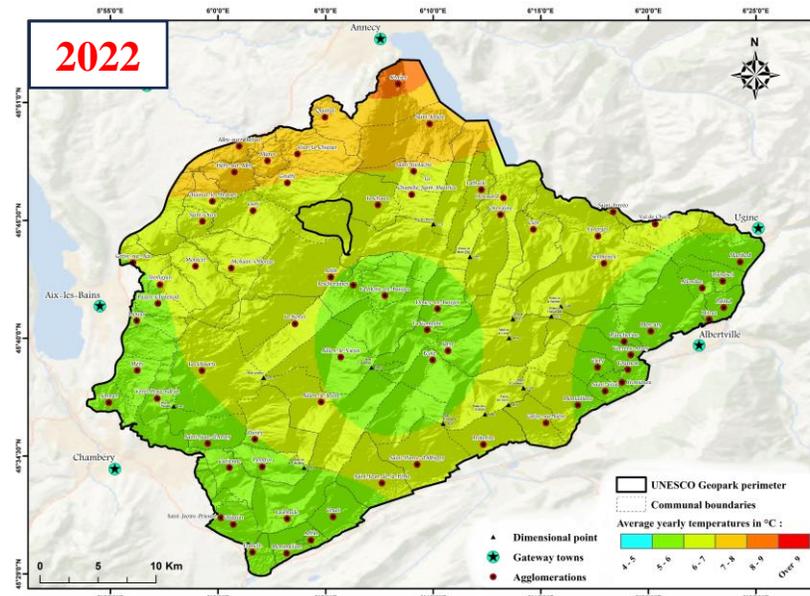
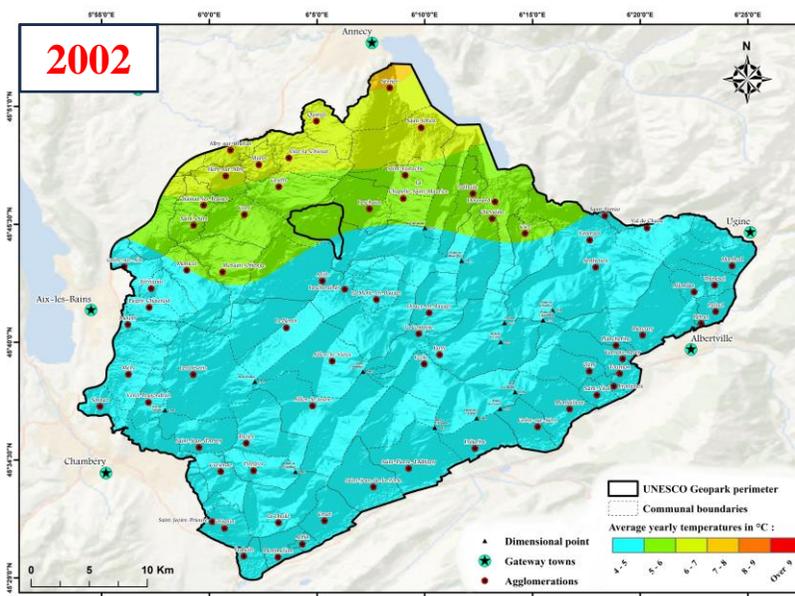
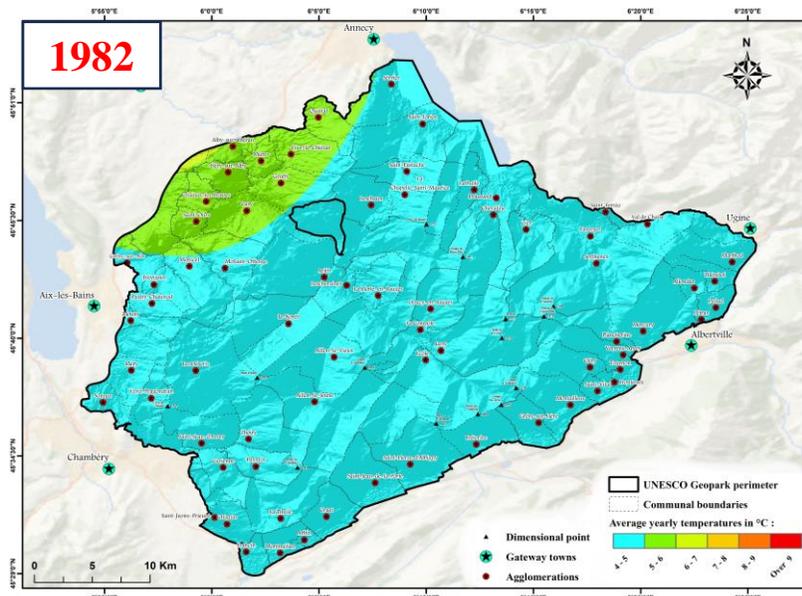
- Average yearly rainfall follows a declining trend, mirroring temperature changes.

Temperature :

- The Massif des Bauges experiences a cool and wet climate common to pre-alpine massifs, acting as a barrier to oceanic disruptions, leading to consistent heavy rainfall throughout the year.



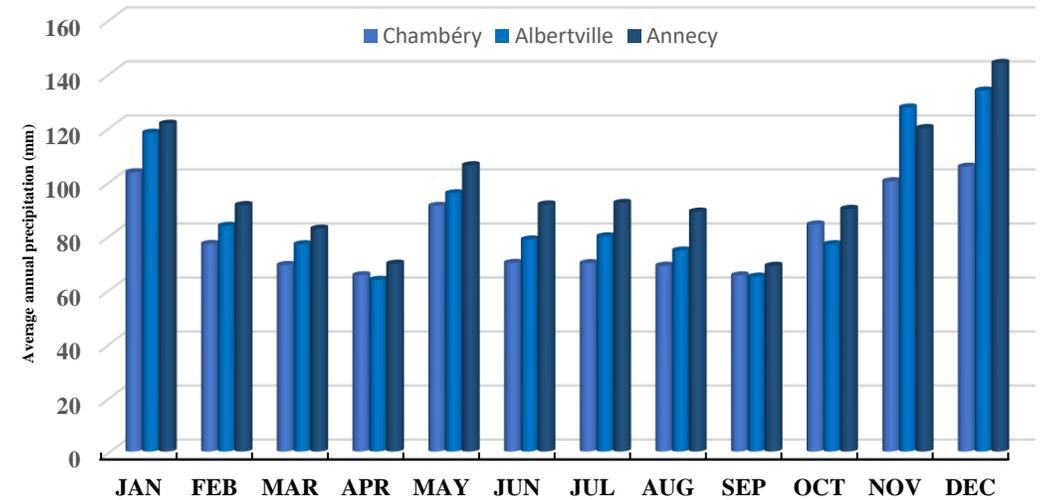
Source: NASA Langley Research Center (LaRC) (<https://power.larc.nasa.gov>).



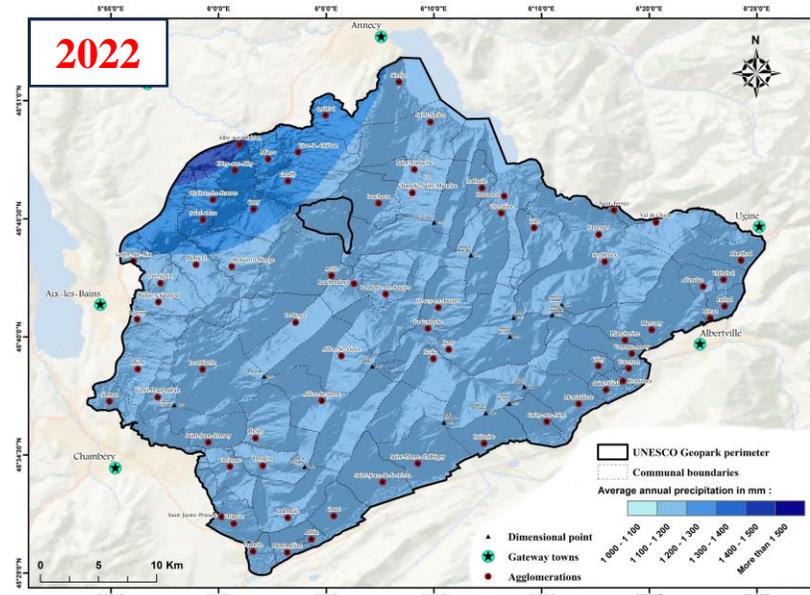
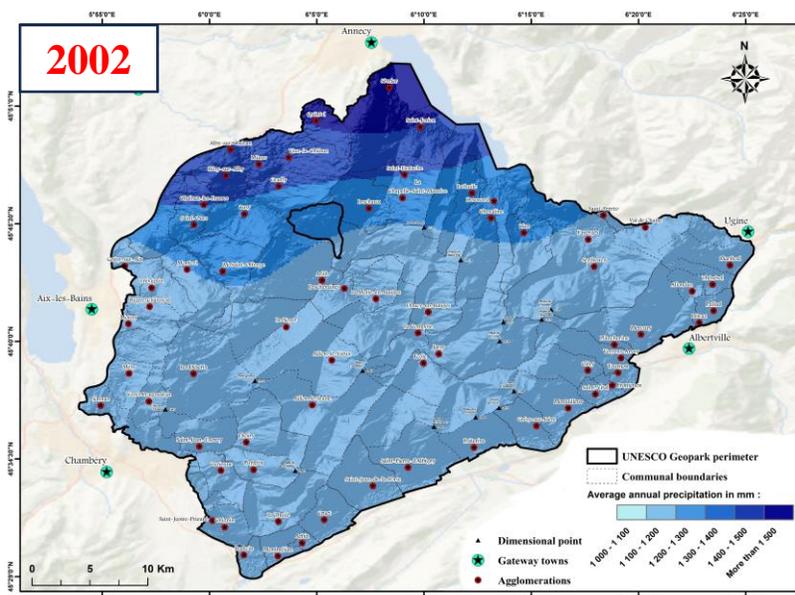
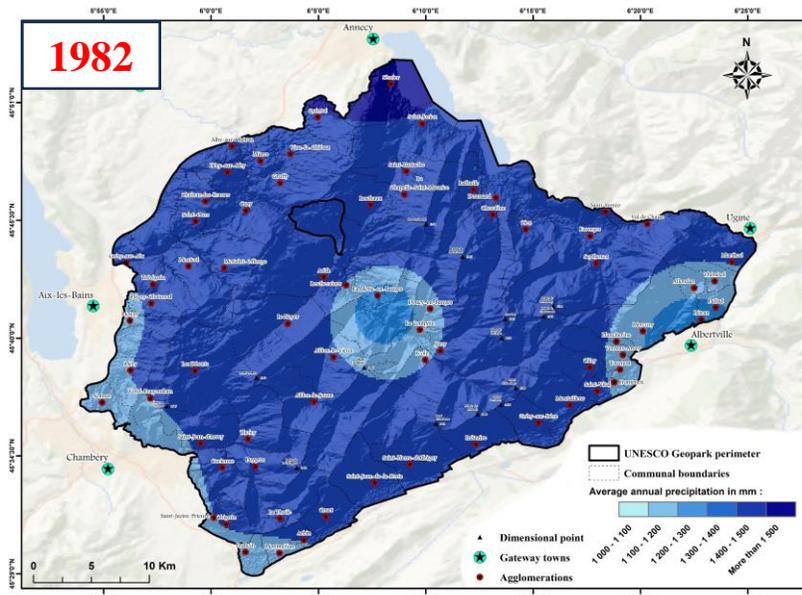
- Yearly average temperatures are on a consistent rise, highlighting a clear contrast between the colder mountain zones and the warmer Piedmont regions.

Rainfall :

- Snow falls from October to May, making up to 50% of yearly precipitation, and its gradual melting in spring significantly affects local river flow.



Source: NASA Langley Research Center (LaRC) (<https://power.larc.nasa.gov>).



- From the southern and southeastern parts of the Geopark, there is a diminishing presence of uninterrupted rainfall that extends toward the northwest.

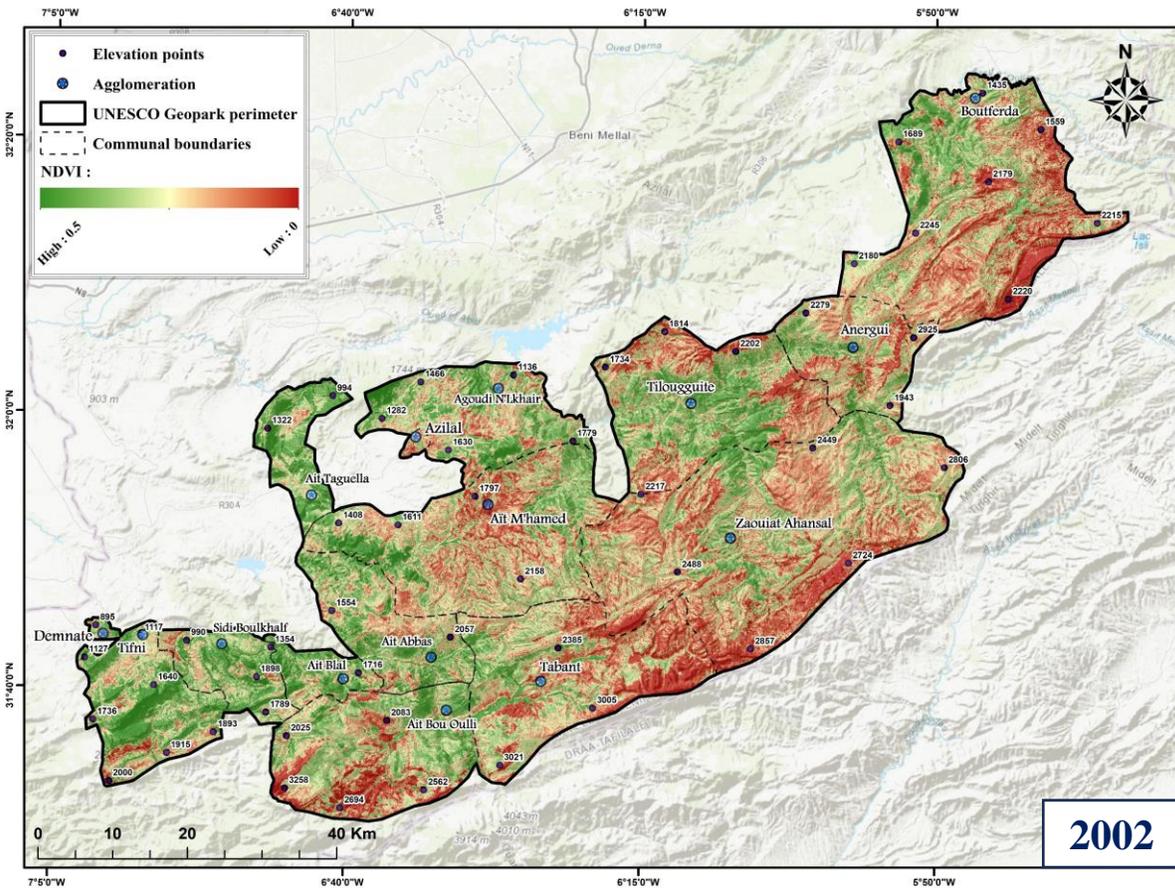
Vegetation Areas Degradation:

- This encompasses a decrease in both the extent and density of forest coverage, alongside a deterioration in the quality of agricultural crops within the region.

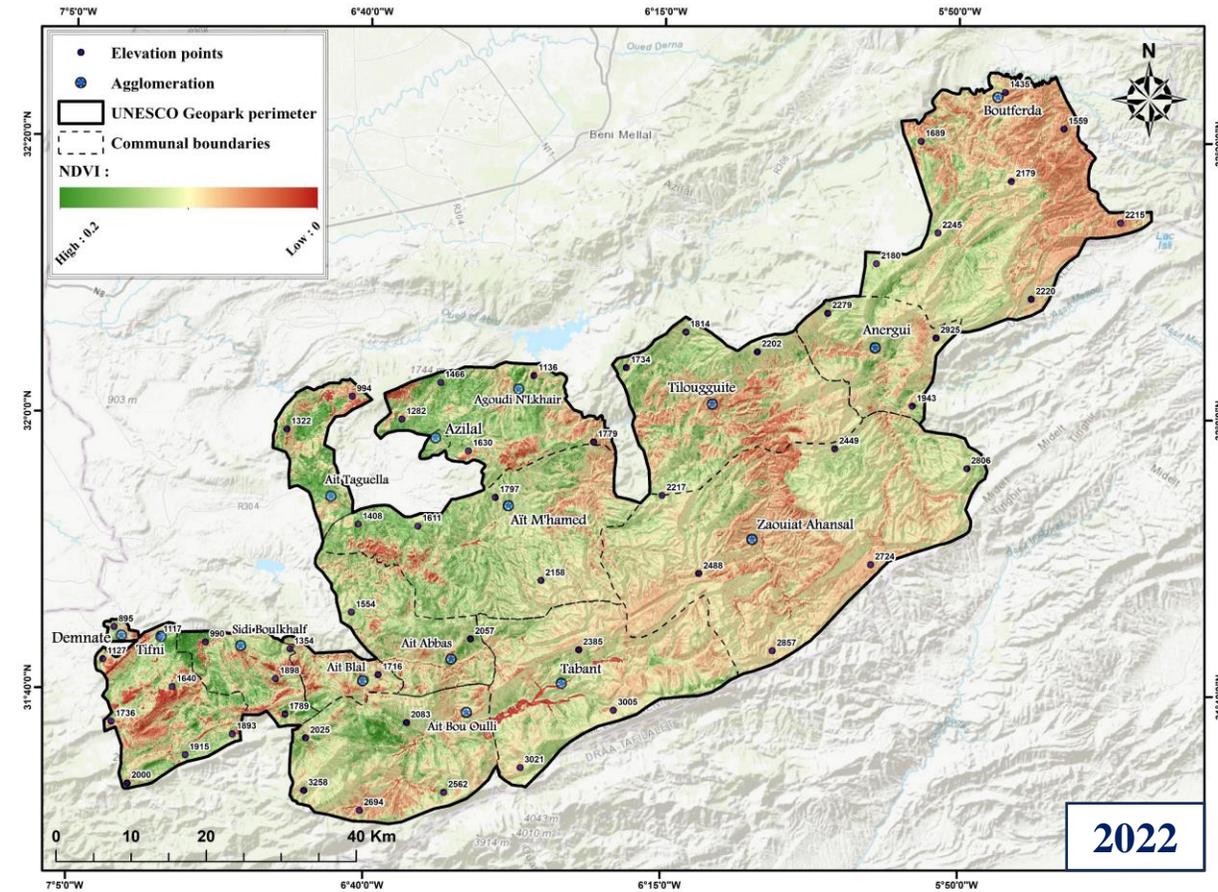


Forest cover:

- One of the most widely used indices for vegetation monitoring is the **Normalized Difference Vegetation Index** ($NDVI = (NIR - Red) / (NIR + Red)$)

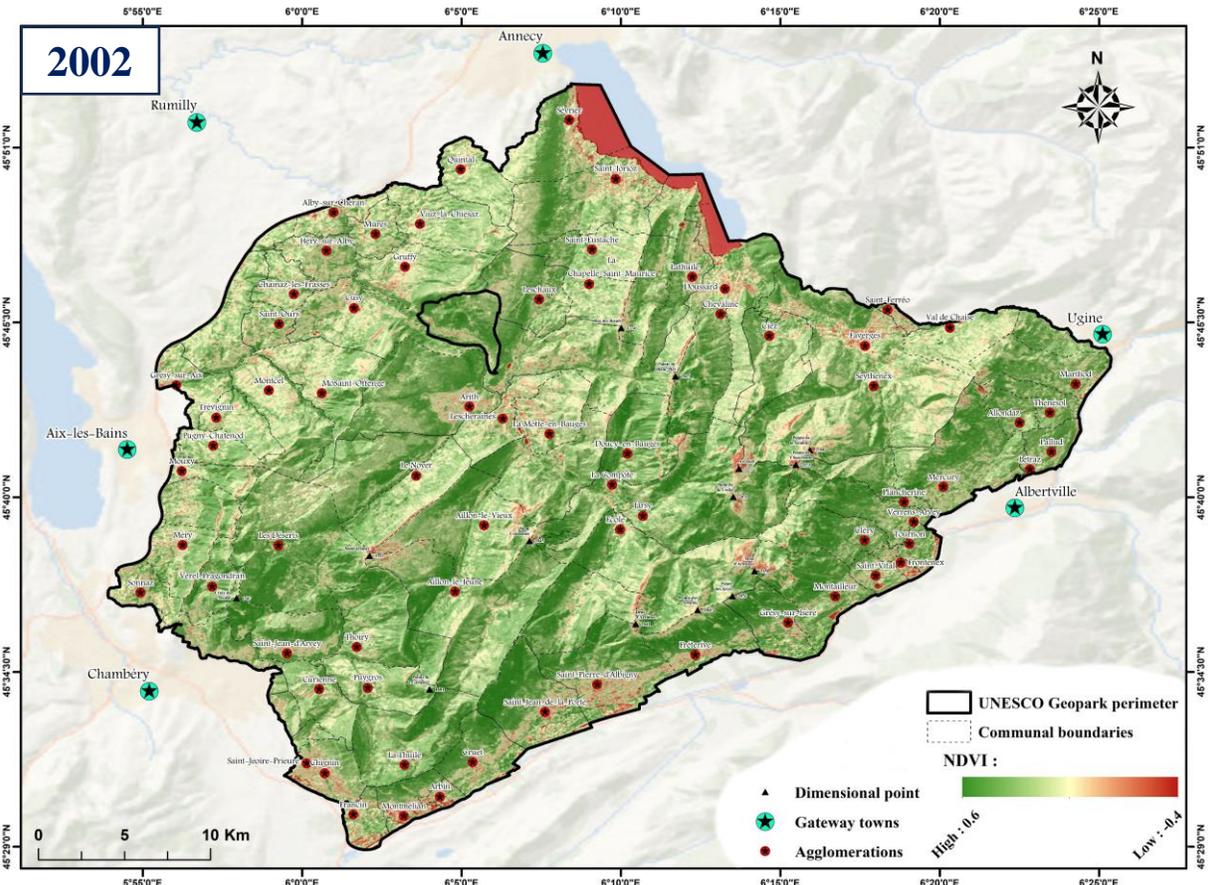


367 365.49 hectares

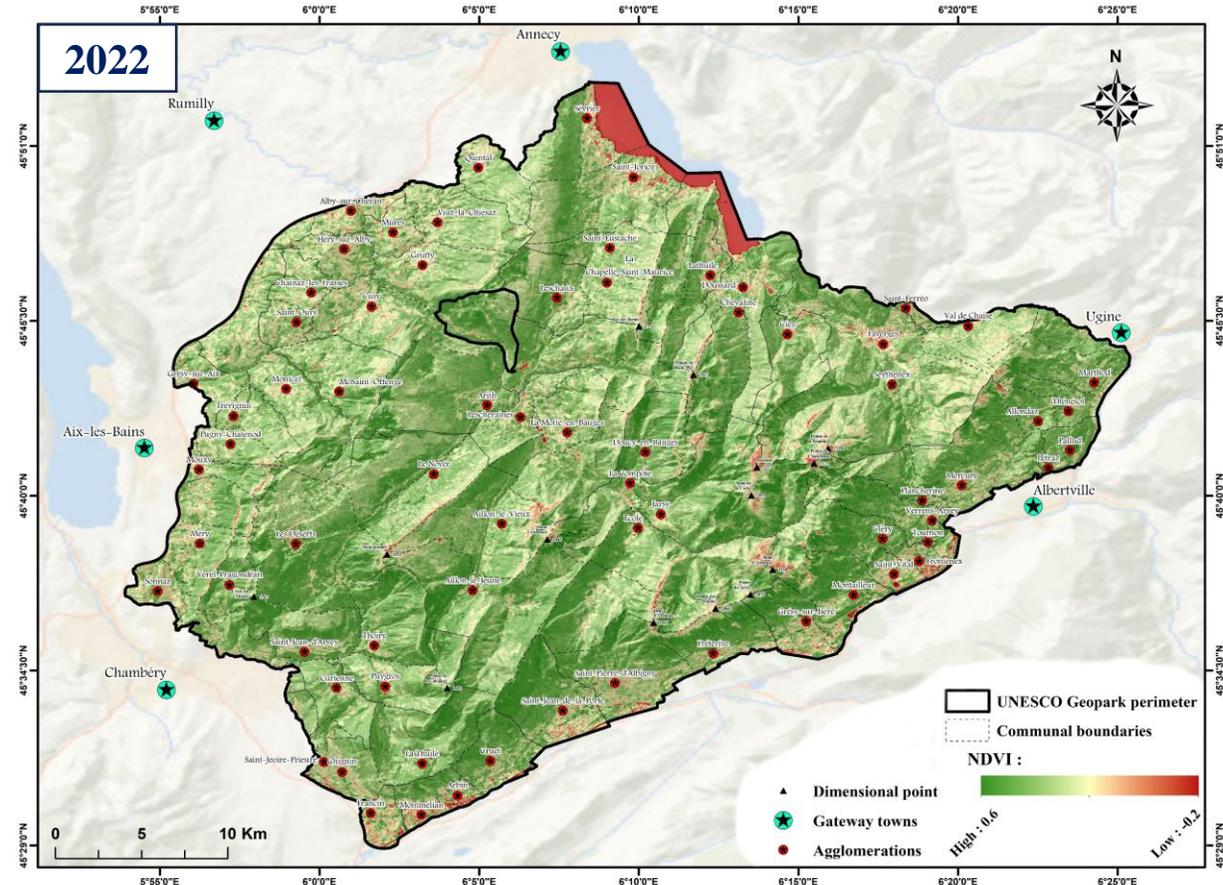


270 421.59 hectares

Decline rate of **-26.4% (-1.5% annually)**.



87 438.22 hectares

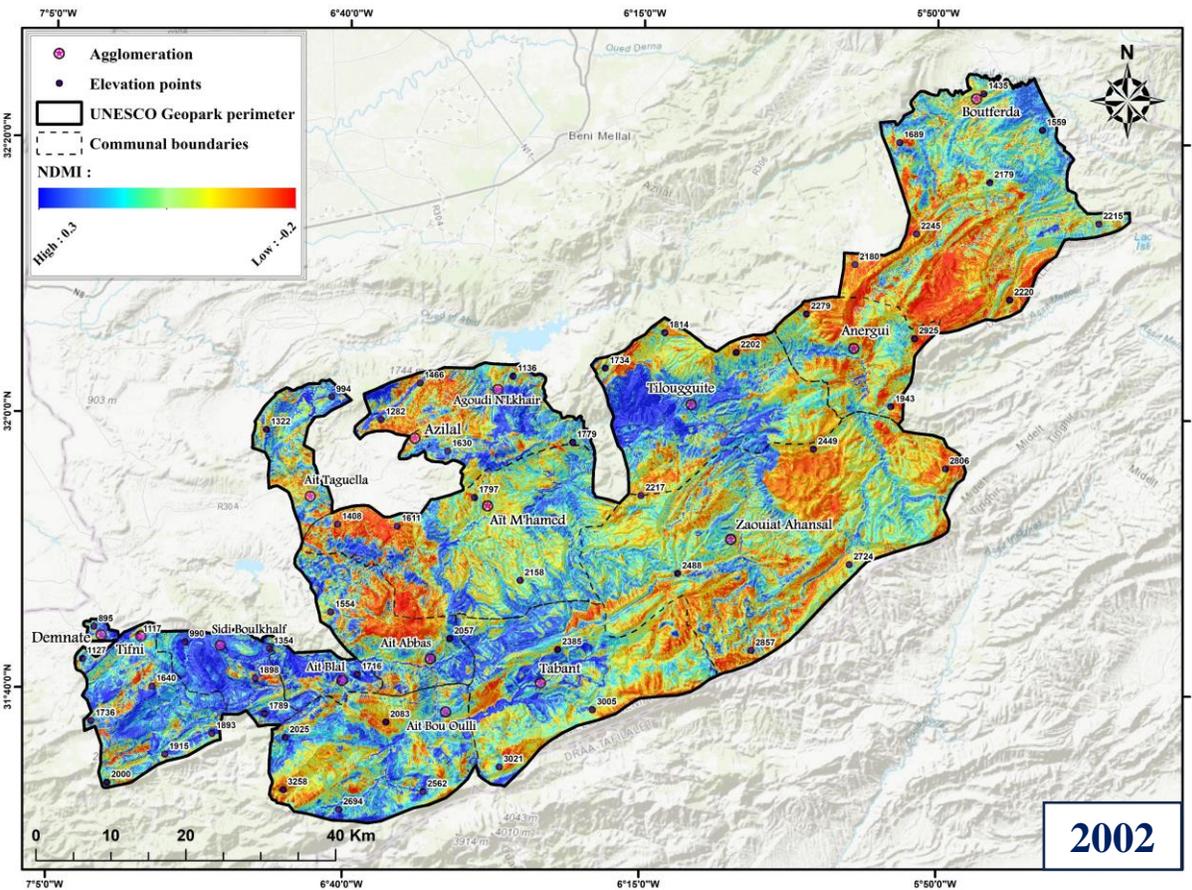


87 357.98 hectares

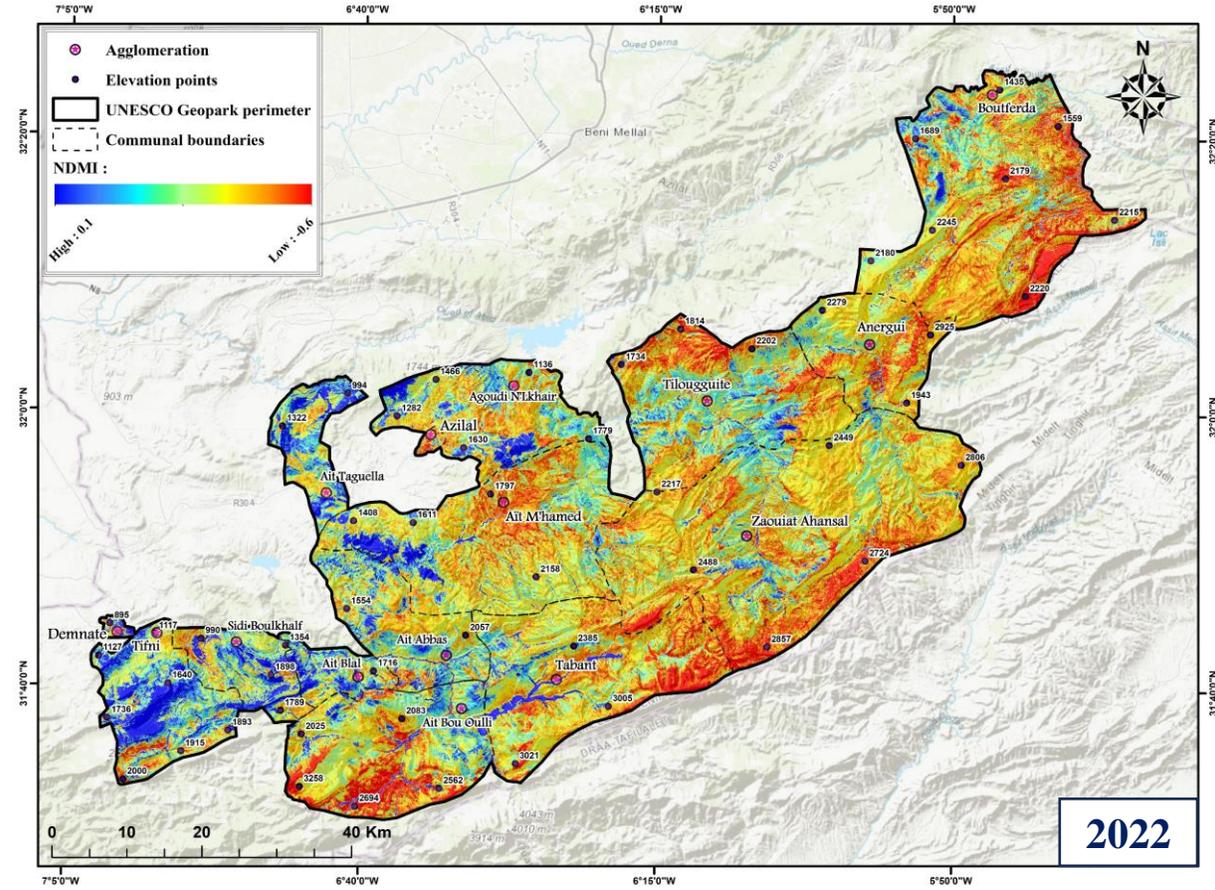
Decline rate of less than **-0.1%**.

Water stress :

- One of the most widely used indices for irrigation monitoring is the **Normalized Difference Moisture Index**, which can detect water stress at an early stage. ($NDMI = (NIR - SWIR) / (NIR + SWIR)$).

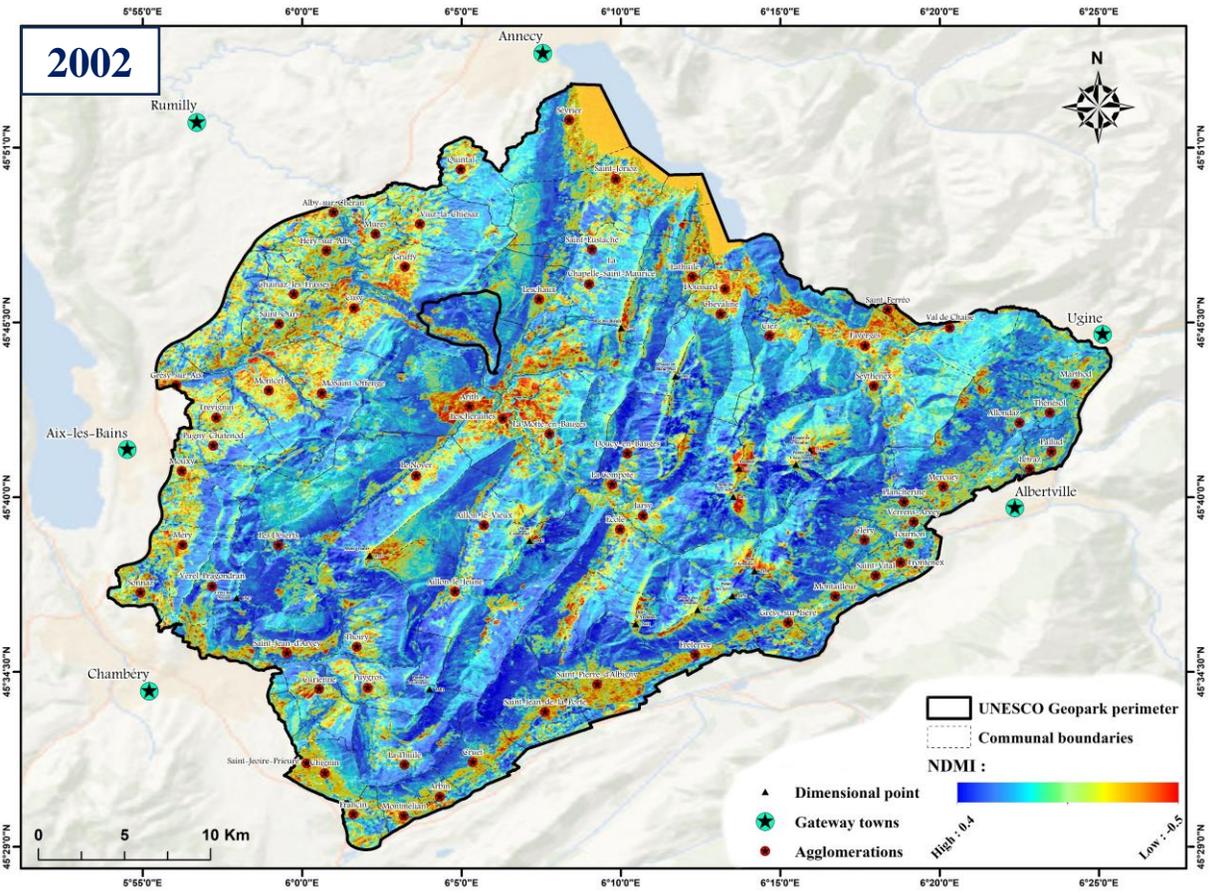


298 558.77 hectares

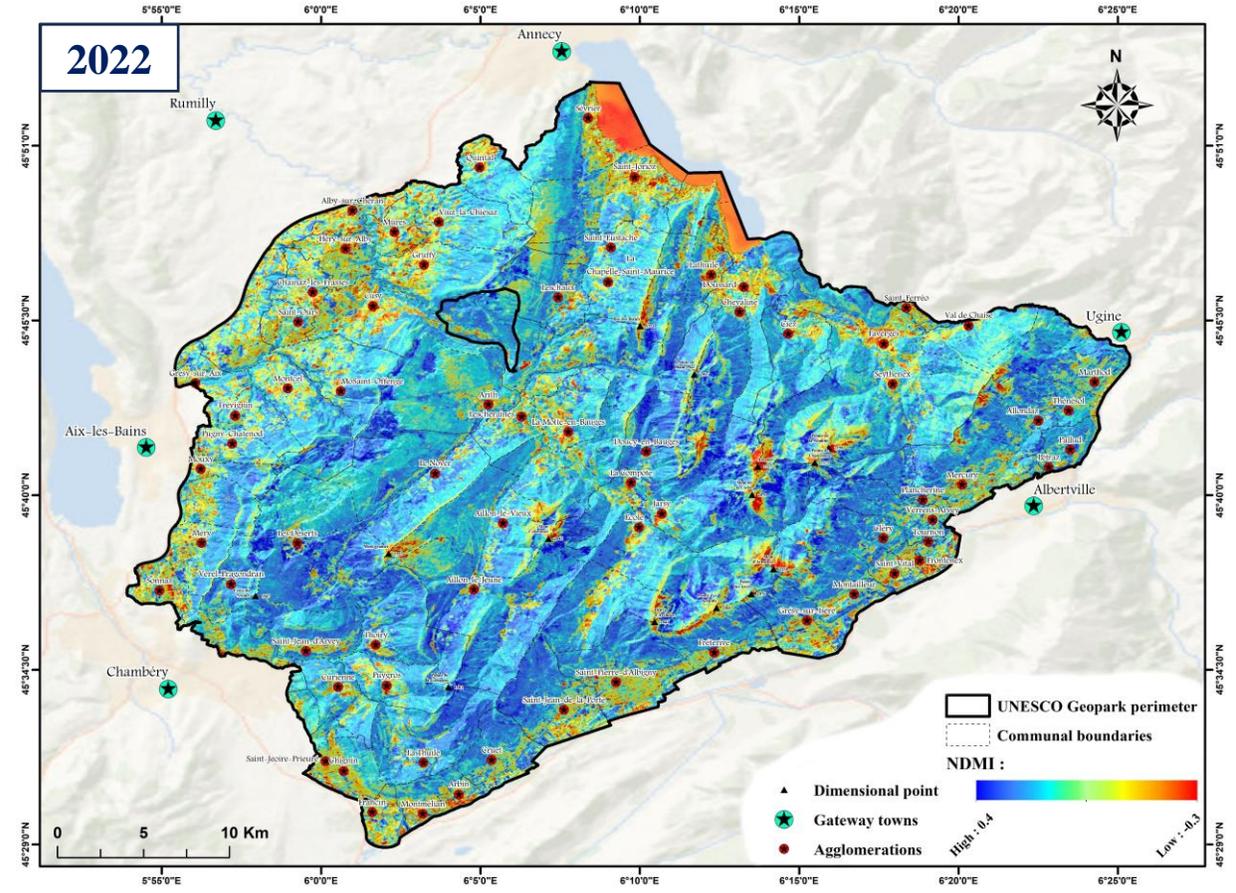


490 195.68 hectares

Growth rate of **64.2% (2.5% annually)**.



80 411.88 hectares



81 747.88 hectares

Growth rate of merely **1.7%** (equivalent to **0.1%** annually).

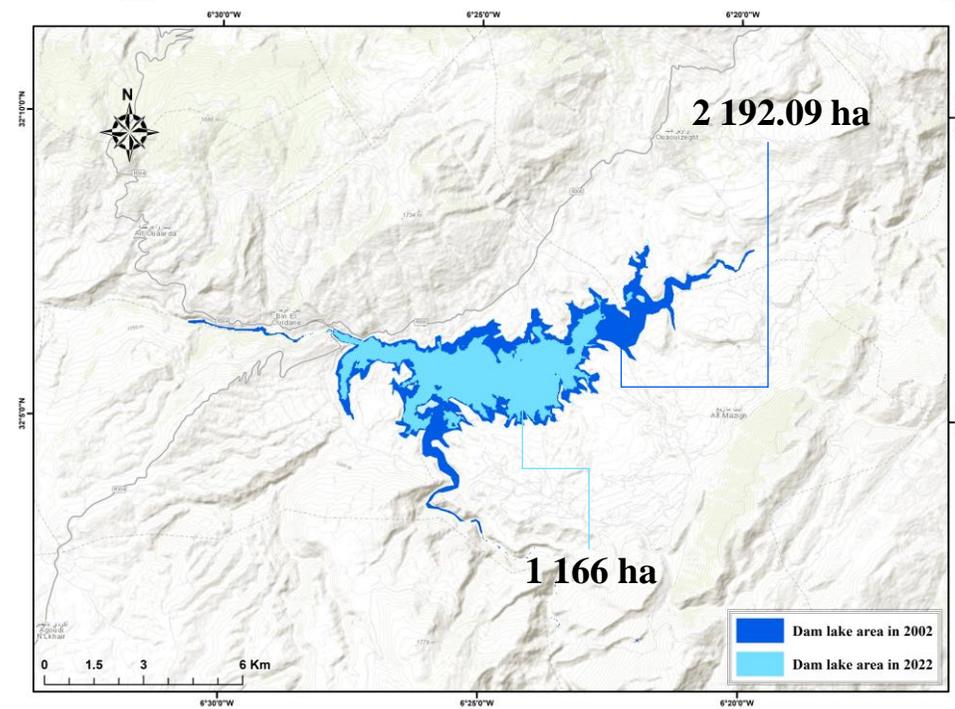
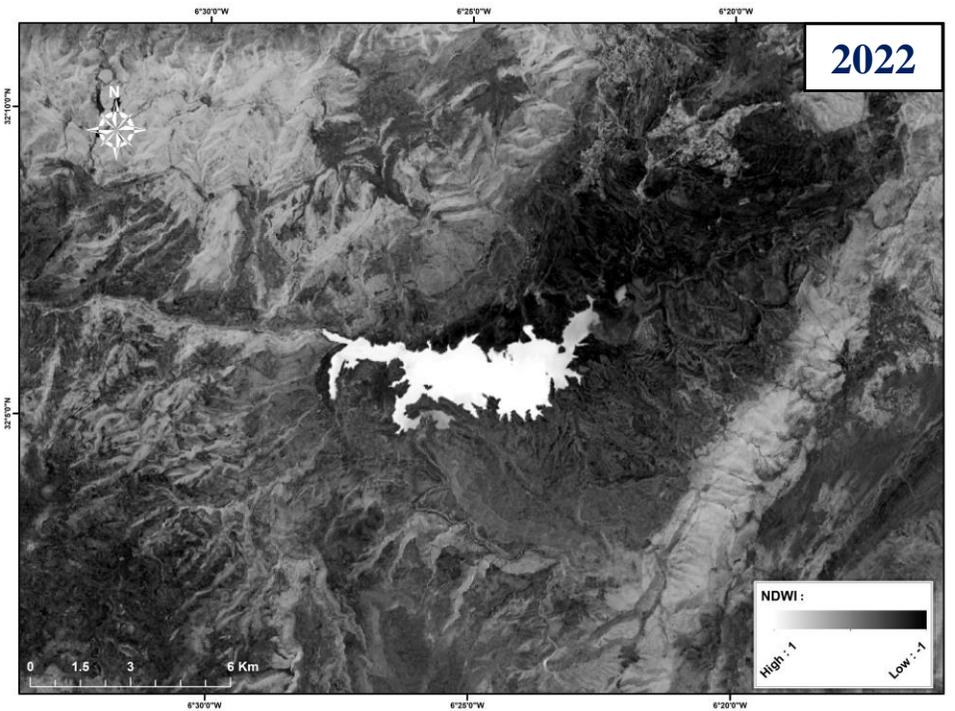
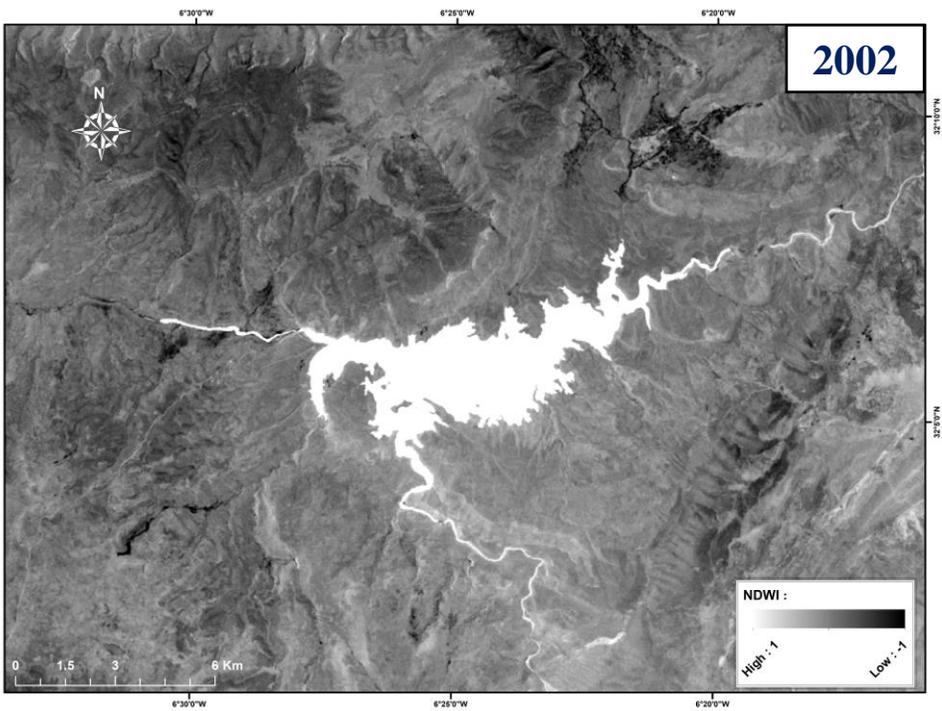
Waterbodies :

- The Normalized Difference Water Index ($NDWI = (Green - NIR) / (Green + NIR)$) is used to highlight open water features in a satellite image, allowing a water body to “stand out” against the soil and vegetation.

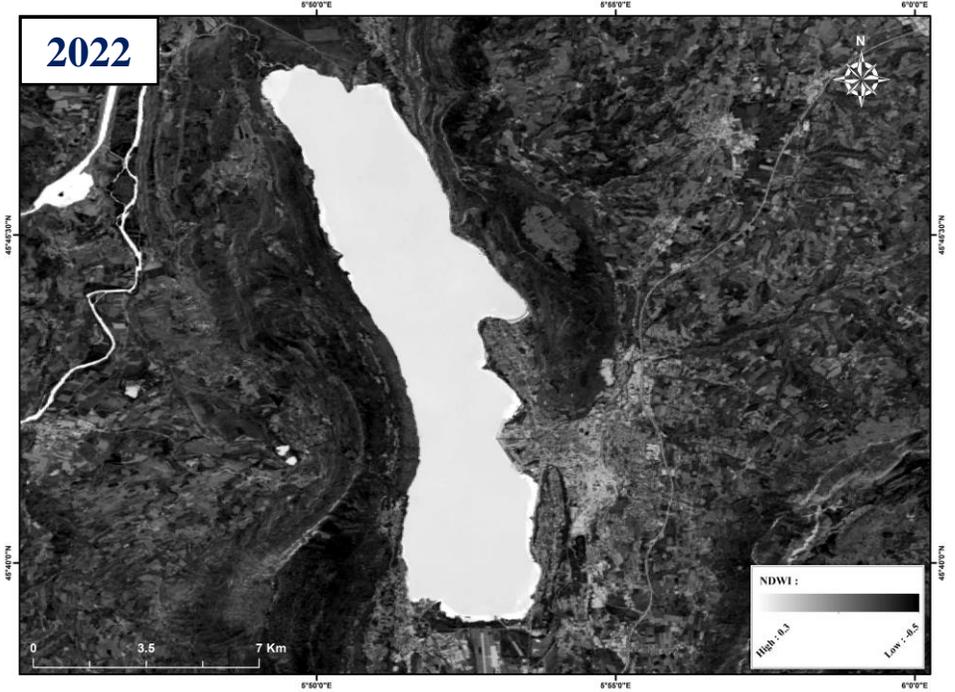
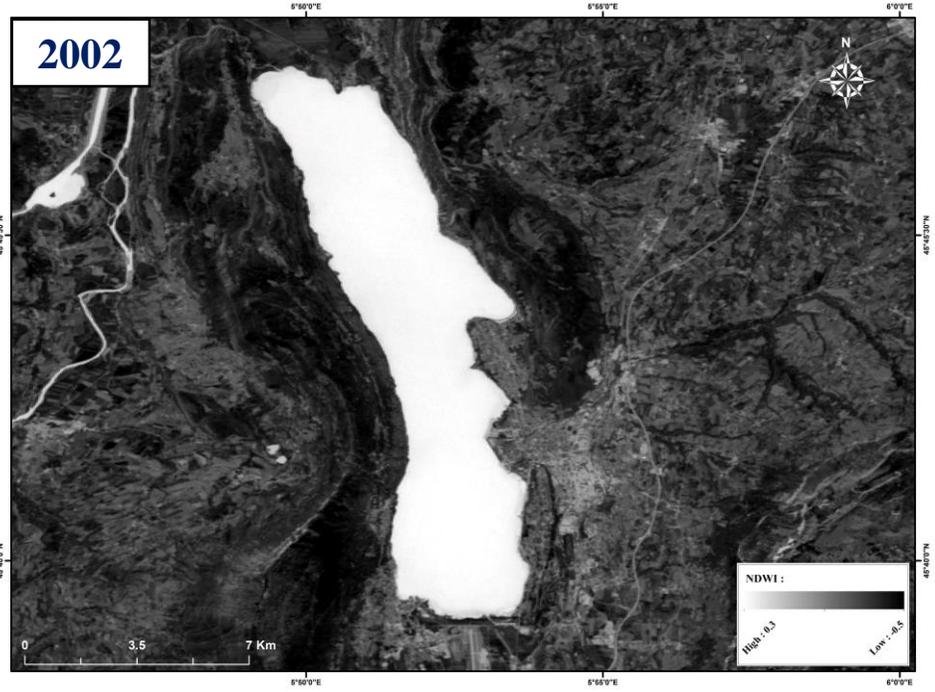
- Bin El Ouidane lake :



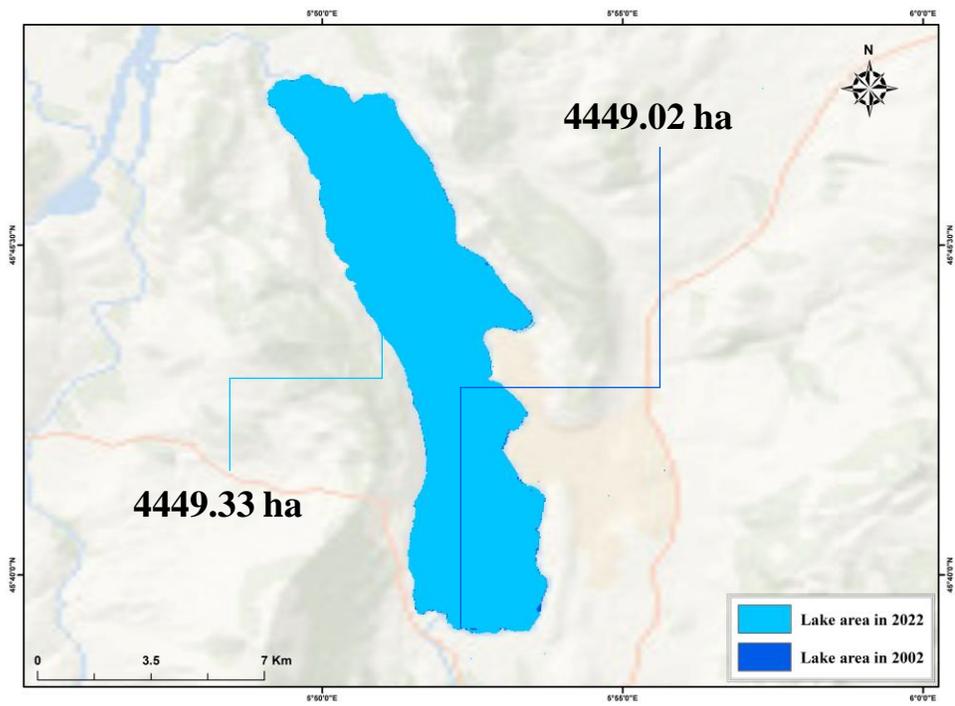
- By March 2015, the Bin El Ouidane dam contained 1 045.6 million cubic meters of water, however by 2022, the reservoir water level had significantly dropped to just 167.7 million cubic meters = **A REDUCTION OF 71% BETWEEN 2015 AND 2022.**



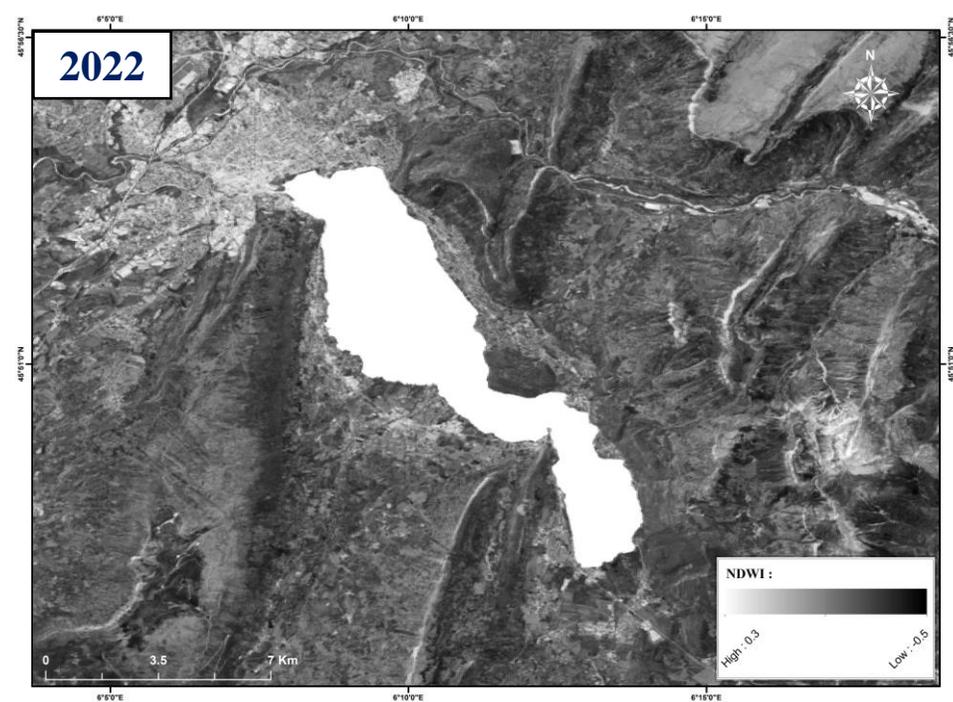
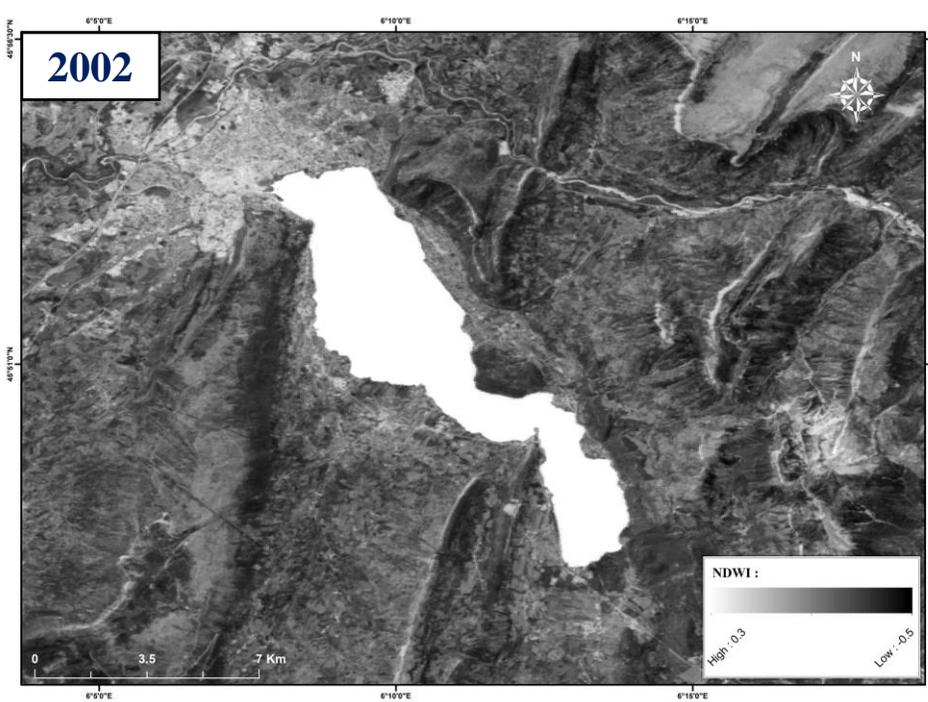
Decline rate of -46.8% (-3.1% annually).



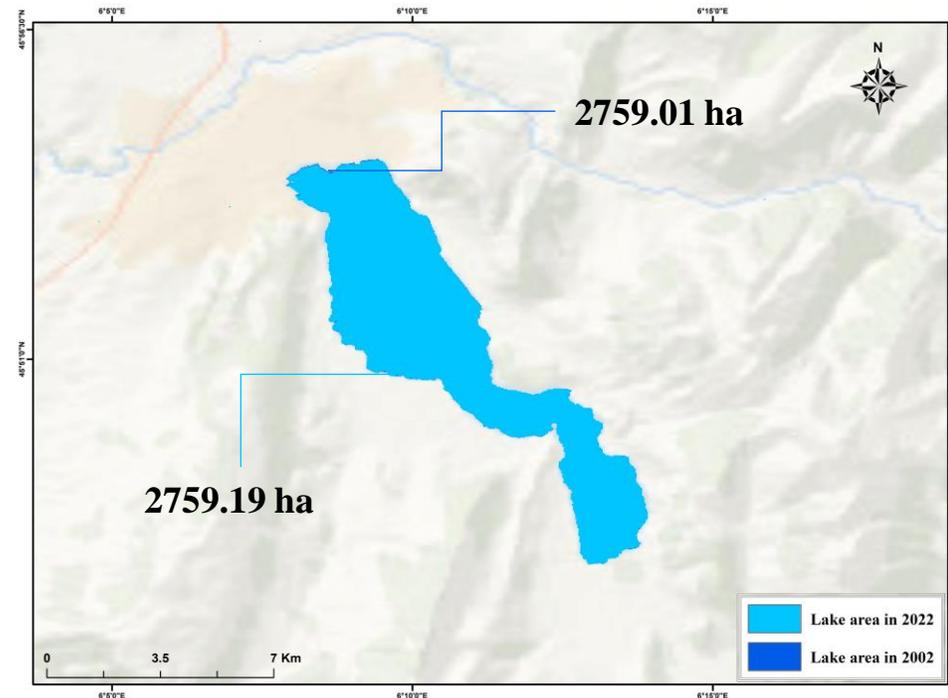
- Lake Bourget :



Decline rate of merely -0.01%.



- Lake Annecy :

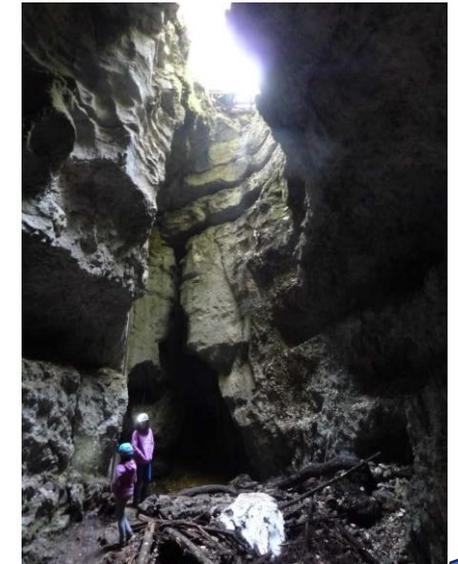
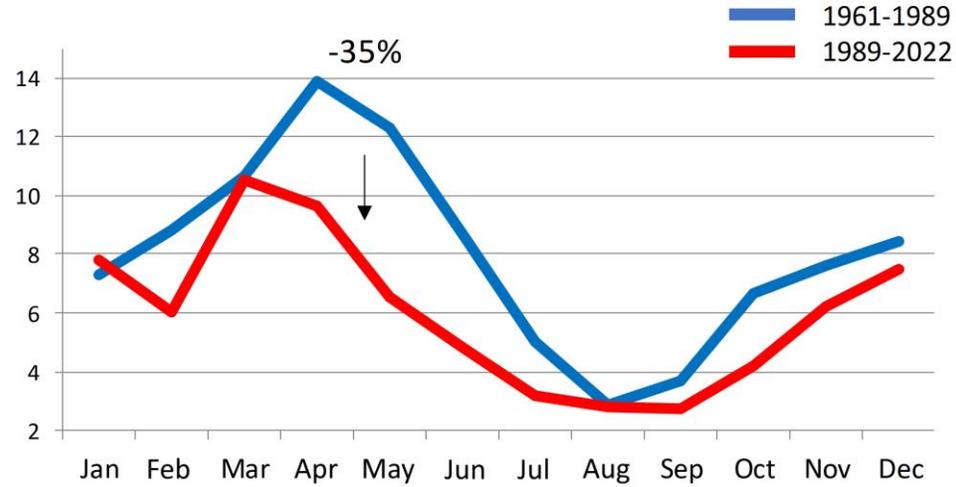


Decline rate of merely -0.01%.

So... Is there no climate change impact in the Massif des Bauges Regional Nature Park/Geopark?

The answer is Yes, but...

Monthly flows of the Chéran river



An aerial photograph of a vast olive grove. The trees are arranged in neat, parallel rows across a hilly landscape. In the foreground, a paved road runs horizontally, with a line of young, green trees planted along its edge. The sky is filled with soft, grey clouds, and the overall lighting is somewhat muted, suggesting an overcast day. The text 'Climate change measures :' is overlaid in the center of the image in a white, sans-serif font, with a thin white horizontal line underneath it.

Climate change measures :

Climate Change Initiatives in the M'Goun Geopark :

Strategic Collaboration:

- Partnered closely with SIREDD for climate change adaptation in the Beni Mellal-Khenifra region.

Climate Change Module:

- Developed collaborative climate change module for exposure, sensitivity, impact, and vulnerability analysis.

Regional Climate Caravan:

- Launched a climate change caravan in collaboration with local stakeholders, themed "Our Environment Calls for Actions"

... évolutive, fédératrice, sécurisée, composée d'une multitude de fonctionnalités liées à la gestion des données environnementales à référence

... à mettre en place un Outil opérationnel décisionnel en matière de gestion de l'environnement de la région.

... et d'analyse de données à caractère environnemental

... régional dédié au partage de données environnementales

... le processus d'aide à la décision

... capacités de la région en matière de suivi des indicateurs environnementaux, du changement climatique et

TABLEAU DE BORD DÉCISIONNEL

L'essentiel de l'information environnementale en une seule vue : Plateforme paramétrable pour appuyer la prise de décisions.



INDICATEURS

Une batterie d'indicateurs à différentes portées pour suivre l'état de l'environnement et des progrès du développement durable, au-delà des données et des fonctionnalités multiples.

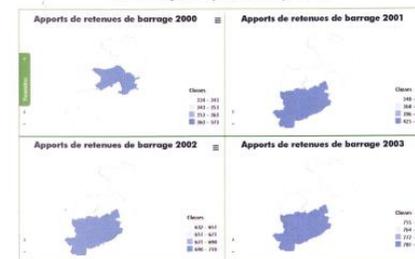
>> Analyse simple



>> Analyse croisée

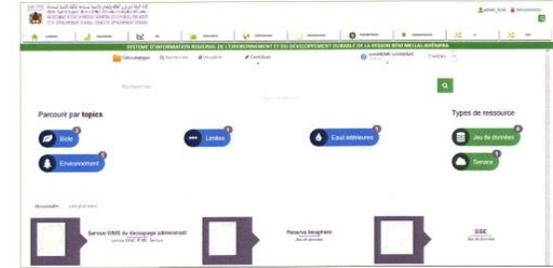


>> Analyse spatiotemporelle



GÉO-CATALOGUE

Des fonctionnalités avancées en matière de partage des données et des métadonnées environnementales



SIG WEB

De la visualisation à l'analyse spatiale des données à caractère géographique.



ODD

Ce module est dédié à l'accompagnement des partenaires en termes de suivi des objectifs du développement durable.



CHANGEMENTS CLIMATIQUES

Un module spécifique aux changements climatiques a été développé selon une approche participative et concertée. Il facilite l'analyse, le suivi-évaluation, et la géo-visualisation des indicateurs d'exposition, de sensibilité, d'impact, et de vulnérabilité au changement climatique.

Climate Change Initiatives in the M'Goun Geopark :

Eco-friendly Planting:

- Planted 10 000 carob trees within the Geopark on International Mountain Day 2020.

Student Awareness Programme:

- Conducted campaigns with Sultan Moulay Slimane University to raise climate change awareness and provide territorial impact training to students.

Hydraulic Basin Interconnection:

- Supported interconnection project to mobilize water resources, irrigate 176 000 hectares, and utilize dams like Bin El Ouidane and Hassan I Dam.



The geopark will also support various climate change adaptation initiatives led by the Ministry of Agriculture, Sea Fisheries, Rural Development, and Water and Forests as part of the new "Green Generation 2020-2030" agricultural strategy in the region, such as :

- Programmes to mitigate greenhouse gas emissions;
- Programmes to control and manage irrigation water;
- Programmes for the conversion of cereals and the intensification of fruit growing;
- Climate risk cover programmes;
- Ecosystem and biodiversity conservation programmes.



The Massif des Bauges Regional Nature Park/Geopark has already launched several climate-related initiatives:

- The development of a climate white paper;
- workshops on “living and working in the mountains in a time of climate change”;
- A positive energy territory project, in partnership with the Grand Ancey, Grand Chambéry and Grand Lac agglomerations;
- “Artaclim”, a multi-sectoral action-research project with an educational component;
- Programmes to diversify activities in the ski resorts to suit all seasons.



English speaking friends
find the presentation
of the profiles on the website
www.dalcoisbauges.com

The Massif des Bauges Geopark proposed actions for addressing climate change :

ADAPT

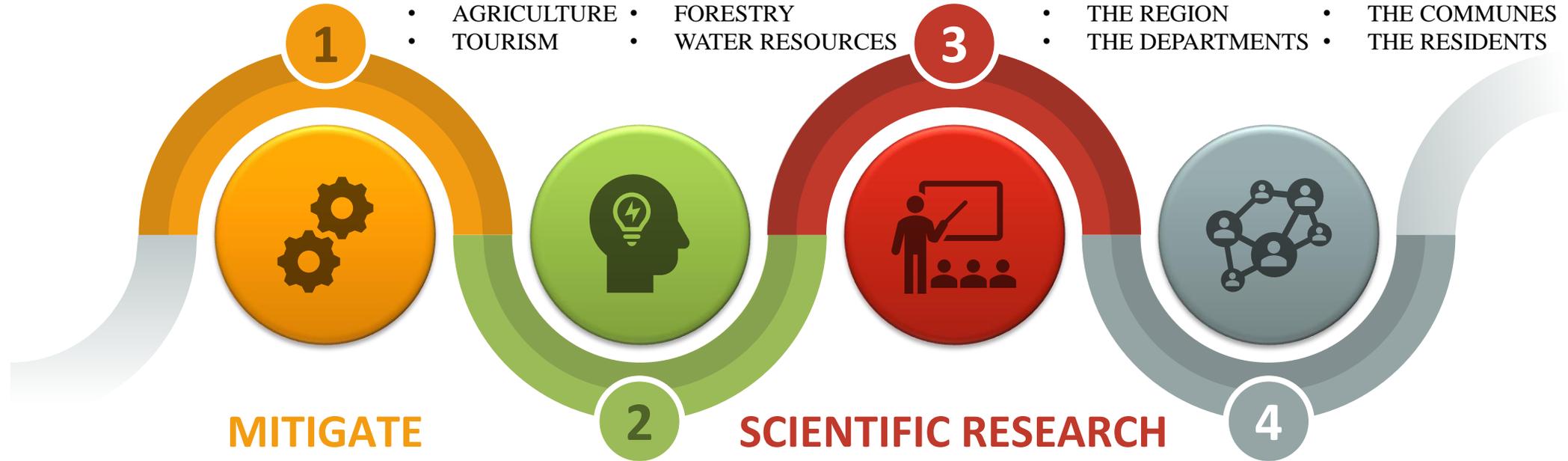
Adapting to meet the challenge of long-term territorial resilience, by rethinking the way they organise themselves, relocating their activities, and changing their practices:

- URBANISM
- ENVIRONMENTS
- AGRICULTURE
- FORESTRY
- TOURISM
- WATER RESOURCES

MULTI-STAKEHOLDER CONFERENCE

Organise a multi-stakeholder conference at massif level, to share issues and actions, approaches, reinforcing programmes and diversification strategies

- THE STATE
- THE REGION
- THE DEPARTMENTS
- THE EPCIs
- THE COMMUNES
- THE RESIDENTS



MITIGATE

Improving regional planning and reducing consumption in order to mitigate climate change:

- URBANISM
- ENERGY
- MOBILITY
- FORESTRY AND WOODLANDS
- TOURISM

SCIENTIFIC RESEARCH

Use research and scientific advice to improve knowledge :

- RAISING AWARENESS
- TRAINING
- OBSERVING
- ANALYSING

Conclusion & Recommendations :

- Despite varying degrees of severity, both Geoparks: M'Goun (Morocco) and the Massif des Bauges (France), are experiencing the effects of climate change, marked by warming temperatures and drought phenomena.
- Both Geoparks are committed to impactful climate change initiatives, fostering partnerships, knowledge-sharing, and sustainable resource management.
- Collective action is essential, involving stakeholders, users, and residents in embracing adaptation, transition, resilience, and mitigation. To meet this challenge together, both Geoparks must enhance their roles as organisers (engagement, consultation, coordination) and innovators (research, experimentation).
- In addition, some strategic geosites are used or could be used as indicators and educational supports to record and show the effects of climate change on natural processes and human activities.

References :

- Artelia Eau & Environnement (2018). Etude sur la vulnérabilité et l'adaptation du territoire au changement climatique, PARC NATUREL REGIONAL - MASSIF DES BAUGES.
- Bijaber, N. & Rochdi A. (2017). Télédétection spatiale pour l'évaluation du risque de sécheresse au Maroc. Revue internationale de géomatique – n° 2/2017, p. 203-221. [DOI:10.3166/rig.2017.00026](https://doi.org/10.3166/rig.2017.00026)
- Bissour, R. (2021). Ressources en eau de l'oued El Abid amont barrage Bin El Ouidane et agriculture irriguée : Caractérisation, quantification et valorisation. Cas du périmètre irrigué de Béni Moussa (Région Béni Mellal Khénifra), pp 331. <https://hal.science/tel-03254247>
- Boutchkkoucht, A. & Elmoufid, R. (2020). Caractérisation des changements climatiques dans la montagne du Haut Atlas Marocain : cas de la vallée des Ait Bouguemaz, International Journal of Advanced Research in Innovation, Management & Social Sciences, Volume 4, Issue 4, p.1-18. <https://eursed.org/ijarimss/>
- Charter project 2023 → 2038 of the Regional Natural Park of The Bauges Massif.
- Dakki, M. & Sehhar, E. (2010). Diagnostic pour la gestion durable des Zones humides du Mgoun-Dades, pp 94. https://rsis.ramsar.org/RISapp/files/4336444/documents/MA2376_mgt190417.pdf
- La Branche, S. & Chaix, C. (2019). Enjeux futurs, le changement climatique dans les Bauges : c'est quoi, on fait quoi ?, pp.39. <https://www.bellecombe-en-bauges.com/wp-content/uploads/2021/10/Soiree-Bellecombe-en-Bauge-synthese.pdf>
- Lutoff, C., Susa, A., La Branche, S., Maréchal, C. & Chamaret, A. (2022). Freins et leviers de l'adaptation au changement climatique : représentations des acteurs de moyenne montagne. An article of the journal Vertigo, Volume 22, Number 2, September 2022, p. 1–37. <https://doi.org/10.4000/vertigo.36477>
- Ouchouia, I. & Chaouki, A. (2022). De la variabilité climatique au changement du régime hydrologique dans le bassin de l'oued Ouzoud/ Haut Atlas Central/ Maroc. pp 10. <https://hal.science/hal-03581861>.