NO ATLAS FOR THE HIGH ATLAS?

A BIO-PHYSICAL AND HUMAN CHARACTERIZATION OF THE MOROCCAN HIGH ATLAS LANDSCAPES FOR BIOCULTURAL AND SOCIOECOLOGICAL RESEARCH

Global Diversity Foundation

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ABSTRACT

Mountainous regions are often less investigated and understood by the scientific community for multiple reasons, including geographical isolation, distance from major research centres and cities, and scholars' preferences. This knowledge gap makes it more challenging to advance any conservation or development program in such remote territories in collaboration with local communities due to the relative lack of baseline information for any intervention or, monitoring and evaluation. Using the existing recent literature (in the natural and the social sciences), publicly available GIS and other cartographic data, along with some other online sources, we describe and map the bio-physical, human and conservation geography of the Moroccan High Atlas, first by defining its limits followed by a characterisation of its geology, pedology, hydrology, climatology, biogeography, ethnology, and other human parameters. In addition to the characteristics at the regional level, the High Atlas has been divided into three distinct regions (western, central, and eastern) based on physical and administrative features. Results point towards these landscapes' myriad environmental and social resources and their fragilities, regional similarities and particularities and existing gaps in the region's knowledge. We hope this compilation is helpful for researchers, governmental organisations, NGOs, policymakers, and others interested in this mountain range, especially after the heart-breaking earthquake that hit the region in September 2023.

KEYWORDS

Amazigh, biocultural diversity, High Atlas, human geography, online GIS databases, physical geography, socioecological systems

INTRODUCTION

Mountainous regions are often less investigated and understood by the scientific community for multiple reasons, including geographical isolation, distance from major research centres and cities, lower population numbers, and educational opportunities. This knowledge gap makes it more challenging to advance, in collaboration with local communities, any conservation or development program in such remote territories (Fonstad 2018).

This is the case for the Atlas mountain system (belt) and, more concretely, the Moroccan High Atlas mountain range in its western flanks. The High Atlas hosts a rich biological and cultural diversity due to their rich history and environments, while it is also facing multiple threads in current times, mainly relating to extreme weather, land abandonment or intensification and depopulation. Located at a cultural crossroads, the Maghreb is a land of contact between populations of different origins. The Amazigh have inhabited the Maghreb since at least 10,000 BC (Ilahiane 2006), interacting with populations of the northern Sahara since early times and later with Phoenicians, Carthaginians, Romans, Hebrews, Byzantines, and Vandals.

Since the dawn of Islam, around the mid-7th century, a series of migration waves brought Arab populations to the Maghreb with their religion, beliefs, traditions, and scientific knowledge. However, it was only in the eleventh to thirteenth centuries that the greatest migrations from Arabia and the Middle East occurred due to the rapid expansion of Bedouin tribes fleeing from Arabia and Upper Egypt. They spread and settled throughout the Maghreb, from the coastal areas to the Sahara. These migrants progressively established themselves in desert zones, steppes, and plains, pushing the Amazigh peoples to occupy the more inaccessible mountain regions (Bellakhdar 2003). Andalusian populations of Muslims and Jews fled Spain and came to the Maghreb after the Iberian Peninsula was conquered by Christians, and enslaved peoples brought along the trans-Saharan trade routes also settled in the Maghreb. Finally, in the fifteenth century, the arrival of the Turks from the Ottoman Empire in Algeria and Tunisia brought Asian and Balkan populations to the region. European settlers and colonisers of the twentieth century did not significantly mix with local populations, although their presence impacted culture and lifestyles.

The word “Atlas”, of an Ancient Greek origin (Ἄτλᾱς, *Átlās*), stems from the belief that the mountain range was the body of the Titan – with the same name – after being turned to stone. As a penitent, he would have to hold the earth and heaven on his shoulders for the rest of his life (Homer 2018). The name was further transferred to Tamazight (ⵉⴷⵓⵔⴰⵔ ⵏ ⵡⴰⵟⵍⴰⵙ, *idurar n waṭlas*) and Arabic (جِبَال الأَطْلَس, *jbāl al-ʔaṭlas*) and has been the basis for derived terms such as Atlantic (used in multiple toponyms including the Atlantic Ocean) and Atlantis (the fictional island mentioned in several of Plato's works), as well as words such as “atlas” with different meanings including books with maps or charts, or the topmost vertebra of the backbone articulating with the occipital bone of the skull (Merriam-Webster n.d.).

Geography, by nature, is an academic discipline interested in human-environment interactions and the description of a place's physical and human characteristics. Nonetheless, the study of place is not only restricted to geography but also to other disciplines such as geology, hydrology, biology, agronomy, anthropology, sociology, linguistics, or history. At the same time, GIS and geography provide a framework for biocultural conservation efforts (Maffi and Woodley 2010). In parallel, landscape approaches have become of great interest in recent decades especially on complex socioecological systems (SES), with a significant contribution to interdisciplinary and cross-sectoral collaboration (Arts et al. 2017, Plieninger and Bieling 2012, GDF-MBLA 2022). Such landscape approaches have had different degrees of effectiveness in conservation and development projects (Sayer et al. 2017) and still face challenges in analysing multidimensional factors and finding comparable frameworks (Pfund 2010).

The main aims of this publication are to: i) provide an overview of the literature on the geography of the High Atlas, both biophysical and human (including cartographic sources); ii) define using a socioecological approach the limits of the High Atlas; iii) describe the biophysical geography of the region based on state-of-the-art online maps and databases; and, iv) portray the human geography of the territory, including conservation geography, based on available secondary sources. Organised into five main chapters and seven subchapters, this work derives from part of the GIS outcomes of the High Atlas Cultural Landscapes program, coordinated by the Global Diversity Foundation (GDF) and the Moroccan Biodiversity and Livelihoods Association (MBLA) during the years 2016 to 2023 (GDF and MBLA 2022).

Note: While we were writing this manuscript, a 6.8 magnitude earthquake stroke the High Atlas mountain at 11:11 pm on Friday, September 8th, 2023, with an epicentre in Ighil (Al Haouz) with the tragic figure of around 3000 deaths and 6000 injured to date. The level of damage and devastation was very severe, especially in the provinces of Chichaoua, Amizmiz, Asni, Taroudant and Al Haouz. A reverse fault with an ENE-WSW orientation was probably the cause behind this catastrophic seismic event (Lanari et al., 2024).

METHODOLOGY

The methodological approach followed by the present research involves reviewing recent literature about the physical and human geography of the High Atlas and Morocco. Digital data freely available online from various sources was used for a GIS analysis. The software utilised was ESRI ArcGIS Pro, but QGIS and GRASS were also employed.

Procedurally, the first step consisted of defining the area of study, i.e., the High Atlas, starting from available literature and integrating it with GIS data about geology, soils, elevation, water courses and administrative boundaries. The second step was the analysis, mainly in the form of descriptive statistics, of the available online information on the area to create a framework of reference in physical and human geography features. Finally, these results have been considered in discussing threats and near-future perspectives of the High Atlas study area.

Literature review

The recent literature on High Atlas cultural landscapes (within the past 15 years) is abundant and diverse if we include disciplines relating to the natural and the social sciences and related interdisciplinary approaches such as ethnobiology and conservation biogeography. In addition, older seminal works provide the foundations of the region's academic knowledge. Despite this relative abundance, the region is little known compared to other Mediterranean areas. Here, we give a summarised literature review, subject area by subject area, including relevant academic articles and books, cartographic sources (GIS or not), and other related sites. Proper digital sources to be processed through GIS software are detailed in the next section, “Digital Data Sources”.

Certainly, High Atlas Mountains research and action, roughly determined by the number of publications of all types (peer-reviewed articles, academic books, maps of different kinds and other online resources), is still dominated by the natural science community and the study of biophysical environments. The last 15 years have also seen considerable developments in the use of GIS and remote sensing in Morocco, especially in the fields of risk assessment related to land and water management and their relationship with climate change, some of which has been applied to the High Atlas region too (i.e. Hessel et al. 2014, Simonneaux et al. 2015, Chadli 2016, Gourfi and Daoudi 2019 among many others). Nevertheless, while GIS applies to many management and development challenges, there is an increasing awareness of the limitations of conventional techniques in mountainous terrain, especially in the African continent (e.g., inaccuracies and lack of field corroboration, amongst others) (Jombo et al. 2023).

Concerning the geospheric features of the region topographical, structural, and geomorphological research (including orography, erosion and weathering) (Delcaillau et al. 2010, Ayarza et al. 2005, Ellero et al. 2012, Domènech 2015, Bussard et al. 2022, Lanari et al. 2023, Ait Inoh et al. 2023), along with tectonics (Teixell et al. 2003,

Sébrier et al. 2006, Martín-Martín et al. 2017, Moragas et al. 2018) comprise a substantial proportion of the literature published in the past 15 years. The perspectives followed in these studies vary markedly, with most taking place at the local scale and only a few at the sub-regional or regional scale. Other relevant academic publications on geological aspects include chronological studies (mainly stratigraphical, paleontological, and geochronological) (Driss 1996, Voigt et al. 2010 and 2011, Khalloufi and Jalil 2020), and to a lesser extent on physical geology (lithology and sedimentology) (Skikra et al. 2021) and natural resources (soils, mineralogy, and soil science) (Ait Inoh et al. 2023). Morocco has an incomplete Geological Map at different scales and quite detailed at the level of the single geological formation. Still, the sheets – which do not cover all the High Atlas region – are available only at a specific cost on the website of the *Département de la Transition Énergétique of the Ministère de la Transition Énergétique et du Developpement Durable* (2023).

Regarding hydrospheric and atmospheric characteristics of the High Atlas, studies on snow accumulation dominate hydrological research (e.g., Hanich et al. 2022, Tuel et al. 2022), along with meteorological and bioclimatic studies (Zkhiri et al. 2019, El Mehdi Saidi et al. 2020, Meliho et al. 2023). Relevant academic publications on hydrology include Marchane et al. 2017, Zkhiri et al. 2017, Goumih et al. 2022 and Benikrane et al. 2020. Data sources on the location of hydrological and meteorological stations are partially available online and will be provided in the next section, "Digital Data Sources". Climate change studies under different scenarios constitute a relevant part of atmospheric publications on the High Atlas (e.g., Simonneaux et al. 2015, Eloudi et al. 2021). The following section will also provide climate projections maps and digital data.

Regarding biospheric attributes, Morocco, located in the westernmost corner of North Africa, constitutes a biogeographical crossroads between the Saharan/Afrotropical and the Mediterranean/western Palearctic floras and faunas, which has allowed for different kinds of genetic material exchanges and ecological interactions (Lavergne et al. 2012). Biogeographical studies in the High Atlas are significant both for plants and animals, although again, no regional studies, reviews or projects cover the complete Atlasic geography (Msanda et al. 2021, Ndiaye et al. 2011, Dey et al. 2022).

Morocco is featured by a rich biocultural diversity both at the species of living organisms and ecosystem level, especially in rural and mountainous areas (GDF and MBLA 2022). In the Atlasic region, such diversity is enhanced by the topography and relative isolation and as the natural barrier that the mountains create between the Mediterranean and Saharan climates. The High Atlas is also well known for its high levels of endemism, both in flora and fauna, especially reptiles, mammals, and amphibians (CHMBM-CBD 2023).

Floristic studies in the country and the Atlasic region have been significant, with Fennane and Tattou (2008) and Fennane et al. (1999, 2007, 2014) as key references. As for faunistic studies, there is lesser systematisation at the regional or national levels and usually focused on field guides at the species, family, or order levels (e.g., for butterflies Tennent 1996, for birds Bergier et al. 2022, and for

mammals Aulagnier et al. 2017). Recent studies on other organisms, especially fungi, protists, and bacteria, are relatively scarce apart from research on mycorrhizal fungi (Sadaka et al. 2003; El Khaddari et al. 2019; Limane and Saadoun 2022), diatoms (Minaoui et al. 2021).

The High Atlas flora, with a total of 1916 wild species of spermatophytes inventoried (Fennane et al. 1999, 2007, 2014) hosts almost half of the flora of the country, estimated at 3913 wild species (Fennane and Tattou 2008), with levels of endemism above 22% both at the regional (Rankou et al 2013) and national levels (Médail and Quézel 1997). For other groups of plants, such as macroscopic algae (which may include some protists), bryophytes and pteridophytes, 500, 350 and 60 species have been inventoried, respectively, at the national level (CHMBM-CBD 2023). No data at the High Atlas level has been found for these groups of Plantae. In addition, a database for the Flora of Morocco has been elaborated at the national level (GDF and MBLA 2016), as well as the IUCN conservation assessments for species of monocots (Rankou et al. 2015) and dicots (Rankou et al. 2020, amongst others). In addition to the relatively abundant literature on these subjects, a database of the Moroccan flora has been made public (e-Monograph of Moroccan Flora 2016), comprising an extensive listing of taxa organised by families, genera, and species.

For the Moroccan fauna, depending on the source of information consulted, different figures are obtained for the different groups of animals, with very few regional studies existing. Therefore, the data provided here exclusively corresponds to the whole country, not the High Atlas region. According to national sources, 24,602 animal species have been identified in the country (Secretariat of the Convention on Biological Diversity 2023a). Considering that about 1/3 of these live at least part of the year in the High Atlas mountains, this would correspond to more than 8,200 faunal species.

For fungi and lichens, very little data at the regional level is available, and some at the country level, although a bit outdated, before the 2000s. Following national sources, the total number of species of ascomycete and basidiomycete fungi in the country amounts to 820, 700 in the case of lichens (Secretariat of the Convention on Biological Diversity 2023b, based on Fennane 1996). However, older sources point to higher numbers of the latter (Egea 1996). Other groups of fungi have not been inventoried in the consulted bibliography. In the case of protists, except for macroscopic non-green algae and bacteria, the available inventories, bibliography, and research are very poor.

Various works on ecosystems exist at the High Atlas level, including vegetation types (Taleb and Fennane 2019), plant cover dynamics (Nguyen et al. 2023), agroforestry (Taibi et al. 2019), and collective pasturelands (Auclair et al. 2011, Auclair and Alifriqui 2012). Other works include the ecosystem profile of the Mediterranean basin biodiversity hotspot led by the Critical Ecosystems Partnership Funds (CEPF 2017).

Regarding conservation geography, a few publications and websites usually provide national-level data with much less information at the

regional level. According to UNEP-WCMC (2023), in the country, there are 89 protected areas in total, most of them terrestrial and all governed by national agencies (UNEP-WCMC 2023). In addition to national parks and reserves, recently, a network of ICCAs has been developed in the country, including ICCAs in the High Atlas mountains, especially *agdals*. Also, key biodiversity areas (KBAs) have been identified, including important plant areas (IPAs) (CEPF 2017, Rankou et al. 2018, UNEP-WCMC 2023). Moreover, Morocco has been signatory of multiple treaties, conventions and declarations relating to biological or cultural policies, including the Convention on Biological Diversity (CBD) (ratified by Morocco in 1995), the Implementation of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) (ratified in 2006), and the Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP) (voted in favour in 2018). In addition, it is an active member of the Aichi Biodiversity Targets and actively engages in the Sustainable Development Goals (SDGs).

Likewise, a series of strategies have been launched at the national level, including Plan Maroc Vert and its continuation, Génération Green 2020-2030. On the contrary, the Declaration on the Rights of Indigenous Peoples (UNDRIP) and the Nagoya Protocol on Access and Benefit-sharing (ABS) have not been ratified. History of the environmental and other reforms (*Royaume du Maroc. Secrétariat d'Etat auprès du Ministre de l'Energie, des Mines et du Développement Durable, chargè du Developpement Durable* 2017). Regarding conservation geography, publications linking tourism with the geological and biological richness in the region have increased in recent years, including geotourism and others.

Whilst research in purely biological, geological, and other earth and natural sciences has been more prominent in the High Atlas mountains, the contribution of human geography and other social sciences and humanities has been more scattered, with probably the exception of history and anthropology along with associated disciplines of the latter, including ethnobiology. Academic literature is more significant here, compared to maps or other online resources, and it is often in the form of books (for the case of anthropology and history) or articles (for the case of ethnobiology and linguistics).

The historical significance of the High Atlas is also worth mentioning here, as two of the most important dynasties in North African and Iberian histories, the Almoravid and the Almohad dynasties, originated or expanded in the foothills of this mountainous chain. This region was also highly significant during the trans-Saharan trade routes in the High Middle Ages. Amongst these important medieval centres worth mentioning are the town Aghmat (close to Ourika and currently an archaeological site), conquered in 1058 by the Almoravids, which became the capital of the Empire for a few years until Marrakech was founded, and the town of Tinmel which was the cradle of the latter Almohad caliphate. Other important cities in the High Atlas region include the coastal and millennial city of Agadir to the west, the more modern Essaouira (formerly Mogador), and in the vicinities of the High Atlas, Marrakech (amongst the top touristic

cities in the country) on the north-western flank, the once vital trade city of Sijilmasa (close to Erfoud and currently an archaeological site), Er-Rachidia on the eastern flank, and Ouarzazate on the south-western flank.

Relevant sociodemographic and other human geography data come from the Moroccan national censuses led by the High Planning Commission (*Haut Commissariat au Plan*), the leading institution generating official national statistics, although unfortunately, these are only carried out every decade, the last one being carried out in 2014 (6th edition). Therefore, in 2023, the most accurate and detailed data comes from almost a decade ago, while the social dynamics over these years have been significant. September 2024 will see a new population and household census (7th edition), which will help put up-to-date sociodemographic and economic data for the whole country, particularly the municipalities of the High Atlas region. Sociodemographic censuses are done at the commune (rural municipality) level but no lower than that (*douar* level), making it impossible to do intracommunal analyses. Data available from these censuses is provided in various indicators such as demographics, education and alphabetisation, activity, employment, handicapped, and living conditions of households, along with indicators of financial and multidimensional poverties (Haut-Commissariat au Plan 2023). Other relevant databases with sociodemographic figures and tendencies include FAOSTAT (FAO 2023) and the World Bank (World Bank 2023) as the most relevant ones.

Based on the administrative divisions of the country, reorganised in the last Constitution of 2011, the smallest administrative rural unit is the *douar* (hamlet), followed by the rural commune (constituted by multiple hamlets), in turn, grouped into districts (caïdat), circles, provinces and economic regions (*Royaume du Maroc. Secretariat Général du Gouvernement* 2011). A parallel and complex governance and legislation system exists in the High Atlas region where customary and official/common law is applied, with different application levels and variations throughout the mountainous range.

Regarding the anthropology and tribal system within the region under study, a series of books and, to a lesser extent, peer-reviewed articles have been published in the past 15 years. Some examples of the former include Crawford 2008, McDougall and Parks 2017, and of the latter Crawford 2017 and 2020, Silverstein 2020, amongst others. Trimestral publications such as Hespéris-Tamuda, published by the Mohammed V University in Rabat, provide current research on anthropological topics in Morocco and the Maghreb. Also, there is an online georeferenced map at the URL address http://tribusdumaroc.free.fr/ (TribusDuMaroc 2024) of the patrilineal lineage groups for the whole country, yet with little clarity of where the boundaries have been taken from, although several references are given to the seminal works by the polymath Ibn Khaldoun (Ibn Khaldûn n.d.). Other sociological investigations, including Amazigh women's rights, are worth mentioning here (Gagliardi 2017 and 2019).

Ethnobiological research in the region, especially on ethnobotany and ethnoecology, is profuse if compared to other fields, in part due to the rich biocultural diversity of the area and to the development of multiple research programmes, including the High Atlas Cultural Landscapes programme. Ethnobotanical research includes Belhaj et al. 2020, Teixidor-Toneu et al. 2016a 2016b, and references therein, and ethnoecological research includes Teixidor-Toneu et al. 2020 and Plieninger et al. 2023. Studies on ethnotaxonomy are scarcer (Bernis-Fonteneau et al. 2023, Soldal et al. 2023). The study of pastoralists in the High Atlas is particularly interesting, especially of the traditional collective grazing system known as *agdal*. These pastoral systems of practice have been profusely studied since the seminal works of Auclair, Alifriqui and collaborators on multiple socio-ecological topics and foci (Auclair and Alifriqui 2012).

Pastoral agdals have received the most scholarly attention (see Auclair and Alfriqui 2012). They have been extensively studied for their institutional and governance aspect (Ait Hamza 2012), legal recognition (or lack of it) (Barrière 2007), ecological impact (Alaoui-Haroni 2009, Alaoui-Haroni et al. 2009); and social and cultural characteristics (Dominguez 2017, Dominguez et al. 2010, Nieto 2014, Mahdi 2015). The numerous transformations they have undergone have also been extensively documented (Dominguez and Benessaiah 2018, Mahdi and Dominguez 2009, Ramou 2012), whether due to state interventions (Ait Hamza 2002, Brinet 2012, Genin et al. 2007), socio-economic changes (Cherkaoui et al. 2012, Herzeni 2012) or tourism developments (Bellaoui 2012, Boujrouf et al. 2021). As a result, new opportunities for their recognition are increasingly being studied (Hammoudou 2012, Mahdi 2010, Mahdi 2015, Mesnildrey 2021).

On a smaller scale, forest agdals have also been studied in terms of their capacity to provide fodder for livestock. Authors have mainly explored their institutional characteristics (Auclair et al. 2011) and ecological impact on tree cover and regeneration (Genin et al., 2012; Genin and Simenel 2011). In recent years, other traditional pastoral practices, and the traditional ecological knowledge they encompass have increasingly been recognised (MBLA and GDF 2020) for their impact on livestock health (Teixidor-Toneu et al. 2019), usage of NTFPs (Fakhech et al. 2020, Genin et al. 2018, Genin et al. 2016) and conservation abilities (Teixidor-Toneu et al. 2020). In addition to the rich literature on these subjects, a database of the biocultural diversity of the region has been published (GDF and MBLA 2020), which includes floristic, ethnobotanical and commercialisation data for 615 plant species grown, used, and sold in the High Atlas.

Linguistic and other philological studies in the region are much scarcer, with first language data available from the decadal national censuses (mother tongue was censused for the first time in 2004, once again up to the commune administrative level). Oral histories in the region (Kraus 2019a and 2019b). Poetics studies and other literary investigations are also rare (Chafii 2015 and 2022, Bentahar and Twohig 2020, Merolla 2020). An important journal on Amazigh linguistics edited by the Maison des Sciences de l'Homme (MSH) Paris Nord is "Études et Documents Berbères". In parallel, a relevant overseas French research institute on human and social sciences

research is the Centre Jacques Berque (CJB), located in Rabat, and an offshoot of the Contemporary Maghreb Research Institute (IRMC) in Tunisia (Ziamari and De Ruiter 2015). Ethnomusicological studies, once of great importance in the region (including the pioneering works by Paul Bowles in the late 1950's) are now part of the research surrounding ethnographic and anthropological studies (Wolfgang Kraus et al.). Worth mentioning here are the works by the IRCAM, the Royal Institute of Amazigh culture, to bring the Amazigh language to school curricula and the wider public with multiple publications and tools (IRCAM 2024).

Data and publications on economics (micro- and/or macro-) along with the exchange of goods and services in the country are reduced, with national censuses also being an important, yet outdated, source of information. These include a household survey, with questions related to family economy, means of production, and goods and services available within households. Indicators of financial and multidimensional poverty are also included. As mentioned earlier, for rural areas, data is only available for economic regions, provinces, and communes but not for hamlets (*douar*).

While research at the level of subject area is rather abundant, especially as we have seen with geological, biological, and ethnobotanical literature, more integrative works are lacking, especially with a geographical focus. An exception would be the publication Tadla-Azilal regional atlas (2015) produced by Moroccan researchers and published by the French University of Angers, which integrates historical, geological, climatological, land use, economy, and language of the region, amongst others, and which includes in its southern flank part of the Central High Atlas (Taibi et al. 2015).

Digital Data Sources

The information needed to provide a general quantitative description of the High Atlas region, as presented in this paper, comprehended digital data on geology, soils, elevation, watercourses, biomass, land cover, climate, local administrative boundaries, population, conservation areas, languages, and tribes, which are free and available in SHP or other formats compatible with GIS software.

As for geology, the source that represented the best compromise between detail and scale has been identified in the USGS Superficial Geology of Africa map, which differentiates between sedimentary and volcanic and focuses on the formation's geological age (Persits et al. 1997). Soil data in shapefile format have been obtained from the FAO Digital Soil Map of the World Version 3.6, completed in January 2003; the map is freely available online (FAO 2007).

Elevation and morphology, in general, have been investigated through the manipulation of a DEM layer. After evaluating the different available sources (APLOS PALSAR, ASTER, SRTM), the definitive layer was obtained by merging a series of SRTM tiles from the NASA servers (Watkins 2023) in SRTMHGT format with a resolution of 30x30m. Watercourses data have been obtained from the platform OpenStreetMap (www.openstreetmap.org) and from

the Esri World Topographic Map (Esri 2022), while the location of dams has been derived from the FAO's AQUASTAT database (FAO 2021).

As of Above Ground Biomass, expressed in Mg ha^{-1}, the necessary data were found in Bouvet et al. 2018: these layers were produced by the authors based on the 2010 ALOS PALSAR mosaics by the Japanese Space Exploration Agency (JAXA) at a 25 m spatial resolution.

The location of Morocco's rainfall and weather stations has been obtained from data published by Sultan Moulay Slimane University researcher Rachid Bissour on his website (Bissour 2023). Rainfall and average yearly temperature data were downloaded in raster format from the WorldClim website (WorldClim 2020-2022, www.worldclim.org), which makes available climate data for the period 1970-2000, and provides data on max and min temperature, solar radiation, wind speed and water vapour pressure. Another data source on winds is available on the Global Wind Atlas website (Davis et al. 2023). Another climatic data source, raster maps showing Koppen-Geiger climatic classification for both present (1980-2016) and future (2071-2100), were processed from Beck et al. 2018. Future maps are based on an ensemble of 32 climate model projections, referring to the RCP 8.5 scenario (van Vuuren et al. 2011).

Land cover data have been obtained from the ESA WorldCover 2021 Map v200 (Zanaga et al. 2022), which uses an algorithm based on the one that produced the dynamic yearly Copernicus Global Land Service Land Cover (CGLS-LC) map at 100 m resolution (Buchhorn et al. 2020). The classification is based on 11 classes: bare/sparse vegetation, built-up, cropland, grassland, herbaceous wetland, mangroves, moss and lichen, permanent water bodies, shrubland, snow and ice, and tree cover. Water bodies have not been quantified in the present work as land cover for technical reasons –portions of the sea are also present in the sample due to irregularities in municipality borders. Interesting data on the forest cover of Morocco can be found on the website of the *Agence Nationale des Eaux et Forêts* (2022a). Still, no map format is available, only PDF, so they could not be processed in the present work.

For the production of human geography maps and analysis, several online sources have been considered – including CSV statistical files to integrate GIS layers –: in particular, Moroccan administrative data are made available by the company Geomatic on the Esri ArcGIS repository (Geomatic 2018), while a dedicated section of the *Haut-Commissariat au Plan* of the Moroccan Government has been used to provide information about population demographics, languages and other socio-economic features from the 2014 National Census (Haut-Commissariat au Plan 2023). Moroccan tribes' territories' map has been created referring to the already mentioned website http://tribusdumaroc.free.fr/ (TribusDuMaroc 2024).

Finally, the main digital source for the conservation geography features (protected areas in general) has been the World Database on Protected Areas (WDPA) edited by UNEP-WCMC and IUCN (2024) and the World Database of Key Biodiversity Areas (BirdLife International 2022).

RESULTS AND DISCUSSION

Area Definition

One of the main aims of this work is to define a proper 'High Atlas' area, which can then be analysed and investigated digitally. The region's physical and administrative features have been considered to define the area's border to achieve this aim. Traditionally and in strictly physical terms, the High Atlas range has been considered to span between the Atlantic Ocean to the west and the Algerian border to the east, for a total of about 750 km; it is from 30 to 140 km wide, and it is delimited to the N by the valleys of the rivers Moulouya and Oum Er-Rbia.

In this work, such traditional boundaries have been modified and integrated within the administrative subdivisions at the municipal level to use the actual borders of these latter and thus unify the calculation units for both physical and human geographical parameters (Fig. 1). Features such as the presence/absence of Jurassic outcrops (see further in the Geology, Soils and Morphology section) have been considered relevant to define such a distinction, especially in the case of eastern and northern borders. In fact, as of the first one, it is difficult to identify a neat border in this part of the region, where the High Atlas merges quite blurry with the Saharan Atlas, except for the absence of Jurassic outcrops to the east of the municipalities of Ain Chair, Bouchaouene and Bouanane.

In the case of the north-western border, the administrative limits of several municipalities have been used together with the geological map to include the area of the basin of the Barrage Moulay Adbderahmane (Aguerd, Ait Said, Bizdad, Bouabout, Sidi Ahmed Essayeh, Ezzaouite, Lahsinate, Ouad Lbour, Ounagha, Rahhala, Sidi Abdelmoumen, Meskala and Sidi Hmad Ou Hamed, Taouloukoult). In terms of geological tectonic regions, it would belong to the Moroccan Meseta and to the Essaouni province – which is different from the proper Atlas Uplift province – but in terms of geological formations, there is a strong continuity in the presence of Cretaceous outcrops in the area, and there is also a morphological continuity.

The southern border of the range is geologically separated from the Anti-Atlas chain by the geological feature called South Atlas Fault or SAF, a feature with SW-NE direction which marks the northern limit of the West African Craton starting from the area of Agadir (Ennih and Liégeois 2001, 2008), which has been considered in shaping the study area for this work, but also slightly modified, to give to the limits a more geographical meaning: in particular, in the area to the S a of the Toubkal National Park, the limit has been moved S to coincide with the Oued Sous river and with its northernmost tributary, for the

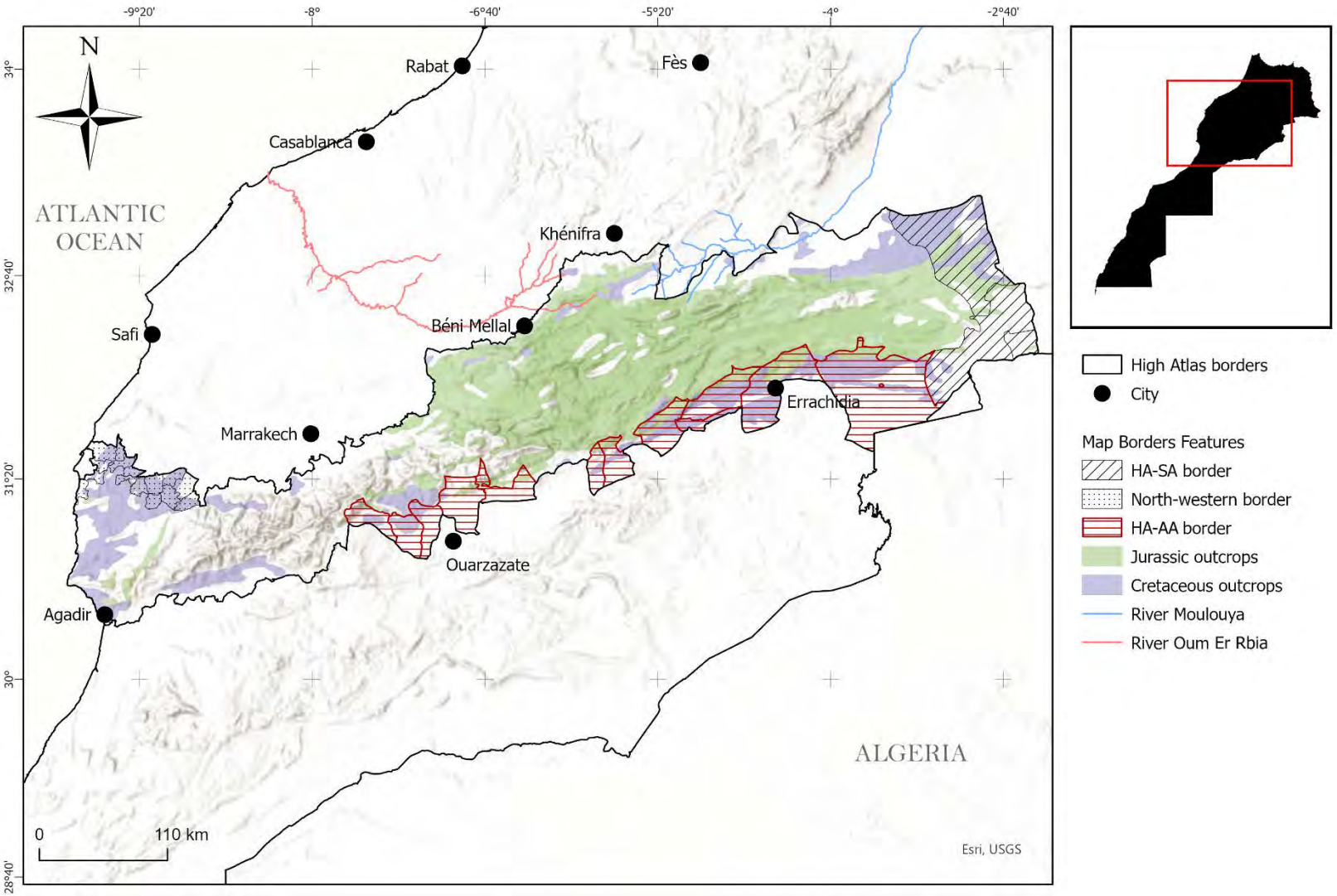

Figure 1 – Boundaries of the High Atlas area are defined in the present work, as well as its distinctive features.

main reason that the SAF would cut valleys and crests in half, weakening the geographic meaning of the boundary.

In the central part of the massif, the distinction with the Anti-Atlas chain is more evident for the presence of the Ouarzazate basin, with an elevation of 1200-1800 m a.s.l., an extension of about 150 km E-W and a width of 40 km filled with Cenozoic alluvial, fluvial, and lacustrine sediments (Fraissinet et al. 1988; Görler et al. 1988; El Harfi et al. 2001; Tesón and Teixell 2008). To the E of Ouarzazate, the distinction between the High Atlas and southern lowlands facing the Anti-Atlas is again apparent and straightforward in both morphological and geologic terms. Also, several municipalities of the southern border (Aghbalou N'Kerdous, Ait Zineb, Amerzgane, Ghassate, Gheris El Ouloui, Imider, Lkheng, Ouaklim, Oued Naam, Tadighoust, Tidli and Toundoute) have territories that slightly exceed the geophysical borders of the High Atlas towards the Anti-Atlas. Still, a choice was made to include them in this work, for otherwise, part of the region would be excluded from the calculation.

In summary, the extent of the High Atlas region, as defined in this work, is around 650 km in length, 50-100 km wide, for a total surface of 78,515.31 km^2. In administrative terms, the number of municipalities that include the study area is 246 (16% of the national total; Tab. 1), belonging to a total of 15 Provinces (Agadir-Ida-ou-Tanane, Al Haouz, Azilal, Béni Mellal, Boulemane, Chichaoua, El Kelaa des Sraghna, Errachidia, Essaouira, Figuig, Khénifra, Midelt, Ouarzazate, Taroudannt and Tinghir) and 6 Regions (Beni Mellal - Khenifra, Draa -Tafilalet, Fes -Meknes, Marrakech -Safi and Oriental -Rif, Souss -Massa) (Fig. 2).

For analysis purposes, this newly defined study area has been further divided into three main sub-regions -western, central, and eastern High Atlas-based mainly on climatic and ecological features (Fig. 3). In particular, the division lines between the central sub-region and the other correspond to the boundaries of the Al Haouz province to the W and of the Azilal province to the E; the lines go further southwards to include municipalities that don't belong to these provinces but are located at the same longitude.

The western subregion covers 13,488.57 km^2 (17%) and comprises 90 municipalities (37%), the central one occupies 23,590.76 km^2 (30%) and 100 municipalities (41%), and the eastern one covers 41,435.98 km^2 (53%) and 56 municipalities (22%).

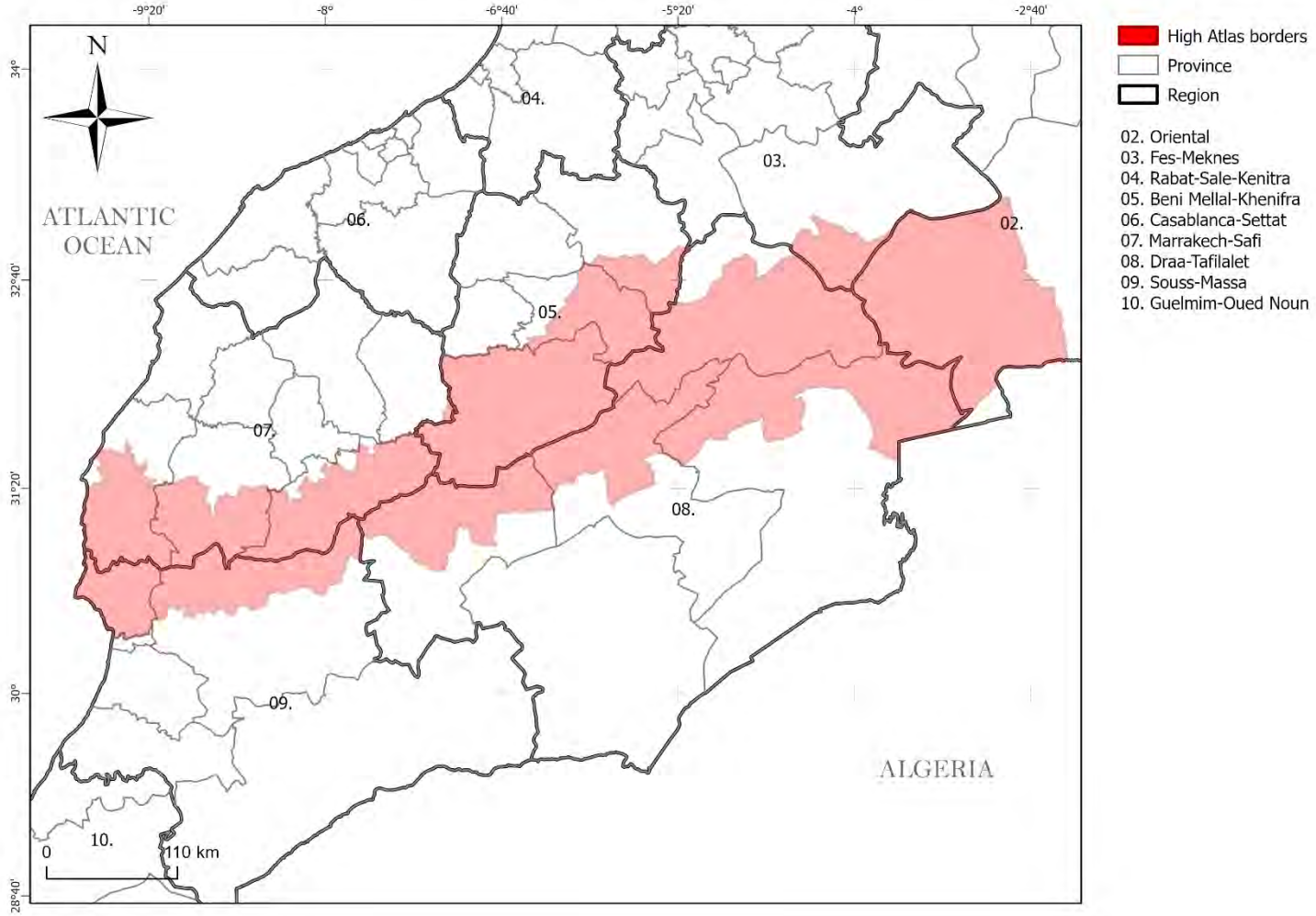

Figure 2 – High Atlas study area in relation to the main Moroccan administrative boundaries (provinces and regions).

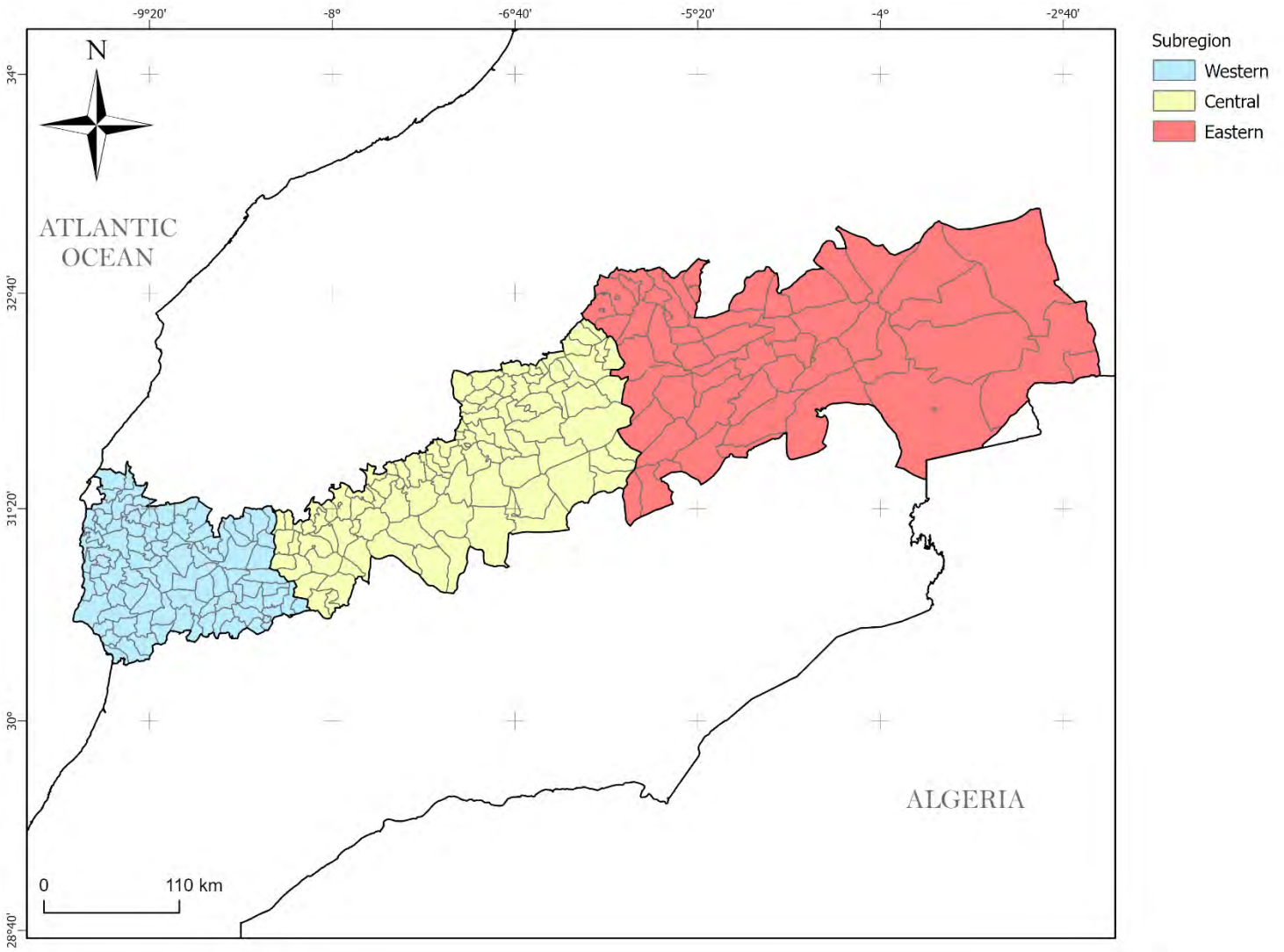

Figure 3 – Municipalities of the High Atlas, divided by subregion (detailed interactive map available at www.global-diversity.org/characterization-of-high-atlas-landscapes).

Biophysical Geography

Morphology

Elevation values in the study area (Figs. 4-5) span from -1 m to 4,165 m with an average value of 1,487 m asl; the central subregion is the highest one on average with 1,751 m, followed by the eastern one with 1,514 m asl and finally by the western with a mean value of 936 m asl. Slope, which spans from 0 to 692% across the region with a mean value of 23%, is again higher in the centre with an average of 32%, followed by 26% in the western area and 17% in the eastern one.

The highest peak is Jbel Toubkal (4,167 m; Agence Nationale de la Conservation Foncière du Cadastre et de la Cartographie – Direction de la Cartographie 2012) in the province of Al Haouz, region of Marrakech-Safi, while several other peaks reach above the 4,000 m, such as Ras Ouanoukrim (4023 m; Agence Nationale de la Conservation Foncière du Cadastre et de la Cartographie – Direction de la Cartographie 2012), Timizguida n-Ouanoukrim (4093 m; Agence Nationale de la Conservation Foncière du Cadastre et de la Cartographie – Direction de la Cartographie 2012), and Ighil n-M'Goun (4,071 m; Britannica 2023), all in the central subregion.

Hydrology

According to OpenStreetMap data, the High Atlas territory contains 33,693 km of watercourses, of which 7,697 km (23%) are rivers, the rest being seasonal streams or artificial channels. These statistics must be taken quite carefully though, for the distinction between "river" and "stream" is done by users, so it is mainly subjective, and in the area most watercourses are in general seasonal at best.

In the new layer produced for this study, such distinction has been eliminated and only those watercourses that could be named have been kept – in total 255 units for a total length of 7,323 km (Tab. 2). Of these watercourses, 48% (124) have a length between 9 and 27 km, 15% (38) inferior to 9 km, 3% (7) superior to 100 km. It must be remembered that this "length" refers only to the linear extension of the river inside of the High Atlas study area.

The rivers with the highest length (> 100 km) that flow across the region are (Fig. 4):

- the *Oued El Abid* (circa 231 km), which originates in the municipality of Aghbala in the Beni Mellal province and flows to the west, becoming a tributary of the main Oum Er Rbia, the second river of Morocco, which ends into the Atlantic Ocean about 20 km north of the city of El Jadida);
- the *Oued Guir* (179 km inside of the study area), which originates northeast of the town of Gourrama in the Midelt province, flows south-east to Algeria, where it enters the Djorf Torba dam;

- the *Assif Melloul* (circa 155 km), which starts in the municipality of Bou Azmou in the eastern subregion, flows eastwards first, then northwards and westwards to become another tributary of the Oum Er-Rbia;
- the *Oued Nfiss* (131 km inside of the study area), which flows to the north and ends in the Oued Tensift;
- the *Oued Ziz* (125 km inside of the study area), which starts near the town of Amouguer in the Midelt province and flows south towards Algeria, dying into the Sahara desert;
- *Oued Ait Aissa* (123 km inside of the study area), which starts in the municipality of Boumerieme in the eastern subregion and flows towards the south-east to become a tributary of the Oued al Hallouf, which in turn goes on southwards ending in the Oued Guir;
- the *Oued Tassaoute* (118 km inside of the study area), which flows northwards to become a tributary of the Oum Er-Rbia;
- the *Oued Moulouya* (105 km inside of the study area), one of main rivers of Morocco, with a total length of more than 500 km, which starts in the Jbel Ayachi in the eastern High Atlas and ends into the Mediterranean Sea to the north near Saidia in the the Berkane Province.

In the region, 12 dams (Fig. 6; Tab. 3) were built between 1935 and 2020. In terms of height, they span from the 21 m of the Douiss dam to the 145 m of the Hassan I and have a total capacity of 2,718 million m^3. They are all used for irrigation; 4 (33%) are also used as water supplies, 1 (8%) – the Hassan Addakhil one near Earrachidia – is used for flood control, and 6 (50%) produce electricity.

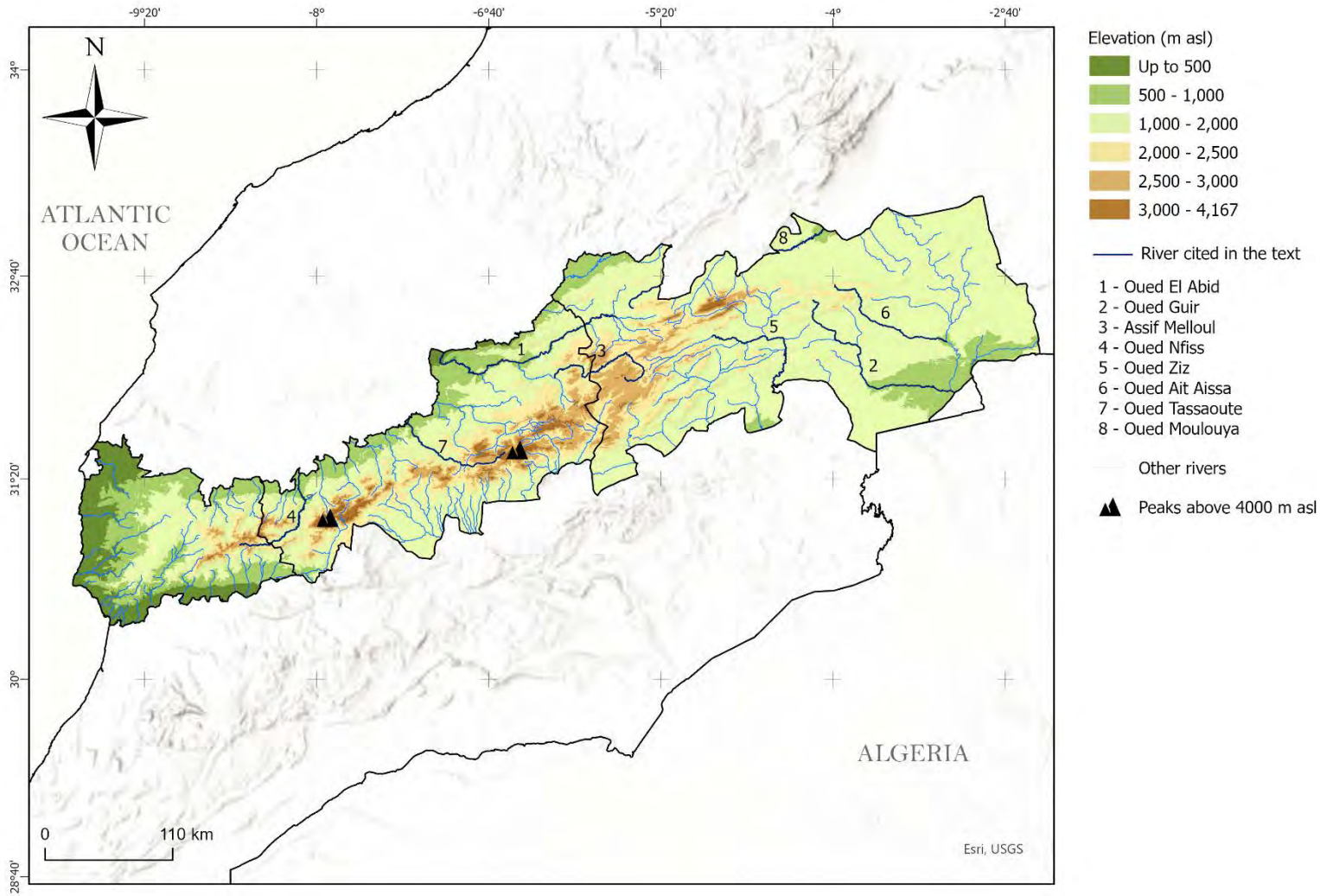

Figure 4 – Map of the High Atlas showing elevation (after Watkins 2023), the location of the two areas with peaks higher than 4000 m asl and rivers (after OSM and Esri 2022).

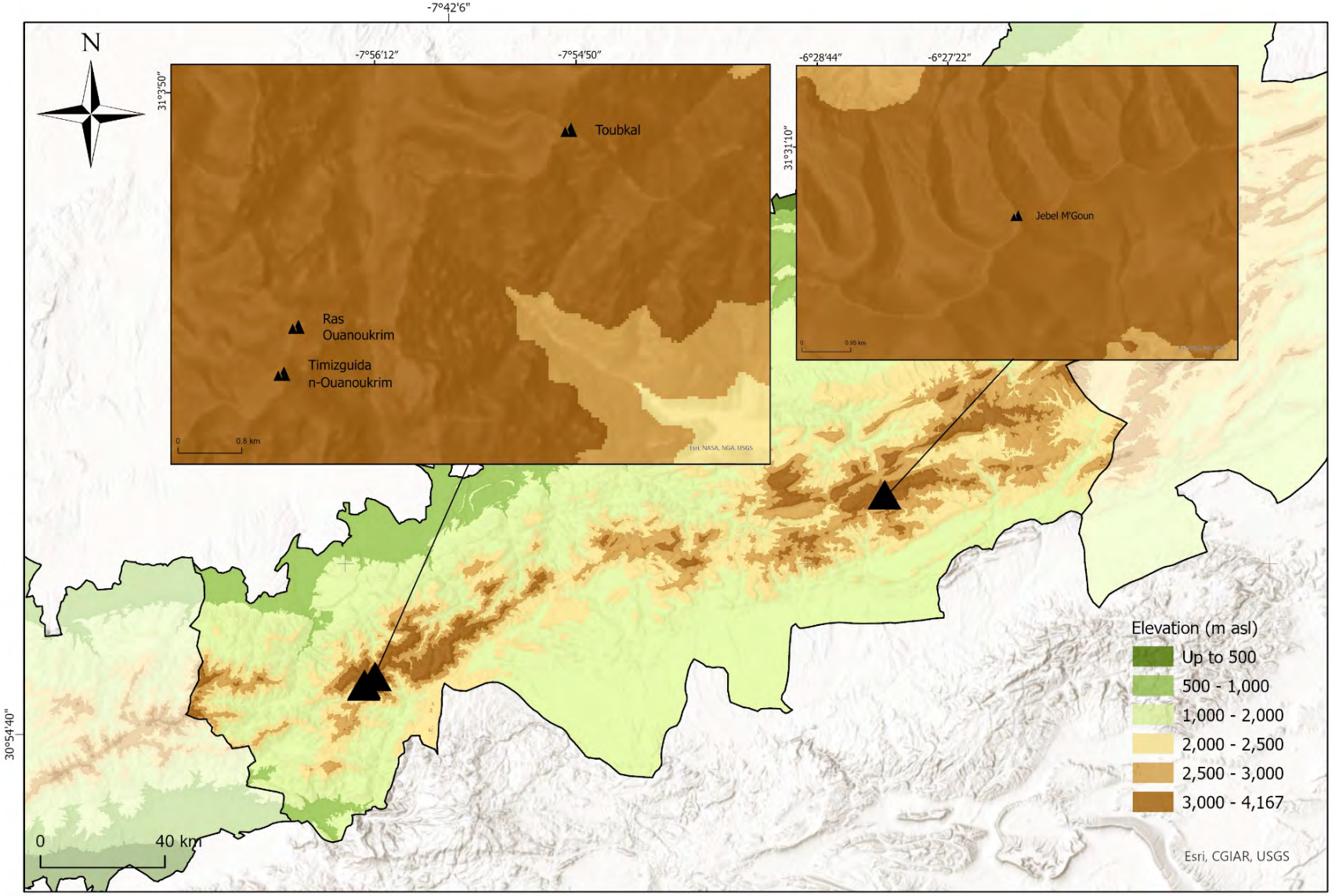

Figure 5 – Altitudinal map focusing on the central subregion showing the main peaks cited in the text.

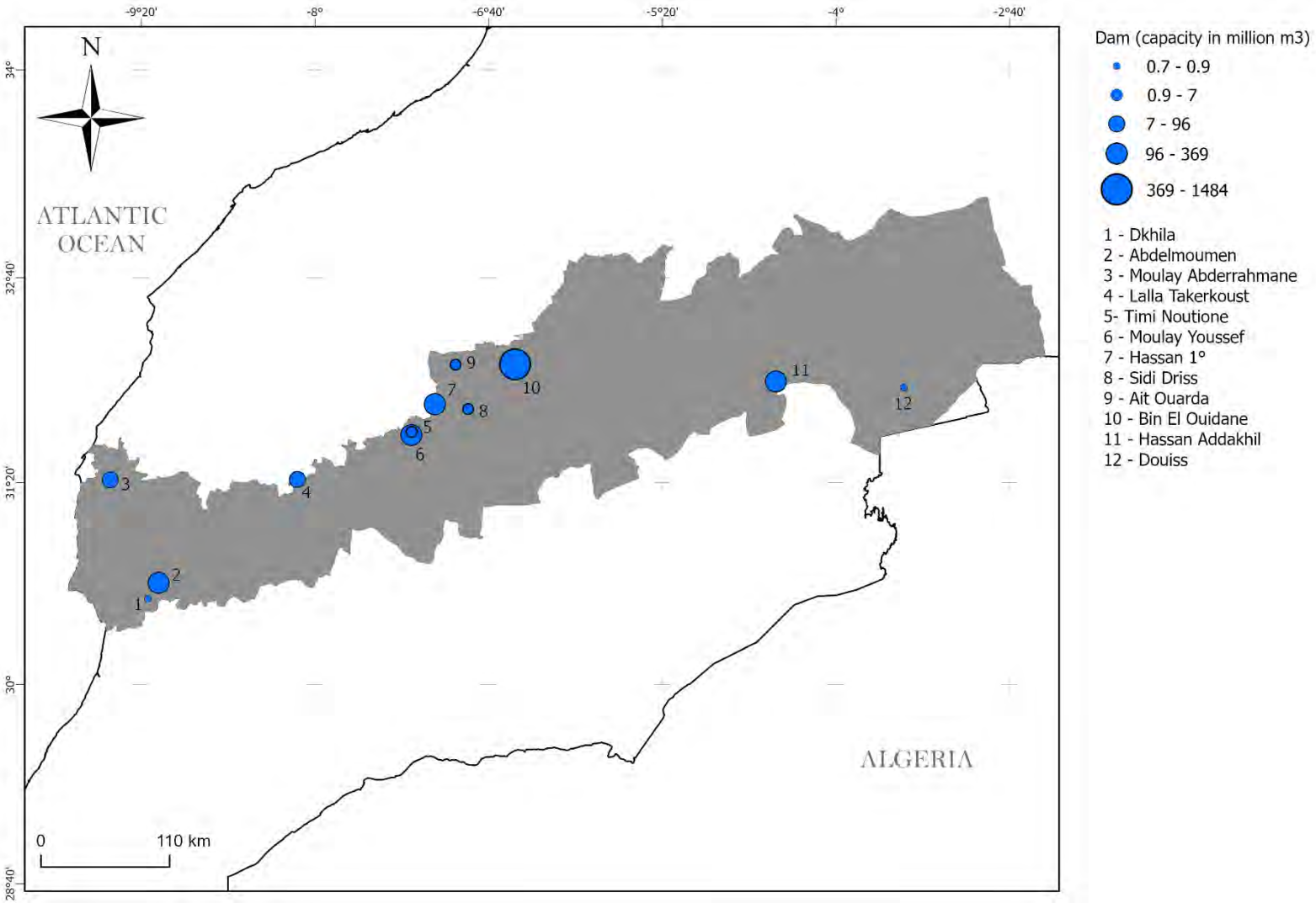

Figure 6 – Dams of the High Atlas area after FAO 2021.

Geology and Soils

According to the World Geologic Maps by the USGS, from a geological structural point of view, the High Atlas chain, born out of processes of crustal shortening and thickening but also partially of mantle upwelling, is essentially made up of Jurassic rock, with more ancient formations, especially Cambrian and Proterozoic, cropping out in some isolated sectors (Figs. 7-8). In the western area, Cretaceous and Cambrian formations are prevalent, with some Quaternary and Jurassic-Cretaceous relevant presence; in the central subregion, alongside the dominant Jurassic outcrops, Precambrian (the so-called 'Massif Ancien' in the Marrakech area) and Triassic formations occupy relevant amount of surface, followed by Tertiary and Cretaceous ones; finally, the eastern part is featured mainly by Jurassic and Cretaceous formations, followed by Tertiary, Quaternary and Triassic ones.

The High Atlas region is very rich in several strategic mineral resources, such as antimony, barite, copper, fluorspar, lead, manganese, niobium, silver, and tantalum (US Geological Survey 2021; Fig. 9, Tab. 4). Four oil/gas sources are also present in the western area in the municipalities of Ait Said, Ezzaouite, and Sidi Ghaneme (Persits et al. 1997).

In terms of dominant soils (Figs. 10-11), the region is featured mainly by *lithosols* – typical of mountain regions where erodible material is removed by erosion very rapidly – where vegetation cover is primarily made of shrubs or grassland, suitable for grazing but often of poor nutritive value, and arable agriculture is not feasible (FAO 1974). The western area presents a relevant percentage of *calcic cambisols* – soils with a calcic or gypsic horizon or concentrations of soft powdery lime within 125 -75 cm of the surface and calcareous at least between 20 and 50 cm from the surface –, usually well-suited for a variety of annual and perennial crops or as grazing land. *Rendzinas* – humus-rich shallow soils, usually formed from carbonate parent material and typical of mountain regions, with a pH between 5 and 8 –, usually poorly suited to agriculture, characterise especially the central area. *Yermosols* – soils with a very weak ochric A horizon, an aridic moisture regime, and very low contents of organic matter in the topsoil – represent an important percentage of the eastern area. Other types of soils are locally present, the most important one being *xerosols* – and in particular *calcic xerosols* – soils with a weak ochric A horizon, an arid moisture regime, a calcic horizon within 125 cm of the surface, and moderate contents of organic matter in the topsoil. In summary, most of the region is featured by soils that are poorly suitable for agriculture but generally good enough for grazing – especially goats and sheep.

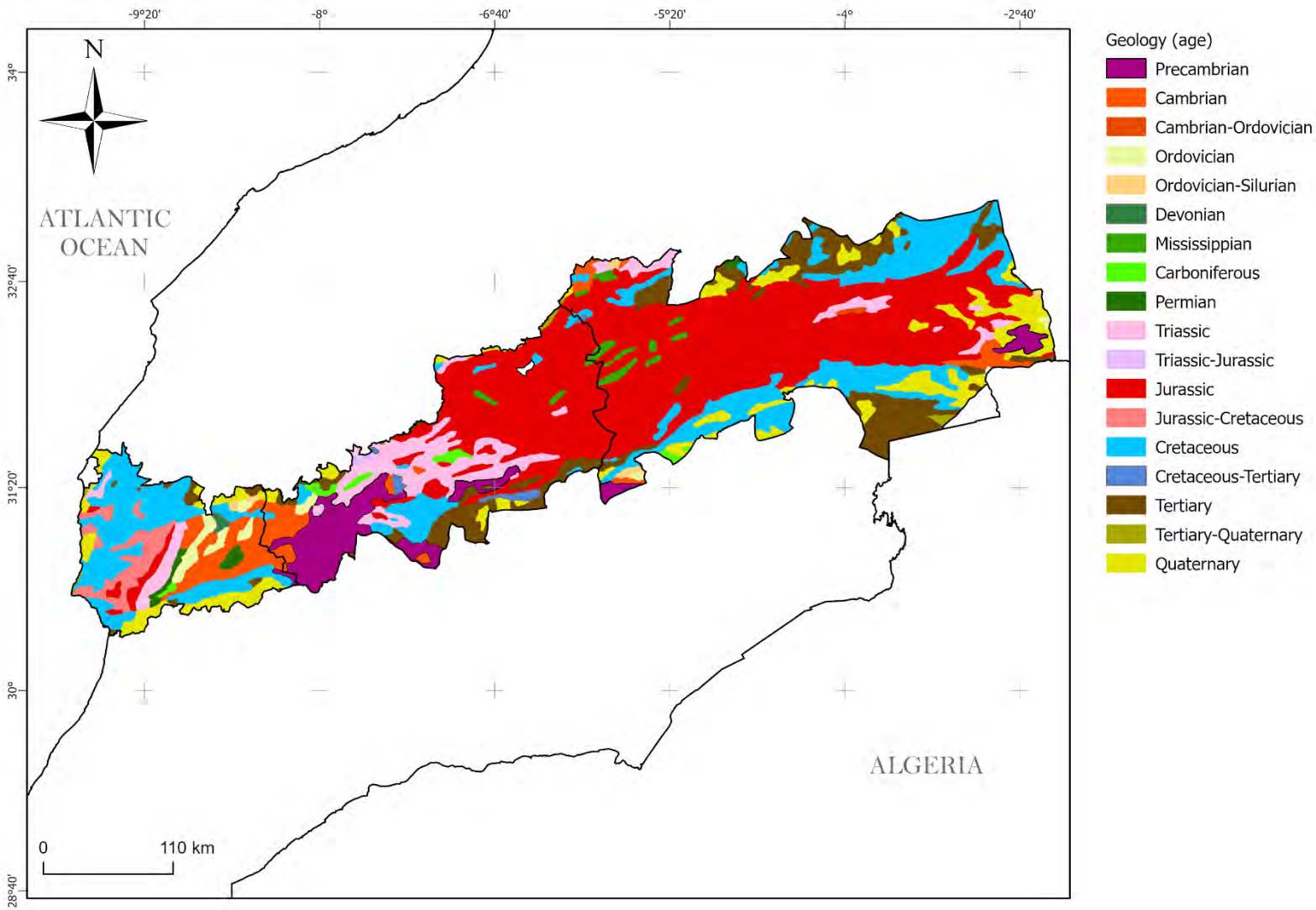

Figure 7 – Geological map of the High Atlas after Persits et al. 1997.

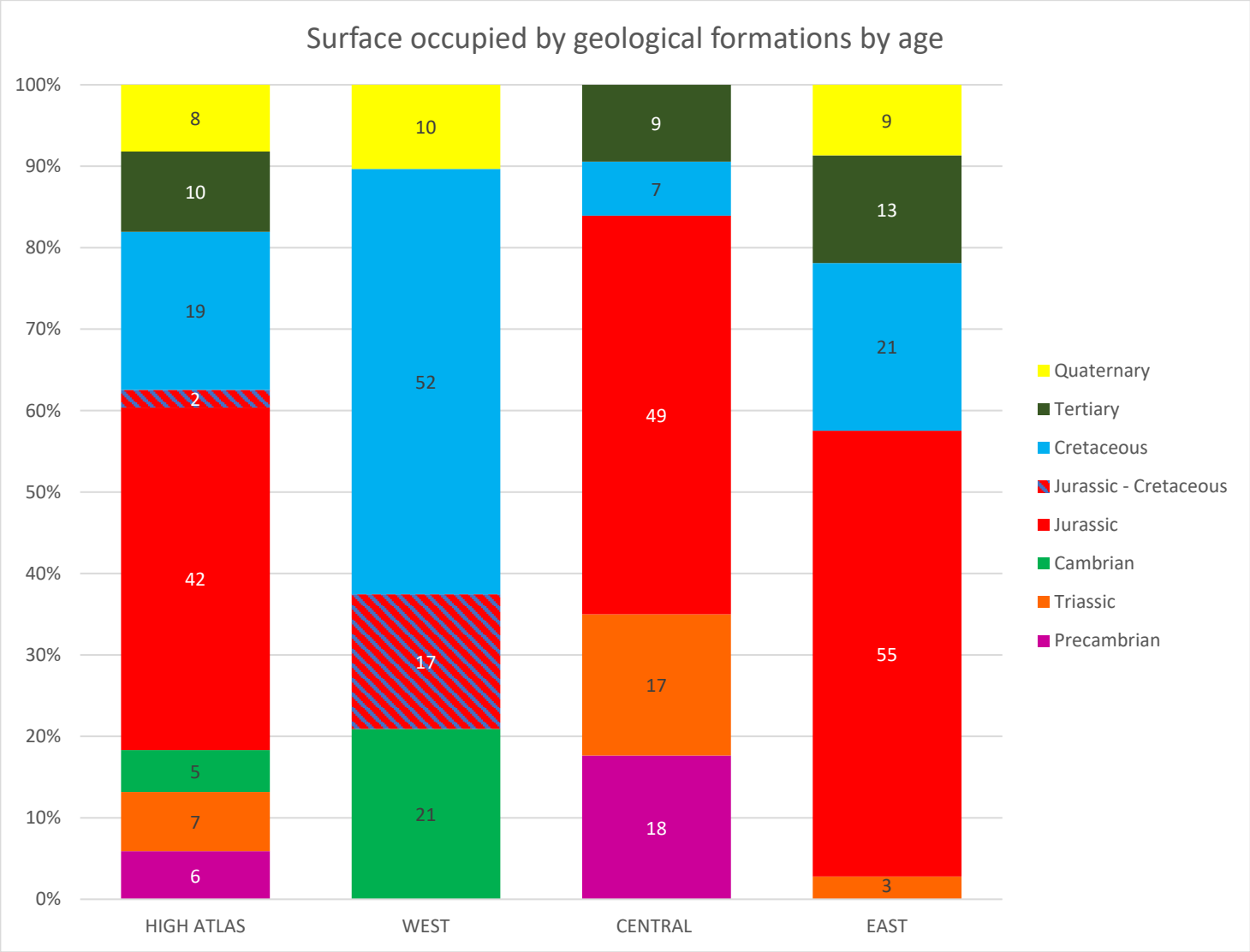

Figure 8 – Column chart showing the per cent of surface occupied by the main geological formations (> 10000 ha of total surface) by age in the High Atlas and the three sub-regions.

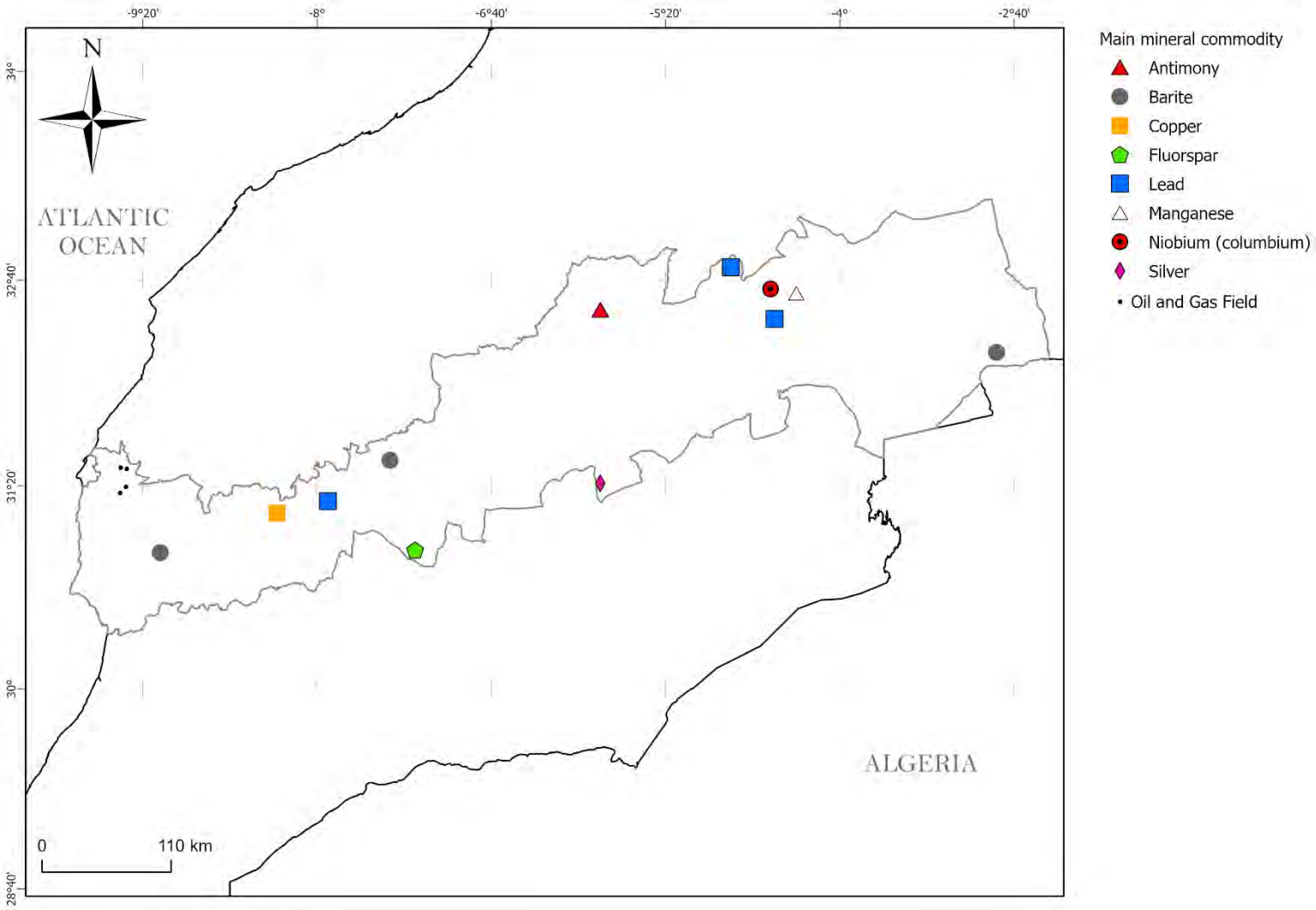

Figure 9 – Map showing the location of the main mineral commodities in the High Atlas, according to Persits et al. 1997.

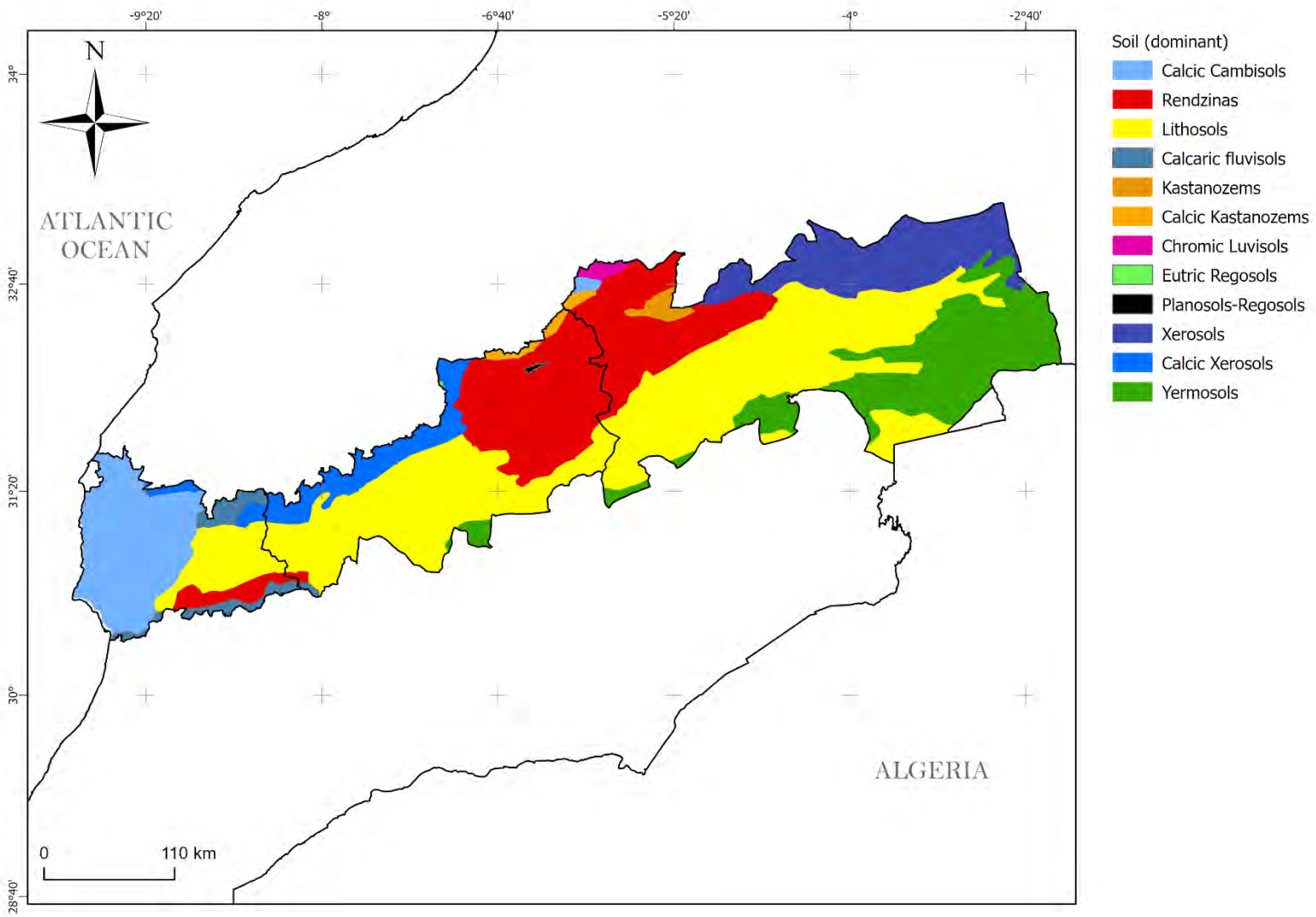

Figure 10 – Dominant soil types of the High Atlas region, according to FAO 2007.

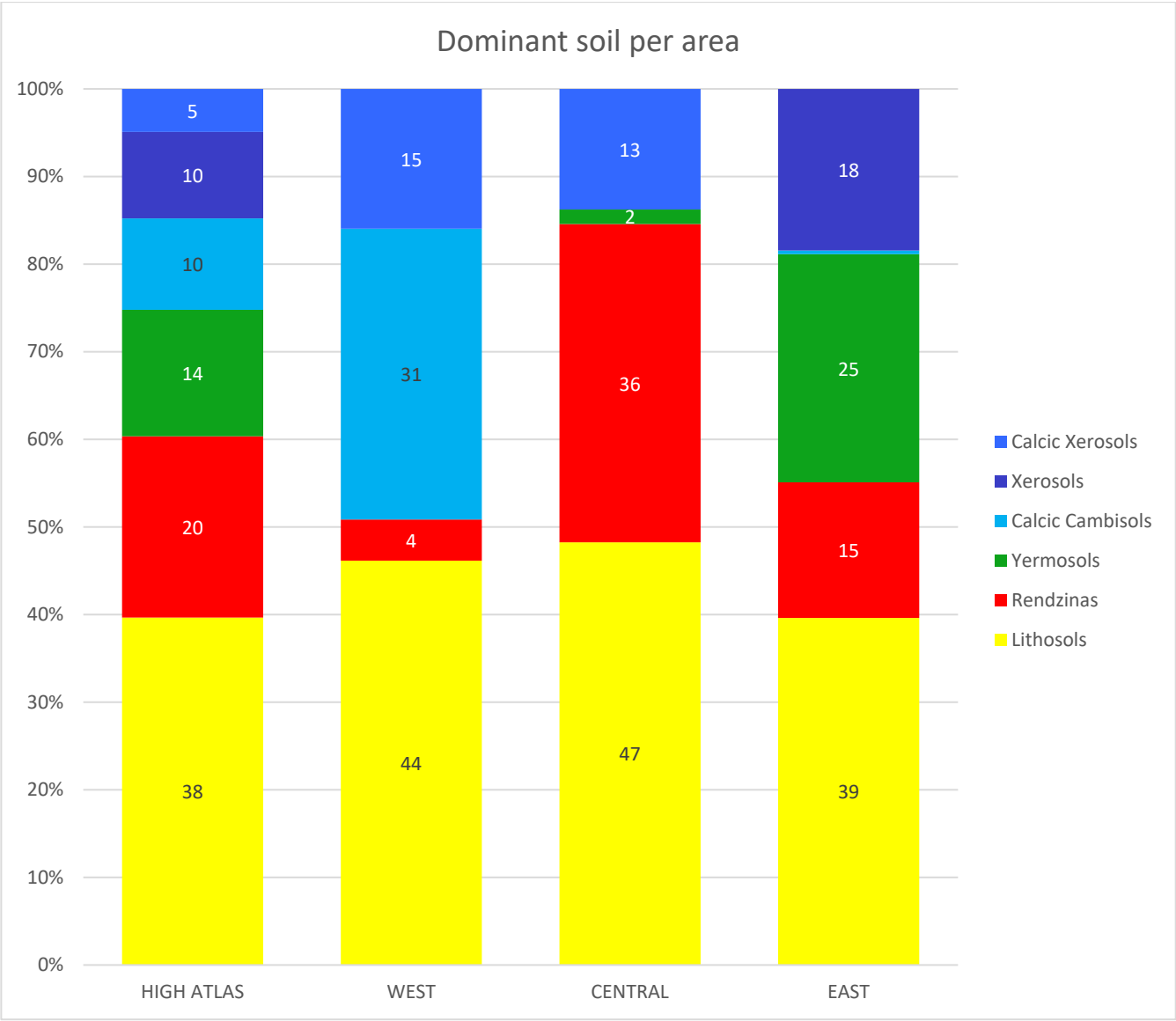

Figure 11 - Column chart showing the percentage of the different dominant soil types in the High Atlas and the three sub-regions.

Weather and Climate

In the study area, 26 weather stations are present and active (Fig. 12; Tab. 5), although no direct data from these sources has been available for this work so far. The stations are managed by the authorities of the basins of Cotiers Marocains (1 station), Guir Dra (1 station), Moulouya (1 station), Oum Er Rbia (12 stations), Souss-Draa (3 stations), Tensift (2 stations) and Ziz (6 stations).

Based on WorldClim website data collected between the years 1970 and 2000, annual rainfall values span between 114 to 773 mm yr^{-1} in the High Atlas region, with an average value of 311 mm yr^{-1}, close to the national mean of 346 mm yr^{-1} (Fig. 13; Tab. 6). The central area is featured by the higher mean value of annual rainfall with 420 mm yr^{-1}, followed by the western and the eastern one, which is the one with fewer precipitations in general. This area also shows the lowest minimum at 114 mm yr^{-1} and the highest maximum at 773 mm yr^{-1}.

According again to WorldClim data collected between the years 1970 and 2000, the average temperature spans between 1.2 and 20.2 °C with a mean of 14.4 °C (Fig. 14; Tab. 6). The western area shows the highest maximum and minimum values (15.7 and 5.1 °C), while the eastern one is featured by the highest mean value of 20.2 °C. The central part of the region is the cooler, with a mean annual average of 12.9 °C, quite inferior to the mean for the whole High Atlas.

Based on Koppen-Geiger climate data (Figs. 15-16; Tab. 7), four climates exist at present and will also exist in the future according to the scenario RCP8.5: Polar (E), Arid (B), Cold (D) and Temperate (C). The first is typical of mountain tops at these latitudes and is defined by the warmest temperature of any month below 10 °C. According to the 2071-2100 projection, this climate zone, which is present only in the region's central area, will disappear entirely.

Arid climates are characterised by an annual precipitation value of less than a threshold approximating the potential evapotranspiration. When the annual precipitation is less than 50% of this threshold, we have a ‘desert’ climate; otherwise, it is a ‘steppe’ climate. Although they look confined mainly to the eastern part of the region, arid climates – both cold and hot, especially desert – will dominate the whole High Atlas in the future.

Cold – or better ‘continental’ – climates show mean temperatures above 10 °C in their warmest months and a coldest month average below 0 °C. In the High Atlas case, we currently have two zones distinguishable by different summer temperatures, which will disappear almost entirely according to the proposed scenario.
Temperate climates have an average temperature above 0 °C in the coldest month and below 18 °C in the warmest month. Nowadays, two thirds of the region (the central and western parts) fall mainly within the temperate zone, but this situation will change rapidly in the following decades, with these areas turning to arid climates.

In summary, following the RCP 8.5 scenario, the High Atlas region's climate will become hotter and drier, while all the temperate areas will disappear. Also, steppe climates will be substituted in the western area by desert. This general trend is also consistent with older models, which showed how, in Morocco, the warming pattern was more pronounced in the Atlas Mountains rather than in the coastal areas of the Atlantic Ocean and the Mediterranean Sea (Schilling et al. 2012).

Recent data from 29 weather stations for the periods 1971-1980 and 1998-2007 in Morocco also revealed a general warming trend that in some areas reached an increase of temperatures of 4°C and a decrease in annual rainfall up to 42 mm (13.5% of the High Atlas average value of 311 mm/yr); further increases in average annual temperatures are expected in the following decades, and in particular, according to the old A2 scenario (based on a pronounced regionalization of the economic development and of the climate change policies, an increasing population, and a high level of emissions, similar to the RPC 8.5), they will reach 5 °C by the year 2099 (Ait Brahim et al. 2017).

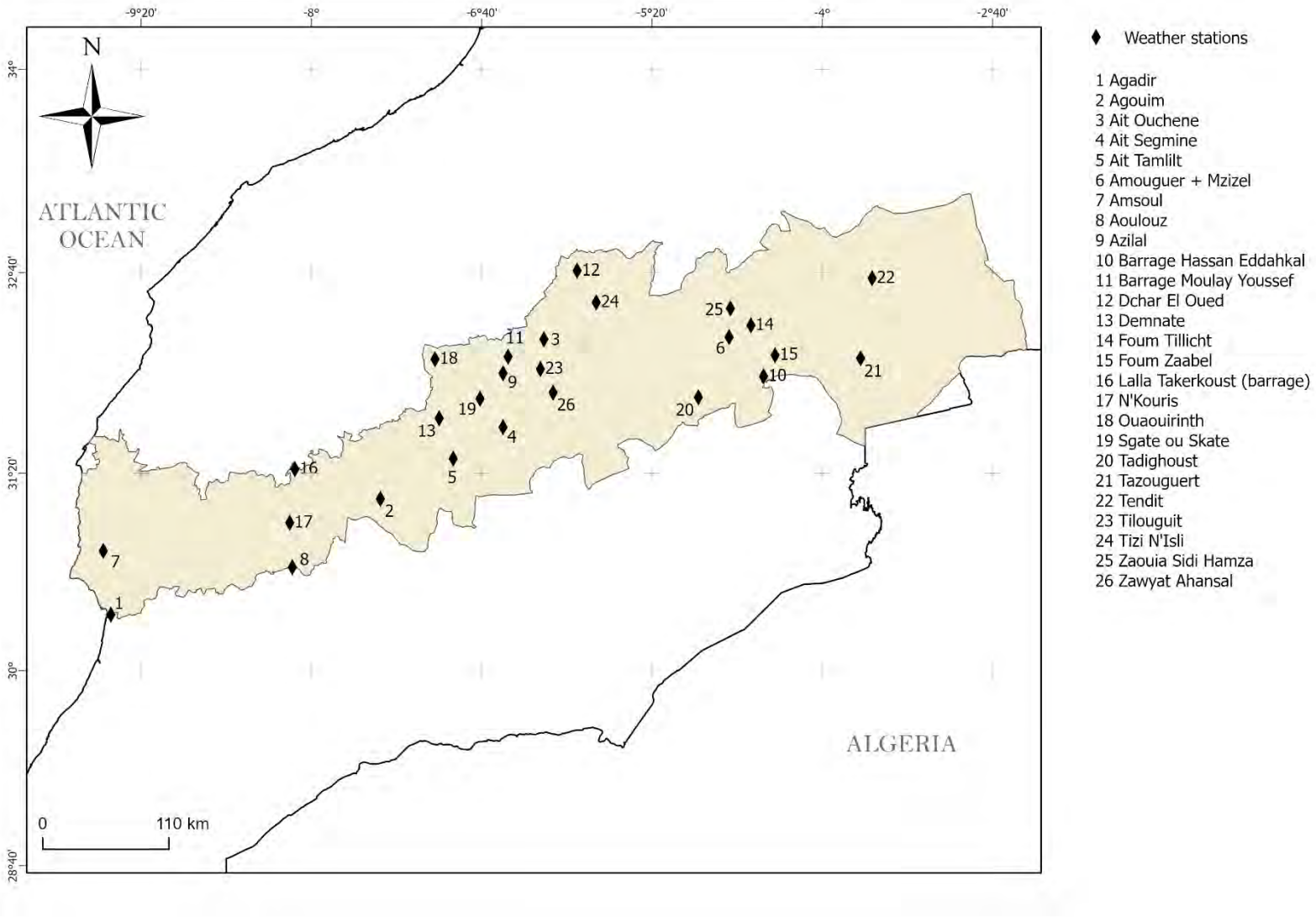

Figure 12 - Weather stations in the High Atlas area, after GeogRachid BISSOUR 2023.

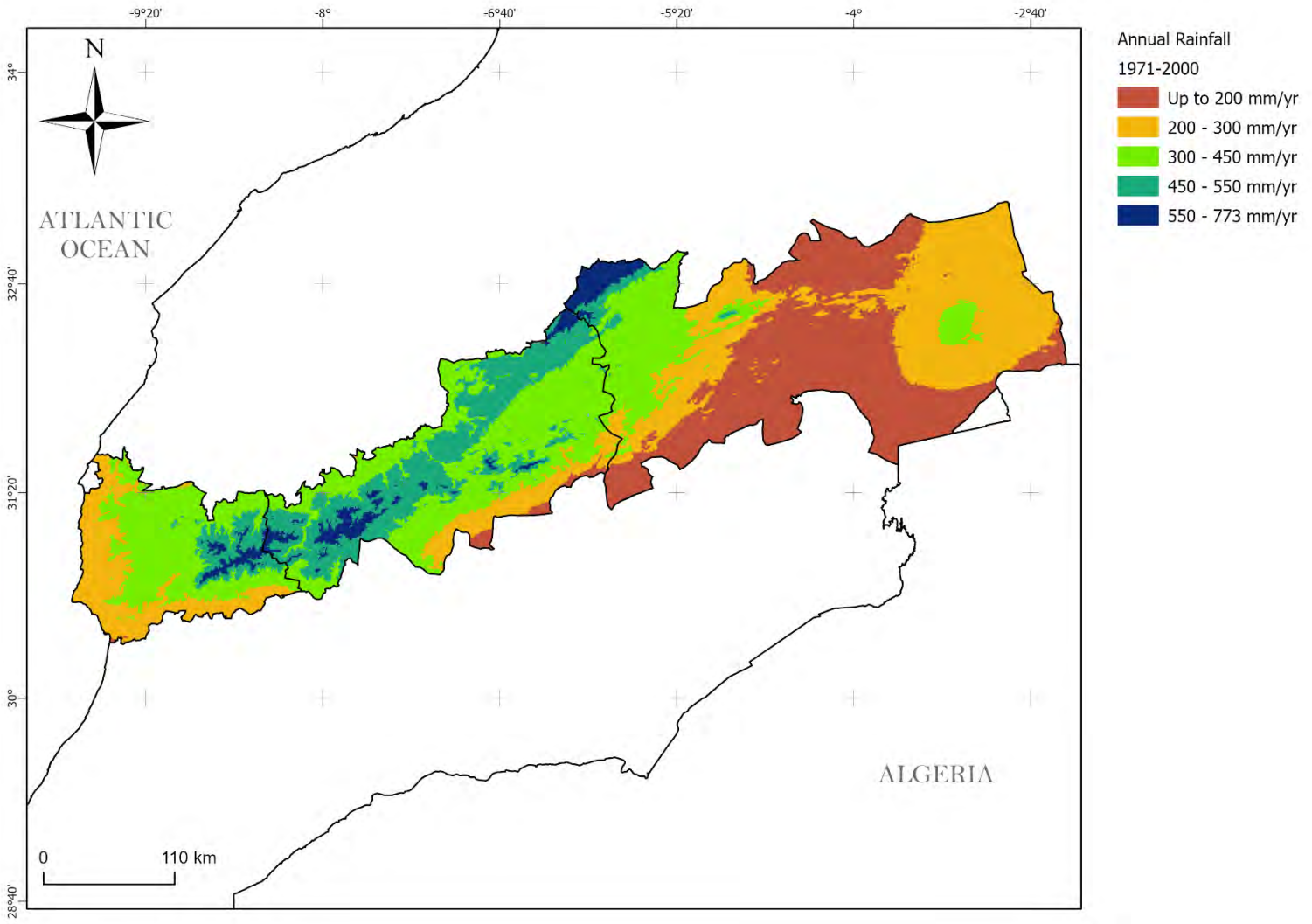

Figure 13 – Annual Rainfall in mm/yr in the High Atlas area, after WorldClim 2020-2022.

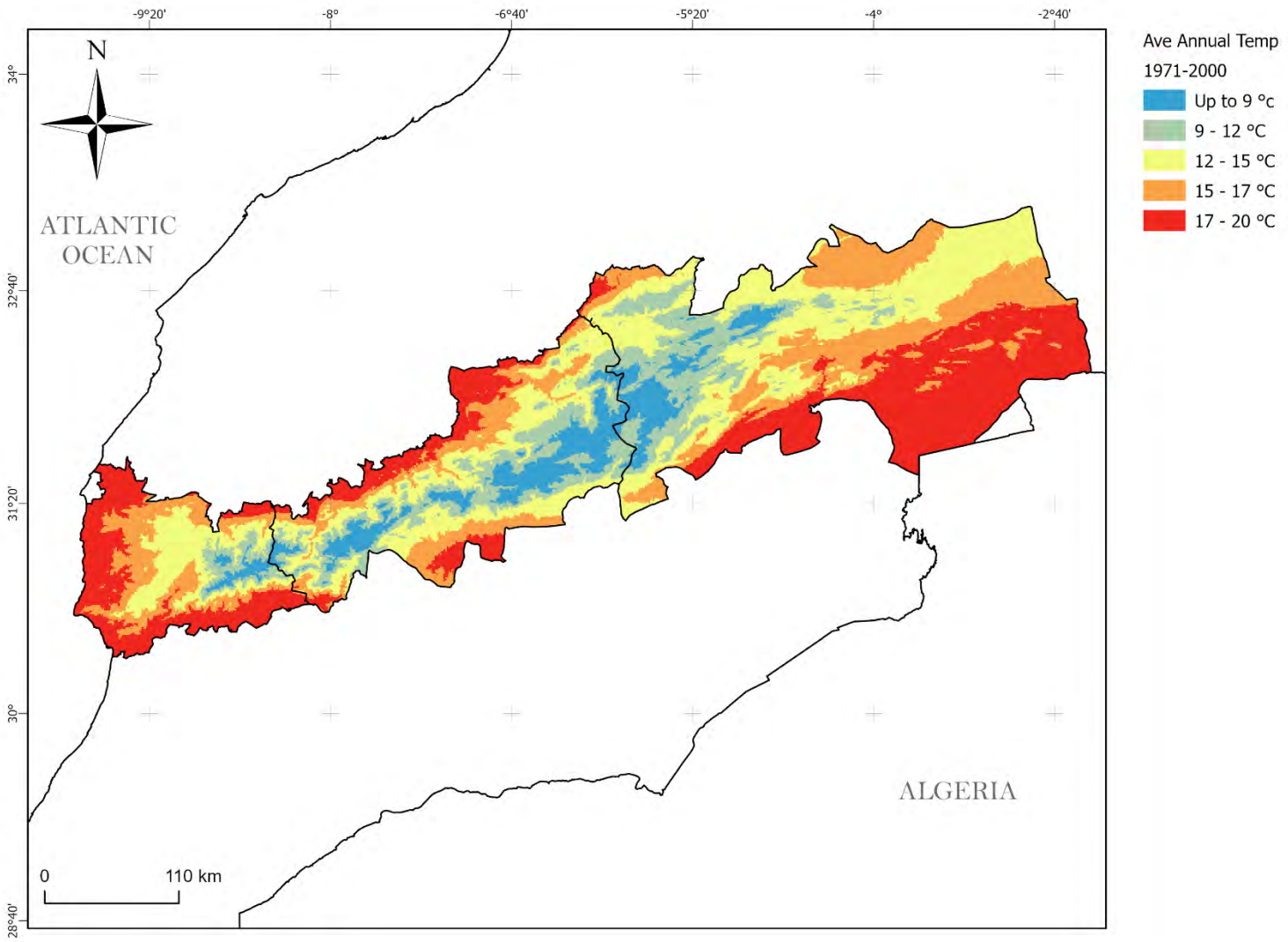

Figure 14 – Average Annual Temperature in °C of the High Atlas area, after WorldClim 2020-2022.

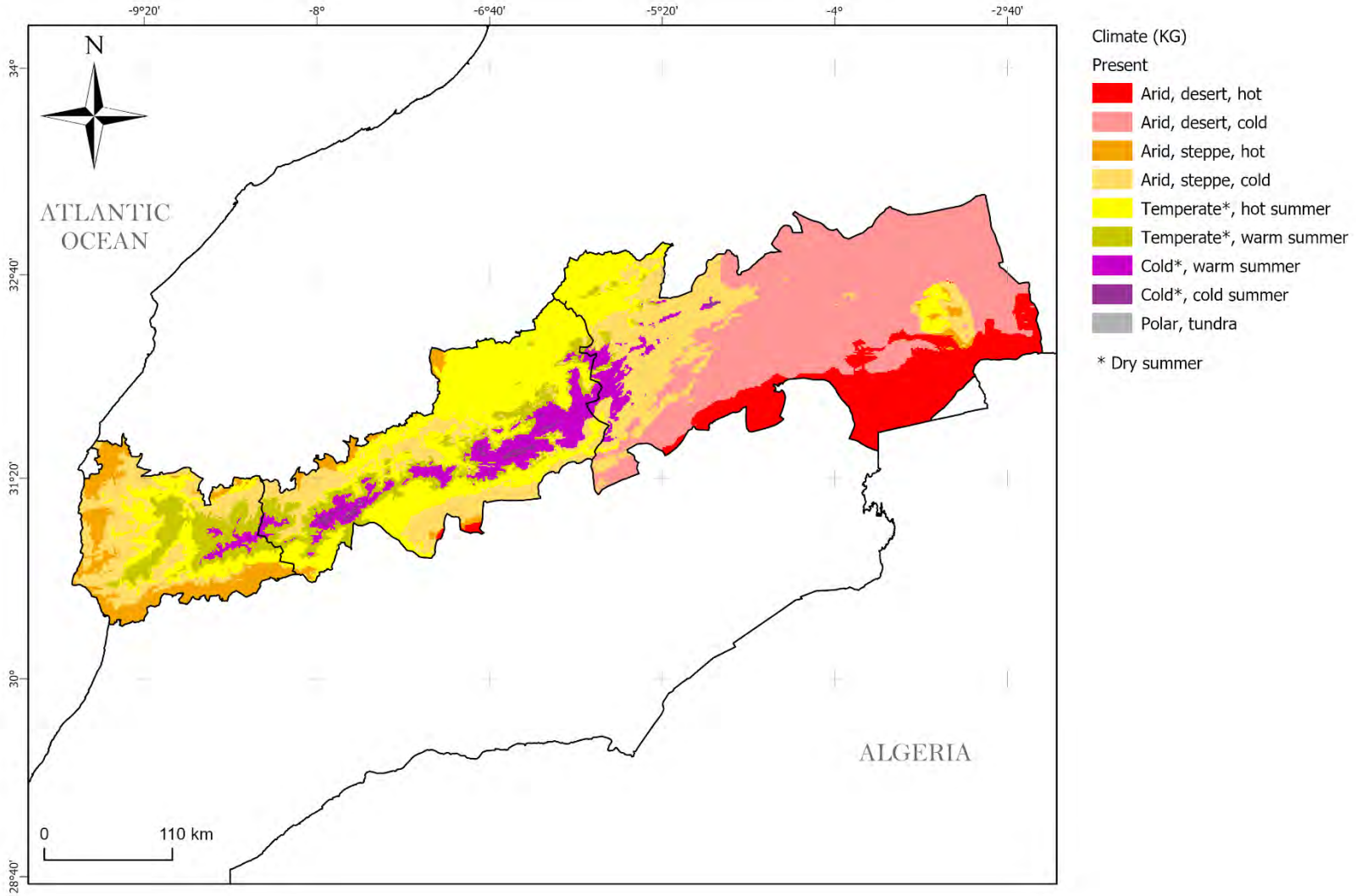

Figure 15 – Koppen-Geiger climate zones of the High Atlas area at present, after Beck et al. 2018.

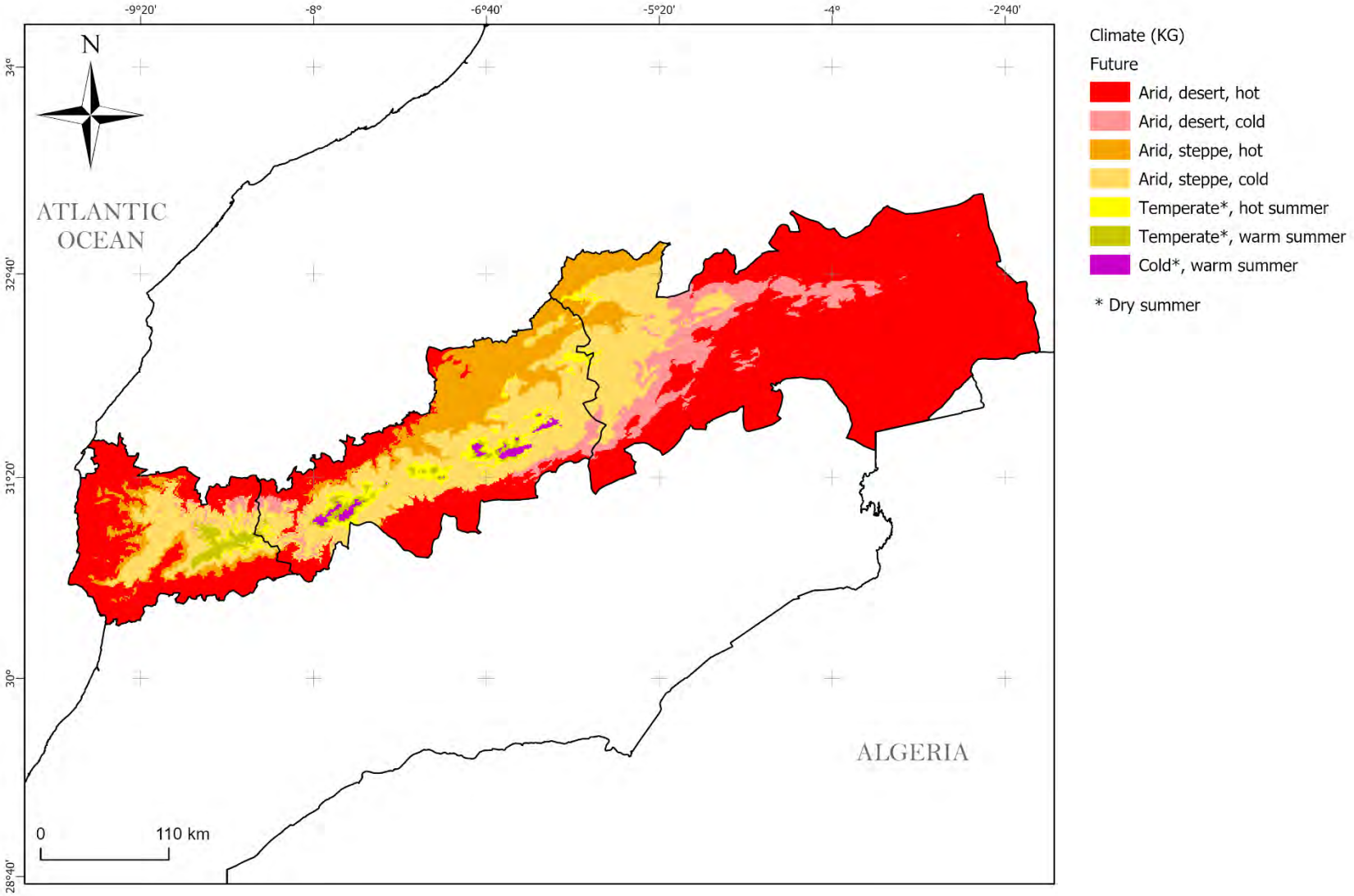

Figure 16 – Koppen-Geiger climate zones of the High Atlas area for the period 2071-2100 following the 8.5 RPC scenario, after Beck et al. 2018.

Land Cover and Vegetation

In terms of land cover (Figs. 17-18; Tab. 8), following the ESA WorldCover 2021, most of the High Atlas region is bare or featured by sparse vegetation (44%) or is covered by grassland (38%). These categories cover more than 80% of the entire area. Shrubland, trees and cropland follow, covering less than 7% of the surface. Buildings and herbaceous wetlands together don't even amount to 0.3 % of the total.

Some relevant differences can be noted between the three geographical sub-regions: in particular, in the west, grassland and shrubland are highly prevalent, covering more than 70% of the surface, and cropland per cent value is three points higher than the mean for the High Atlas (7.3%); in the centre, grassland prevails, but together with bare/sparse vegetation, which in this case is second per importance, while tree cover almost doubles the value for the whole region; finally, the eastern area is dominantly bare (66.1%), with some relevant grassland (26.5%), with all other values inferior to the High Atlas means.

Woodland is made primarily of Tetraclinis articulata (Vahl) Mast and *Argania spinosa (L)* Skeels in the western area; this latter, together with the Moroccan gum (*Acacia gummifera* Willd) and olive trees (*Olea europaea* L. subsp. maroccana (Greuter and Burdet) P. Vargas et al.), is the main component of the *arganerie*, a traditionally managed agroecological landscape which covers 1,076,040 ha across the whole country (FAO 2020). The *arganeraie* produces the *argan oil* and is based on a traditional socio-economic model, although current population growth, climate change and excessive exploitation make its management less and less sustainable (Faouzi 2017; Msanda et al. 2021).

It is difficult to quantify its exact extension within the High Atlas borders as defined in this work. Still, considering the forest map available on the website of the *Agence Nationale des Eaux et Forêts*, it would be circa half of it, the rest being mainly located in the Sous-Massa region to the south (Agence Nationale des Eaux et Forêts 2022b). Instead, in the central and eastern subregions, the forest is made of *Quercus rotundifolia* Lam. and *Juniperus thurifera* L. with some acacia formations [*Vachellia tortilis* subsp. *raddiana* (Savi) Kyal. and Boatwr] in the more deserted regions.

Turning to above-ground biomass, values span between 0 and 85 Mg ha^{-1} in the High Atlas region, with a mean value of 21 Mg ha^{-1} (Fig. 19) – an average temperate forest's value is around 210 Mg ha^{-1} – which means an average of circa 10 tons of C stocked up on the soil per hectare, excluding the roots. In the western and central subregions, the mean value rises to 32 and 30 Mg ha^{-1}, respectively, while it drops to 12 Mg ha^{-1} in the deserted eastern one.

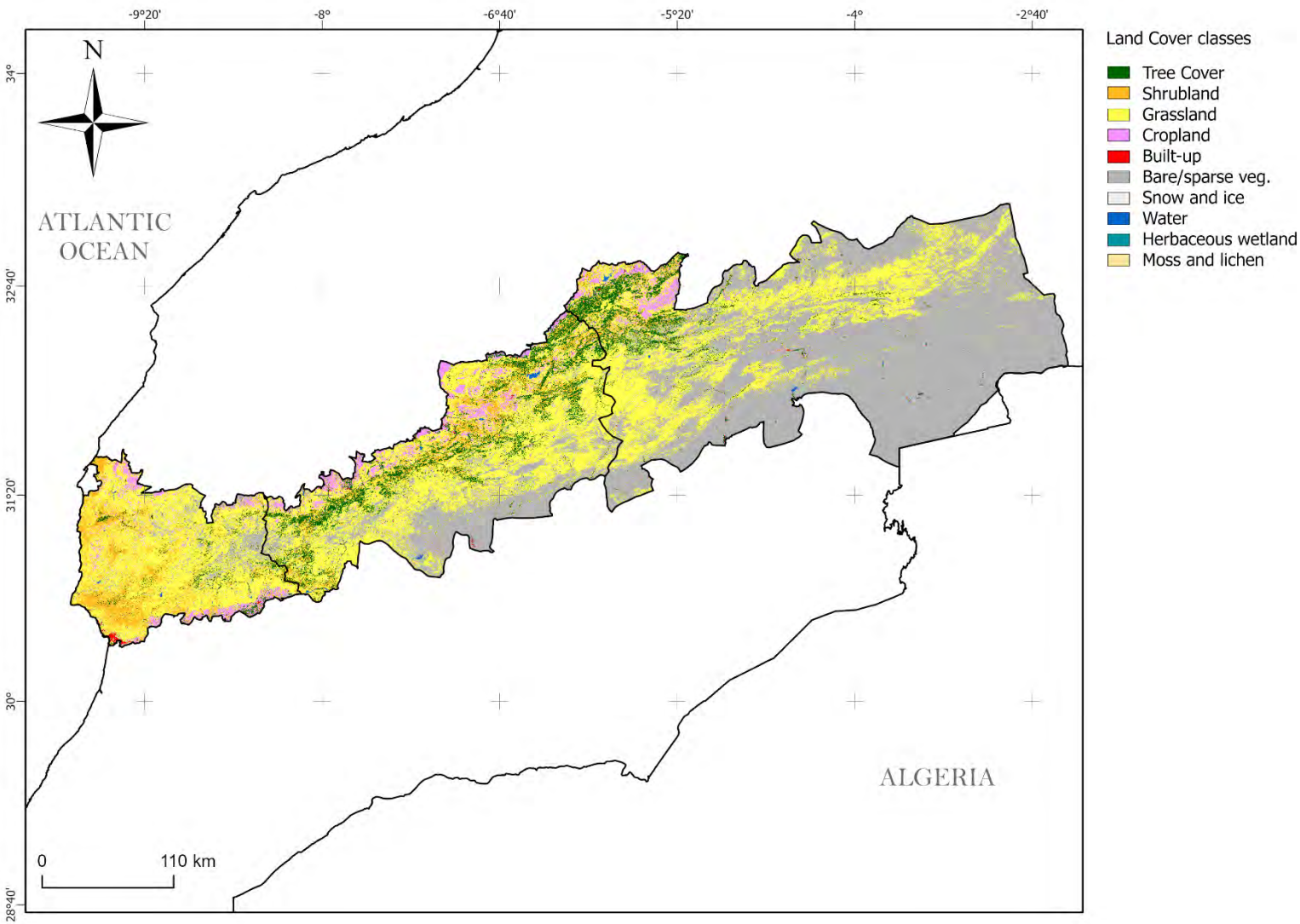

Figure 17 – Land cover of the High Atlas area, following the ESA WorldCover 2021.

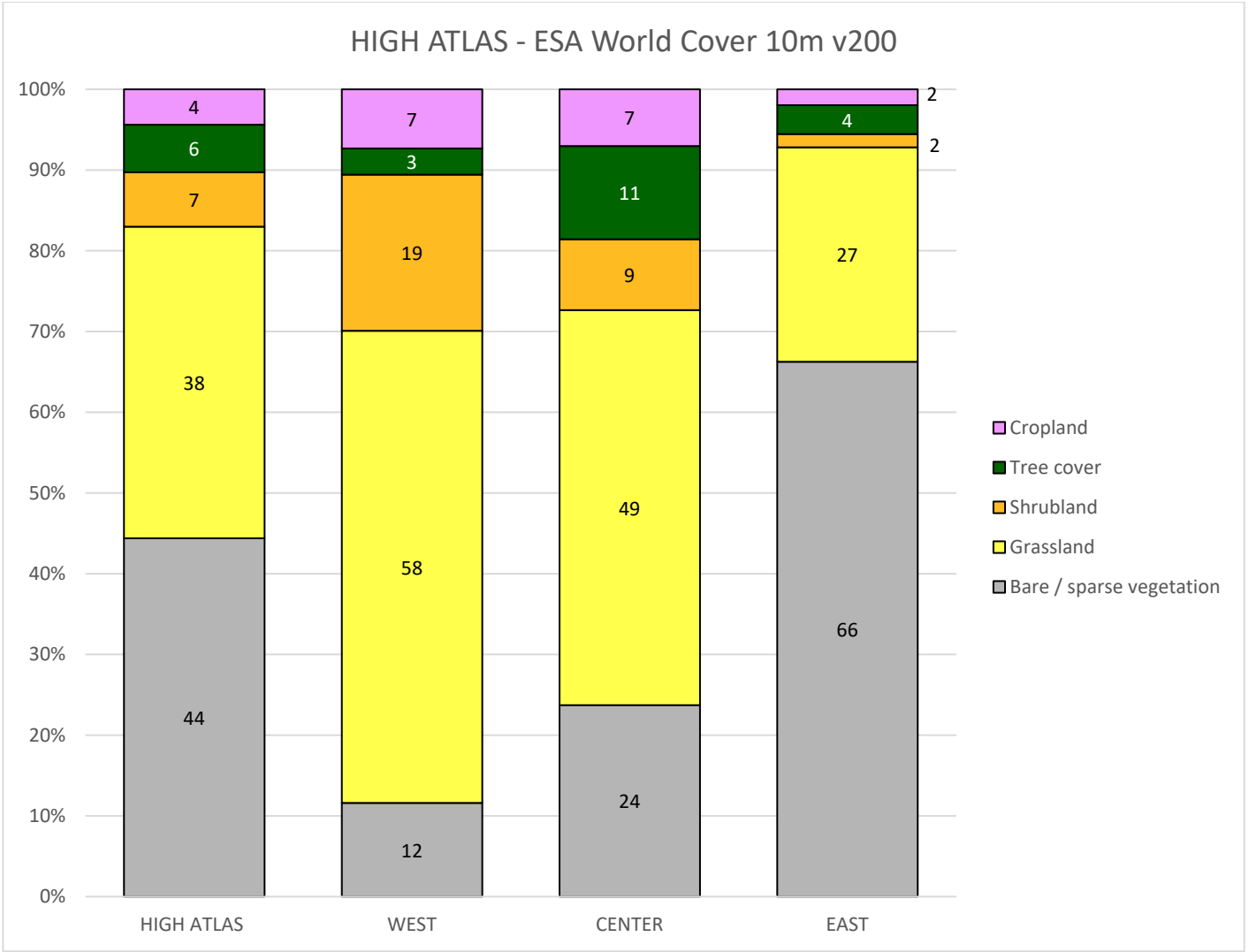

Figure 18 – Column chart illustrating the percentage of cover of the High Atlas and the three sub-regions based on the ESA WorldCover 10m v200 of the year 2021.

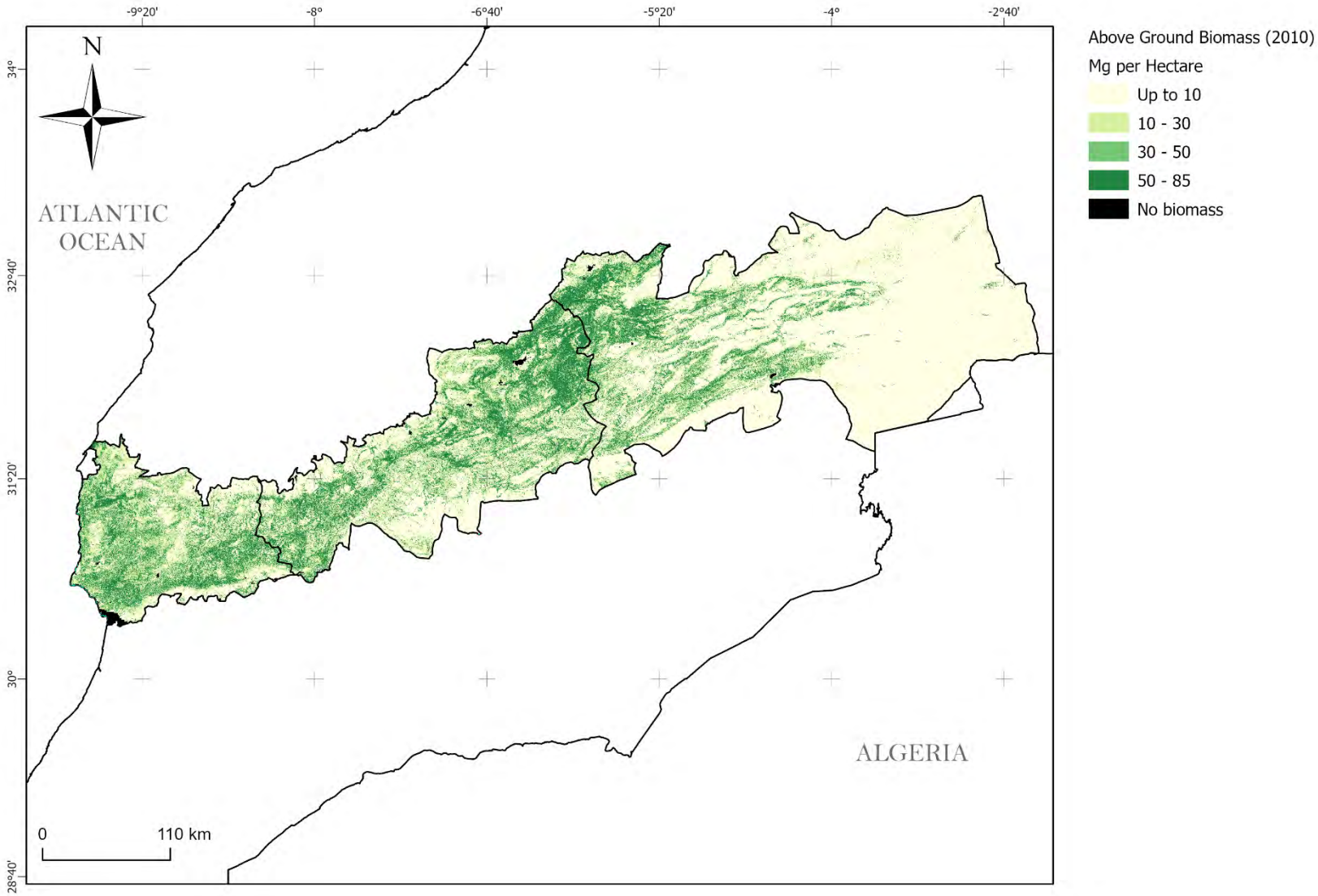

Figure 19 – Above Ground Biomass of the High Atlas area for the year 2010 after Bouvet et al. 2018.

Human Geography

Population and Languages

According to the 2014 national census, the inhabitants of the High Atlas region, as defined in this work, are 2,959,538, of which 4,306 are foreigners (a mere 0.14%) and 2,955,232 Moroccans. These latter belong mainly to the Amazigh minority. However, that is impossible to determine in detail from the census, which contained no ethnicity-based questions – in the 2011 Constitution there is no acknowledgement of different ethnicities across the country (Gagliardi 2019: 7). The average population density is 41 inhabit/km^2, with higher values on the central subregion and very low values on the eastern and western ones, except for the area of the city of Agadir to the south-west (Fig. 20; Tab. 9).

According to OpenStreetMap data, the region is featured by 2,510 urban units – proper towns, villages, and hamlets – and the city of Agadir, all connected by 43,713 km of roads. Given that 246 of the settlements are municipal capitals, also considering Agadir as a city, it leaves circa 2263 villages/hamlets scattered across the region (0.03 per square km).

Seventy-four tribes are present in the High Atlas study area (Fig. 21; Tab. 10). The ones occupying the most significant amount of land are the Ait Yafalmane (Fig. 21, n. 25) and the Ait Seghrouchen (Fig. 21, n. 57), both in the eastern part of the region.

According to the 2014 census, five languages are currently spoken in the region, of which three belong to the Amazigh group (Afroasiatic language family) – Tachelhit, Tamazight, and Tarifit – and two to the Semitic languages' family – Moroccan Arabic (locally known as Darija) and Hassaniya Arabic (Figs. 22-26; Tab. 12). Amazigh languages – which article number 5 of the 2011 Constitution made official in the form of Standard Moroccan Tamazight (ⵜⴰⵎⴰⵣⵉⵖⵜ ⵜⴰⵏⴰⵡⴰⵢⵜ - *tamaziɣt tanawayt*) – are more widespread, the Tachelhit one being spoken in the western half of the region (Fig. 22), Tamazight in the east (Fig. 23) and Tarifit (the indigenous language of the Rif region, with an extremely low number of speakers in the High Atlas) in the very East and West (Fig. 24). Being the High Atlas, a region traditionally inhabited by Amazigh communities, Darija speakers are concentrated at the periphery of the area, especially in the North and East (Fig. 25). Hassaniya, which is a variety of Maghrebi Arabic spoken in Mauritania, southern Morocco, and Western Sahara, reaches a few speakers around 1% only in the three municipalities of Agadir, Asni, and Drargua (Fig. 24), possibly due to migrants from southern regions.

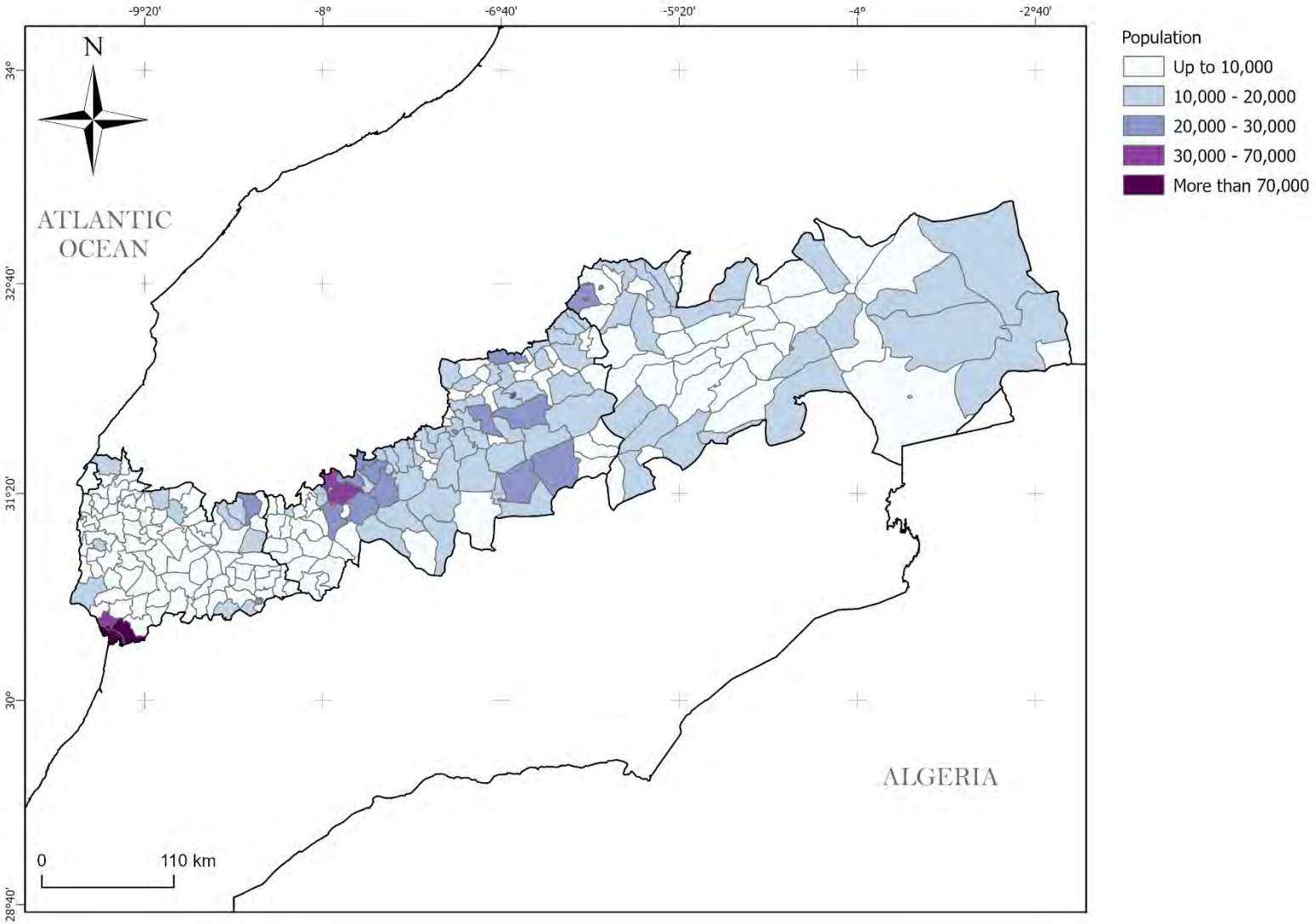

Figure 20 – Population map of the High Atlas area per municipality after Haut-Commissariat au Plan 2023.

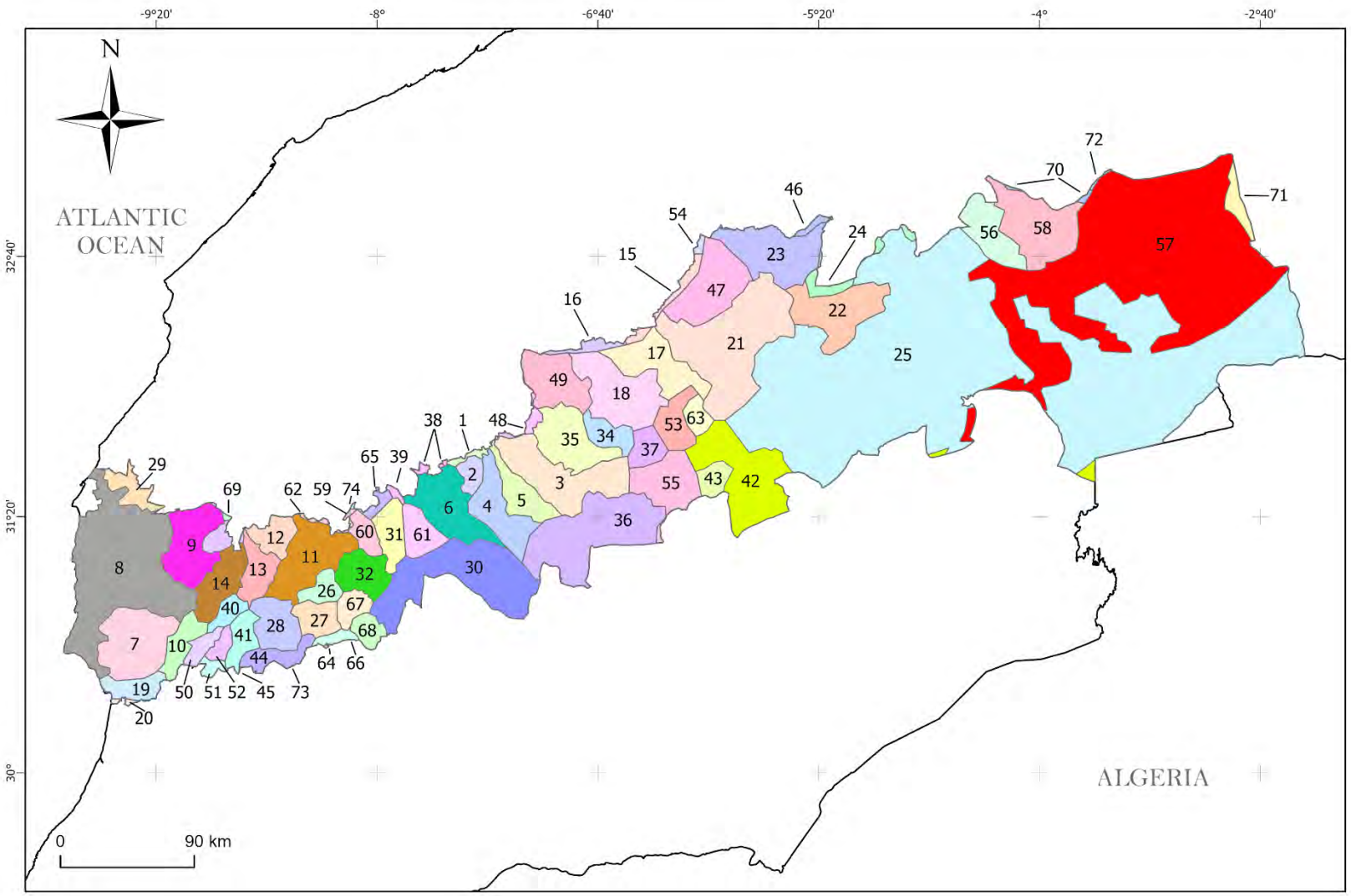

Figure 21 – Tribes in the High Atlas area after TribusDuMaroc 2024 (see Tab. 10 for correspondences).

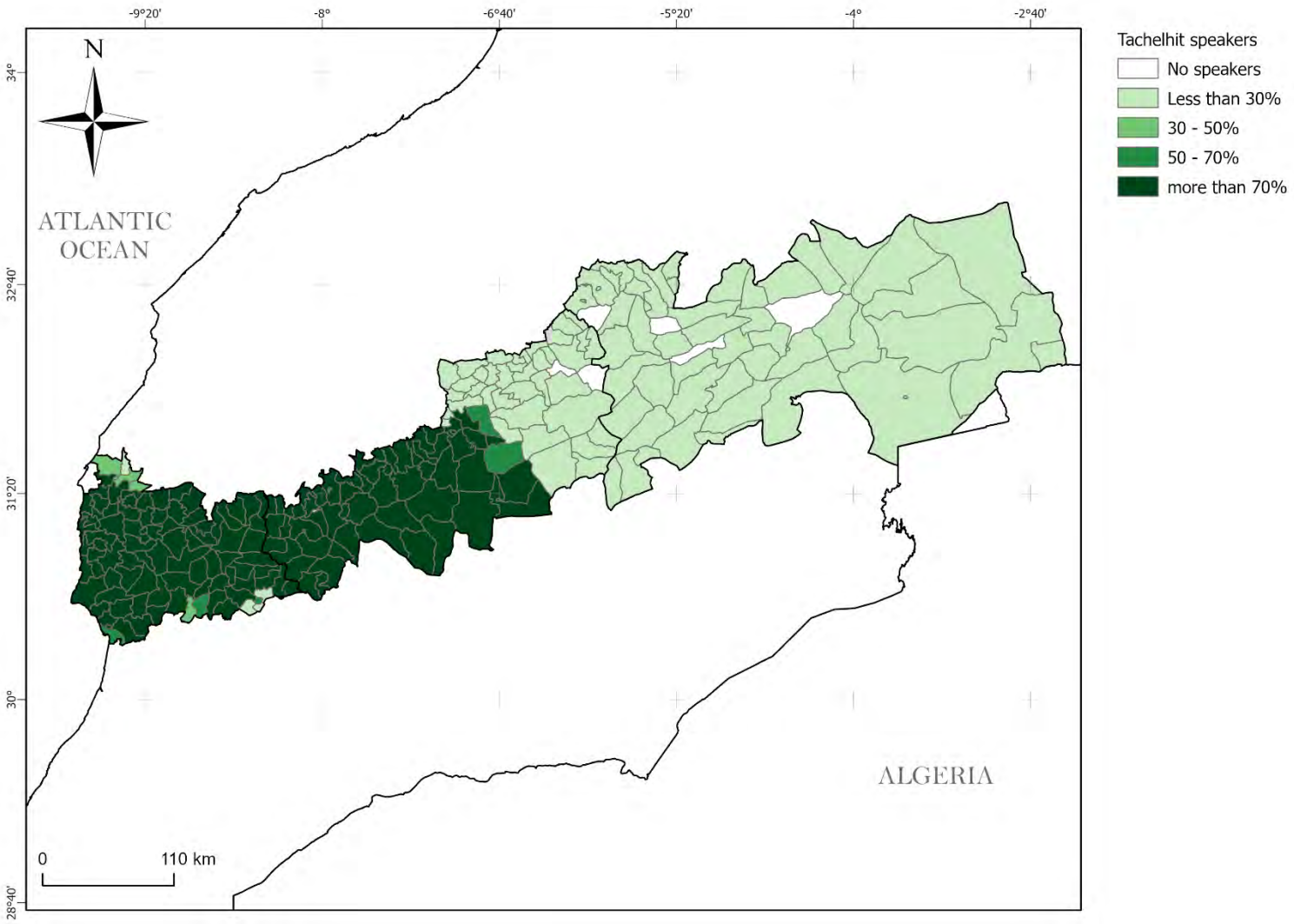

Figure 22 – Percent of Tachelit speakers per municipality in the HA area after Haut-Commissariat au Plan 2023.

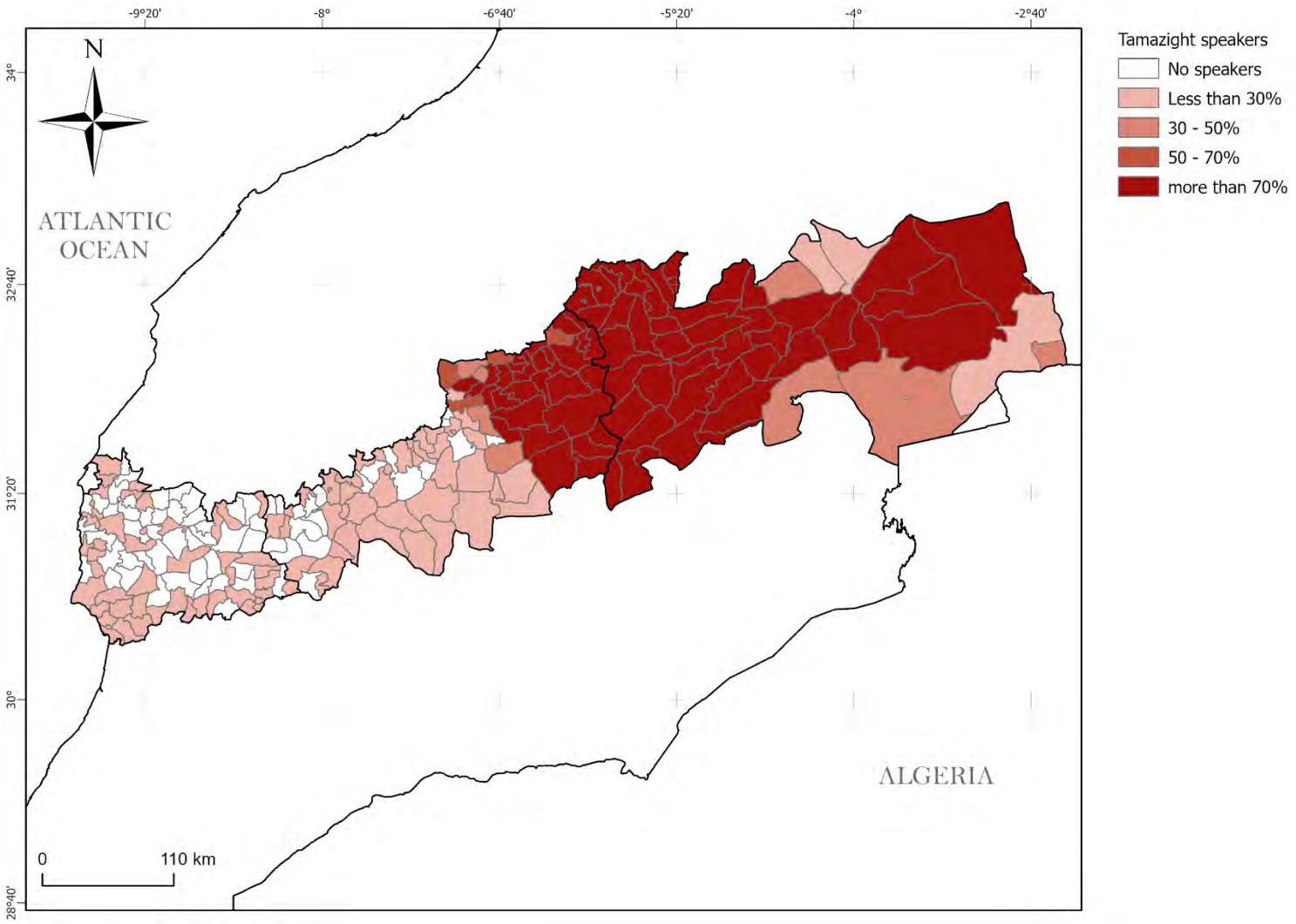

Figure 23 – Percent of Tamazight speakers per municipality in the HA area after Haut-Commissariat au Plan 2023.

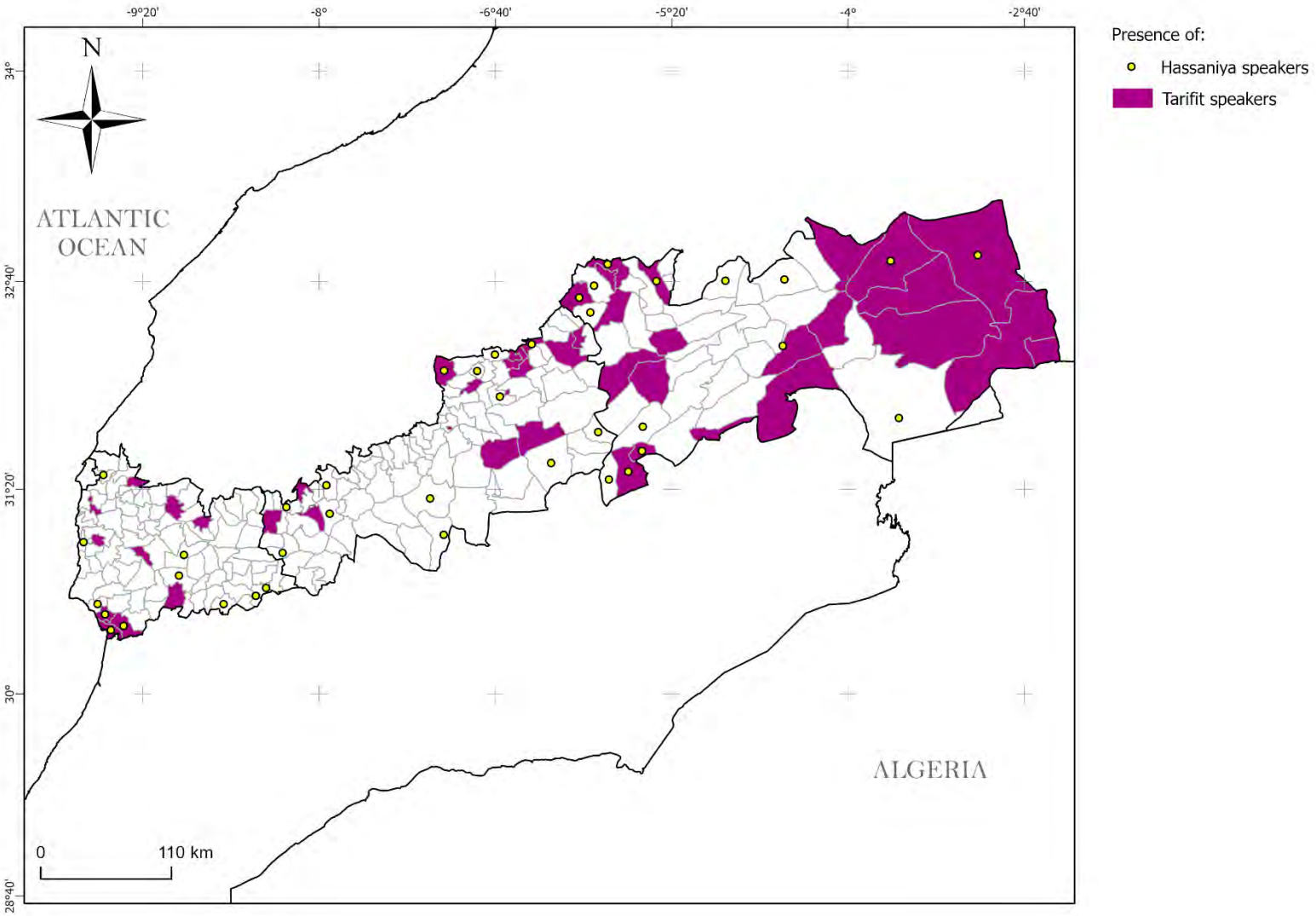

Figure 24 – Presence of Hassaniya and Tarifit speakers per municipality in the HA area after Haut-Commissariat au Plan 2023.

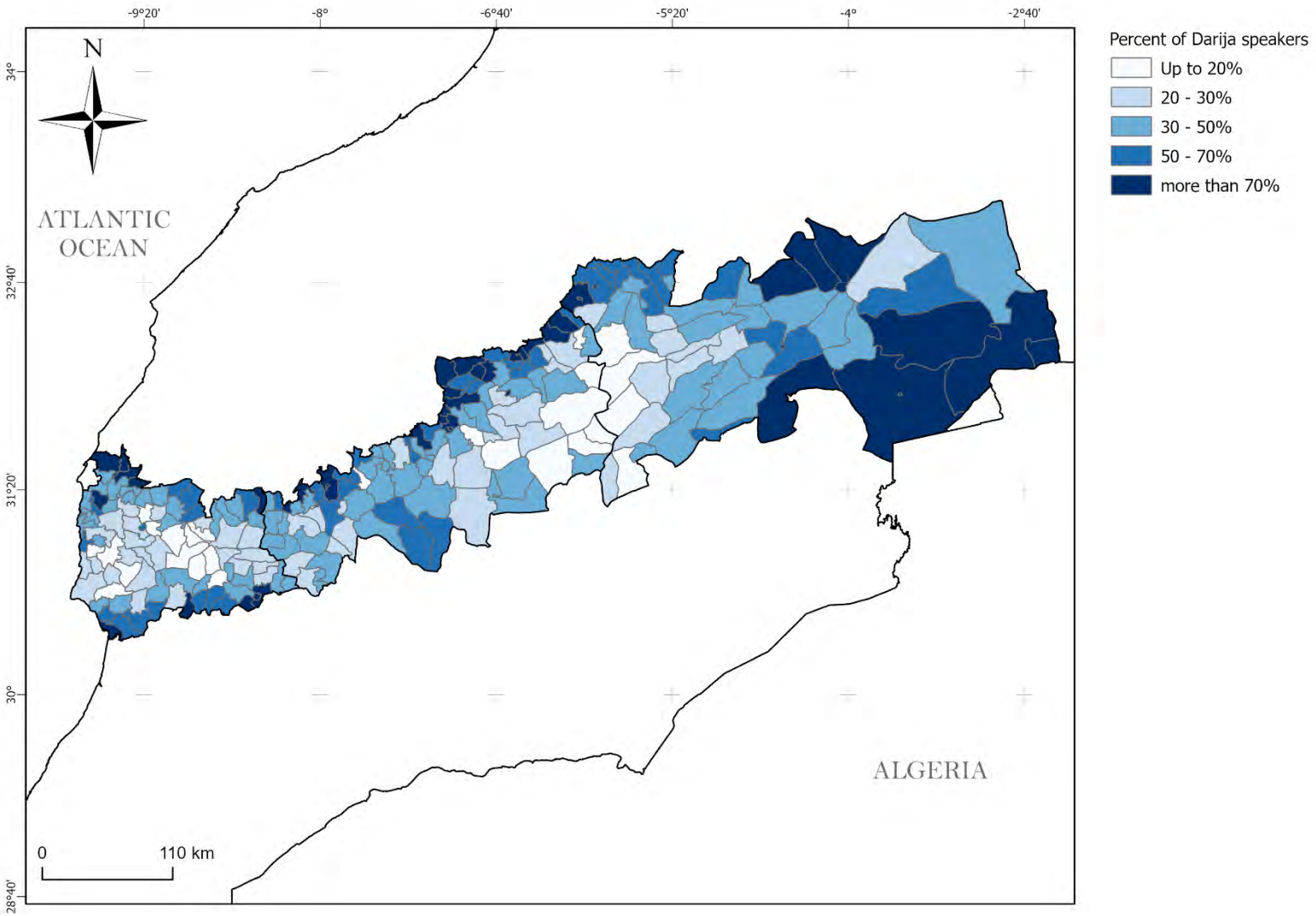

Figure 25 – Percent of Darija speakers per municipality in the HA area after Haut-Commissariat au Plan 2023.

Based again on the 2014 census, the average rate of schooling in the region is lower than the national one by four per cent points (95 to 91%), while the illiteracy rate is far higher (32 to 50%; Fig. 26, Tabs. 12 and 13), especially considering the female population, among which it reaches an average value of 60%, with a significant divide existing in comparison to the male population with a mean value of 37% and a maximum difference of 37 per cent points. It has been recently noted how the Moroccan State fails to guarantee the Amazigh community's access to language and education rights, as enumerated in arts. 13–14 of the UN Declaration on the Rights of Indigenous Peoples (Gagliardi 2019), this being especially true for women.

The municipalities with the higher illiteracy rate are in the eastern subregion (Anemzi, Bouchaouene, Boumerieme, Boutferda, Imilchil, and Sidi Yahya Ou Youssef), with three of them in the central subregion (Anergoui, Ait Abbas and Zaouiat Ahansal) and three in the western one (Assais, Bouabout Amdlane, and Tahelouante).

On average, most of the population is literate in Arabic only (44%, with peaks of 81% in some municipalities, relatively higher than the national value of 31%). This is followed by 39% literate in Arabic and French (lower than the national 45%), 8% literate in Arabic, French, and English, and a final average of 10% in other languages (Tamazight, presumably).

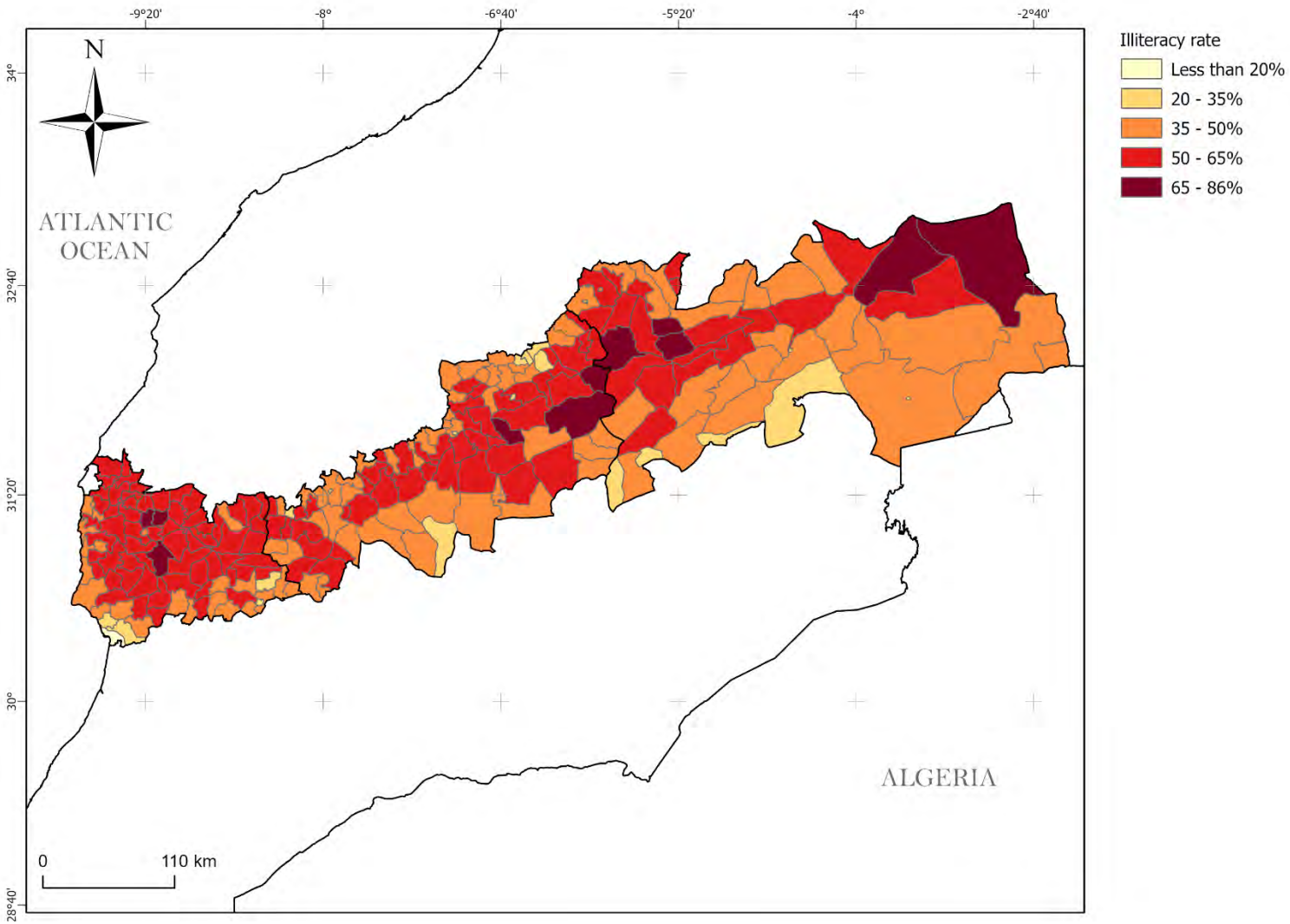

Figure 26 – The illiteracy rate in the High Atlas region after Haut-Commissariat au Plan 2023.

Economy

Official data from the 2014 national census reveals the active population of the High Atlas region as 912,454 individuals, with an average net activity rate of 43% and an average unemployment rate of 11%, relatively lower than the national value of 16% (Fig. 27; Tab. 14). Unemployment is higher in the south-eastern portion of the region, reaching peaks of 40% in some municipalities, while it is at its lowest in the central subregion.

In terms of job category (Fig. 28), most of the working population can be classified as private sector employees (47%) or independent (35%, a value higher than the national one of 30%). The sectors with the highest percentage of workers are agriculture, forestry, and fisheries (41%) and construction (27%), both of which show an average percentage value that is significantly higher than the national value (respectively 23% and 14%). In all other sectors, the average percentage of workers is lower than the national value.

The gender gap is higher than at the national level (Fig. 29; Tab. 15), starting with the unemployment rate, which is 35% on average for women and 8% for men (national values being 30% and 12%). Women are more employed in the primary sector (50% vs 38%) and in mining and manufacturing (12% vs 4%), and less in construction (3% vs 30%). The municipalities with higher gender gap values are located primarily in the eastern, central, southern, and western subregions. In the western subregion there are 15 municipalities showing the higher values (difference of > 55 percent points).

The rural economy in the region has been – and currently is – mostly related to irrigated terraced agriculture in valleys between roughly 1000 and 2500 m, seasonal grazing between approximately 500 and 3300 m, and large commercial irrigation schemes only below 500 m (Maselli 1996). The landscape of the western part of the region, as reported above, is also featured by the traditional *arganeraie*, which occupies a relevant space in the regional and national economy. subregion, 15 municipalities show higher values (a difference of > 55 per cent points).

Even though several *dahirs* (decrees) were promulgated between 1912 and 1956, during the French protectorate period, to place lands and natural resources under state control, following the belief that nomadic and indigenous management of the land had led to over-exploitation and, in general, landscape depletion (Mesnildrey 2021), nomadic pastoralism and common grazing are is still carried out despite a general decline (Bencherifa and Johnson 1991), especially in the pastoral *agdals*, or *igdalen n-tuga*, the already cited high-altitude grassland areas managed following traditional communitarian practices, aimed at the protection of the vegetation for and from grazing. Agdals, which exist in the Moroccan south in various types (sanctuaries, pastoral, forestall, agricultural, and so on), are traditional managing approaches of specific resources in a limited territory and in a communitarian way: their use is usually shared by different tribes based on traditional agreements/contracts, and they remain ‘closed’ for specific periods

of the year, to allow regeneration (for an extensive panoramic on the subject see the Literature review section above).

As for the secondary sector, the analysis of USGS data shows that the area is featured by a complex and varied geology, which makes it rich in several mineral strategic resources. The Moroccan government sees the extraction and processing of such commodities, which currently account for 10% of the national GDP, as “a strategic imperative for economic development” (Oxford Business Group 2023). This trade, though, usually does not generate any valuable and sustainable advantage for local communities/regions, for it is in the hands of private foreign companies on the one side in many cases and for its very extractive nature (not regenerative).

The tertiary sector is mainly represented by tourism, particularly by its sustainable ‘eco’ branch, which started in Morocco in early 2000 (Rhattas 2015, Kenza 2021). In the country, the tourist industry has steadily increased during the last few decades. Despite the earthquake, 2023 has registered a new record of 14.5 million tourists, currently representing 7% of the national GDP (Reuters 2023). However, this national trend, which is pushed and funded by the state, is not directly reflected in the ecotourism sector, which at present lacks several essential elements to become efficient and economically sustainable for local communities, in particular financial, material, and human resources for promotion, formalisation of the existing offer, professionalism, and strategic approach; furthermore, usually there is little involvement of the local population (El Azizi 2020; El Azyzy and Ekiz 2021; Chellik 2023).

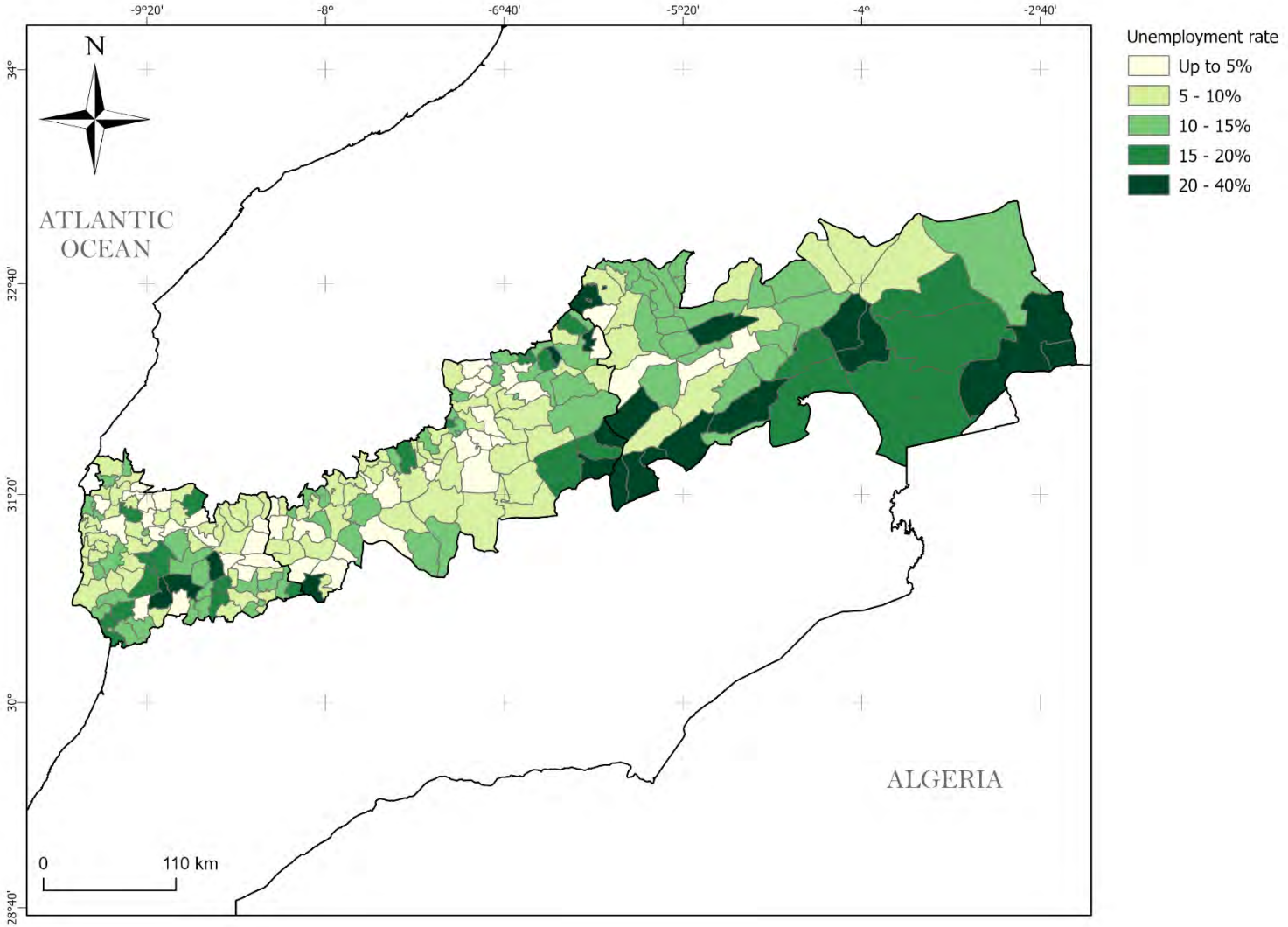

Figure 27 – Unemployment rate per municipality across the High Atlas region, after Haut-Commissariat au Plan 2023.

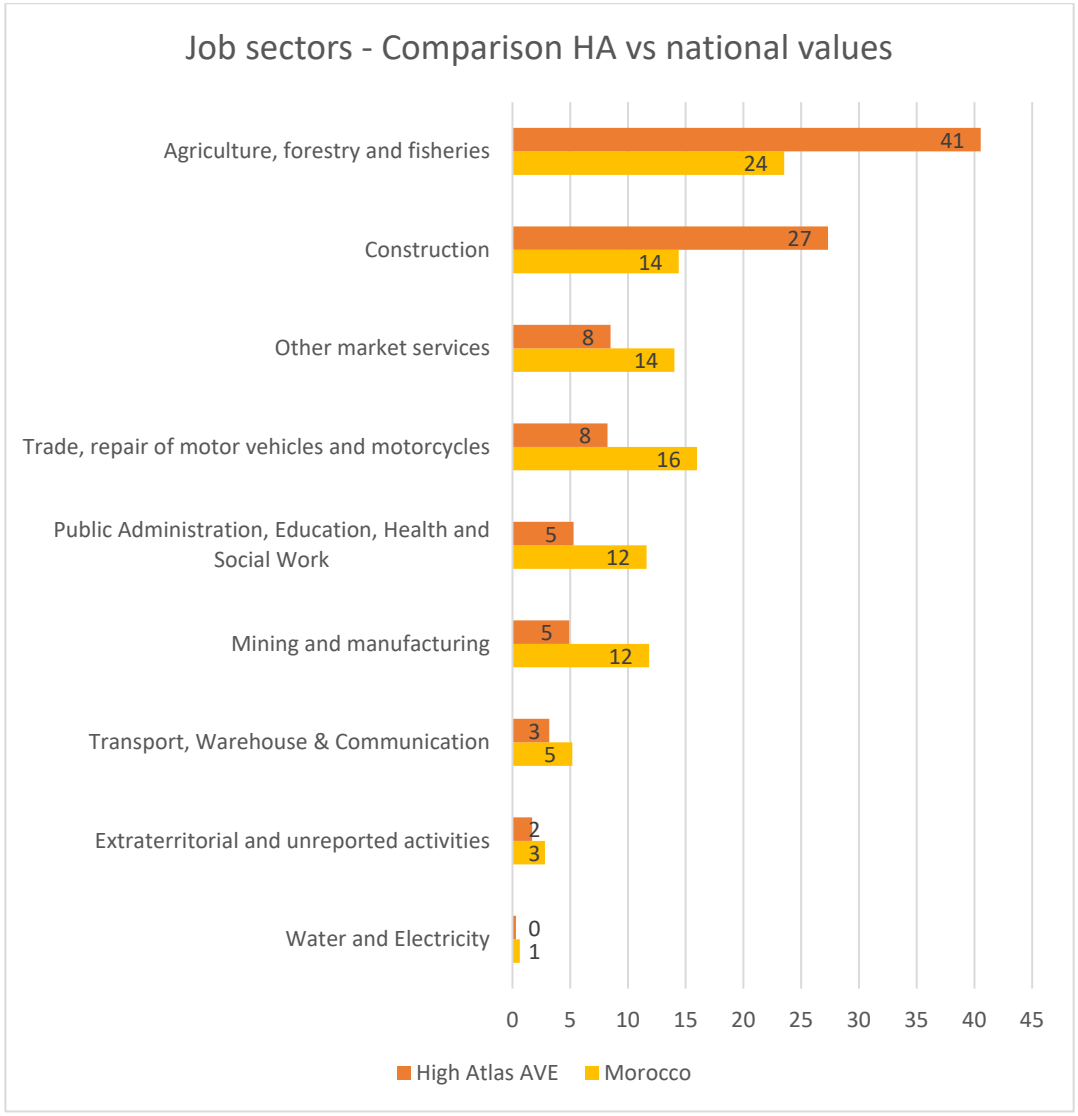

Figure 28 – Percentage of employees in different job sectors – comparison between High Atlas and national values, after Haut-Commissariat au Plan 2023.

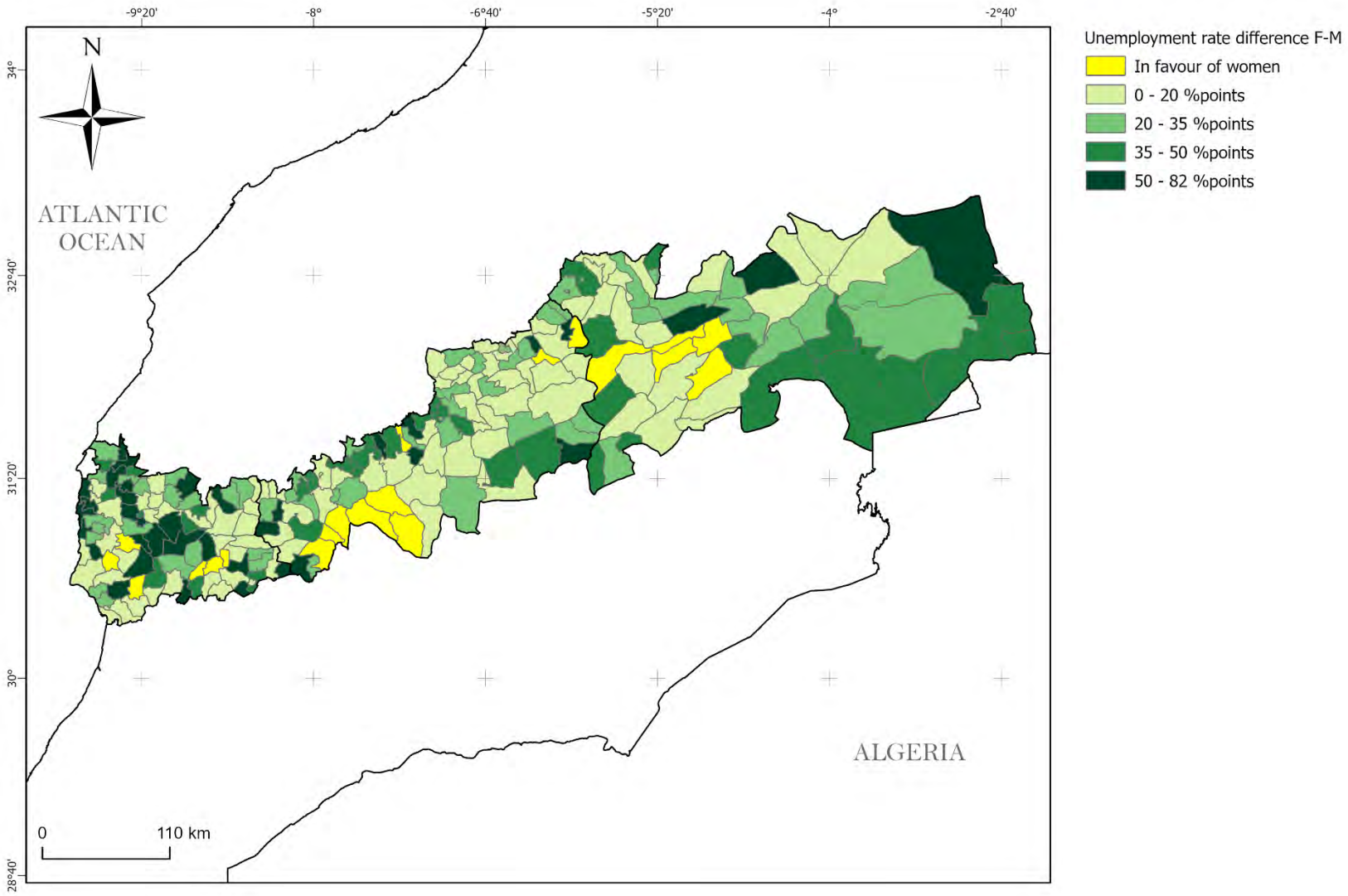

Figure 29 - Difference in the unemployment rate between women and men per municipality across the High Atlas region, after Haut-Commissariat au Plan 2023.

Conservation Geography

In terms of conservation, several sites of interest are spread across the whole High Atlas study area, all managed by the National Department of Water and Forests: in particular five national parks, which cover a total of 223,697 ha (4% of the total surface of the study area; Fig. 30; Tab. 16), 18 SIBE (*Site d'Intérêt Biologique et Écologique*) sites, for a total of 139,366 ha (2% of the study area; Fig. 30; Tab. 17), one biological reserve – the Imarigha one – (Fig. 31), and 6 RAMSAR sites (Wetland of International Importance; Fig. 31; Tab. 18). Of the national parks, two have been designated, Parc National du Haut-Atlas-Oriental and Parc National de Toubkal – this latter being the first one in 1942 – while Ain Asmama, Tamga and Tamri Cap-Ghirthe keep the status of 'proposed' since 2014. As for the SIBE and RAMSAR sites, they have all been either established or designated. In the High Atlas, 16 Key Biodiversity Areas have also been defined (Fig. 30; Tab. 19), with sizes spanning from the 38 ha of Barrage al Mansour Ad-Dhabi to the more than 330,000 ha of Wad Lakhdar, for a total surface of 904,956 ha.

Finally, a new feature related to conservation in the High Atlas region is represented by the M'Goun UNESCO Global Geopark (http://www.geoparc-mgoun.ma/), located directly South of the town of Beni Mellal and covering a total surface of 573,000 ha. This protected area also hosts 22 geosites (https://www.geoparc-mgoun.ma/carte-interactive-des-geosites).

The park's application as a UNESCO site was verified for the first time in 2014 and recently revalidated for 2019-2022. The Association Géoparc M'Goun manages the park. So far, no data have been found to build a proper map of this area for the present work.

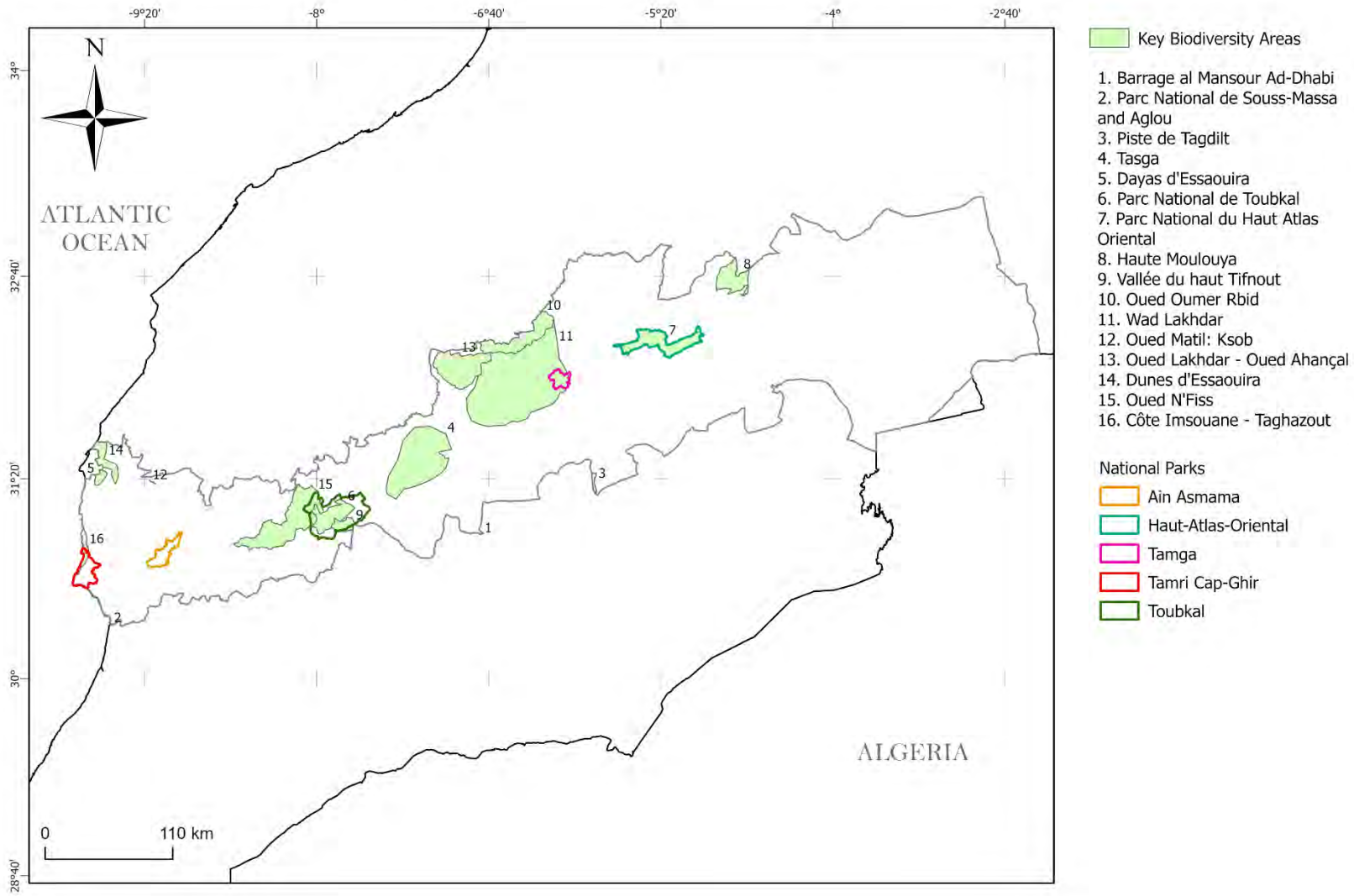

Figure 30 – National parks and KBA in the High Atlas region (after BirdLife International 2023 and UNEP-WCMC 2023).

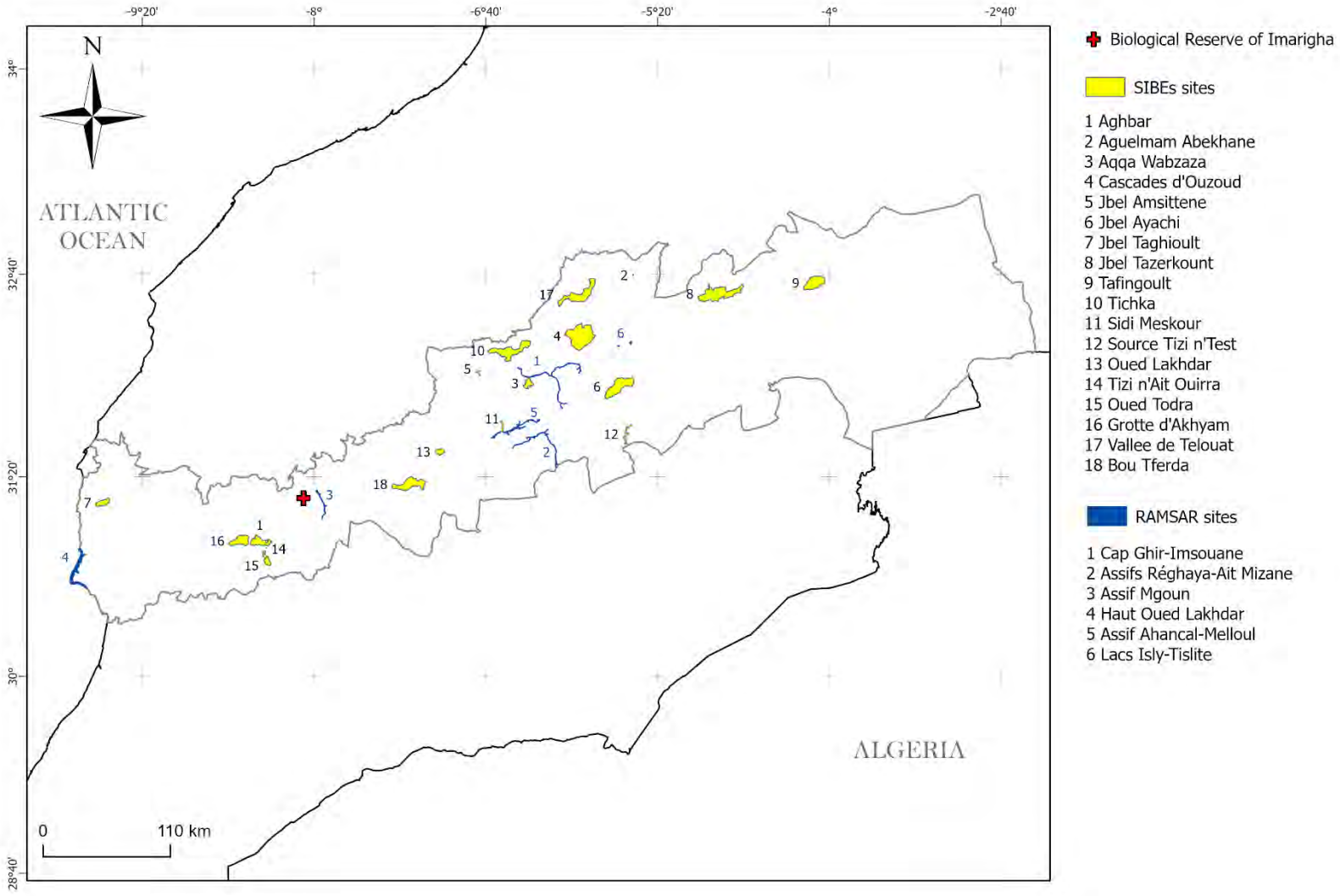

Figure 31 – Biological Reserve of Imarigha, SIBE and RAMSAR sites in the High Atlas region (after *UNEP-WCMC 2023)*.

CONCLUDING REMARKS

The information provided herein has several relevant implications. First, regarding the definition of an area that could be safely named 'High Atlas', this work offers a proposal that unifies physical and human geography to have a single and practical platform to carry out analysis and generally to work on. Such definition, including the very physical borders of the High Atlas mountain range, incorporates them into the local administrative municipal boundaries. This approach guarantees the possibility of working on the same units (municipalities) in both spatial research's physical and social fields. The lack of detailed data at a smaller scale, such as douars, does not allow for additional accurate geographical analysis at the hamlet level.

The detailed literature review presented in this manuscript has shown the diversity and breadth of academic studies on physical and biological sciences, social sciences, and the humanities but also the many gaps observed, including recent investigations, long-term studies, regional analyses or the pure lack of data and information in a myriad of disciplines and issues. This is somewhat problematic as it hinders further deepening in basic and applied science and action, essential for local and regional development and conservation, and especially in cases of emergency (persistent such as drought or extreme cold, or sporadic such as earthquakes and heavy rains.
Turning to the GIS analysis outcomes, they revealed the main features of the High Atlas region to be harsh morphology, dry climate, poor soils, and a predominance of grassland in terms of land cover. The analysis of data on human geography has shown the High Atlas to be a low-density population region – with areas of higher concentration mainly in the central and western sub-regions – and featured by a highly diversified and fragmented tribal landscape (74 different tribes are present). Such features imply that, from a socio-economic point of view, the region is particularly fit for the kind of goat and sheep extensive grazing that has been traditionally carried out, but also unfit for the development policies that Morocco is currently implementing in other areas of the country – i.e. industrial developments in agriculture.

As presented above, climatic projections of business-as-usual scenarios indicate that the whole High Atlas will shift towards an arid climate, mostly desert, by the end of the century. The national approach carried out by the Moroccan government in the last 20 years to fight climate change at the land level has been focused on three main points: (1) intensive agriculture with technological inputs (Laouina 2006), (2) the development of a strategy oriented towards maintaining and improving the present state of forests (*Ministère de l'Agriculture, de la Pêche Maritime, du Développement Rural et des Eaux et Forêts* 2023), (3) containment of desertification (*Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification* 2013).

Agriculture, for its dependence on water, is already suffering in the High Atlas area and remains a very urgent problem for the government all over the country: in the last years, drought, together with high commodity prices, has caused a sharp deceleration in the

national GDP growth (The World Bank Group 2023). A considerable decrease in agricultural and overall productivity – almost 30% – is projected by 2080 due mainly to the decrease in precipitation (Cline 2007; Schilling et al. 2012). During the last 50 years, the attitude of the Moroccan government has been focused on large-scale, export-oriented agriculture, which excludes marginal areas such as the High Atlas and, in general, very rural traditional regions; this, together with the 'technological agriculture' approach adopted to build an alternative for the future, are not economically sustainable in these contexts, for they require a certain level of investment, which is not going to be balanced by profits.

A local approach, focused on agroecological practices, such as the *arganeraie* in the West and the *agdal* across the whole region, inspired by traditional management, is preferable. Still, it has been heavily threatened by 'socio-economic modernisation' processes, like privatisation of the common land, the transition from pastoralism to agriculture and fruit arboriculture, abandonment of transhumance, touristic and in general urban development projects, illegal logging, and so on. As seen above, these started during the colonial period, with the privatisation of the land and other attacks on the traditional communal management of the landscape. Still, in the last decades, the pace of the degradation has been accelerating due to globalisation.

Global markets have acted and currently act in such a way that local economies are not sustainable anymore, so the rural population is forced to urbanisation and further marginalisation. In turn, this leads to environmental degradation and agrobiodiversity loss in the abandoned areas of origin, for local communities and their relationships were the only factors that guaranteed a sort of ecological equilibrium necessary for the exploitation of scarce natural resources - like in the case of the *agdals* or the *arganeraie*.

The same framework applies to the secondary and tertiary sector, where the Moroccan state has been oriented toward a large-scale national strategy (extraction and tourism), which is not giving enough (if anything) in return to local communities, throughout the country and specifically in the High Atlas area. As formerly shown, this region, due to its importance as a biodiversity spot, is rich in conservation and protection sites, which represent essential features of this landscape in the framework of future socio-environmental sustainability yet impose restrictions and limitations on local users.

To implement their role as such, local participation and decision-making are inevitably needed to reach an equilibrium that could profit both local communities and their environment. As of today, the void left by the Moroccan state in these processes has been filled by many private and civil organisation initiatives, which have been contributing to the establishment of local projects related to ecotourism (Chellik 2023). This tension between the national approach – slow and ineffective in the case of the High Atlas – and local self-organisation has been revealed by the reaction to the 2023 earthquake crisis when several collectives have participated in its rather deficient response: local communities from the affected areas, governmental agencies, and non-governmental institutions and individuals.

Finally, human geography features analysis has revealed (among other things so far discussed) the presence of a significant gender equality imbalance in the High Atlas region, far wider than the national one, which was already relevant, even though the article n. 19 of Morocco's 2011 Constitution affirmed the principle of equality between men and women. This phenomenon is evident in both the areas of education and labour, where women are severely under-schooled and under-occupied in comparison to their male counterparts, or after the earthquake, with women not having the same access to national post-recovery subsidies compared to men. This is common throughout the country, but the situation is significantly worse in the High Atlas area.

In summary, the High Atlas is rich in natural resources and biocultural diversity. Nevertheless, from a socio-economic point of view, it is characterised by a high degree of marginality due to geophysical (morphology and soil features mostly) and historical (tradition of nomadic pastoralism) reasons. This marginality is also deeply related to the condition of the amazighophones within the national state, which is the dominant ethnic and linguistic constituent of the High Atlas population. As formerly reported, the Moroccan constitution of 2011 does not recognise the Amazigh as an ethnic unit of any sort but just as a linguistic one; it is then quite difficult to associate a specific economic condition with an ethnic minority in official statistics.

Such a high level of socio-economic marginality exposes this territory to several significant threats in the present historical and socio-economic context, among which climate change (which in this case means loss of land and water) and global markets economy (which press on traditional social structures and make them disintegrate) can be considered as the most urgent to face. As discussed above, following the RPC8.5 scenario, the High Atlas climate will get more and more arid throughout the century, mostly desert at the end of it, making it particularly unfit for agriculture and production. For local communities to survive, such change would require rapid adaption, which could be acquired only through agroecology means – consisting primarily of diversification and focus on local.

The role of the Moroccan state in addressing this situation is pivotal. However, so far, the idea of development at the national level – an intensive and technological approach to agriculture with a focus on international export – has revealed itself to be incompatible with the needs and specific features of the High Atlas region. Furthermore, several forces within the administration act as powerful obstacles to regional development, such as poor financial and human resources management.

To conclude, we trust that this work (and the references and maps included in it) can be of use to researchers, governmental organisations, NGOs, and policymakers for regional planning, future emergencies, and integrated knowledge generation in socio-environmental disciplines and beyond, as well as for anyone interested in this mountain range.

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TABLES

Table 1 – List of the municipalities of the High Atlas area (after Haut-Commissariat au Plan 2023).

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Abadou	ابادو	07.041.11.01.	90	Marrakech-Safi	Al Haouz	Central
Adaghas	ادغاس	07.211.05.01.	96	Marrakech-Safi	Essaouira	Western
Adassil	اداسيل	07.161.07.01.	117	Marrakech-Safi	Chichaoua	Western
Afalla Issen	افلا يسن	07.161.05.01.	123	Marrakech-Safi	Chichaoua	Western
Afourar	افورار	05.081.11.01.	51	Béni Mellal-Khénifra	Azilal	Central
Agadir	اكادير	09.001.01.01.	117	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Aghbala	اغبالة	05.091.05.01.	525	Béni Mellal-Khénifra	Béni Mellal	Eastern
Aghbalou N'Kerdous	اغبالو انكردوس	08.201.13.01.	847	Drâa-Tafilalet	Errachidia	Eastern
Aghbar	اغبار	07.041.07.01.	229	Marrakech-Safi	Al Haouz	Western
Aghouatim	اغواطيم	07.041.09.13.	237	Marrakech-Safi	Al Haouz	Central
Aglif	اكليف	07.211.05.03.	175	Marrakech-Safi	Essaouira	Western
Agoudi N'Lkhair	اكودي نلخير	05.081.03.01.	273	Béni Mellal-Khénifra	Azilal	Central
Agoudim	أكوديم	08.363.05.03.	576	Drâa-Tafilalet	Midelt	Eastern
Aguerd	اكرض	07.211.05.05.	88	Marrakech-Safi	Essaouira	Western
Ahl Tifnoute	أهل تفنوت	09.541.07.03.	141	Souss-Massa	Taroudannt	Central
Ain Chair	عين الشعير	02.251.03.13.	364	Oriental	Figuig	Eastern
Ain Tazitounte	عين تزيتونت	07.161.05.03.	96	Marrakech-Safi	Chichaoua	Western
Ait Aadel	أيت عادل	07.041.11.03.	104	Marrakech-Safi	Al Haouz	Central
Ait Abbas	أيت عباس	05.081.03.03.	233	Béni Mellal-Khénifra	Azilal	Central
Ait Aissi Ihahane	أيت عيسى اححان	07.211.05.07.	159	Marrakech-Safi	Essaouira	Western
Ait Ayach	أيت عياش	08.363.07.05.	531	Drâa-Tafilalet	Midelt	Eastern
Ait Blal	أيت بلال	05.081.15.01.	76	Béni Mellal-Khénifra	Azilal	Central
Ait Bou Oulli	أيت بوعلي	05.081.03.05.	484	Béni Mellal-Khénifra	Azilal	Central
Ait Daoud	أيت داوود	07.211.01.01.	20	Marrakech-Safi	Essaouira	Western
Ait Faska	أيت فاسكا	07.041.03.05.	111	Marrakech-Safi	Al Haouz	Central
Ait Haddou Youssef	أيت حدو يوسف	07.161.05.05.	142	Marrakech-Safi	Chichaoua	Western
Ait Hani	أيت هاني	08.577.03.01.	691	Drâa-Tafilalet	Tinghir	Eastern
Ait Hkim-Ait Yzid	أيت حكيم - أيت يزيد	07.041.11.07.	114	Marrakech-Safi	Al Haouz	Central
Ait Igas	أيت ايكاس	09.541.09.03.	164	Souss-Massa	Taroudannt	Western
Ait Ishaq	أيت اسحاق	05.301.03.01.	255	Béni Mellal-Khénifra	Khénifra	Eastern
Ait Izdeg	أيت ازدك	08.363.07.09.	339	Drâa-Tafilalet	Midelt	Eastern
Ait Majden	أيت ماجدن	05.081.15.03.	150	Béni Mellal-Khénifra	Azilal	Central
Ait Makhlouf	أيت مخلوف	09.541.09.05.	137	Souss-Massa	Taroudannt	Western
Ait Mazigh	أيت مزيغ	05.081.09.03.	179	Béni Mellal-Khénifra	Azilal	Central
Ait M'Hamed	أيت امحمد	05.081.03.07.	561	Béni Mellal-Khénifra	Azilal	Central

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Ait Ouaarda	أيت واوردا	05.081.11.05.	72	Béni Mellal-Khénifra	Azilal	Central
Ait Oum El Bekht	أيت أم البخث	05.091.07.03.	414	Béni Mellal-Khénifra	Béni Mellal	Eastern
Ait Oumdis	أيت أو مديس	05.081.13.05.	394	Béni Mellal-Khénifra	Azilal	Central
Ait Ouqabli	أيت اوقبلي	05.081.09.07.	99	Béni Mellal-Khénifra	Azilal	Central
Ait Saadelli	أيت سعدلي	05.301.03.03.	70	Béni Mellal-Khénifra	Khénifra	Eastern
Ait Said	أيت سعيد	07.211.03.01.	112	Marrakech-Safi	Essaouira	Western
Ait Sedrate JbelEl Oulia	أيت سدرات الجبل العليا	08.577.05.05.	343	Drâa-Tafilalet	Tinghir	Central
Ait Sedrate JbelEL Soufla	أيت سدرات الجبل السفلى	08.577.05.07.	330	Drâa-Tafilalet	Tinghir	Central
Ait Taguella	أيت تكلا	05.081.05.01.	136	Béni Mellal-Khénifra	Azilal	Central
Ait Tamlil	أيت تمليل	05.081.13.07.	627	Béni Mellal-Khénifra	Azilal	Central
Ait Yahya	أيت يحيى	08.363.15.01.	251	Drâa-Tafilalet	Midelt	Eastern
Ait Zineb	أيت زينب	08.401.03.01.	530	Drâa-Tafilalet	Ouarzazate	Central
Amellagou	املاكو	08.201.13.02.	596	Drâa-Tafilalet	Errachidia	Eastern
Amersid	امرصيد	08.363.07.11.	819	Drâa-Tafilalet	Midelt	Eastern
Amerzgane	امرزكان	08.401.03.03.	567	Drâa-Tafilalet	Ouarzazate	Central
Amghras	امغراس	07.041.05.01.	75	Marrakech-Safi	Al Haouz	Central
Amizmiz	أمزميز	07.041.01.03.	43	Marrakech-Safi	Al Haouz	Central
Amouguer	اموكر	08.363.15.03.	440	Drâa-Tafilalet	Midelt	Eastern
Amskroud	امسكروض	09.001.05.01.	201	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Anemzi	انمزي	08.363.05.13.	372	Drâa-Tafilalet	Midelt	Eastern
Anergui	انركي	05.081.09.09.	274	Béni Mellal-Khénifra	Azilal	Central
Anougal	انوكال	07.041.05.05.	93	Marrakech-Safi	Al Haouz	Central
Anzou	انزو	05.081.13.09.	142	Béni Mellal-Khénifra	Azilal	Central
Aourir	أورير	09.001.07.03.	100	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Aqesri	اقصري	09.001.07.05.	186	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Argana	اركانة	09.541.05.03.	295	Souss-Massa	Taroudannt	Western
Asni	أسني	07.041.07.03.	269	Marrakech-Safi	Al Haouz	Central
Assais	اسايس	07.211.05.09.	272	Marrakech-Safi	Essaouira	Western
Assif El Mal	اسيف المال	07.161.07.03.	105	Marrakech-Safi	Chichaoua	Western
Assoul	اسول	08.577.03.05.	894	Drâa-Tafilalet	Tinghir	Eastern
Azgour	ازكور	07.041.05.07.	190	Marrakech-Safi	Al Haouz	Central
Aziar	ازيار	09.001.07.07.	141	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Azilal	أزيلال	05.081.01.01.	12	Béni Mellal-Khénifra	Azilal	Central
Bigoudine	بيكودين	09.541.05.07.	231	Souss-Massa	Taroudannt	Western
Bin El Ouidane	بين الويدان	05.081.09.11.	136	Béni Mellal-Khénifra	Azilal	Central
Bizdad	بيز ضاض	07.211.05.11.	120	Marrakech-Safi	Essaouira	Western
Bni Ayat	بني عياط	05.081.11.03.	148	Béni Mellal-Khénifra	Azilal	Central
Bni Hassane	بني حسن	05.081.05.05.	141	Béni Mellal-Khénifra	Azilal	Central
Bni Tadjite	بني تادجيت	02.251.03.03.	3146	Oriental	Figuig	Eastern

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Bou Azmou	بوازمو	08.363.15.05.	668	Drâa-Tafilalet	Midelt	Eastern
Bouabout	بوعبوط	07.161.09.01.	168	Marrakech-Safi	Chichaoua	Western
Bouabout Amdlane	بوعبوط امدلان	07.161.09.03.	105	Marrakech-Safi	Chichaoua	Western
Bouanane	بوعنان	02.251.03.05.	2809	Oriental	Figuig	Eastern
Bouchaouene	بوشاوون	02.251.03.07.	3544	Oriental	Figuig	Eastern
Boudnib	بوذنيب	08.201.01.03.	5	Drâa-Tafilalet	Errachidia	Eastern
Boumerieme	بو مريم	02.251.03.09.	1819	Oriental	Figuig	Eastern
Boutferda	بوتفردة	05.091.05.05.	633	Béni Mellal-Khénifra	Béni Mellal	Eastern
Bouzemmour	بوزمور	07.211.05.13.	193	Marrakech-Safi	Essaouira	Western
Bzou	بزو	05.081.05.07.	238	Béni Mellal-Khénifra	Azilal	Central
Dar Jamaa	دار جمعة	07.041.05.09.	92	Marrakech-Safi	Al Haouz	Central
Demnate	دمنات	05.081.01.03.	9	Béni Mellal-Khénifra	Azilal	Central
Dir El Ksiba	دير القصيبة	05.091.07.07.	287	Béni Mellal-Khénifra	Béni Mellal	Eastern
Douirane	ادويران	07.161.07.05.	169	Marrakech-Safi	Chichaoua	Western
Drargua	الدراركة	09.001.05.09.	210	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Eddir	الدير	09.541.05.09.	138	Souss-Massa	Taroudannt	Western
El Kbab	القباب	05.301.03.05.	279	Béni Mellal-Khénifra	Khénifra	Eastern
El Ksiba	القصيبة	05.091.01.03.	6	Béni Mellal-Khénifra	Béni Mellal	Eastern
En-nzala	النزالة	08.363.09.01.	942	Drâa-Tafilalet	Midelt	Eastern
Er-rich	الريش	08.363.01.07.	6	Drâa-Tafilalet	Midelt	Eastern
Ezzaouite	الزاويت	07.211.05.15.	75	Marrakech-Safi	Essaouira	Western
Foum El Anceur	فم العنصر	05.091.03.11.	183	Béni Mellal-Khénifra	Béni Mellal	Central
Foum Jemaa	فم الجمعة	05.081.05.09.	94	Béni Mellal-Khénifra	Azilal	Central
Foum Oudi	فم اودي	05.091.03.01.	91	Béni Mellal-Khénifra	Béni Mellal	Central
Ghassate	غسات	08.401.07.01.	1000	Drâa-Tafilalet	Ouarzazate	Central
Gheris El Ouloui	اغريس العلوي	08.201.13.07.	250	Drâa-Tafilalet	Errachidia	Eastern
Ghmate	اغمات	07.041.03.11.	119	Marrakech-Safi	Al Haouz	Central
Gourrama	كرامة	08.363.09.03.	771	Drâa-Tafilalet	Midelt	Eastern
Guers Tiaallaline	غرس تعلالين	08.363.09.05.	745	Drâa-Tafilalet	Midelt	Eastern
Guir	كير	08.363.09.07.	830	Drâa-Tafilalet	Midelt	Eastern
Ichamraren	اشمرارن	07.161.09.05.	128	Marrakech-Safi	Chichaoua	Western
Ida Ou Aazza	ايذا وعزا	07.211.05.17.	83	Marrakech-Safi	Essaouira	Western
Ida Ou Gailal	ادا وكيلال	09.541.04.17.	185	Souss-Massa	Taroudannt	Western
Ida Ou Guelloul	ايدا اوكلول	07.211.05.19.	90	Marrakech-Safi	Essaouira	Western
Ida Ou Kazzou	ايدا وكازو	07.211.05.21.	233	Marrakech-Safi	Essaouira	Western
Ida Ou Moumen	إد او مومن	09.541.09.19.	113	Souss-Massa	Taroudannt	Western
Ida Ougoummad	ادا وكماض	09.541.04.21.	102	Souss-Massa	Taroudannt	Western
Idmine	اضمين	09.001.05.11.	172	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Ighil	اغيل	07.041.07.05.	166	Marrakech-Safi	Al Haouz	Central
Ighil N'Oumgoun	اغيل نومكون	08.577.05.15.	880	Drâa-Tafilalet	Tinghir	Central
Ighrem N'Ougdal	اغرم نوكدال	08.401.03.07.	468	Drâa-Tafilalet	Ouarzazate	Central

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Igli	اكلي	09.541.04.23.	89	Souss-Massa	Taroudannt	Western
Igoudar Mnabha	إيكودار منابهة	09.541.04.25.	124	Souss-Massa	Taroudannt	Western
Iguerferouane	اكرفروان	07.041.03.13.	86	Marrakech-Safi	Al Haouz	Central
Iguidi	ايكيدي	09.541.07.13.	347	Souss-Massa	Taroudannt	Central
Ijoukak	اجوكاك	07.041.07.07.	308	Marrakech-Safi	Al Haouz	Central
Imgdal	امكدال	07.041.07.09.	276	Marrakech-Safi	Al Haouz	Central
Imgrade	امكراد	07.211.05.23.	248	Marrakech-Safi	Essaouira	Western
Imi N'Oulaoune	امي نولاون	08.401.07.05.	600	Drâa-Tafilalet	Ouarzazate	Central
Imi N'Tlit	ايمي نتليت	07.211.05.25.	83	Marrakech-Safi	Essaouira	Western
Imider	اميضر	08.577.07.19.	355	Drâa-Tafilalet	Tinghir	Eastern
Imilchil	املشيل	08.363.15.07.	687	Drâa-Tafilalet	Midelt	Eastern
Imilmaiss	اميلمايس	09.541.05.13.	183	Souss-Massa	Taroudannt	Western
Imindounit	امندونيت	07.161.07.09.	247	Marrakech-Safi	Chichaoua	Western
Imlil	املیل	05.081.15.11.	97	Béni Mellal-Khénifra	Azilal	Central
Imoulass	ايمولاس	09.541.09.27.	136	Souss-Massa	Taroudannt	Western
Imouzzer	ايموزار	09.001.07.13.	202	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Imsouane	امسوان	09.001.07.15.	127	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Irohalen	ارحالن	07.161.05.07.	126	Marrakech-Safi	Chichaoua	Western
Isseksi	اسكسي	05.081.09.13.	75	Béni Mellal-Khénifra	Azilal	Central
Kerrouchen	كروشن	05.301.03.07.	181	Béni Mellal-Khénifra	Khénifra	Eastern
Kouzemt	كوزمت	07.161.09.07.	97	Marrakech-Safi	Chichaoua	Western
Ksabi Moulouya	القصابي ملوية	03.131.05.01.	731	Fès-Meknès	Boulemane	Eastern
Lahsinate	لحسينات	07.211.03.13.	82	Marrakech-Safi	Essaouira	Western
Lalla Aaziza	للا عزيزة	07.161.05.09.	330	Marrakech-Safi	Chichaoua	Western
Lalla Takarkoust	للا تكركوست	07.041.05.11.	95	Marrakech-Safi	Al Haouz	Central
Lamnizla	لمنيزلة	09.541.09.31.	215	Souss-Massa	Taroudannt	Western
Lkheng	الخنك	08.201.07.07.	1695	Drâa-Tafilalet	Errachidia	Eastern
Meskala	مسكالة	07.211.03.17.	80	Marrakech-Safi	Essaouira	Western
Moulay Aissa Ben Driss	مولاي عيسى بن إدريس	05.081.05.11.	117	Béni Mellal-Khénifra	Azilal	Central
Moulay Brahim	مولاي ابراهيم	07.041.09.01.	107	Marrakech-Safi	Al Haouz	Central
M'Semrir	امسمرير	08.577.05.21.	255	Drâa-Tafilalet	Tinghir	Central
M'Zizel	امزيزل	08.363.09.09.	471	Drâa-Tafilalet	Midelt	Eastern
M'Zouda	امزوضة	07.161.07.13.	202	Marrakech-Safi	Chichaoua	Western
Naour	ناوور	05.091.07.11.	273	Béni Mellal-Khénifra	Béni Mellal	Eastern
Ouad L'bour	واد البور	07.161.05.13.	149	Marrakech-Safi	Chichaoua	Western
Ouaklim	واكليم	08.577.07.23.	557	Drâa-Tafilalet	Tinghir	Eastern
Ouaouizeght	واويزغت	05.081.09.15.	139	Béni Mellal-Khénifra	Azilal	Central
Ouaoula	واولى	05.081.15.13.	267	Béni Mellal-Khénifra	Azilal	Central
Ouaoumana	واو مانة	05.301.03.09.	122	Béni Mellal-Khénifra	Khénifra	Eastern
Ouazguita	وزكيطة	07.041.05.13.	101	Marrakech-Safi	Al Haouz	Central
Oued Naam	وادي النعام	08.201.07.09.	4073	Drâa-Tafilalet	Errachidia	Eastern
Ouirgane	ويركان	07.041.07.11.	155	Marrakech-Safi	Al Haouz	Central

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Ouizeght	ويزغت	03.131.05.03.	1044	Fès-Meknès	Boulemane	Eastern
Oukaimden	أوكايمدن	07.041.09.03.	53	Marrakech-Safi	Al Haouz	Central
Oulad Berhil	أولاد برحيل	09.541.01.07.	22	Souss-Massa	Taroudannt	Western
Oulad Khallouf	أولاد خلوف	07.191.05.25.	36	Marrakech-Safi	El Kelâa des Sraghna	Central
Ounagha	اوناغة	07.211.03.31.	234	Marrakech-Safi	Essaouira	Western
Ouneine	اوناين	09.541.04.35.	267	Souss-Massa	Taroudannt	Central
Ourika	أوريكة	07.041.09.05.	148	Marrakech-Safi	Al Haouz	Central
Outerbat	اوتربات	08.363.15.09.	402	Drâa-Tafilalet	Midelt	Eastern
Ouzioua	اوزيوة	09.541.07.37.	104	Souss-Massa	Taroudannt	Central
Rahhala	رحالة	07.161.09.09.	138	Marrakech-Safi	Chichaoua	Western
Rfala	ارفالة	05.081.05.13.	192	Béni Mellal-Khénifra	Azilal	Central
Sidi Aayad	سيدي عياد	08.363.09.11.	401	Drâa-Tafilalet	Midelt	Eastern
Sidi Abdellah Ou Said	سيدي عبد الله أو سعيد	09.541.04.39.	72	Souss-Massa	Taroudannt	Western
Sidi Abdelmoumen	سيدي عبد المومن	07.161.09.11.	208	Marrakech-Safi	Chichaoua	Western
Sidi Ahmed Essayeh	سيدي أحمد السايح	07.211.05.27.	99	Marrakech-Safi	Essaouira	Western
Sidi Boulkhalf	سيدي بوخالف	05.081.15.15.	171	Béni Mellal-Khénifra	Azilal	Central
Sidi El Jazouli	سيدي الجزولي	07.211.05.29.	148	Marrakech-Safi	Essaouira	Western
Sidi Ghanem	سيدي غانم	07.161.05.15.	137	Marrakech-Safi	Chichaoua	Western
Sidi Ghaneme	سيدي غانم	07.211.05.31.	82	Marrakech-Safi	Essaouira	Western
Sidi Hmad Ou Hamed	سيدي احمد أوحامد	07.211.05.35.	84	Marrakech-Safi	Essaouira	Western
Sidi H'Mad Ou M'Barek	سيدي احمد او مبارك	07.211.05.33.	93	Marrakech-Safi	Essaouira	Western
Sidi Ouaaziz	سيدي واعزيز	09.541.04.47.	152	Souss-Massa	Taroudannt	Western
Sidi Yacoub	سيدي يعقوب	05.081.13.17.	158	Béni Mellal-Khénifra	Azilal	Central
Sidi Yahya Ou Saad	سيدي يحيى أو ساعد	05.301.03.11.	190	Béni Mellal-Khénifra	Khénifra	Eastern
Sidi Yahya Ou Youssef	سيدي يحيى اويوسف	08.363.05.21.	224	Drâa-Tafilalet	Midelt	Eastern
Smimou	سميمو	07.211.05.39.	55	Marrakech-Safi	Essaouira	Western
Sour El Aaz	سور العز	07.191.05.29.	42	Marrakech-Safi	El Kelâa des Sraghna	Central
Sti Fadma	ستي فاطمة	07.041.09.07.	357	Marrakech-Safi	Al Haouz	Central
Tabant	تبانت	05.081.03.09.	510	Béni Mellal-Khénifra	Azilal	Central
Tabaroucht	تبروشت	05.081.09.17.	118	Béni Mellal-Khénifra	Azilal	Central
Tabia	تابية	05.081.05.15.	91	Béni Mellal-Khénifra	Azilal	Central
Tadighoust	تاديغوست	08.201.13.13.	1014	Drâa-Tafilalet	Errachidia	Eastern
Tadrart	تدرارت	09.001.07.21.	209	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Tafedna	تافضنا	07.211.05.41.	104	Marrakech-Safi	Essaouira	Western
Tafingoult	تافنكولت	09.541.04.49.	151	Souss-Massa	Taroudannt	Western
Tafraouten	تافراوتن	09.541.09.51.	94	Souss-Massa	Taroudannt	Western
Taghazout	تاغزوت	09.001.07.23.	111	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Taghzirt	تاكزيرت	05.091.07.13.	200	Béni Mellal-Khénifra	Béni Mellal	Central
Tagleft	تاكلفت	05.081.09.19.	375	Béni Mellal-Khénifra	Azilal	Central

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Tahannaout	تحناوت	07.041.01.09.	6	Marrakech-Safi	Al Haouz	Central
Tahelouante	تاهلوانت	07.211.05.43.	108	Marrakech-Safi	Essaouira	Western
Takoucht	تاكوشت	07.211.05.45.	133	Marrakech-Safi	Essaouira	Western
Talat N'Yaaqoub	تلات نيعقوب	07.041.07.13.	230	Marrakech-Safi	Al Haouz	Central
Talgjount	تالكجونت	09.541.04.53.	151	Souss-Massa	Taroudannt	Western
Talmakante	تالمكانت	09.541.05.31.	206	Souss-Massa	Taroudannt	Western
Talsint	تالسينت	02.251.03.11.	1739	Oriental	Figuig	Eastern
Tamaguert	تمكرت	07.041.11.17.	103	Marrakech-Safi	Al Haouz	Central
Tamaloukte	تملوكت	09.541.09.55.	163	Souss-Massa	Taroudannt	Western
Tamanar	تمنار	07.211.01.09.	65	Marrakech-Safi	Essaouira	Western
Tamda Noumercid	تامدا نومرسيد	05.081.03.11.	180	Béni Mellal-Khénifra	Azilal	Central
Tamri	تامري	09.001.07.25.	356	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Tanant	تنانت	05.081.05.17.	183	Béni Mellal-Khénifra	Azilal	Central
Tanougha	تانوغة	05.091.07.15.	96	Béni Mellal-Khénifra	Béni Mellal	Central
Taouloukoult	تاولوكلت	07.161.09.13.	164	Marrakech-Safi	Chichaoua	Western
Taounza	تاونزا	05.081.05.19.	165	Béni Mellal-Khénifra	Azilal	Central
Targante	تاركانت	07.211.05.47.	171	Marrakech-Safi	Essaouira	Western
Tazart	تزارت	07.041.11.21.	238	Marrakech-Safi	Al Haouz	Central
Telouet	تلوات	08.401.03.15.	752	Drâa-Tafilalet	Ouarzazate	Central
Tidili Fetouaka	تدلي فطواكة	05.081.13.19.	111	Béni Mellal-Khénifra	Azilal	Central
Tidili Mesfioua	تيدلي مسفيوة	07.041.03.23.	167	Marrakech-Safi	Al Haouz	Central
Tidli	تيدلي	08.401.03.17.	505	Drâa-Tafilalet	Ouarzazate	Central
Tidzi	تدزي	07.211.05.49.	109	Marrakech-Safi	Essaouira	Western
Tiffert N'Ait Hamza	تيفرت نايت حمزة	05.081.09.21.	210	Béni Mellal-Khénifra	Azilal	Central
Tifni	تفني	05.081.15.21.	254	Béni Mellal-Khénifra	Azilal	Central
Tighassaline	تيغسالين	05.301.03.13.	411	Béni Mellal-Khénifra	Khénifra	Eastern
Tighedouine	تيغدوين	07.041.11.25.	351	Marrakech-Safi	Al Haouz	Central
Tigouga	تيكوكة	09.541.04.59.	143	Souss-Massa	Taroudannt	Western
Tilmi	تلمي	08.577.05.29.	703	Drâa-Tafilalet	Tinghir	Eastern
Tilougguite	تيلوكيت	05.081.09.23.	470	Béni Mellal-Khénifra	Azilal	Central
Timezgadiouine	تمزكدوين	07.161.05.17.	314	Marrakech-Safi	Chichaoua	Western
Timizguida-Ouftas	تمزكدة- أوفتاس	07.211.05.51.	72	Marrakech-Safi	Essaouira	Western
Timlilt	تمليلت	07.161.09.15.	263	Marrakech-Safi	Chichaoua	Western
Timoulilt	تيموليلت	05.081.11.25.	45	Béni Mellal-Khénifra	Azilal	Central
Tiqqi	تقي	09.001.07.29.	279	Souss-Massa	Agadir-Ida -Ou-Tanane	Western
Tisqi	تسقي	05.081.05.21.	87	Béni Mellal-Khénifra	Azilal	Central
Tisrasse	تيسراس	09.541.07.65.	214	Souss-Massa	Taroudannt	Central
Tizguine	تيزكين	07.041.05.19.	73	Marrakech-Safi	Al Haouz	Central
Tizi N'Isly	تيزي نيسلي	05.091.05.17.	375	Béni Mellal-Khénifra	Béni Mellal	Eastern
Tizi N'Test	تيزي نتاست	09.541.04.67.	117	Souss-Massa	Taroudannt	Western

Name (LAT)	Name (ARAB)	National Code	Area (km2)	Region	Province/Prefec.	Subregion
Touama	التوامة	07.041.11.27.	109	Marrakech-Safi	Al Haouz	Central
Toubkal	توبقال	09.541.07.23.	326	Souss-Massa	Taroudannt	Central
Toudgha El Oulia	تودغى العليا	08.577.07.31.	161	Drâa-Tafilalet	Tinghir	Eastern
Toundoute	توندوت	08.401.07.11.	655	Drâa-Tafilalet	Ouarzazate	Central
Tounfite	تونفيت	08.363.05.27.	530	Drâa-Tafilalet	Midelt	Eastern
Zaouia Annahlia	الزاوية النحلية	07.161.07.15.	169	Marrakech-Safi	Chichaoua	Western
Zaouiat Ahansal	زاوية احنصال	05.081.03.13.	1049	Béni Mellal-Khénifra	Azilal	Central
Zaouiat Cheikh	زاوية الشيخ	05.091.01.13.	7	Béni Mellal-Khénifra	Béni Mellal	Eastern
Zaouiat Sidi Hamza	زاوية سيدي حمزة	08.363.09.13.	368	Drâa-Tafilalet	Midelt	Eastern
Zerkten	زرقطن	07.041.11.29.	403	Marrakech-Safi	Al Haouz	Central

Table 2 - List of the watercourses of the High Atlas area, ordered by their length from the longest (after OSM and Esri World Topographic Map).

Name	Lenght (km)
Oued el Abid	231.39
Oued Guir	179.12
Assif Melloul	154.58
Oued Nfiss	131.57
Oued Ziz	125.55
Oued Ait Aissa	123.15
Oued Tassaoute	118.50
Oued Moulouya	104.99
Oued Lakhdar	95.23
Oued al Hallouf	92.88
Oued Tamri	82.16
Oued Oum Er Rbia	73.55
Oued Gheris	73.24
Oued Bamat	72.29
Oued Zat	62.28
Oued Ksob	60.77
Oued Ansegmir	59.83
Oued Ghdat	58.08
Oued Derna	57.76
Oued M'Goun	56.99
Oued Rheraya	56.85
Oued Todgha	56.72
Aqqa-n-Ouanine	56.12
Oued Issen	55.62
Oued Tifnoute	54.24
Assif Ouhansal	53.69
Oued Srou	53.58
Assif Ghasaf	53.33
Oued Qadou	53.13
Oued Safsaf W	53.03
Oued Bani Muhammad	52.50
Oued Mislah	51.51
Azarhar-n-Sidi Bou Yacoub	48.66
Oued Dades	48.12
Oued Izerki	48.06
Oued Ghazouane	46.43
Assif Marghin	46.37
Assif Ouaziz	45.86
Oued-n-Igli	45.58
Oued Imassine	45.33
Oued Ourika	45.13
Oued Imi Naou Aqqa	44.92

Name	Lenght (km)
Assif Ait Mas'oud	43.56
Oued Ounila	42.60
Assif Imini	41.99
Oued Mutlili	41.95
Oued Hamza	41.66
Aqqa Zidet	41.25
Oued Taghounista	40.73
Oued Shouf Jamr	40.54
Oued Bouanfir	40.13
Assif Ouzioua	39.72
Assif Natrjit	39.69
Assif Ayt Ahmad	39.18
Assif Imdghas	38.80
Oued Tissakht	37.76
Oued Attach	37.75
Oued Asfti	37.47
Oued al Loush	36.58
Oued Taisint	36.57
Assif-n-Mejdeg	35.91
Assif Ait Tammant	35.26
Assif Tanit	34.90
Assif Natadli	34.21
Oued Taoulil	33.85
Oued Muhasar	33.71
Assif Naou Ahansal	32.97
Oued al Arar	32.94
Oued Targa	32.04
Assif Timrazki	31.46
Oued Nizalah	31.38
Assif Sarou	31.34
Oued Tangmin	31.30
Assif Idda Oumhtoud	31.28
Oued Ougar	31.01
Oued Amane-n-Ouisdrane	30.94
Oued Feija	30.65
Assif-n-Ouirine	30.64
Assif Tisiht	30.49
Iseel Iylighrar	30.43
Oued Outerbat	30.11
Assif-n-Ougheddou	30.00
Assif Lagh	29.75
Assif Na'iriri	29.38

Name	Lenght (km)
Assif Ouashir	28.95
Oued Adraka	28.80
Oued Agheddou	28.64
Assif Azart	28.43
Oued Moudir Ain al Shayr	28.36
Assif Aghouni	28.30
Oued Outat	28.23
Assif-n-Targha	28.12
Assif Taoudirsin	27.66
Oued Aoufous	27.02
Oued Aouar	26.47
Oued al Roumaylah	26.32
Assif Natjini	26.24
Oued Um al Sama	26.15
Assif Na'ursad	25.88
Oued Sebkha	25.85
Aghni Nayt Ighz	25.85
Assif Talkijount	25.76
Assif Eeghouzoul	25.60
Oued Safsaf E	25.44
Assif Tamnat	25.35
Oued Tagenza	25.29
Oued Tasfelalait	25.12
Oued Idouma	25.05
Oued Zelmou	24.86
Aqqa Natsrourt	24.68
Oued Maqris	24.27
Oued Madri	24.12
Oued El Bour	23.93
Assif Talnat	23.91
Name	**Lenght (km)**
Oued Jaffar	23.85
Assif Nisli Imoutine	23.61
Assif-n-Ait Toumert	23.59
Assif Tihaouna	23.39
Oued Na'ifradan	23.14
Assif-n-Ait Hkim	23.05
Assif Imoutene	23.05
Assif al Mal	22.99
Assif-n- Tassent	22.76
Oued Talfast	22.28
Oued Ikis	22.22

Name	Lenght (km)
Assif Oughni	22.18
Assif Ba Lakoup	21.96
Oued Laarba	21.81
Oued Ameznas	21.67
Assif Natzaki	21.58
Oued Taouma	21.50
Oued Soudour	21.49
Assif Grit	21.35
Oued Tabiyah	21.32
Aqqa Ifghildin	21.18
Oued Ibourk	21.07
Oued al Middad	21.05
Assif Ghadjou	20.99
Amane-n-Tarhefrast	20.82
Assif Ait Lahasan	20.64
Oued Agoudim	20.62
Assif-n-Tissili	20.52
Oued Tidrit	20.49
Assif Natla't	20.44
Aqqa Natrarah	20.44
Oued Amizmiz	20.31
Tankourmt	20.28
Assif Aghouzrf	20.27
Oued Muhayyarah	19.58
Oued Lahouah	19.09
Assif Imi Tazaght	19.00
Oued Sidi Muhammad Ou Yousuf	19.00
Assif Anskmir	18.61
Oued Sidi Ziane	18.56
Assif Ait al Shayib	18.29
Oued Adighioual	18.26
Assif Ou Ighrouz	18.14
Assif al Mankoub	17.99
Assif Ayt Ghayr	17.76
Aguerd Ouarim	17.62
Oued Tamraght	17.28
Ighzir Amsadmas	17.14
Oued Anoual	17.01
Assif Ou al Ma	16.97
Assif Ouani	16.91
Oued Tadoua	16.89
Aqqa Naousin	16.65
Assif Ifar	16.50
Assif-n-Oulilimt	16.36

Name	Lenght (km)
Oued Badjah al Jadid	16.25
Assif Nareedi	16.12
Assif Tazaght	16.09
Aqqa Naourjin	15.90
Assif-n-Bou Guemez	15.78
Assif Tiziki	15.73
Oued Asserssif	15.55
Asif Timirrhizna	15.53
Oued Irohalen	15.51
Assif Tizrkit	15.36
Oued Tizghi	15.16
Oued Taia	15.13
Oued Ikidass	14.58
Assif Naqdman	14.52
Assif Anoughal	14.39
Assif Ait Lakik	13.83
Assif Amasin	13.65
Assif Taroubiyah	13.58
Oued Ibn Rart	13.38
Oued Iyig	13.36
Aqqa Tiddioua	13.34
Oued Tildi	13.22
Oued Tifra	13.07
Oued OudinÃ¨s	13.07
Assif-n-Ait Mallal	12.99
Oued Assaki	12.79
Oued Tamda-n-Messaoud	12.70
Oued Souss	12.59
Assif Anatim	12.50
Assif Nazraqi	12.48
Assif Fouzarah	12.14
Assif Younskitn	12.02
Oued Taghzirbi	11.85
Assif-n-Sremt	11.76
Assif Mouhdouf	11.47
Oued Bou Ougoun	11.38
Assif Amoughr Sain	11.29
Oued-n-Tanamert	11.22
Oued Issyl	11.00
Oued Tamellaste	10.96
Oued-n-Tagoulmint	10.66
Aqqa Izourar	10.57
Taghya	10.33
Oued Amzri	9.97

Name	Lenght (km)
Oued Ouikiys	9.68
Assif alighan	9.67
Aqqa Ouiad	9.39
Assif Iriri	8.98
Oued Ibn al 'Arabi	8.72
Oued Bani Mouhammad	8.60
Assif Rbat	8.59
Assif Znag	8.41
Assif Natmjounsah	8.35
Assif-n-Tazit	8.03
Oued Izougharn	7.66
Oued Esghiouer	7.61
Oued Tamstint	7.38
Assif-n-Fedghat	7.34
Oued Shariyyat al Dhi'ab	7.21
Oued Imintanoute	6.88
Assif Taghyah	6.72
Aqqa-n-Oulzouay	6.16
Assif-n-Tasslent	5.52
Assif-n-Tighfist	5.52
Aqqa-n-Taghya	5.32
Assif Tinghir	5.00
Aqqa-n-Ait Ou Sekka	4.80
Assebqi	4.41
Aqqa-n-Tsedoune	4.41
Aqqa-n-Tiflichcha	4.31
Aqqa-n-Temkerrit	4.24
Oued Tarda	4.02
Issil-n-Iherratene	3.92
Aqqa-n-Touayya	3.15
Bou Zerga	3.09
Ibaloulen	2.84
Oued Ameskar	2.29
Assif Bou Oualghu	2.27
Assif Oumarigh	1.87
Oued Ait Maala	1.57
Assif Natafraoute	1.11
Assif Mgoune	0.98
Asseqbi	0.44
Assif Dunachale	0.05
Oued Ouzioua	0.01
Assif Ait al Mas'oud	0.01

Table 3 – List of the dams of the High Atlas area (after FAO 2021; coordinates EPSG 4326).

Name	LAT	LONG	Year	River	Basin	Height	Capacity (million m3)	Area (km^2)	Use
Abdelmoumen	30° 40' 30.0" N	009° 11' 57.84" W	1981	Issen	Souss - Massa	94	216.0	0.75	Irrigation, water supply, electricity
Ait Ouarda	32° 06' 10.08" N	006° 55' 9.84" W	1953	El Abid	Oum Er Rbia	43	4.0	0.05	Irrigation, electricity
Bin El Ouidane	32° 06' 24.12" N	006° 27' 50.04" W	1953	El Abid	Oum Er Rbia	133	1484.0	15.00	Irrigation, electricity
Dkhila	30° 34' 9.12" N	009° 17' 8.16" W	1986	Issen	Souss - Massa	32	0.7	1335.00	Irrigation, water supply
Douiss	31° 57' 20.16" N	003° 28' 40.08" W	1992	Douiss	Guir	21	0.9	0.02	Irrigation
Hassan 1°	31° 50' 44.88" N	007° 04' 41.88" W	1986	Lakhdar	Oum Er Rbia	145	273.0	6.70	Irrigation, water supply, electricity
Hassan Addakhil	31° 59' 38.04" N	004° 27' 42.12" W	1971	Ziz	Ziz	85	369.0	1.90	Irrigation, water supply, flood control
Lalla Takerkoust	31° 21' 18.0" N	008° 08' 8.88" W	1935	N'tis	Tensift	71	96.0	6.00	Irrigation, electricity
Moulay Adbderahmane	31° 21' 3.21" N	009° 34' 18.45" W	2020	Ksoub	Ksoub	72	65.0	13.00	Irrigation
Moulay Youssef	31° 38' 43.08" N	007° 15' 39.96" W	1969	Tessaout	Oum Er Rbia	100	197.0	0.50	Irrigation, electricity
Sidi Driss	31° 48' 52.92" N	006° 49' 22.08" W	1984	Lakhdar	Oum Er Rbia	42	7.0	0.11	Irrigation
Timi Noutione	31° 39' 56.88" N	007° 15' 29.16" W	1981	Tessaout	Oum Er Rbia	45	5.5	0.53	Irrigation

Table 4 – Strategic mineral sources in the High Atlas area (after Persits et al. 1997; coordinates EPSG 4326).

Name	ID	LAT	LONG	Minerals	Geologic deposit type
Aouli	MAd033	32° 25' 0.01" N	004° 30' 0.0" W	Lead, zinc, silver	Hydrothermal
Azegour	MAd012	31° 09' 18.0" N	008° 18' 21.6" W	Copper	Hydrothermal
Douar Hajar	MAd030	31° 13' 59.88" N	007° 55' 0.12" W	Lead, zinc	Hydrothermal
Imiter	MAd049	31° 21' 0.0" N	005° 50' 0.96" W	Silver	Hydrothermal
Seksaoua	MAd006	30° 53' 45.96" N	009° 12' 0.0" W	Barite	Hydrothermal
Tamazeght	MAd041	32° 36' 36.0" N	004° 31' 48.0" W	Niobium (columbium), tantalium	Alkaline granite and syenite
Tiaratine	MAd038	32° 34' 59.99" N	004° 19' 59.99" W	Manganese	Unclassified
Tiouine	MAd020	30° 55' 0.12" N	007° 15' 0.0" W	Fluorspar, barite, manganese	Hydrothermal
Tizi N'Tichka	MAd008	31° 30' 0.0" N	007° 26' 26.16" W	Barite	Hydrothermal
Tourtite	MAd002	32° 28' 58.8" N	005° 49' 58.8" W	Antimony	Hydrothermal
Zeida	MAd026	32° 45' 0.0" N	004° 49' 59.88" W	Lead, silver, barite	Hydrothermal
Zelmou	MAd004	32° 12' 0.0" N	002° 48' 0.0" W	Barite	Vein, cavity-fill, metasomatic, hydrothermal

Table 5 – Climatic stations of the High Atlas (after Bissour 2023; coordinates EPSG 4326).

ID	Name	LAT	LONG	Basin	Type
1	Agadir	30° 22' 48.0" N	009° 34' 12.0" W	Cotiers Marocains	Climatic station
2	Agouim	31° 09' 36.0" N	007° 27' 36.0" W	Souss - Draa	Rainfall station
3	Ait Ouchene	32° 13' 30.0" N	006° 10' 48.0" W	Oum Er Rbia	Rainfall station
4	Ait Segmine	31° 38' 24.0" N	006° 30' 0.0" W	Oum Er Rbia	Rainfall station
5	Ait Tamlilt	31° 25' 48.0" N	006° 53' 24.0" W	Oum Er Rbia	Rainfall station
6	Amouguer + Mzizel	32° 14' 24.0" N	004° 43' 48.0" W	Ziz	Rainfall station
7	Amsoul	30° 48' 36.0" N	009° 37' 48.0" W	Souss - Draa	Rainfall station
8	Aoulouz	30° 42' 0.0" N	008° 09' 0.0" W	Souss - Draa	Rainfall station
9	Azilal	32° 00' 0.0" N	006° 30' 0.0" W	Oum Er Rbia	Weather station
10	Barrage Hassan Eddahkal	31° 58' 48.0" N	004° 27' 36.0" W	Ziz	Rainfall station
11	Barrage Moulay Youssef	32° 06' 36.0" N	006° 27' 36.0" W	Oum Er Rbia	Rainfall station
12	Dchar El Oued	32° 40' 48.0" N	005° 55' 12.0" W	Oum Er Rbia	Rainfall station
13	Demnate	31° 42' 0.0" N	007° 00' 0.0" W	Oum Er Rbia	Weather station
14	Foum Tillicht	32° 19' 4.8" N	004° 33' 32.4" W	Ziz	Rainfall station
15	Foum Zaabel	32° 07' 12.0" N	004° 22' 12.0" W	Ziz	Rainfall station
16	Lalla Takerkoust (barrage)	31° 21' 36.0" N	008° 07' 48.0" W	Tensift	Rainfall station
17	N'Kouris	31° 00' 0.0" N	008° 10' 12.0" W	Tensift	Rainfall station
18	Ouaouirinth	32° 05' 38.25" N	007° 01' 57.02" W	Oum Er Rbia	Rainfall station
19	Sgate ou Skate	31° 49' 48.0" N	006° 40' 48.0" W	Oum Er Rbia	Rainfall station
20	Tadighoust	31° 50' 24.0" N	004° 58' 12.0" W	Ziz	Rainfall station
21	Tazouguert	32° 06' 0.0" N	003° 42' 0.0" W	Guir Dra	Rainfall station
22	Tendit	32° 37' 48.0" N	003° 36' 36.0" W	Moulouya	Rainfall station
23	Tilouguit	32° 01' 39.9" N	006° 12' 25.88" W	Oum Er Rbia	Rainfall station
24	Tizi N'Isli	32° 28' 12.0" N	005° 46' 12.0" W	Oum Er Rbia	Rainfall station
25	Zaouia Sidi Hamza	32° 25' 48.0" N	004° 43' 12.0" W	Ziz	Rainfall station
26	Zawyat Ahansal	31° 52' 15.18" N	006° 06' 29.1" W	Oum Er Rbia	Rainfall station

Table 6 – Rainfall and temperature basic statistics for the High Atlas region and the three sub-regions.

		HIGH ATLAS	WEST	CENTRAL	EAST
ANNUAL RAINFALL	**MIN**	114	194	153	114
	MAX	773	687	742	773
	MEAN	311	350	420	237
	STDEV	126	90	92	99
AVERAGE ANNUAL TEMPERATURE	**MIN**	1.2	5.1	1.2	3
	MAX	20.2	20.1	19.3	20.2
	MEAN	14.4	15.7	12.9	14.9
	STDEV	3.4	2.8	3.6	3.1

Table 7 - Table illustrating the amount of surface (in ha) of the High Atlas study area per every Koppen-Geiger climate zone at present and the difference between such values and those projected for the period 2071-2100 based on the RCP8.5.

		% DIFFERENCE PRESENT-2100			
KG CLIMATE	**PRESENT (ha)**	**HIGH ATLAS**	**WEST**	**CENTRAL**	**EAST**
Cold, dry summer, cold summer	32,783	-100	0	-100	-100
Polar, tundra	270	-100	0	-100	0
Cold, dry summer, warm summer	486,246	-91	-100	-88	-100
Temperate, dry summer, hot summer	1,637,337	-88	-92	-86	-94
Temperate, dry summer, warm summer	639,674	-81	-78	-82	-100
Arid, desert, cold	2,161,064	-74	+100	+10,938	-79
Arid, steppe, cold	1,680,519	+2	-30	+88	-32
Arid, steppe, hot	431,961	+110	-54	+712	+639
Arid, desert, hot	794,748	+439	+100	+4,922	+282

Table 8 – Land Cover classes and surface occupied in the High Atlas and in the three sub-regions.

	Surface occupied (%)			
LC Classes	HIGH ATLAS	WEST	CENTER	EAST
Bare / sparse vegetation	44	12	24	66
Grassland	38	58	49	27
Shrubland	7	19	9	2
Tree cover	6	3	11	4
Cropland	4	7	7	2
Built-up	0.2	0.6	0.2	0.1
Herbaceous wetland	0.0	0.0	0.0	0.0

Table 9 – High Atlas municipalities' demographics (after Haut-Commissariat au Plan 2023).

Municipality	Population	Strangers	Moroccans
Abadou	10,602	0	10,602
Adaghas	2,825	0	2,825
Adassil	7,454	0	7,454
Afalla Issen	8,129	0	8,129
Afourar	21,382	7	21,375
Agadir	421,844	3,426	418,418
Aghbala	12,781	1	12,780
Aghbalou N'Kerdous	10,313	0	10,313
Aghbar	5,182	0	5,182
Aghouatim	30,776	18	30,758
Aglif	8,028	0	8,028
Agoudi N'Lkhair	11,752	0	11,752
Agoudim	4,113	0	4,113
Aguerd	5,378	64	5,314
Ahl Tifnoute	5,910	1	5,909
Ain Chair	1,554	0	1,554
Ain Tazitounte	5,509	1	5,508
Ait Aadel	7,925	0	7,925
Ait Abbas	12,633	0	12,633
Ait Aissi Ihahane	4,143	0	4,143
Ait Ayach	11,946	2	11,944
Ait Blal	7,770	0	7,770
Ait Bou Oulli	11,095	0	11,095
Ait Daoud	2,957	0	2,957
Ait Faska	26,210	4	26,206
Ait Haddou Youssef	6,263	2	6,261
Ait Hani	10,587	2	10,585
Ait Hkim-Ait Yzid	8,812	0	8,812
Ait Igas	10,256	0	10,256
Ait Ishaq	19,133	0	19,133
Ait Izdeg	6,819	0	6,819
Ait Majden	17,572	1	17,571
Ait Makhlouf	4,752	6	4,746
Ait Mazigh	3,330	0	3,330
Ait M'Hamed	23,696	1	23,695
Ait Ouaarda	1,644	0	1,644
Ait Oum El Bekht	8,198	0	8,198
Ait Oumdis	15,408	0	15,408
Ait Ouqabli	3,298	0	3,298
Ait Saadelli	2,540	0	2,540
Ait Said	6,819	3	6,816
Ait Sedrate JbelEl Oulia	5,031	0	5,031
Ait Sedrate JbelEL Soufla	5,273	2	5,271
Ait Taguella	8,268	18	8,250
Ait Tamlil	19,930	0	19,930
Ait Yahya	4,560	0	4,560
Ait Zineb	10,078	29	10,049
Amellagou	4,975	0	4,975
Amersid	5,857	1	5,856
Amerzgane	8,820	1	8,819
Amghras	6,160	0	6,160
Amizmiz	14,364	15	14,349
Amouguer	4,840	0	4,840

Municipality	Population	Strangers	Moroccans
Amskroud	9,351	1	9,350
Anemzi	4,885	0	4,885
Anergui	3,570	0	3,570
Anougal	4,353	1	4,352
Anzou	15,429	0	15,429
Aourir	36,948	179	36,769
Aqesri	4,128	5	4,123
Argana	4,804	0	4,804
Asni	21,244	1	21,243
Assais	6,915	0	6,915
Assif El Mal	7,511	0	7,511
Assoul	7,165	1	7,164
Azgour	6,865	0	6,865
Aziar	2,948	0	2,948
Azilal	38,520	11	38,509
Bigoudine	5,131	0	5,131
Bin El Ouidane	5,421	7	5,414
Bizdad	7,959	0	7,959
Bni Ayat	22,900	1	22,899
Bni Hassane	12,077	0	12,077
Bni Tadjite	16,149	8	16,141
Bou Azmou	9,583	0	9,583
Bouabout	11,494	0	11,494
Bouabout Amdlane	7,541	0	7,541
Bouanane	10,035	0	10,035
Bouchaouene	13,057	1	13,056
Boudnib	11,373	5	11,368
Boumerieme	8,521	0	8,521
Boutferda	7,391	0	7,391
Bouzemmour	5,874	1	5,873
Bzou	14,072	2	14,070
Dar Jamaa	5,911	0	5,911
Demnate	29,504	12	29,492
Dir El Ksiba	22,855	1	22,854
Douirane	16,138	2	16,136
Drargua	70,793	49	70,744
Eddir	7,565	3	7,562
El Kbab	16,157	12	16,145
El Ksiba	20,001	15	19,986
En-nzala	4,390	0	4,390
Er-rich	25,992	7	25,985
Ezzaouite	6,341	0	6,341
Foum El Anceur	18,412	2	18,410
Foum Jemaa	9,873	0	9,873
Foum Oudi	12,233	4	12,229
Ghassate	8,448	0	8,448
Gheris El Ouloui	12,043	1	12,042
Ghmate	25,220	28	25,192
Gourrama	14,927	4	14,923
Guers Tiaallaline	12,927	3	12,924
Guir	4,022	0	4,022
Ichamraren	7,023	0	7,023
Ida Ou Aazza	7,923	0	7,923
Ida Ou Gailal	6,436	0	6,436

Municipality	Population	Strangers	Moroccans
Ida Ou Guelloul	5,999	0	5,999
Ida Ou Kazzou	5,182	0	5,182
Ida Ou Moumen	6,105	0	6,105
Ida Ougoummad	7,880	0	7,880
Idmine	3,179	0	3,179
Ighil	5,695	0	5,695
Ighil N'Oumgoun	22,010	0	22,010
Ighrem N'Ougdal	14,804	0	14,804
Igli	11,197	1	11,196
Igoudar Mnabha	8,767	0	8,767
Iguerferouane	11,812	1	11,811
Iguidi	9,100	0	9,100
Ijoukak	6,700	1	6,699
Imgdal	5,467	0	5,467
Imgrade	6,486	0	6,486
Imi N'Oulaoune	21,061	1	21,060
Imi N'Tlit	8,057	0	8,057
Imider	4,420	0	4,420
Imilchil	8,870	1	8,869
Imilmaiss	6,584	0	6,584
Imindounit	11,363	0	11,363
Imlil	10,435	3	10,432
Imoulass	8,388	1	8,387
Imouzzer	5,402	0	5,402
Imsouane	8,866	1	8,865
Irohalen	5,854	0	5,854
Isseksi	1,674	13	1,661
Kerrouchen	7,021	0	7,021
Kouzemt	4,103	0	4,103
Ksabi Moulouya	10,614	0	10,614
Lahsinate	5,315	0	5,315
Lalla Aaziza	8,448	0	8,448
Lalla Takarkoust	7,311	18	7,293
Lamnizla	4,224	0	4,224
Lkheng	14,177	0	14,177
Meskala	4,330	0	4,330
Moulay Aissa Ben Driss	13,797	0	13,797
Moulay Brahim	11,813	0	11,813
M'Semrir	8,866	0	8,866
M'Zizel	7,388	8	7,380
M'Zouda	23,148	1	23,147
Naour	5,999	0	5,999
Ouad L'bour	5,944	0	5,944
Ouaklim	11,338	0	11,338
Ouaouizeght	14,570	7	14,563
Ouaoula	24,790	0	24,790
Ouaoumana	8,849	0	8,849
Ouazguita	5,440	1	5,439
Oued Naam	5,340	0	5,340
Ouirgane	7,727	8	7,719
Ouizeght	5,743	0	5,743
Oukaimden	4,861	4	4,857

Municipality	Population	Strangers	Moroccans
Oulad Berhil	24,288	3	24,285
Oulad Khallouf	8,605	1	8,604
Ounagha	12,461	71	12,390
Ouneine	7,866	2	7,864
Ourika	37,316	26	37,290
Outerbat	6,819	0	6,819
Ouzioua	7,692	0	7,692
Rahhala	5,691	0	5,691
Rfala	9,749	2	9,747
Sidi Aayad	8,629	0	8,629
Sidi Abdellah Ou Said	3,463	0	3,463
Sidi Abdelmoumen	9,007	0	9,007
Sidi Ahmed Essayeh	6,198	1	6,197
Sidi Boulkhalf	15,625	5	15,620
Sidi El Jazouli	6,462	0	6,462
Sidi Ghanem	9,326	1	9,325
Sidi Ghaneme	4,718	0	4,718
Sidi Hmad Ou Hamed	4,034	3	4,031
Sidi H'Mad Ou M'Barek	5,482	0	5,482
Sidi Ouaaziz	8,320	0	8,320
Sidi Yacoub	17,054	0	17,054
Sidi Yahya Ou Saad	7,051	0	7,051
Sidi Yahya Ou Youssef	4,637	0	4,637
Smimou	8,026	1	8,025
Sour El Aaz	3,850	1	3,849
Sti Fadma	24,129	5	24,124
Tabant	14,963	9	14,954
Tabaroucht	3,830	0	3,830
Tabia	7,849	0	7,849
Tadighoust	6,243	4	6,239
Tadrart	4,530	0	4,530
Tafedna	5,617	0	5,617
Tafingoult	6,635	0	6,635
Tafraouten	7,999	0	7,999
Taghazout	5,260	27	5,233
Taghzirt	19,936	5	19,931
Tagleft	14,423	0	14,423
Tahannaout	12,102	12	12,090
Tahelouante	3,919	0	3,919
Takoucht	4,312	0	4,312
Talat N'Yaaqoub	7,866	1	7,865
Talgjount	5,816	0	5,816
Talmakante	4,004	0	4,004
Talsint	16,166	3	16,163
Tamaguert	10,540	0	10,540
Tamaloukte	4,739	1	4,738
Tamanar	10,584	0	10,584
Tamda Noumercid	11,922	0	11,922
Tamri	18,577	20	18,557
Tanant	10,706	1	10,705
Tanougha	12,783	2	12,781
Taouloukoult	10,682	0	10,682

Municipality	Population	Strangers	Moroccans
Taounza	11,488	2	11,486
Targante	7,605	0	7,605
Tazart	15,243	0	15,243
Telouet	14,060	0	14,060
Tidili Fetouaka	12,759	0	12,759
Tidili Mesfioua	21,706	2	21,704
Tidli	15,285	0	15,285
Tidzi	4,057	5	4,052
Tiffert N'Ait Hamza	3,499	0	3,499
Tifni	11,760	0	11,760
Tighassaline	15,204	7	15,197
Tighedouine	22,971	0	22,971
Tigouga	4,553	0	4,553
Tilmi	11,372	0	11,372
Tilougguite	10,544	0	10,544
Timezgadiou ine	7,825	0	7,825
Timizguida-Ouftas	5,189	0	5,189
Timlilt	7,078	0	7,078
Timoulilt	6,616	3	6,613
Tiqqi	8,773	0	8,773
Tisqi	6,147	1	6,146
Tisrasse	7,656	0	7,656
Tizguine	4,899	1	4,898
Tizi N'Isly	11,918	6	11,912
Tizi N'Test	5,182	0	5,182
Touama	11,243	16	11,227
Toubkal	8,489	0	8,489
Toudgha El Oulia	5,476	8	5,468
Toundoute	10,606	0	10,606
Tounfite	13,297	0	13,297
Zaouia Annahlia	10,757	0	10,757
Zaouiat Ahansal	10,657	0	10,657
Zaouiat Cheikh	25,388	5	25,383
Zaouiat Sidi Hamza	5,454	0	5,454
Zerkten	19,926	1	19,925

Table 10 – List of tribes of the High Atlas (after Haut-Commissariat au Plan 2023).

Name	Map
Ahl Missour	69
Ait Abbas	33
Ait Atta	41
Ait Bou Iknifen	52
Ait Bougmez	36
Ait Bouzide	16
Ait Iggas	40
Ait Messate/Ait	17
Ait Roboa	14
Ait Sedrate	42
Ait Seghrouchen	56
Ait Seri	46
Ait Yafalmane	24
Ait yahya	21
Anetifa	48
Beni Mguild	23
Beni Moussa	15
Beni Zemmour	53
Beni Guil	70
Chiadma	28
Chorfa de Kasabi	55
Demsira	13
Eddaouitanae	6
El Arabe	73
Erguita	51

Name	Map
Frouga	61
Ftouaka	2
Glaoua	3
Goundafa	31
Guich	38
Haha	7
Haouiara	50
Ichkern	22
Ida Oumahmoud	39
Ida Ouzal	49
Ihane Salen	62
Imerhrane	35
Indaouzal	63
Irghin	72
Iziki	9
Kdamoute	10
Ksima	19
Lamnabha	43
Mesfioua	5
Mesguina	18
Mgouna	54
M'Touga	8
Mzouda	11
Nfifa	32
Ogdemt	25

Name	Map
Ouaouzguite	29
Ouled Ben Sbâa	68
Ouled El Haj	71
Ouled Khaoua	57
Ouled Mtaa	58
Ouled Yahya	44
Oultana	34
Ounein	66
Ourika	60
Ouzguita	59
Ouzioua	67
Rahhala	65
Rhamna	37
Rhirhaya	30
Rhoujdama	4
Saksawa	12
Samgue	26
Sektana	64
Soukhmane	20
Sraghna	47
Tougana	1
Zayane	45
Zdarat	27
Zemrane	74

Table 11 – Percent of speakers of different languages per municipality (after Haut-Commissariat au Plan 2023).

Municipality/Language (%)	Darija	Tachelhit	Tamazight	Tarifit	Hassania
Abadou	55.4	96.5	0.1	0	0
Adaghas	22	97.5	0	0.6	0
Adassil	41.4	99.7	0	0	0
Afalla Issen	16	99.8	0	0	0
Afourar	88.9	3.7	77.1	0.1	0
Agadir	90.5	53.7	1.4	0.4	1
Aghbala	31.1	1.2	97.1	0	0
Aghbalou N'Kerdous	31.5	0.2	99.1	0	0
Aghbar	25	99.7	0.1	0	0
Aghouatim	84.3	82.1	0.2	0	0
Aglif	26.7	98.8	0	0	0
Agoudi N'Lkhair	45.8	2.9	96.7	0	0
Agoudim	32.1	0.2	99.5	0	0
Aguerd	40.7	95.6	0.2	0	0.1
Ahl Tifnoute	24.4	99.2	0.3	0	0
Ain Chair	99.3	0.4	48.6	0.3	0
Ain Tazitounte	23.1	99.3	0	0.1	0
Ait Aadel	42.3	99	0.1	0	0
Ait Abbas	24.8	27.2	73.3	0	0
Ait Aissi Ihahane	29.4	99.3	0	0	0
Ait Ayach	60.1	1.7	95.7	0	0.1
Ait Blal	29.9	99.6	0	0	0
Ait Bou Oulli	18	60	38.8	0.1	0
Ait Daoud	61.6	96.9	0.4	0	0
Ait Faska	50.6	93.1	0.1	0	0
Ait Haddou Youssef	24.9	99.3	0.1	0	0
Ait Hani	25.2	0.5	99.2	0	0.1
Ait Hkim-Ait Yzid	30.1	99.7	0	0	0
Ait Igas	70	91.6	0	0	0.2
Ait Ishaq	65.1	1.9	89.3	0.1	0.1
Ait Izdeg	44.3	1.7	90.7	0	0
Ait Majden	40.5	86.5	11.4	0	0
Ait Makhlouf	63.8	68.7	0.3	0	0
Ait Mazigh	47.9	0.2	99.5	0	0
Ait M'Hamed	29.8	0.8	98.6	0	0
Ait Ouaarda	59.8	0.9	98.7	0.1	0
Ait Oum El Bekht	66.9	0.8	96.8	0	0.1
Ait Oumdis	27.7	99.2	0.3	0	0
Ait Ouqabli	9.6	0.1	99.1	0.1	0
Ait Saadelli	38.4	0.5	98.6	0	0
Ait Said	74	46	0	0	0
Ait Sedrate JbelEl Oulia	18.3	0.8	98.8	0	0
Ait Sedrate JbelEL Soufla	34.4	22.9	77.9	0	0
Ait Taguella	41.5	9.9	88	0	0
Ait Tamlil	29.1	99.5	0.1	0	0
Ait Yahya	23.6	0	99.1	0	0
Ait Zineb	54.6	97.8	0.3	0	0.1
Amellagou	35.2	0.5	99.2	0	0
Amersid	78.7	25.6	38.9	0	0.2
Amerzgane	56.6	98.4	0.5	0	0
Amghras	40.8	99	0	0	0
Amizmiz	75.4	86.5	0.2	0	0.2
Amouguer	26.7	0.1	99.4	0	0
Amskroud	52.1	98.9	0.1	0	0
Anemzi	21.5	12.8	86.5	0.1	0
Anergui	8.5	0	99.6	0	0
Anougal	31.2	99.5	0.1	0	0
Anzou	80.7	83.1	9.2	0	0
Aourir	69.4	86.4	0.4	0.2	0.1
Aqesri	43.1	98.6	0.4	0	0

Municipality/Language (%)	Darija	Tachelhit	Tamazight	Tarifit	Hassania
Argana	31.3	99.2	0	0	0.1
Asni	55.5	96.9	0.1	0	1.2
Assais	21.2	99.7	0	0	0
Assif El Mal	70.8	98.6	0.2	0	0
Assoul	49.1	0.5	98.2	0	0
Azgour	42.2	99.2	0.1	0.1	0
Aziar	23.9	99.1	0	0	0
Azilal	79	11	75.8	0.1	0
Bigoudine	33.3	99	0	0	0
Bin El Ouidane	55.8	0.4	97.3	0.1	0
Bizdad	41.3	98.6	0.3	0	0
Bni Ayat	66.6	0.5	69.3	0	0.1
Bni Hassane	60.8	1.2	89.6	0	0
Bni Tadjite	77.4	0.4	72.8	0.3	0
Bou Azmou	26.5	0.9	99.5	0.1	0
Bouabout	50	99	0	0	0
Bouabout Amdlane	23.7	99.4	0	0	0
Bouanane	99.3	1.6	5.5	0.1	0
Bouchaouene	30.5	0.4	90.9	0.2	0.1
Boudnib	99.1	3.5	28	0.1	0.1
Boumerieme	21.9	0.2	98.9	0.1	0.1
Boutferda	7.1	0.3	99.2	0	0
Bouzemmour	23.4	99.2	0.1	0	0
Bzou	95	1.5	55.5	0.1	0.1
Dar Jamaa	43.2	99.6	0	0	0
Demnate	80.3	88.2	0.7	0.1	0
Dir El Ksiba	71	1	82	0.1	0
Douirane	49	98.9	0.1	0	0
Drargua	62.7	79.5	1.1	0.1	0.8
Eddir	51.7	93.3	0.1	0	0
El Kbab	67.9	1.1	80.4	0.1	0.1
El Ksiba	88.1	0.7	82.9	0.1	0.1
En-nzala	46.6	0	99.6	0	0
Er-rich	92.3	3	73.2	0.1	0.1
Ezzaouite	37.9	99.1	0.1	0	0
Foum El Anceur	81.9	6.7	59.3	0	0
Foum Jemaa	99	1	22.2	0	0
Foum Oudi	89.3	2.5	77.3	0.1	0.1
Ghassate	22.4	95.8	0.2	0	0
Gheris El Ouloui	62.8	0.2	98.2	0.1	0
Ghmate	54.4	96	0.1	0	0
Gourrama	49.8	1.4	91.9	0.1	0
Guers Tiaallaline	63.1	0.1	91.7	0.1	0
Guir	48.6	0.1	96.7	0	0
Ichamraren	38	99.3	0.1	0	0
Ida Ou Aazza	30.2	99.7	0.2	0	0
Ida Ou Gailal	35.2	97.7	0.1	0	0
Ida Ou Guelloul	14.1	99.4	0.1	0	0
Ida Ou Kazzou	9.5	98.8	0	0	0
Ida Ou Moumen	82.3	48.3	0.2	0	0
Ida Ougoummad	36.1	99.3	0.3	0	0
Idmine	27.7	99.6	0.1	0	0
Ighil	41.6	99.8	0	0	0
Ighil N'Oumgoun	11.8	0.2	98.5	0	0.1
Ighrem N'Ougdal	59.3	98.9	0.1	0	0
Igli	93.7	28.8	0.1	0	0
Igoudar Mnabha	93.2	25.2	0.2	0	0.4
Iguerferouane	19.2	99.8	0	0	0
Iguidi	33.6	99.3	0.3	0	0
Ijoukak	33.5	99.4	0	0	0
Imgdal	27.5	99.6	0	0	0
Imgrade	28.2	99.6	0.1	0	0

Municipality/Language (%)	Darija	Tachelhit	Tamazight	Tarifit	Hassania
Imi N'Oulaoune	31.3	99.2	0.2	0	0
Imi N'Tlit	32.9	99.5	0	0	0
Imider	27.1	1.3	97.9	0	0.1
Imilchil	17	0.4	98.5	0.1	0
Imilmaiss	16.9	99.5	0	0	0
Imindounit	26.1	99.3	0	0	0
Imlil	91.6	95.3	0.4	0	0
Imoulass	18.2	99.7	0	0	0
Imouzzer	16.5	98.8	0.4	0	0
Imsouane	28.6	99.5	0	0	0
Irohalen	13.4	99.6	0	0	0
Isseksi	24.8	0.6	98.4	0	0
Kerrouchen	63.9	0.3	94.8	0	0
Kouzemt	14.7	99.2	0	0	0
Ksabi Moulouya	97.4	0.2	21.9	0	0
Lahsinate	99.9	1	0	0	0
Lalla Aaziza	27.9	99.7	0	0	0
Lalla Takarkoust	93.7	76.3	0.1	0.2	0
Lamnizla	28	98.8	0.1	0.1	0
Lkheng	91	0.2	48.7	0.1	0
Meskala	97.5	48.8	0.3	0.1	0
Moulay Aissa Ben Driss	76.1	0.5	85.2	0	0
Moulay Brahim	62.4	97.6	0	0	0
M'Semrir	5.9	0.4	98	0	0.1
M'Zizel	49.9	0.2	98.5	0	0
M'Zouda	58.4	99	0	0	0
Naour	24	0	99.6	0	0.1
Ouad L'bour	56.5	99.5	0	0	0
Ouaklim	15	0.5	99.2	0.1	0.1
Ouaouizeght	63.6	0.8	92.8	0	0
Ouaoula	31.8	65.9	33.5	0	0
Ouaoumana	55	0.5	97.1	0.1	0
Ouazguita	31.1	99.5	0	0	0
Oued Naam	83.4	13.5	38.2	0	0.1
Ouirgane	29.2	98.1	0	0.1	0
Ouizeght	94.3	0.2	27.8	0.1	0
Oukaimden	30	99.3	0.1	0	0
Oulad Berhil	83.4	61.3	0.7	0	0.3
Oulad Khallouf	99.3	2.5	0	0	0
Ounagha	91.2	30.9	0.1	0	0
Ouneine	23.8	99.4	0.1	0	0
Ourika	66.5	94.8	0.3	0	0
Outerbat	25.9	0.3	99.4	0	0
Ouzioua	31.5	98.3	0.2	0	0
Rahhala	53.3	98.7	0	0	0
Rfala	98.1	0.5	43.6	0	0
Sidi Aayad	64.7	0.3	96.4	0	0
Sidi Abdellah Ou Said	35.4	99.4	0.1	0	0
Sidi Abdelmoumen	52.7	99.6	0	0	0
Sidi Ahmed Essayeh	33.3	99.1	0	0	0
Sidi Boulkhalf	13.2	99.3	0.2	0	0
Sidi El Jazouli	37.6	99.7	0	0	0
Sidi Ghanem	40.7	99.3	0.2	0	0
Sidi Ghaneme	48.2	98.8	0	0	0
Sidi Hmad Ou Hamed	37.3	98.9	0.2	0	0
Sidi H'Mad Ou M'Barek	26.3	99	0.1	0	0
Sidi Ouaaziz	31.9	96	0	0	0
Sidi Yacoub	49.3	99.4	0.3	0	0
Sidi Yahya Ou Saad	49	0.1	98.9	0	0
Sidi Yahya Ou Youssef	29	0	99.5	0	0
Smimou	56.7	95.6	0.3	0.2	0
Sour El Aaz	99.2	4.1	0	0	0

Municipality/Language (%)	Darija	Tachelhit	Tamazight	Tarifit	Hassania
Sti Fadma	31.8	98.2	0.7	0	0
Tabant	29.6	4.7	98.5	0.1	0
Tabaroucht	21.6	0	99.6	0	0
Tabia	67	0.1	99.4	0.1	0
Tadighoust	40.6	1	98.3	0	0
Tadrart	14.4	99.8	0	0	0
Tafedna	37.7	99.6	0	0	0
Tafingoult	27	98.7	1.1	0	0
Tafraouten	36.4	98.4	0	0	0
Taghazout	41.3	97.4	0.1	0	0.2
Taghzirt	87.3	3.6	75.3	0	0
Tagleft	28.4	0.1	98.7	0.1	0
Tahannaout	90.3	60.1	1.5	0.1	0.2
Tahelouante	19.1	99.9	0	0	0
Takoucht	21	98.7	0	0	0
Talat N'Yaaqoub	36.9	98	0	0	0.1
Talgjount	39.4	99.4	0	0	0
Talmakante	10.8	98.9	0	0	0
Talsint	66.6	9.2	77.6	0.1	0
Tamaguert	44.5	94.4	0.1	0	0
Tamaloukte	52.6	98.9	0.2	0	0
Tamanar	48.1	95.8	0.2	0.1	0
Tamda Noumercid	23.6	0.2	99.7	0	0.1
Tamri	29	98.4	0.3	0	0
Tanant	70.2	25.4	59.4	0	0
Tanougha	67	9.9	84.5	0	0
Taouloukoult	40.7	98.9	0	0.1	0
Taounza	44.7	0.5	99	0	0
Targante	24.8	99.8	0	0	0
Tazart	28.3	98.4	0.2	0	0
Telouet	37.8	99	0.1	0	0.1
Tidili Fetouaka	64.9	94.3	0.1	0	0
Tidili Mesfioua	37.1	99.5	0	0	0
Tidli	40.9	95.1	4.6	0	0
Tidzi	79.4	99.1	0	0	0
Tiffert N'Ait Hamza	30.6	0.1	99.2	0	0
Tifni	48.3	99.8	0	0	0
Tighassaline	64.4	0.2	94.2	0	0
Tighedouine	35.8	99.2	0.1	0	0
Tigouga	28	99.6	0	0	0
Tilmi	9.4	0.4	99.3	0	0
Tilougguite	42.8	2	97.2	0	0
Timezgadiouine	15.1	99.2	0.1	0	0.1
Timizguida-Ouftas	56.5	99.4	0.3	0	0.1
Timlilt	18.5	99.5	0	0	0
Timoulilt	74.2	0.3	95.3	0.1	0
Tiqqi	24	99.4	0.1	0	0
Tisqi	82.4	0.8	46.7	0	0.1
Tisrasse	21.8	99.6	0	0	0
Tizguine	56.6	98.1	0	0	0
Tizi N'Isly	36.6	0.2	98.9	0.1	0
Tizi N'Test	29.6	99.8	0.1	0	0
Touama	49.5	98.9	0	0	0
Toubkal	24	99.5	0.1	0	0
Toudgha El Oulia	46.9	0.5	98.7	0.1	0.1
Toundoute	35.5	98.6	0.2	0	0
Tounfite	47.6	0.2	98.3	0	0
Zaouia Annahlia	47.6	99.4	0	0	0
Zaouiat Ahansal	16.5	8.9	90.6	0	0
Zaouiat Cheikh	95.8	1.5	55	0.1	0.1
Zaouiat Sidi Hamza	34.8	1.1	98.2	0	0
Zerkten	33	99.4	0	0	0

Table 12 – Main Education indicators in the municipalities of the High Atlas area (AR - Arabic, FR - French, EN – English; M – Male, F – Female).

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Abadou	95.23	44.24	57.88	37.03	4.60	0.49	95.08	30.50	95.38	59.67
Adaghas	78.66	63.03	62.47	25.81	1.37	10.35	82.44	49.91	75.00	75.54
Adassil	88.04	62.62	49.06	48.59	1.03	1.32	89.37	54.12	86.67	70.70
Afalla Issen	93.75	60.62	57.49	40.75	1.15	0.61	94.57	50.56	92.91	69.66
Afourar	98.30	27.57	25.59	49.43	21.03	3.95	98.83	15.88	97.75	37.69
Agadir	98.78	17.86	20.97	41.77	28.12	9.14	98.80	10.08	98.75	25.71
Aghbala	87.74	51.40	29.47	34.06	8.49	27.99	88.87	40.55	86.62	61.60
Aghbalou N'Kerdous	95.16	40.15	50.58	40.30	6.39	2.73	96.25	25.86	94.03	54.45
Aghbar	94.72	54.99	73.15	14.52	0.41	11.91	95.28	39.96	94.20	68.90
Aghouatim	94.02	44.00	50.36	42.29	6.62	0.72	95.14	32.29	92.82	56.66
Aglif	88.47	60.84	56.47	37.48	4.97	1.09	92.43	46.07	84.32	73.07
Agoudi N'Lkhair	93.80	52.86	40.32	53.04	5.08	1.56	95.02	40.68	92.52	65.77
Agoudim	94.63	60.63	8.07	2.72	2.17	87.03	94.54	53.38	94.72	68.70
Aguerd	87.79	54.45	54.72	37.16	3.37	4.74	94.21	41.51	81.19	67.91
Ahl Tifnoute	92.86	54.23	27.80	27.17	2.32	42.71	94.18	39.82	91.71	65.75
Ain Chair	82.58	43.58	46.59	40.78	11.76	0.87	83.58	33.80	81.82	52.06
Ain Tazitounte	89.47	56.30	36.13	56.53	6.53	0.80	92.39	43.98	86.05	68.53
Ait Aadel	94.54	51.29	58.68	38.44	2.64	0.24	95.47	38.39	93.42	66.02
Ait Abbas	80.52	65.70	54.22	40.67	2.40	2.70	81.79	56.79	79.16	75.10
Ait Aissi Ihahane	92.75	58.40	66.83	18.22	1.00	13.95	94.70	42.35	90.77	72.07
Ait Ayach	95.71	44.03	50.74	24.58	4.47	20.21	96.01	30.77	95.41	57.33
Ait Blal	82.15	59.39	58.49	38.03	2.72	0.76	84.77	46.61	79.19	73.05
Ait Bou Oulli	89.00	57.95	57.06	38.32	3.68	0.95	91.36	47.42	86.68	68.20
Ait Daoud	96.66	37.82	41.16	42.14	13.95	2.75	96.13	19.57	97.19	55.40
Ait Faska	96.27	41.59	39.19	49.36	10.77	0.67	97.16	28.63	95.33	55.18
Ait Haddou Youssef	92.93	56.39	70.40	28.07	0.51	1.03	92.24	47.88	93.55	64.56
Ait Hani	81.70	55.98	32.79	53.45	10.55	3.21	85.34	43.71	78.01	68.44
Ait Hkim-Ait Yzid	90.17	54.52	59.77	38.26	1.56	0.41	91.16	41.21	89.22	68.77
Ait Igas	95.89	44.16	33.89	36.24	7.80	22.08	96.44	31.94	95.29	56.41
Ait Ishaq	93.86	46.89	22.36	40.44	14.18	23.02	94.24	37.16	93.45	55.88
Ait Izdeg	87.88	44.12	32.48	33.62	5.97	27.92	89.84	30.60	85.87	57.07
Ait Majden	91.61	51.14	56.25	37.86	5.11	0.78	94.39	36.96	88.59	65.95

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Ait Makhlouf	95.32	52.02	44.14	47.74	5.32	2.80	96.14	41.66	94.30	61.68
Ait Mazigh	87.17	53.78	21.80	71.76	6.10	0.33	93.98	38.76	79.70	69.39
Ait M'Hamed	83.45	60.23	54.58	38.26	5.64	1.53	87.27	49.39	79.46	71.94
Ait Ouaarda	91.76	47.75	33.04	55.12	9.36	2.49	92.59	31.97	91.09	62.57
Ait Oum El Bekht	92.06	61.07	34.89	53.17	11.26	0.69	93.09	51.26	90.96	71.57
Ait Oumdis	90.91	62.22	56.85	41.01	1.30	0.84	91.91	51.82	89.91	72.26
Ait Ouqabli	89.95	56.89	40.98	38.05	12.75	8.22	90.87	45.55	89.00	67.79
Ait Saadelli	87.59	56.22	18.94	53.38	11.41	16.28	88.72	44.56	86.52	67.92
Ait Said	92.01	56.96	62.53	33.25	3.31	0.91	94.33	45.84	89.51	68.54
Ait Sedrate JbelEl Oulia	91.55	42.11	13.60	7.67	1.43	77.31	93.92	26.73	89.42	56.59
Ait Sedrate JbelEL Soufla	91.85	41.43	32.06	38.84	4.73	24.37	92.90	26.22	90.50	56.70
Ait Taguella	95.88	46.30	39.83	45.78	12.89	1.51	95.93	31.90	95.83	60.88
Ait Tamlil	87.55	58.15	57.91	38.75	2.28	1.07	91.03	44.81	84.32	71.72
Ait Yahya	93.37	54.39	41.45	52.13	5.44	0.99	95.50	40.59	91.08	70.79
Ait Zineb	97.04	34.59	34.84	49.68	12.66	2.82	96.65	19.62	97.45	47.21
Amellagou	97.23	43.09	26.79	36.70	8.26	28.25	97.26	26.64	97.19	59.19
Amersid	92.61	45.16	39.37	51.95	6.61	2.07	95.20	33.33	90.12	57.10
Amerzgane	97.62	39.48	45.32	42.13	10.48	2.06	98.67	25.73	96.53	50.96
Amghras	93.78	53.67	62.25	34.82	2.03	0.90	94.92	40.88	92.72	66.49
Amizmiz	98.59	29.25	30.00	49.65	18.86	1.49	98.63	17.79	98.56	40.36
Amouguer	91.78	52.47	40.29	50.49	8.29	0.93	92.69	37.48	90.91	69.16
Amskroud	95.37	45.60	36.83	53.21	8.12	1.85	96.56	32.47	94.16	56.72
Anemzi	80.19	74.24	39.44	30.54	1.76	28.26	78.76	68.71	81.71	80.30
Anergui	70.06	68.42	63.55	30.26	4.37	1.82	78.40	56.79	60.63	80.06
Anougal	94.28	55.06	61.86	35.06	1.51	1.57	94.96	44.62	93.57	65.53
Anzou	94.52	45.04	35.15	52.65	7.60	4.59	96.29	32.19	92.55	58.75
Aourir	97.96	27.08	31.14	44.00	12.20	12.66	97.91	16.29	98.01	38.42
Aqesri	95.91	45.35	35.16	58.39	4.64	1.81	98.17	26.37	93.40	62.88
Argana	93.25	54.57	47.63	41.80	9.55	1.03	93.06	39.68	93.45	68.28
Asni	95.73	43.80	52.76	40.23	6.31	0.69	96.38	31.24	95.08	56.65
Assais	74.67	67.30	81.14	16.55	0.59	1.72	82.86	52.08	66.80	81.71
Assif El Mal	92.00	53.07	49.22	43.60	6.20	0.97	93.01	40.03	91.01	65.47
Assoul	88.56	39.90	27.30	53.68	11.85	7.17	90.05	24.46	87.09	55.22
Azgour	90.10	50.93	63.84	30.44	3.95	1.77	92.20	35.31	87.99	66.51

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Aziar	90.31	60.82	63.94	32.34	2.86	0.85	97.16	44.33	81.87	73.76
Azilal	98.25	27.35	26.56	41.61	28.63	3.20	98.42	16.33	98.07	37.82
Bigoudine	93.60	53.08	54.09	37.79	6.88	1.25	97.37	38.46	89.81	67.00
Bin El Ouidane	94.42	47.29	44.92	45.51	8.67	0.90	95.11	34.14	93.61	60.44
Bizdad	91.16	60.02	54.48	34.43	3.67	7.42	95.00	47.93	87.60	71.65
Bni Ayat	96.91	40.70	33.45	50.19	15.28	1.08	97.71	26.57	96.00	53.99
Bni Hassane	92.48	51.65	44.23	49.15	6.33	0.29	94.48	36.83	90.61	67.25
Bni Tadjite	90.25	37.18	38.92	43.77	16.02	1.29	91.86	27.39	88.63	45.67
Bou Azmou	95.82	55.71	33.09	19.91	4.45	42.55	96.44	43.76	95.23	68.99
Bouabout	91.40	61.08	54.51	40.86	3.39	1.25	93.54	50.28	89.08	71.03
Bouabout Amdlane	85.85	67.11	80.10	16.92	1.87	1.12	88.93	55.10	82.72	76.96
Bouanane	79.31	48.50	29.91	51.90	15.64	2.55	83.68	40.39	74.60	55.98
Bouchaouene	26.81	85.69	57.18	32.56	4.17	6.10	29.33	81.09	24.17	90.37
Boudnib	97.42	22.00	23.81	54.30	18.32	3.57	97.62	13.08	97.21	30.06
Boumerieme	67.17	67.32	41.81	41.47	6.45	10.27	73.72	55.91	60.18	78.57
Boutferda	69.04	68.74	39.38	36.39	3.90	20.32	72.68	59.64	65.49	78.39
Bouzemmour	84.27	61.42	67.93	29.39	1.34	1.34	90.75	45.04	77.52	76.29
Bzou	97.71	41.56	28.44	51.32	19.53	0.71	98.08	26.68	97.32	54.11
Dar Jamaa	90.56	54.42	56.75	39.44	3.02	0.79	95.09	38.74	85.53	69.72
Demnate	98.04	32.51	27.07	49.20	18.67	5.07	98.06	20.50	98.01	43.96
Dir El Ksiba	96.29	44.78	28.93	41.25	12.90	16.92	96.92	31.87	95.59	57.31
Douirane	86.03	49.76	45.91	42.11	6.33	5.64	88.30	36.45	83.50	63.10
Drargua	97.61	31.76	38.62	42.90	13.57	4.91	97.94	22.06	97.27	41.84
Eddir	93.69	55.34	53.67	39.45	5.58	1.30	95.35	45.82	91.90	64.88
El Kbab	96.42	46.52	23.13	43.04	15.65	18.18	96.51	35.66	96.34	56.90
El Ksiba	98.38	33.46	21.47	46.38	20.25	11.89	98.19	20.90	98.58	44.43
En-nzala	68.55	60.25	27.82	64.06	6.44	1.69	73.13	48.53	63.88	72.57
Er-rich	98.99	23.45	24.93	44.88	25.49	4.71	99.10	12.24	98.88	33.88
Ezzaouite	90.91	62.23	55.04	41.69	1.88	1.39	95.18	49.51	86.49	73.63
Foum El Anceur	85.23	44.75	34.91	50.09	12.35	2.65	88.45	33.47	82.27	55.58
Foum Jemaa	97.49	40.48	31.91	50.55	16.42	1.12	97.72	25.60	97.24	54.17
Foum Oudi	96.19	34.64	17.23	50.74	20.45	11.59	97.89	22.45	94.36	46.55
Ghassate	97.53	45.51	61.04	31.68	5.48	1.81	98.18	31.68	96.83	57.61
Gheris El Ouloui	97.56	28.37	28.39	33.52	15.31	22.78	97.13	15.16	98.03	39.71

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Ghmate	95.77	41.89	43.64	46.37	8.95	1.03	96.07	30.74	95.47	53.78
Gourrama	80.64	48.34	41.63	41.39	12.37	4.60	85.88	38.34	75.55	57.67
Guers Tiaallaline	92.14	43.10	36.57	43.29	13.37	6.77	93.93	30.22	90.18	55.20
Guir	88.84	48.84	45.60	45.60	8.04	0.76	91.74	37.30	86.06	58.94
Ichamraren	78.60	59.64	68.15	21.52	1.51	8.83	79.58	47.91	77.49	71.73
Ida Ou Aazza	89.69	56.36	48.26	43.95	2.02	5.77	94.67	41.11	84.36	73.03
Ida Ou Gailal	94.60	50.92	46.38	29.05	4.16	20.42	95.30	38.43	93.85	62.92
Ida Ou Guelloul	92.13	52.78	61.46	34.56	2.42	1.57	95.18	38.69	89.19	66.76
Ida Ou Kazzou	89.60	58.45	35.47	23.37	1.66	39.50	94.37	45.23	84.57	70.66
Ida Ou Moumen	93.34	48.30	65.29	30.25	3.94	0.52	94.57	36.20	92.07	59.88
Ida Ougoummad	98.35	48.01	46.79	42.63	8.99	1.59	97.77	31.73	98.88	61.47
Idmine	88.10	56.61	59.68	35.30	3.96	1.06	90.91	40.80	85.35	69.00
Ighil	95.05	49.86	52.14	41.03	1.98	4.85	95.31	36.56	94.75	62.33
Ighil N'Oumgoun	85.94	58.82	53.39	19.89	3.19	23.53	88.60	47.76	83.39	68.85
Ighrem N'Ougdal	97.88	38.88	37.84	46.88	8.98	6.30	98.21	27.00	97.52	50.05
Igli	96.48	40.06	46.52	44.29	8.31	0.88	96.58	27.73	96.37	51.94
Igoudar Mnabha	94.49	38.69	49.52	39.50	10.38	0.59	95.65	28.42	93.30	48.89
Iguerferouane	85.10	59.64	68.86	28.95	1.70	0.49	88.37	49.65	81.78	69.90
Iguidi	95.09	53.56	43.74	46.29	2.31	7.66	95.64	40.91	94.52	64.26
Ijoukak	93.04	52.48	57.23	35.47	1.45	5.84	93.36	39.16	92.73	65.29
Imgdal	91.42	58.44	71.00	26.88	1.12	1.01	93.25	50.72	89.38	66.19
Imgrade	92.65	54.95	57.05	38.80	2.72	1.43	95.92	40.37	89.44	68.59
Imi N'Oulaoune	92.06	52.52	47.89	28.36	2.52	21.23	93.57	37.49	90.48	65.33
Imi N'Tlit	92.97	57.11	46.35	16.54	1.36	35.76	96.62	42.44	89.00	70.45
Imider	96.21	29.88	29.31	49.62	12.94	8.12	96.60	19.57	95.82	39.74
Imilchil	76.07	64.61	27.08	26.75	8.71	37.45	79.14	54.75	72.91	75.17
Imilmaiss	93.14	59.10	70.47	28.38	0.40	0.75	92.84	47.73	93.45	68.71
Imindounit	87.95	61.76	59.69	37.65	0.40	2.25	87.96	51.97	87.94	71.20
Imlil	97.01	37.05	20.39	56.72	19.27	3.61	98.06	21.31	95.89	51.86
Imoulass	96.34	47.59	49.49	26.52	2.31	21.67	97.42	30.96	95.23	61.54
Imouzzer	91.09	51.12	55.53	38.25	4.75	1.47	94.16	34.23	87.92	66.48
Imsouane	93.19	44.21	56.90	37.36	4.91	0.83	95.33	27.87	90.80	61.19
Irohalen	94.44	56.12	63.41	34.30	1.87	0.42	95.05	44.32	93.84	66.87
Isseksi	93.26	60.08	59.23	26.15	6.92	7.69	96.15	48.07	89.89	72.73

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Kerrouchen	93.00	54.77	31.65	37.46	5.73	25.16	94.40	44.78	91.45	64.90
Kouzemt	93.18	61.18	75.56	22.75	0.72	0.96	92.61	50.74	93.75	69.39
Ksabi Moulouya	91.34	40.90	34.09	52.24	12.93	0.73	93.41	26.94	89.19	55.23
Lahsinate	92.05	55.07	60.01	35.06	4.66	0.26	94.62	43.54	89.24	68.36
Lalla Aaziza	93.23	55.55	69.61	28.94	1.05	0.40	93.17	43.18	93.30	68.08
Lalla Takarkoust	97.86	35.32	37.97	51.50	9.38	1.16	98.76	24.54	96.92	46.46
Lamnizla	91.96	48.82	51.14	44.06	4.34	0.46	96.24	32.64	88.09	64.54
Lkheng	94.83	29.14	31.22	50.08	14.54	4.16	95.74	18.69	93.83	38.58
Meskala	93.36	59.07	55.86	38.07	3.44	2.64	93.97	49.50	92.80	68.84
Moulay Aissa Ben Driss	96.33	40.00	32.67	50.02	16.38	0.93	96.86	26.83	95.76	54.19
Moulay Brahim	90.33	46.98	46.90	38.34	7.24	7.52	91.41	36.23	89.25	57.77
M'Semrir	93.42	39.74	14.39	3.65	2.23	79.73	95.07	27.11	91.72	52.84
M'Zizel	91.45	42.39	24.81	47.30	13.01	14.87	92.52	26.59	90.23	58.96
M'Zouda	95.23	54.47	43.74	50.79	4.79	0.67	95.93	42.18	94.46	65.87
Naour	89.37	63.76	17.38	17.49	3.88	61.25	88.60	54.30	90.09	73.87
Ouad L'bour	89.32	57.55	57.77	39.08	2.35	0.80	89.86	45.63	88.76	68.26
Ouaklim	89.85	39.79	19.48	24.20	3.16	53.15	89.99	27.69	89.72	52.40
Ouaouizeght	97.50	33.46	24.91	47.32	24.92	2.84	97.99	21.86	96.95	44.07
Ouaoula	82.31	60.34	52.73	40.55	5.60	1.11	86.31	46.30	78.01	73.72
Ouaoumana	95.36	50.66	7.11	13.20	6.25	73.44	95.91	39.64	94.79	60.93
Ouazguita	97.95	51.45	36.76	31.03	1.78	30.43	98.64	37.27	97.12	65.48
Oued Naam	83.33	41.37	37.58	51.05	10.06	1.30	88.47	30.71	77.78	49.91
Ouirgane	92.98	49.65	60.43	29.20	9.09	1.28	94.49	37.00	91.42	62.48
Ouizeght	83.24	53.08	27.29	62.47	10.09	0.14	85.83	40.10	80.57	66.74
Oukaimden	92.36	50.70	40.48	55.62	3.29	0.60	94.69	39.75	90.03	62.27
Oulad Berhil	97.24	29.40	41.66	42.31	14.58	1.45	97.55	17.85	96.92	40.91
Oulad Khallouf	97.14	39.84	47.18	43.67	8.74	0.40	98.20	23.96	95.95	57.09
Ounagha	93.45	53.58	43.61	46.07	7.90	2.42	94.56	44.47	92.29	63.10
Ouneine	93.62	52.97	57.85	34.43	3.62	4.09	96.20	39.59	91.05	64.26
Ourika	96.45	36.23	44.98	42.05	7.75	5.22	97.19	22.42	95.65	50.89
Outerbat	94.12	56.00	40.19	34.03	9.92	15.86	94.18	41.97	94.05	71.45
Ouzioua	95.64	49.06	45.34	29.90	6.34	18.41	95.80	35.57	95.48	60.20
Rahhala	92.35	57.25	72.47	24.97	2.14	0.42	94.95	46.09	89.39	67.90
Rfala	94.39	49.76	30.42	60.90	8.01	0.67	96.40	35.13	92.14	64.31

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Sidi Aayad	95.51	41.46	27.47	50.82	10.34	11.37	95.81	27.43	95.15	55.55
Sidi Abdellah Ou Said	94.19	58.84	65.49	32.34	1.26	0.90	94.89	45.07	93.48	70.69
Sidi Abdelmoumen	85.27	55.52	57.48	39.39	2.04	1.09	88.13	43.67	82.45	66.85
Sidi Ahmed Essayeh	90.96	48.53	55.61	30.23	2.91	11.26	91.87	34.28	90.18	64.12
Sidi Boulkhalf	90.69	59.36	51.62	45.73	2.02	0.62	92.75	46.09	88.46	73.69
Sidi El Jazouli	90.99	62.39	36.17	27.03	3.04	33.75	93.76	50.84	87.70	73.61
Sidi Ghanem	94.54	54.18	48.97	44.73	5.27	1.03	95.99	42.38	93.14	65.67
Sidi Ghaneme	92.23	57.47	36.46	38.42	3.65	21.46	94.41	42.85	90.13	72.53
Sidi Hmad Ou Hamed	84.33	60.10	46.51	47.52	4.96	1.01	88.98	45.62	79.26	74.08
Sidi H'Mad Ou M'Barek	93.04	51.58	41.26	35.44	4.63	18.67	95.16	35.21	90.75	66.65
Sidi Ouaaziz	96.88	48.12	44.97	46.50	5.83	2.71	98.23	33.56	95.47	60.70
Sidi Yacoub	93.14	52.16	30.49	50.16	3.89	15.46	94.72	40.58	91.41	63.91
Sidi Yahya Ou Saad	90.49	51.05	12.44	9.99	5.39	72.18	92.41	38.70	88.73	63.11
Sidi Yahya Ou Youssef	75.04	68.10	36.84	32.95	4.86	25.35	74.67	59.07	75.40	76.98
Smimou	92.53	45.21	45.29	18.96	5.80	29.95	95.64	27.97	89.54	62.35
Sour El Aaz	96.55	39.40	63.91	30.47	4.75	0.86	97.60	23.87	95.45	55.65
Sti Fadma	91.20	51.59	62.16	33.17	3.84	0.83	91.99	39.09	90.38	64.81
Tabant	87.64	47.78	56.20	34.92	7.83	1.05	88.95	33.68	86.32	62.39
Tabaroucht	94.31	52.84	48.86	46.65	2.72	1.77	96.86	40.13	91.25	67.38
Tabia	93.42	52.49	46.15	48.12	5.46	0.28	97.00	39.90	89.80	65.82
Tadighoust	96.82	40.74	24.61	35.96	11.32	28.11	96.62	26.34	97.01	50.99
Tadrart	90.78	57.89	53.64	41.65	3.06	1.66	95.00	45.64	86.45	68.53
Tafedna	91.08	49.82	62.03	28.62	2.62	6.74	93.71	36.92	88.29	63.80
Tafingoult	96.62	34.62	50.83	25.85	7.60	15.72	98.43	19.64	94.82	49.33
Tafraouten	94.14	52.50	58.01	37.37	2.07	2.55	94.29	38.58	93.99	63.67
Taghazout	95.53	39.90	53.49	31.68	7.66	7.17	95.88	27.62	95.16	53.50
Taghzirt	93.85	44.92	26.22	49.46	15.00	9.32	95.32	30.95	92.28	57.71
Tagleft	84.82	56.05	29.47	49.50	13.06	7.97	88.98	44.37	80.53	67.12
Tahannaout	98.34	21.71	23.70	47.42	26.91	1.97	97.87	12.18	98.85	31.00
Tahelouante	76.07	70.16	75.08	23.69	1.01	0.22	87.50	58.16	66.67	80.96
Takoucht	87.35	61.33	64.54	29.24	2.18	4.04	93.17	46.01	82.08	74.37
Talat N'Yaaqoub	95.09	43.51	45.83	45.83	6.99	1.35	95.96	25.49	94.22	59.99
Talgjount	94.58	44.32	28.79	62.12	6.37	2.72	94.78	27.40	94.39	60.35
Talmakante	92.97	52.97	67.08	31.11	1.32	0.49	92.93	40.98	93.01	62.56

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Talsint	73.77	52.36	34.39	45.68	18.05	1.89	74.90	44.83	72.60	59.33
Tamaguert	94.06	52.28	46.88	46.56	5.90	0.67	95.72	40.32	92.28	65.66
Tamaloukte	96.54	44.64	40.32	50.50	8.27	0.91	97.37	30.21	95.67	58.34
Tamanar	94.90	40.16	37.25	35.30	11.49	15.97	98.10	24.94	91.57	55.06
Tamda Noumercid	95.39	50.28	35.04	43.00	7.47	14.49	96.14	38.09	94.59	63.18
Tamri	94.42	42.80	54.79	33.12	5.20	6.89	96.24	29.44	92.68	57.19
Tanant	93.87	50.40	38.62	43.65	10.82	6.91	95.48	38.61	92.17	62.34
Tanougha	89.40	53.12	33.42	54.64	11.04	0.90	91.91	41.60	86.71	64.39
Taouloukoult	86.03	55.42	52.09	28.76	3.26	15.89	88.46	42.93	83.41	67.82
Taounza	94.48	49.58	47.29	45.33	6.58	0.80	96.31	35.26	92.56	65.22
Targante	94.00	52.49	33.53	32.07	3.07	31.33	95.92	38.70	91.94	66.93
Tazart	92.13	51.96	58.34	34.84	5.71	1.10	94.96	39.11	89.37	65.50
Telouet	95.24	48.92	50.83	42.37	5.81	0.99	95.97	35.40	94.49	61.43
Tidili Fetouaka	95.51	43.80	44.55	47.16	7.02	1.28	95.70	31.44	95.32	57.37
Tidili Mesfioua	91.31	54.46	53.95	39.50	6.01	0.54	93.12	42.16	89.33	67.89
Tidli	97.26	41.98	53.61	39.53	3.93	2.93	97.80	26.50	96.71	56.56
Tidzi	87.12	59.79	36.16	55.34	4.47	4.02	90.52	47.07	84.05	72.70
Tiffert N'Ait Hamza	83.92	56.56	17.51	52.35	18.21	11.93	86.15	46.53	81.85	66.82
Tifni	96.65	54.69	47.80	47.70	3.41	1.10	97.59	41.65	95.74	68.50
Tighassaline	95.60	46.34	26.77	39.70	11.24	22.29	96.61	35.61	94.63	56.18
Tighedouine	92.80	56.11	57.48	36.12	5.31	1.08	93.42	45.57	92.15	68.16
Tigouga	89.38	54.35	37.61	21.48	0.87	40.04	91.72	40.11	87.09	67.45
Tilmi	93.48	48.98	20.68	13.37	1.62	64.33	94.06	36.21	92.87	61.43
Tilougguite	82.23	55.15	46.61	44.09	8.15	1.15	85.51	43.05	78.64	68.12
Timezgadiouine	92.18	63.51	59.33	37.86	2.55	0.26	93.23	56.00	91.22	70.48
Timizguida-Ouftas	91.99	44.05	37.95	56.84	3.46	1.75	95.15	28.81	88.60	61.17
Timlilt	87.91	61.27	64.78	33.46	0.56	1.21	89.26	51.66	86.51	70.33
Timoulilt	97.77	33.90	28.25	53.57	16.63	1.55	98.95	20.73	96.46	45.37
Tiqqi	90.31	54.79	50.52	41.09	4.65	3.74	91.62	40.39	89.04	67.82
Tisqi	97.95	49.19	50.04	38.80	10.32	0.83	96.60	35.26	99.36	63.47
Tisrasse	95.70	45.66	16.78	14.99	2.12	66.12	97.82	34.76	93.50	54.47
Tizguine	98.20	43.04	45.59	45.28	8.16	0.97	98.23	26.37	98.17	59.84
Tizi N'Isly	84.38	53.45	14.79	21.17	8.52	55.52	86.93	41.46	82.09	65.40
Tizi N'Test	96.15	52.44	64.45	31.58	2.43	1.55	96.88	38.73	95.29	64.54

Municipality	Scolarization rate	Illiteracy rate	AR	AR and FR	AR, FR and EN	Other lang	M - Scol rate	M - Ill rate	F - Scol rate	F - Ill rate
Touama	96.00	49.63	39.39	50.30	9.41	0.89	97.95	38.27	93.98	60.77
Toubkal	94.20	38.81	17.69	16.49	0.68	65.14	94.50	31.01	93.93	44.25
Toudgha El Oulia	96.35	25.13	31.77	31.80	7.85	28.59	96.22	11.76	96.50	37.59
Toundoute	95.67	42.43	59.25	33.54	6.16	1.04	98.13	24.03	93.08	57.17
Tounfite	90.60	48.34	21.29	35.14	9.15	34.42	89.89	36.51	91.31	59.77
Zaouia Annahlia	96.08	55.17	55.24	38.95	5.20	0.61	97.02	45.44	94.99	65.60
Zaouiat Ahansal	65.34	68.11	64.10	29.18	4.23	2.48	68.89	59.03	61.59	77.48
Zaouiat Cheikh	98.12	36.27	28.34	48.65	21.84	1.17	98.24	24.19	98.00	46.42
Zaouiat Sidi Hamza	76.91	55.29	56.57	32.75	2.19	8.49	78.98	40.06	74.93	71.22
Zerkten	92.55	54.20	67.55	30.22	1.80	0.43	92.29	41.86	92.82	67.10

Table 13 – Education main indicators for Morocco and the High Atlas.

	Morocco	High Atlas AVE
Scolarization rate	95	91
Illiteracy rate	32	50
Arabic only	31	44
Arabic and French only	45	39
Arabic, French and English	18	7
Other lang	5	10
Kindergarden	37	52
Pre-school	5	4
Primary	28	30
Secondary (college)	14	8
Secondary (tech)	10	3
University	6	2

Table 14 – Jobs market main indicators for Morocco and the High Atlas.

	Morocco	High Atlas
Population Active	11,548,464.00	912,454.00
Population Inactive	22,061,620.00	2,039,872.00
Net activity rate	47.58	43.09
Unemployment rate	16.17	10.76
Employee	2.87	1.22
Indipendent	29.80	35.26
Employee - public sector	10.22	5.11
Employee - private sector	47.57	46.57
Caregiver	6.49	9.49
Apprentice	0.85	0.64
Associate or Partner	1.76	1.25
Other job type	0.45	0.46
Water and Electricity	0.64	0.30
Extraterritorial and unreported activities	2.81	1.70
Transport, Warehouse & Communication	5.18	3.19
Mining and manufacturing	11.83	4.92
Public Administration, Education, Health and Social Work	11.61	5.29
Trade, repair of motor vehicles and motorcycles	15.97	8.23
Other market services	14.02	8.49
Construction	14.40	27.32
Agriculture, forestry and fisheries	23.53	40.55

Table 15 - Gender gap in the High Atlas (after Haut-Commissariat au Plan 2023).

	Men	**Women**
Unemployment rate	8.4	33.7
Agriculture, forestry and fisheries	38.2	49.6
Mining and manufacturing	4.2	12.0
Water and Electricity	0.3	0.2
Construction	30.1	3.3
Trade, repair of motor vehicles and motorcycles	8.8	3.9
Transport, Warehouse & Communication	8.3	0.4
Other market services	3.5	14.2
Public Administration, Education, Health and Social Work	4.9	12.5
Extraterritorial and unreported activities	1.6	3.8

Table 16 – List of the Natural Parks of the High Atlas (after UNEP-WCMC 2023).

Name	**Map n.**	**Status**	**Status year**	**Area (ha)**	**Manag. plan**
Ain Asmama	1	Proposed	2014	22,457	Existing
Parc National de Toubkal	2	Designated	1942	102,005	Existing
Parc National du Haut- Atlas-Oriental	3	Designated	2004	55,680	Existing
Tamga	4	Proposed	2014	13,957	Existing
Tamri Cap-Ghir	5	Proposed	2014	29,598	Existing

Table 17 – List of the SIBE sites of the High Atlas (after *UNEP-WCMC 2023).*

Name	Map n.	Status	Status year	Area (ha)	Manag. plan
Aghbar	1	Established	1994	6,564	Existing
Aguelmam Abekhane	2	Established	1994	39	No
Aqqa Wabzaza	3	Established	1994	2,930	Existing
Bou Tferda	4	Established	1994	25,203	Existing
Cascades d'Ouzoud	5	Established	1994	153	No
Grotte d'Akhyam	6	Established	1994	15,085	Existing
Jbel Amsittene	7	Established	1994	3,497	Existing
Jbel Ayachi	8	Established	1994	19,668	Existing
Jbel Taghioult	9	Established	1994	10,098	Existing
Jbel Tazerkount	10	Established	1994	15,232	Existing
Oued Lakhdar	11	Established	1994	574	No
Oued Todra	12	Established	1994	1,090	Existing
Sidi Meskour	13	Established	1994	2,191	Existing
Source Tizi n'Test	14	Established	1994	3	No
Tafingoult	15	Established	1994	2,893	Existing
Tichka	16	Established	1994	7,567	Existing
Tizi n'Ait Ouirra	17	Established	1994	14,202	Existing
Vallee de Telouat	18	Established	1994	12,377	Existing

Table 18 – List of the RAMSAR sites of the High Atlas (after *UNEP-WCMC 2023).*

Name	Map n.	Status	Status year	Area (ha)	Manag. plan
Assif Ahançal-Melloul	1	Designated	2019	1383	No
Assif Mgoun	2	Designated	2019	1370	No
Assifs Réghaya-Aït Mizane	3	Designated	2019	827	No
Cap Ghir-Imsouane	4	Designated	2019	6829	No
Haut Oued Lakhdar	5	Designated	2019	2249	No
Lacs Isly-Tislite	6	Designated	2005	274	No

Table 19 – List of the KBA sites of the High Atlas (after *UNEP-WCMC 2023).*

Name	Map n.	SitRec ID	IBA Status	AZE Status	Status year	Quality	Legacy KBA	Area (ha)
Barrage al Mansour Ad-Dhabi	1	6510	confirmed		08-02-07	Global	confirmed	38
Parc National de Souss-Massa and Aglou	2	6513	confirmed		03-07-18	Global	confirmed	131
Piste de Tagdilt	3	6507	confirmed	-	03-07-18	Global/ Regional TBD	confirmed	2,651
Tasga	4	31726	-	-	03-07-18	Global/ Regional TBD	-	149,674
Dayas d'Essaouira	5	31799	-	-	03-07-18	Global/ Regional TBD	-	6,203
Parc National de Toubkal	6	6509	confirmed	-	03-07-18	Global/ Regional TBD	confirmed	37,194
Parc National du Haut Atlas Oriental	7	6502	confirmed	-	03-07-18	Global/ Regional TBD	confirmed	55,471
Haute Moulouya	8	46660	-	-	03-07-18	Global/ Regional TBD	-	36,154
Vallée du haut Tifnout	9	46644	-	-	03-07-18	Global/ Regional TBD	-	12,388
Oued Oumer Rbid	10	31713	-	-	03-07-18	Global/ Regional TBD	-	54,434
Wad Lakhdar	11	46645	-	-	03-07-18	Global/ Regional TBD	-	331,407
Oued Matil: Ksob	12	7228	confirmed		03-07-18	Global	confirmed	124
Oued Lakhdar - Oued Ahansal	13	46669	-	confirmed	11/21/18	Global	-	73,755
Dunes d'Essaouira	14	29693	-	confirmed	03-07-18	Global	-	19,913
Oued N'Fiss	15	47162	-	confirmed	11/21/18	Global	-	113,579
Cote Imsouane - Taghazout	16	46676	-	-	09/18/19	Global/ Regional TBD	-	11,840