Human Ecology (2024) 52:515–530
https://doi.org/10.1007/s10745-024-00514-4

Transformation of Relationships with the Environment — Exploring Environmental Memories in Dakar

Laura Juillard[1,2] · Enguerran Macia[2] · Priscilla Duboz[2] · Anne-Caroline Prévot[1]

Accepted: 3 June 2024 / Published online: 5 July 2024

Abstract
We examine the role of phenomenological environmental memories to understand environmental changes and favor conservation in Dakar, Senegal, a context of great environmental change and historical traditions of oral memory transmission, where we conducted 42 semi-structured interviews in nine neighborhoods. Our results indicate that experienced environmental memories capture past interactions with the environment, perceived as a place of life, and past representations of this environment, whereas transmitted environmental memory captures information about past environmental conditions, past uses and practices, as well as myths and storytelling. Our informants consider both these forms of memory to be under threat as social relations and environmental conditions change. Furthermore, our conceptual analysis reveals transformations in relationships with the environment. Dakar residents are ambivalent about these changes, wanting improvements in former economic, environmental, and social conditions, but resisting changes to the status quo. We argue that this ambivalence stems from economic and geographic constraints, which are nuanced by perceived interests in the environment as well as a desire to reappropriate it. Our findings are consistent with the literature, except for the role of the media in memory, which is more influential in Western contexts.

Keywords Experienced and transmitted environmental memory · Urbanization · Environmental change · Nature and People · Dakar · Senegal · Africa

Introduction

Environmental crises are increasing worldwide (IPBES, 2019; IPCC, 2022), and institutional discourses are failing to raise awareness of these problems (Buell, 2017). In addition to the diversity of scientific approaches to these issues, human memory could provide a perspective on climate change and the current biodiversity crises (Endfield, 2014). Environmental memory describes the representations of the environment and the experienced or transmitted relationships individuals and communities have with it in a more or less recent past (Buell, 2017). We use the word *environment* in a broad sense to denote "the whole universe as a place, source and result of material phenomena (including human beings)" (Ducarme, 2019: 38). This definition includes biodiversity, spaces, and landscapes, but also every human and anthropic realization. Guarnieri et al. (2003) distinguished two dimensions in environmental memory: *phenomenological environmental memory,* defined as memory carried by humans; and *logical-scientific memory*, which results from technical and scientific work. In addition to the need to mobilize scientific environmental memory to preserve historical data on anthroposystems (Lévêque, 2003), Buell (2017) insists on the benefit of eliciting phenomenological environmental memories to raise people's awareness of environmental issues. Hence, these two complementary notions effectively perpetuate representations of the past environment (Juillard et al., 2024). For instance, pro-environmental practices and ecological knowledge can be transmitted through phenomenological environmental memory (e.g., Barthel et al., 2010; Crumley, 2000). Furthermore, given its role in individual and collective identities, as well

✉ Laura Juillard
laura.juillard1@mnhn.fr

[1] Centre d'Ecologie et des Sciences de la Conservation (CESCO), Muséum national d' Histoire naturelle, Centre National de la Recherche Scientifique (CNRS), Sorbonne Université, CP 135, 57 rue Cuvier, 75005 Paris, France

[2] UMR 7268 ADES, (CNRS/EFS/Aix-Marseille Université), Marseille, France

as in the place-attachment it engenders, phenomenological environmental memory can contribute to the desire to preserve the known environment (Buell, 2017; Gorman-Murray, 2010). Finally, it allows for the maintenance of a diversity of relationships with the environment and thus multiple adaptive solutions to environmental crises (Bousquet et al., 2022; Folke et al., 2003; Tengö & Hammer, 2003; Whyte, 2017).

Numerous research projects have highlighted the importance of direct experiences and the resulting phenomenological environmental memory to generate empirical knowledge of environmental changes and give them a local meaning that encourages engagement (e.g., Geoghegan & Leyson, 2012; Strauss & Orlove, 2021). This is in line with what Pyle (2003) called the *extinction of experience* that engenders apathy towards environmental concerns.

Experiences of nature are multidimensional and include knowledge, attitudes, behaviors, emotions, social appraisal, etc. (e.g., Clayton et al., 2017). They are particularly meaningful during childhood as children learn and create meaning in their living environment (Chawla, 1986, 1999; Hollander, 1958). Chawla (1986) showed that several factors, such as place, economic status, social configurations, rules imposed by the family nucleus, social pressure, as well as age, direct meaning and emotions concerning the environment during childhood. The same dimensions influence the construction and transmission of memory. For instance, emotions are a key factor (Bless, 2000; Hyman et al., 1996), and attention is necessary to remember the characteristics of a long-term environment (Loftus, 1979; Mulligan, 1998). In addition, the meanings provided by the social group influence environmental representations (Halbwachs, 1950) and, therefore, memories. The influence of the group also modifies memories over time by contamination of individual memories, by misinformation (Loftus, 1979; Schooler & Loftus, 1993), and by collective inhibition (Basden et al., 1997; Loftus, 2005; Weldon & Bellinger, 1997). Finally, the media, through the choice of information relayed, can also modify memories of personal experiences (Boykoff, 2008; Carvalho & Burgess, 2005).

We use the word *nature* rather than *environment* to refer to "the non-human world, including co-produced features, with particular emphasis on living organisms, their diversity, their interactions among themselves and with their abiotic environment" (IPBES, 2021), when necessary to reflect the social representations currently operating in Dakar (Marquis, 2001; Diop, 2012).

The continent of Africa is one of the most vulnerable to climate change (Brown et al., 2007). Many African populations are highly and directly dependent on natural resources and environmental degradation has drastic consequences for their livelihoods (Brown et al., 2007). Exploring environmental memories in Africa enables us to investigate the transmission of African memories that differ from Western contexts. Indeed, Western countries are experiencing a rupture between generations (Rosa, 2013), whereas in Africa, the oral transmission of practices and knowledge from one generation to the next remains important, as older people fulfill a respected role in the household and the community (Macia et al., 2015). As individuals, the griots[1] are specifically in charge of oral transmission (Diop, 1995). However, the city of Dakar benefits from a multicultural context where inherited empirical knowledge overlaps with academic knowledge from increasing educational opportunities, with a literacy rate of 61.9% and the highest average number of years of study in the country (6.2 years on average) (RGPHAE, 2014). As the economic and political capital of Senegal, Dakar also is a place of international acculturation and home to many regional administrations and non-governmental organizations. Dakar experienced several internal migration waves in the 1920s and 1950s (Vernière, 1977) and continues to attract new migrants (Duboz et al., 2021; Fall, 1998). Several languages are spoken in Dakar, and the most widespread, Wolof, borrows words from other languages such as French or Arabic (Robert, 2011), reflecting its multicultural population. Nevertheless, there are similarities in household structure among the multiple ethnicities. Men are attributed a dominant role in comparison to women (Ndiaye & Ayad, 2006), who are mostly in charge of domestic tasks. With a very young population (60% under 30 years old, (ANSD, 2014)) and an important informal sector, economic resources remain a central preoccupation for households (Duboz et al., 2021), maintaining the importance of community solidarity networks (Van Praag et al., 2022; for a more complete presentation of the cultural dimensions in Dakar, see Macia et al., 2015; Duboz et al., 2017, 2021).

In this context, we question the representations associated with environmental changes in a city where increasing urbanization, environmental degradation, and cultural contexts are all factors that can influence these representations. Thus, our three objectives are: 1) to explore the experienced environmental memories; 2) to explore the transmitted environmental memories; 3) to identify the factors impacting environmental memories in Dakar. To achieve these objectives, we first conducted semi-structured interviews. Our subsequent cross-sectional analysis of the discourses revealed a phenomenon of transformation of relationships with the environment linked to the emergence of new economic needs and the degradation of the environment. We discuss our results regarding the consequences of this on conservation.

[1] Members of a class of travelling poets, musicians, and storytellers who maintain a tradition of oral history in West Africa.

Context

Demographic Dynamics in Dakar

Located on the Cap Vert peninsula, Dakar is the economic and political capital of Senegal and has grown spectacularly in the last century. For almost three centuries, Dakar was mainly occupied by the Lebou[2] ethnic group. In 1843, it was still a village of several hundred reed huts (according to the naval officer Paul Boutet, cited in Faure, 1914). However, from 1846 onwards, the French gradually settled there and founded the city in 1857. Its political and economic role during French colonization and after independence in 1960, its industrial development, and the rural exodus reinforced by droughts and agricultural crises, have all contributed to urban demographic growth (Lacombe et al., 1977). In the 1960s, the population was 460,000 (Ndour, 2006) and by 2013, this had risen to 1,146,053 (ANSD, 2014). Dakar concentrates more than 87% of the formal jobs in Senegal (ANSD, 2021) and projects an image of modernity (Werner, 1997). The Dakar region reached 3,732,282 inhabitants in 2018, concentrating almost a quarter of the national population in 0.3% of the country's total area (ANSD, 2021).

Dakar's rapid development and expansion over the entire peninsula in addition to the sprawl of the suburbs overwhelmed the authorities. For example, the urban development plans succeeded for a time in formally preventing construction in the Niayes, an area in the Dakar region known to be favorable for cash cropping. However, this prohibition ended with the new 2001 plan, despite the ecological value and services it provided (Ndao, 2012). Private investments in construction (Ndoye, 2023), as well as the development of networks of roads to meet transportation needs (Tremblay & Ndiaye, 2008), also contributed to the urbanization of Dakar.

Vegetation Dynamics in Dakar

In the early twentieth century, agriculture was mainly in the northern part of the peninsula, producing millet, vegetables, and cotton (Diagne, 1998). From the 1950s onwards, these agricultural areas gradually disappeared and, under pressure from the French colonial administration and then the postcolonial Senegalese government, most of the area became public land through confiscation or purchase from the historical occupants, the Lebou (Deme et al., 2020; Fall, 1986). Vegetation decreased as a result of this development, coupled with drought, increasing human activities, and lack of maintenance (Diagne, 1998). Historical spontaneous vegetation remains abundant only near the Dakar airport and "Les Mamelles," while the only remaining forest is in the Hann Zoological Park (Fig. 1). Furthermore, a study of street plants in the city showed that most of the trees are not native to Dakar, but introduced during the colonial period (Deme et al., 2020). Finally, the establishment of green spaces, although mentioned in several framework plans, is sparse and is particularly affected by the illegal development of buildings (Diagne, 1998; Salah, 1999).

Fauna Dynamics in Dakar

Our literature review shows a decrease in the diversity and abundance of wildlife in Dakar. The modernization of fishing has increased the number of catches (Fall, 1986), and stocks of groupers (*Epinephelus marginatus*) and sparids (*Sparidae*) have decreased due to overfishing for export. Contemporary export fishers are thus turning to small pelagics, endangering a stock traditionally prized by Senegalese populations for local consumption (Leport, 2011, 2017). Dynamics of other occasionally consumed species, such as marine turtles (*Chelonia mydas* and *Retmochelys imbricata*), were difficult to assess. Regarding other wild species, a survey of scientific literature and a comparison with old and recent works showed the decline of several species and abundance of reptiles and birds, while change in the mammals species occurred (Barlow et al., 2018; Blancou, 1933; Dalecky et al., 2015; de Rochebrune, 1884; Granjon et al., 2019; Kingdon, 2015; Piot et al., 2021; Trape & Mané, 2006; Thiollay, 2017).

Climate and Pollution

Dakar's climate has also changed over the last century: temperatures on the peninsula significantly increased by 0.9 °C between 1960 and 2013 (Faye, 2019). Although rainfall variability was observed throughout the twentieth century, with years of surplus and years of deficit, a decreasing trend in cumulative rainfall has been observed between 1960 and 2013 (Faye, 2019). Finally, an increase in pollution sources has been noted in Dakar, such as the presence of factories, electricity production, and transport, the last constituting the primary source of pollution in the city, with more than 70% of Senegal's car fleet (Faye et al., 2022).

Materials and Methods

Method

We conducted semi-structured interviews to allow our respondents to speak at length, thus capturing implicit discourses (Bréchon, 2015), and the interviewers to easily introduce new themes (Kaufmann, 1996). Semi-structured

[2] 2 A population of fishermen mostly living in Dakar and the coastal areas of Senegal.

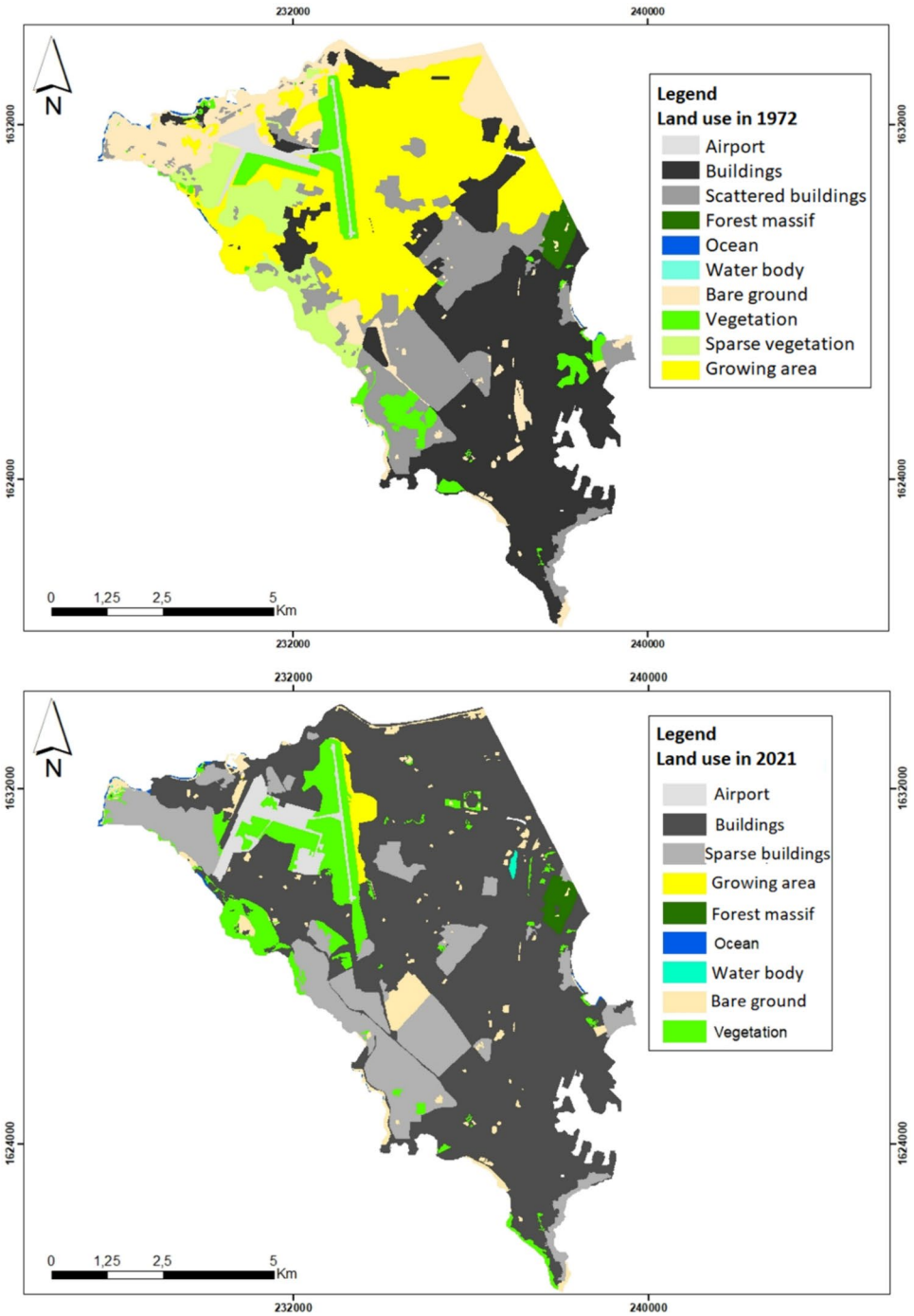

Fig. 1 Evolution of land use between 1972 and 2021, created by Sylla and Juillard (2023)

interviews also allow for a comparison of discourses and for a diversity of individual and social representations. Since this method allows the respondents a great deal of room for expression, it makes it possible establish the cultural context in which the memories are situated.

We conducted 42 qualitative interviews in Dakar between January and April 2022, either by direct contact in the street or, more rarely, by recommendation (Appendix 1). To approach the respondents, we used the customary local greeting before introducing ourselves and the objectives of our study and asking if they were willing to participate for one hour. There was parity between the 20 men and 22 women interviewed. To assess the transmission of environmental memories, we surveyed all age groups between 22 and 86 years old. To take account of the spatial heterogeneity of environmental changes, as well as the different cultural identities, we conducted our interviews in the neighborhoods of Plateau, Medina, Hann,

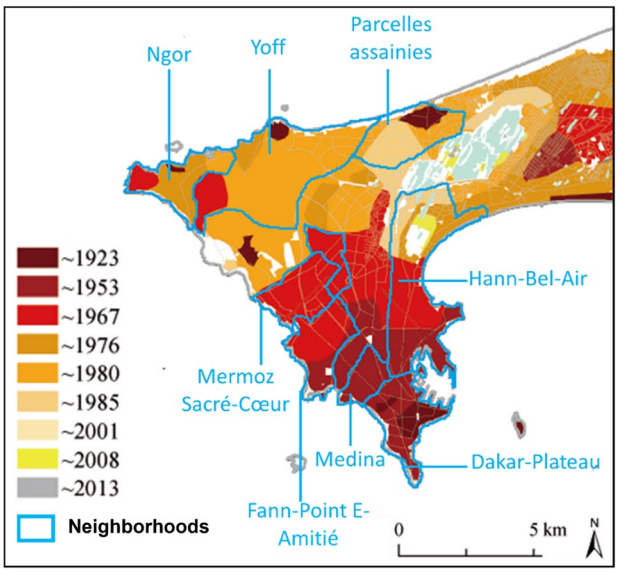

Fig. 2 Temporal evolution of Dakar city and neighborhoods of interviews, adapted from Plan Directeur d'Urbanisme, 2013

Amitié-Point E-Sicap, Ngor, Yoff, Parcelles (Fig. 2). Finally, the level of education of our respondents varied from no schooling to a doctoral thesis.

Conducting the Interviews

The interviews were all conducted by the same interviewer (LJ), accompanied by a Fulani and Wolof interpreter. The use of the words *nature* and *environment* was discussed with the interpreter beforehand to assure a good understanding by both the interviewers and respondents and the validity of their use in a Senegalese context. The interviews were conducted in French, Fulani, or Wolof, according to the respondent's preference, and lasted 40 min on average. Discourse saturation, corresponding to the absence of new elements expressed by the respondents, was reached at the 37th interview, and confirmed with the last 5 interviews.

The surveys were based on an interview grid, which grouped the questions to be asked into seven defined themes. The first question, common to all interviews, elicited the respondent's memories of the environment of their childhood. The interviews focused on perceived environmental changes, impacts of these changes on the respondents' lifestyle or practices, and their reactions or adaptations to these changes. To assess the factors that may influence memory, we also asked questions about their use of natural resources, their relationship with their environment, and the modes of transmission they had benefited from or used to disseminate their knowledge.

Processing and Analysis

The interviews conducted in French were transcribed directly by the interviewer, while the interviews in Fulani and Wolof were translated into French for transcription. This made it possible to answer the interviewer's requests for clarification to adhere as closely as possible to the literal transcription. The transcriptions were analyzed using Mason (1997) method of qualitative thematic analysis. We identified themes answering the question: "What factors impact the conservation and perpetuation of environmental memories?" The themes identified were then validated by a second author.

The second stage of conceptual analysis emerged from a rereading of the interviews to interpret the respondents' discourses. This interpretation, although influenced by the subjectivity of the researcher (Nicolson & Anderson, 2003), nonetheless made it possible to highlight the underlying phenomena that influence the respondents, who revealed a transformation in the relationships with nature in contact with capitalism, which therefore constituted our focus of analysis.

To highlight the influence of personal trajectories on environmental memories, we specified whether respondents came from an urban Dakar neighborhood, or from a neighborhood which had undergone progressive urbanization during their lives. We also specified respondents from a former historic village in Dakar, where the Lebou inhabitants practiced fishing and farming. For respondents not from Dakar, we also specified whether they came from a rural or urban environment (see Appendix 1).

Results and Discussion

Experienced Environmental Memories

In all interviews, the respondents remembered their environment through their interactions with it and with natural elements. They generally refer to an undefined "past" or their childhood to mark progressive changes up to the present.

Most of the interactions with the environment mentioned were related to the use of the living world as a resource. Use of wild trees for food or medicine was recalled with no differences depending on the origin or experience of the respondents:

> "There's a plant called Benta Mare [***Cassia occidentalis***], which has also been used for a long time to treat also for headaches" (respondent 16, woman, 57 years-old, in a historic village of Dakar 25 years ago).

Moreover, most of respondents from historic villages remembered their parents' past self-sufficiency:

> "Cassava (***Manihot esculenta***), groundnuts (***Arachis hypogaea***), millet (***Pennisetum glaucum***), bissap (***hibiscus sabdariffa***), there was everything here. Behind the hospital, there were fields there. The fields that were there, even me, my father had a cassava field, a groundnut field, bissap and kandia (***Abelmoschus esculentu***). He grew all that." (respondent 17, woman, 53 years old, street restaurant owner,[3] from a historic village in Dakar).
> "There were fish that we caught which were called squid (***Loligo vulgaris***)" (respondent 12; male, 40 years old, fisherman, from a historical fishing village in Dakar).

Finally, other specific uses of animals were also mentioned, particularly in terms of farm animal breeding practices, or concerning wild animals captured for mystical purposes:

> "People used to love turtle meat. We fished it, we ate it. Because they say that when a man eats turtle meat, it gives him power." (respondent 32, man, 54 years old, swimming instructor and former fisherman, from a historic village in Dakar).

These memories thus relate to exploitative interactions with nature.

According to some respondents, especially the ones who had experienced fishing or farming, these interactions were learned from the youngest age. This learning was often described as instinctive or independent, as if it were an inheritance:

> "You find 5 or 7 year old children there, with their nets, learning to fish. [...] That's also how we learned to swim, that's it, a Lebou will never tell you that someone taught him to swim." (respondent 32, already cited).

However, this learning always took place in a favorable context, such as in the proximity of adults who were fishing. Thus, these testimonials show that memories of nature-related practices are not just exploitative relationships, but also enable those who experience them to grow and learn in contact with nature and under the supervision of their community.

The existence of past interactions with natural elements makes their decrease visible to respondents, regardless of the interactions they used to engage. This is the case for this municipal employee whose parents were farmers and occasional fishermen:

> "In our time, when we were children, there were a lot of fish, but now there are no fish at all." (respondent 37, man, 51 years old, from a historic village of Dakar).

Even for people who didn't fish or farm, the occasional picking of natural resources in the close environment make the changes visible:

> "Even the lemon you used to see in other houses. Now I don't see lemon trees **[*Citrus* × *limon*]** among these trees" (respondent 41, woman, 46 years old, clothing saleswoman, from urban Dakar).

For some respondents, the awareness of these disappearances leads to a feeling of nostalgia for a bygone era with more abundant resources available, and easier, compared to the present characterized by poverty and lack of resources. That is the case for this 51-year old woman who experienced the urbanization of her historic village and the loss of fields in the 1980s:

> "That's no good. Because the people who were here had fields here. All the vegetables and peanuts were grown there. Tomatoes and hibiscus were grown there, and the ancestors brought them back here, but now there are no more fields to grow them in, there's nothing left." (respondent 34).

Place Experiences

Respondents also remembered their environment, and particularly the nature in it, as a place to live, providing favorable conditions for human life, well-being, and interactions with other human beings. First, elements of nature were often part of the background in memories of daily life, as this 35-year old bricklayer from a recently urbanized neighborhood remembers:

> "Before, it was like that, in the houses, we planted trees [baobab (*Adansonia digitata*)] around the house, sometimes to make - if the tree was big - the ablutions, you do it under the trees. When we were children we even slept under the trees." (respondent 25, man, 35 year old, who used to occasionally fish and benefit from near field in his childhood).

More than enabling the well-being of the inhabitants by improving their conditions, nature is seen as an inherent part of this remembered past, particularly during childhood:

> "Before [in her childhood], we used to see a group of birds returning to their nest at dusk, we don't see them anymore. And we used to sing that the birds [unspecified species][4] were coming back." (respondent 23,

[3] These are little gargotes where women cook breakfasts and lunches at very low prices.

[4] In the rest of the text, we specify when the taxa quoted correspond to a given specie. The general word (tree, bird…) is used when the respondent is not referring to a particular specie.

woman, 28, unemployed, from a recently urbanized neighborhood near a forest and zoological park).

Furthermore, nature was often remembered as a mediator in creating and developing interactions with other humans, as this old driver recounts about learning to fish on his arrival in Dakar:

"Yes, it was important to me, because I had brothers who were here, we are not related, but they taught me how to fish." (respondent 13, 77 years old, driver, from a rural area in Senegal).

Finally, the respondents remembered their interactions with nature as providing many benefits, such as shade, air, or protection from external disturbances. This is the case for this 28- year old woman living near the forest and zoological park who laments the loss of trees in her neighborhood:

"If it's hot, we can stand under the trees, it gives us shade" (respondent 23, already cited).

Perceived benefits were particularly linked to nature since natural spaces were remembered as providing well-being and respondents recalled moments alone or with their families:

"Because we are elements of nature. When you have the chance to walk on a beach where there is sand, or you walk on this grass and you feel good. Nature... You won't feel the same as on concrete. I'm sure you've experienced it." (respondent 1, man, 61 years old, chemical engineer graduate in agronomy, from urban Dakar).

However, in Dakar, the opportunities to relate with nature appear to be decreasing. Areas of low artificialization, used as places of leisure, sport, and social exchanges, have gradually diminished in the face of the construction of car lanes, infrastructures, and privately invested buildings. All respondents made the same remark, even in the long-established urban neighborhoods, as testified by this 46-year-old saleswoman:

"Now there are many cars. For example, when we were children we used to go there [on a public square not far from her house], we used to do bungee jumping, rope jumping and all that, but now you see there is too many bags, too many people, you can't." (respondent 41, already cited).

Moreover, even for respondents who have always lived in downtown Dakar, the privatization of places that were previously open to all was also lamented:

"Before, listen, it was established by law and we played everywhere, there were places where we could play football and so on, now it's forbidden." (respondent 1, already cited).

Representative Experience

Some respondents also remembered their environment through the representations they have about nature in their surroundings. First, nature was remembered through the emotions it conveyed, such as fear or joy. These emotions seemed to vary according to the interviewer's experiences, with rural natives tending to express more negative emotions and urban natives tending to express more positive emotions about nature. For instance, this 40-year old municipal employee testified of his arrival in Parcelles in 1986 when the neighborhood was under construction:

"If you had to live in Parcelles here, you were scared! [...] There was only Yoff and Cambérène. [other neighborhoods near Parcelles]. But the rest, all that, was the bush. The forest." (respondent 19, 40 year old, man).

On the other hand this engineer from another city in Senegal remembered the beautiful environment near his high school in Dakar:

"There were pretty bougainvilleas, with flowers, at that time, we saw very pretty ones, around the refectory, bougainvilleas, that I remember. Really, when the flowers started to appear, it was very pretty. That's something that marked me." (respondent 38, man, 43 years old).

Emotions associated with elements of nature in the past can be linked to their particular significance for the respondents. As an example, this 37 year-old man from urban Dakar, who never farmed, spoke of the trees as sacred:

"Of course, there used to be a lot of trees, but now people cut down trees ... they do anything, but trees are sacred, they should be allowed to grow." (respondent 39, forwarder of goods).

These meanings may be linked to particular experiences with non-human living beings, as testified by this 56- year old woman who was saddened by the destruction of the trees because her late husband had passed on his love for them to her:

"[a month ago] everything was taken away so that houses could be built, so it hurt me, I even felt ill for a week, I couldn't come to work." (respondent 21, medicinal plant seller, from urban Dakar).

Emotions such as feelings of attachment are also expressed, for example by this 43-year-old urban engineer about his domestic pet:

"I had a parrot at home. When I was still a student. We used to sell the parrots in the streets, so that afterwards you could take one home with you, and we used to say

that with time the parrot would start to speak Wolof properly." (respondent 38, already cited).

Transmitted Environmental Memories

In addition to experienced environmental memories, we also asked respondents about the second form of environmental memories, which are transmitted rather than directly experienced. This transmission, which is generally intergenerational, concerns both native and new Dakar residents, showing that transmission takes place through community networks. hese memories can be recounted through oral narratives:

"No, I didn't go into the bush, but my parents did and they were the ones who told me about it. In the forest, you couldn't see the sand, there was only grass, and these animals [livestock : goats, cows, camels] lived on it. There were also tree leaves that fell and these animals ate them." (respondent 5, woman, 60 years old, street vendor, from a rural area in Senegal but who came to Dakar 30 years ago).

Several respondents also mentioned old photographs of Dakar that show the past environment:

"This was really the Dakar of a very, very long time ago, 1958, '60 and so on! There are photos, you often see them there! We show you, this was, this was Sandaga,[5] you see a few, a few huts, little people, water." (respondent 38, man, 43 years old, already cited).

The toponymy of places can also reveal changes:

"Because… I heard, from my great-grandfathers, they said that here there was a street that was called "rue sans soleil" ["street without sun"]. That means there was no sun. There were only trees. Yeah. There were only trees." (respondent 41, woman, 46 years old, already cited).

The observations of respondents 40 years old or older show no differences between people born in or outside Dakar. Indeed, Dakar has changed to such a degree that some respondents noted the difficulty of transmitting the past state of the environment to younger people, such as this 60-year old woman who came to Dakar more than 30 years ago:

"But now you can't tell your children anything about the forest because there is no longer any forest, there are buildings everywhere." (respondent 5, already cited).

We also noted the transmission of a body of knowledge about the use and benefits of certain elements of nature from older to younger generations contributes to preserving plant and animal uses in the collective memory. Both Dakar residents and rural dwellers reported transmission of this diverse and extensive knowledge, but does not always reflect the resources still available in Dakar:

"My grandfather, my father's father, knew about trees. He worked with plants, he healed people with plants, and he treated a lot of things, things that I myself don't know. I only know some of them. My grandfather taught it to my father and my father taught it to us." (respondent 13, already cited).

Some respondents, especially the older ones, considered local schooling to be a source of knowledge that competes with oral transmission:

"The French school, what does it teach us? They teach us the living world. The universe, civilization. So you lose traditional medicine. In the end, we lose traditional medicine." (respondent 9, man, 59 years old, educator, from urban Dakar).

Respondents who experienced natural resources exploitation, such as this fisherman, also mentioned the replacement of practice transmission by theoretical learning:

"When you are a child like I was, you know everything about theory and practice, you know everything; they learn to fish by writing, we, our fishing school, is this [the beach]." (respondent 12, already cited).

Thus, some of the knowledge and practices held by elders is disappearing, including about the weather:

"If you call people to pray for water, the rain comes. If you pray, the rain falls [...]. Now, people say they don't do that because they are toubabs [white people in Wolof]." (respondent 27, woman, vegetable seller, 55-year old woman from urban Dakar, from farmer parents).

Furthermore, the emergence of digital technology provides new sources of knowledge that can discourage intergenerational transmission:

"She [my granddaughter] asks so many questions that, when she talks, I say to her, well, you take your tablet, you look in Wikipedia first, if you don't see something there, you come back and ask me." (respondent 38, already cited).

The use of the internet and social networks also increases contact with foreign cultural influences, particularly Western ones, which some respondents from the older generation consider unwelcome:

"No, because the children don't want to know what was in the forest. They are all white kids, they don't want to know anything. Now there is no child who says to you 'I want to go to the forest.' Today's children prefer to have

[5] A place in Dakar, Plateau.

a bath, dress well, and go out in the street. Even if you have fields, or if you raise livestock, you would have to hire a shepherd to work for you because the children won't take over." (respondent 5, already cited).

Finally, there is also a transmission of storytelling and myths for children:

"Oh yes, it's half past six, they [the adults] used to tell us, 'go inside, the wild animal will come out'. [...] But I don't know the name of this animal. But if we went out we were told 'go back to your room, go back to the house.' It's uh, timis [dusk], and if it comes out it's bad." (respondent 17, already cited).

Nowadays, these stories seem less common in Dakar, as older respondents told us they no longer hear them or tell them, and younger respondents sometimes had never heard them. Older respondents gave several reasons for this: the creatures mentioned escaped from the hustle and bustle and noise of the city (a bit like wild animals) or young generations have lost the ability to see them:

"We never saw them, but our parents had supernatural powers. Our grandparents had supernatural powers." (respondent 9, 59 year-old, already cited).

Conceptual Analysis

Our conceptual analysis showed that environmental memories testify to a transformation of relationships with the environment. We argue that this is a consequence of multi-factor environmental degradation as well as new economic needs in Dakar.

Physical and Cultural Distance from Nature

At the beginning of the twentieth century, Dakar's inhabitants fed themselves through fishing and agriculture, and healed themselves with medicinal plants and animals collected in their close surroundings, although these practices are now rare, if they have not disappeared altogether (Diagne, 1998; Horsin, 1923). People now buy imported foods and medicines, creating a physical distance from the place of supply and from nature as the market economy expanded (see Galaup & Timera, 1988) and the population moved away from resource-related occupations. As an example, this fisherman testifies about the progressive abandonment of fishing by fisherman's sons:

"Before they were fishermen. But now, more than fishing they have a trade [they have a trade other than fishing]. They have left the sea, gone to a trade because the sea is becoming rotten." (respondent 12, already cited).

It is not only the lucrative practices that are affected by the reduction in natural surroundings. Cap Vert, so-called due to its luxurious vegetation, has undergone significant urbanization:

"Yes, there were a lot of trees [in the 90s]! In both directions of the street, there were trees. Now when there's construction to do, they cut them down and don't replant them! So that leaves an empty area! That's how it's done!" (respondent 9, already cited).

Today, some respondents consider the city of Dakar as a place of work, innovation and economic opportunities without a place for nature in contrast to the countryside (Descola, 2005). Some respondents described seeking natural spaces for leisure and contemplation in the countryside, like this rural-native man:

"From time to time I go out of Dakar, from time to time I might go to Mbour, because I like nature as I said, eh, for me it's vital." (respondent 6, 54-year old, man, bank employee).

Ambivalent Perceptions of Change: The Influence of New Economic Needs on Desired Imaginaries

Categories of respondents indicated they were very much aware of the disappearance or privatization of areas previously available for unlimited and free recreational use of the environment:

"They invest, each one takes 300 m^2, 1000 m^2, and we no longer have access to this resource. You have to go to the university to have access to the beach." (respondent 1, already cited).

The disappearance of these benefits is correlated with a perceived alteration in well-being and health:

"At the beginning, there were trees that stopped the dust, but now these trees are no longer there. There is nothing." (respondent 7,already cited).
"I can say, before, we used to find that children didn't have many respiratory diseases, now it's common!" (respondent 30, man, 52, self-employed financial, from urban Dakar).

This is also correlated to a loss of economic opportunities:

"Because before [in her arrival] it was fields, people used to cultivate to earn enough to feed the family, but now there is nothing to feed the family, now there is none. They sold everything, everything is buildings now. The billionaires have bought everything now. They earn their living, while the poor are tired." (respondent 16, already cited).

But changes can be accepted when they do not impact the respondents' living conditions:

"No, no, these changes are not a problem, because we talk about the climate and all that, it's the people who talk about it, but we who live here, we don't give a damn." (respondent 9, already cited).

This acceptance of changes is reinforced by the idea that they are part of the necessary evolution of the world and not necessarily perceived negatively:

"That's the way life is. You go back home for 10 years and there is a big change [when you come back]. Where you used to leave a box, there's a house, that's how life is." (respondent 4, man, 52 years old, tobacconist, from urban Dakar).

Moreover, while some respondents deplore the loss of resources directly gathered in Dakar, others are pleased with the accessibility of new, previously unavailable or mistrusted resources:

"The pharmacy is the safest, most... interesting place to treat yourself. When you use plants from the street, when you get sick, it's not good. Look, when we go to the pharmacy, the pharmacist will tell us what medicine to use for flu, malaria or other illnesses." (respondent 39, already cited).

Moreover, some respondents consider that the changes are beneficial because they reduce some dangers or constraints, such as this male student living in a long-established urban area:

"In this environment, for children, snakes are dangerous." (respondent 40, 22 years old, man).

While the transformation of livelihoods and the related distinction between city and countryside can be perceived as a loss, it also represents new opportunities, both for respondents previously dependent on natural resources exploitation and others:

"Now people need money or something else, they don't have time to go to the fields. Those who go to the fields are those in the villages. But here, when you live in Dakar, you don't need to go to the fields." (respondent 9, already cited).

There is therefore a rupture in family career inheritance along with a monetary valuation of material inheritance, responding to the desire for emancipation from subsistence practices:

"My child will not be a fisherman. [...] Because the sea is rotten. It will be empty." (respondent 12, already cited).

"If you live in Dakar, you have time to go to school, you are educated, you have a new life. You don't want to go farming because what you sell there does not bring you much. Instead, if someone offers you 10 million for a 150 m^2 plot of land, you agree to sell it!" (respondent 9, already cited).

Resistance and Adaptation to Change

While many environmental changes, such as the disappearance of agricultural land, are perceived negatively by respondents, they generally feel powerless and describe an opposition between the people living in Dakar and the government decision-makers:

"Yes, it's because of the government, they're the ones selling the land, they're the ones selling everything." (respondent 7, already cited).

Similarly, lack of money is often mentioned as a reason for exclusion:

"Oh, you can't help it! That is how the world is, the world of money, there's nothing you can do about it, you just watch, as I said, I sit on my bench and watch the world and the world watches me." (respondent 1, already cited).

But this feeling of powerlessness can also be attributed to an omnipotent God who legitimately controls environmental conditions, including the weather:

"There are changes, of course, but... There's nothing we can do about it, it's the good Lord who gives it to us. It's his knowledge, there's nothing we can do about it today, like the rain, the heat... all that. These are decrees from the Almighty." (respondent 39, already cited).

Difficulties encountered in Dakar can lead people to make radical decisions in search of solutions, such as emigration:

"All our brothers are over there, they take the road, they leave, to Spain, everywhere, they don't care, that's what they do. Now here, all the young people have left. Half of the young people have left." (respondent 12, already cited).

Moreover, relationships with the environment are constantly being renegotiated, allowing the preservation of some natural elements in an urban context. Although the neighborhoods are becoming denser under the pressure of urbanization, *palaver* trees[6] survives within delimited spaces still considered as Lebou villages. There are many plant sellers to provide plantings for public squares (e.g., Place de l'Indépendance) and university campuses, and trees are planted on avenues and roadsides Despite the growing

[6] Historically, a large tree in the village square, under which community discussions take place.

pharmaceutical supply, nearly 80% of Senegalese still use medicinal plants to treat themselves and in Dakar, nearly one household in two has used these at some point (Cissé et al., 2019). Similarly, some respondents who report initiatives to replant trees in Dakar take their presence as a given:

> "Well, I told you about the plants, well, we had greenery everywhere, we must replant. The tree you see over there is a… thing, nevadaye [moringa], it was us who replanted it here because it was deforested." (respondent 10, woman, 60, retired secretary, from urban Dakar).

Replanting can be a form of resistance to the uprooting and extensive building in the city, reflecting the stubborn persistence of once abundant and free vegetation. These attempts to conserve plants in Dakar are motivated by their benefits, but also reflect a desire to grow plants within well-defined, controlled spaces. This can be seen in the emergence of new practices in the use of living resources, in hybrid spaces: in the absence of agricultural land, women cultivate plants at home:

"We no longer have these fields. And there [are] no more open areas too. You know, to get the nanas [mint] here, we grow on tables now." (respondent 17, already cited).

Due to the lack of space, domestic animals such as goats or cows are kept in the courtyards or on the balconies of houses.

Evolution of Memories

In most of the interviews, the phenomenological memory matched the information from the literature on environmental changes: most respondents had witnessed a decrease in vegetation, and a great increase in urbanization, as well as in pollution. Health concerns raise awareness of the importance of vegetation and good air quality for Dakar's inhabitants. Memories of weather conditions were more contrasted, as respondents mostly witnessed a decrease in rainfall, but were divided as to whether the temperature had decreased, increased, or remained unchanged. This difference can be attributed to the significance of rain in Senegal, as much for agriculture as for the floods it causes. The decreases in wild animal species was often noted, but not systematically illustrated with specific species no longer present in Dakar, except for fishermen. Overall, respondents seemed less aware of the decrease of animals than of plant species, probably due to their lesser importance as a source of food, although utilitarian plant species were more readily remembered than species historically present but not used.

As the former capital of a French colony from which it inherited its official language, Dakar is particularly aware of French culture and Paris is therefore well-known by its inhabitants. Furthermore, Dakar is undergoing changes that may bring it closer to environmental conditions in Paris, such as physical distance with nature. The comparison is therefore useful to highlight cultural and geographical differences between the two capitals that express the modernity in their respective country (Duboz et al., 2017).

We identified three types of experience with the environment, which respondents use to remember it: representative, interactional, and place. These can be compared to the dimensions of relationships with urban nature proposed by Prévot et al. (2016) in their study of the Paris suburbs. Our *representative* dimension corresponds to Prévot et al.'s *affective* and *sensory* dimensions, which refer respectively to perceptions of elements of nature, and personal experience with nature through one or several senses. Our *interactional* dimension is close to their *utilitarian* dimension, in which nature is evoked for its benefit to personal well-being.[7] Finally, our *place* dimension resembles their *memorial* dimension where natural elements can be used to remember people and events in the context of the environment as a place to live and interact with others. The relationships with urban nature and the memories of past relationships with the environment are quite similar in the Paris suburbs and in Dakar, though embedded in different cultures and not referring to the same experiences.

The modes of creating and transmitting environmental memories in Dakar are consistent with previous studies. For example, Hall and Endfield (2016) also highlighted the role of personal experience and emotions in their work on winter memories in England. As in our study, the collected memories mostly related to childhood, evoking nostalgia for both past environmental conditions and past relational contexts. Transmission through stories and oral history was also present in Hall and Endfield (2016), who also found that some memory events refer to periods before the respondents' birth and come from the family, community networks, or from photographs. Strauss and Orlove (2021) found similar results in their study on the transmission of memories of weather conditions in England. Daigle et al. (2019) showed how practices related to nature are remembered and transmitted in Amerindian communities even though these practices may have disappeared. Such practices are also known to help people remember and transmit the past environment (i.e., Berkes & Folke, 2002; Geoghegan & Leyson, 2012). However, the role of the media in the construction and transmission of environmental memories, highlighted by Hall and Endfield (2016), was rarely mentioned by our respondents. This difference could be explained by the literacy rate in the city (61.9%) which, although the highest in the country, remains low compared to Western societies, especially for girls (Desprez et al., 2021). Furthermore,

[7] In this dimension, however, Prévot et al. do not consider benefits such as provisioning, whereas they are present in our study due to the historical and recent importance of sourcing food from nature in Dakar, which is now very rare in Paris and its suburbs.

the importance of elders in Senegalese societies continues to contribute to maintaining oral transmission as the preferred source of information (Macia et al., 2015).

Our results show that there are temporal changes in the way Dakarese people remember. Indeed, we highlighted a temporal decrease in interactions with nature, as well as in place-based relationships with nature, which is closely related to the decrease in nature itself in Dakar. This was true for all respondents, regardless of where they lived or their age, and for both those who had previously lived off natural resources and those who had more casual and recreational experiences. We believe that this similarity is linked to the meanings attached to these experiences: even for people who lived off natural resources, nature in Dakar was particularly seen as an integral part of the inhabitants' way of life. The decrease of these interactions can lead to a reduction in the role of interactional relationships and place relationships in memories and reinforce the role of transmission and of representative relationships, which do not necessarily require direct contact.

Thus, although the modes of environmental knowledge transmission have been transformed, this does not seem to stem from a weakening of oral transmission, but rather from the difficulties older people face in describing environmental conditions and relationships that have disappeared. The younger generations lack knowledge of the environmental conditions that preceded their birth, and are less able to engage in experiences of nature given the current urban environment. This can lead to generational environmental amnesia, defined by Kahn and Friedman (1995) as the use of experienced environmental conditions as the sole reference for evaluating changes, to the detriment of conditions in the more distant past. Using an overly recent and inappropriate baseline (see Pauly, 1995) can lead to underestimation of the problems associated with climate change and the biodiversity crisis, and to ignorance of the extent of the changes (Papworth et al., 2009; Huitric, 2005). Furthermore, the transition from informal ecological knowledge acquisition to school-based learning, also present in our results, leads to the replacement of inherited local knowledge and practice transmission by delocalized and often decontextualized knowledge, which is sometimes less effective in understanding current environmental issues (Daigle, 2019; Heise, 2017; Pilgrim et al., 2007).

Between Economic and Social Development and Conservation of a Known Environment

The conceptual analysis highlighted a physical and cultural distancing from nature, which is correlated to the socio-economic changes in the city. This phenomenon, illustrated in other case studies and explained with similar arguments (e.g., in Italy, Mattalia et al., 2021), provokes ambivalent reactions among Dakar's inhabitants: while they regret the past conditions and the impossibility of preserving nature in the city, most also appreciate the opportunities offered by economic liberalism, which allow them in particular to expect to earn more money. A few comparisons with Paris may help us to understand their ambivalence and why they might prioritize earning money over protecting nature. While in Dakar, households receive little institutional support (Macia et al., 2015), it is estimated that more than half (54.5%) of them can be considered poor (Antoine & Fall, 2008), in comparison with 15.4% in Paris (ANSD, 2021). While people in Dakar used to be able to rely on the fruits of food production (Fall, 1986), food now represents 38.9% of household expense (Ba & Cantoreggi, 2018) in comparison with 18.1% in France. Housing is a second major expense (Cissé, 2007) in a context of explosive demographic change and excessive occupation (Sinou, 1990), with 64.1% of the population living in overcrowded housing (Antoine & Fall, 2008), in comparison with 15.1% in Paris. In addition, the vast majority of in-migration to Dakar is motivated by economic need, given the agricultural crises and environmental degradation throughout the rest of Senegal, where most towns are less developed (Fall, 1998).

In this respect, willingness to build at the expense of nature may reflect a desire for greater comfort and material goods. According to Duboz et al. (2021), nature can be a source of stress restoration in rural areas of Senegal, but loss of those benefits is compensated by the development of technological and monetized environmental solutions, such as air conditioning. Faced with these economic challenges, it would seem logical that the environment is not a major concern for Dakar's inhabitants, especially as they generally feel powerless in the face of change. However, despite this, there remains a degree of resistance and numerous adaptation mechanisms seeking to integrate or reintegrate nature into the urban environment.

According to Chokor (2004), even if the inhabitants of rural Nigeria understand the long-term rationality of preserving natural resources, economic constraints force them to adopt a short-term perspective. Many other studies illustrate how economic uncertainty takes precedence over environmental concern (e.g., Auyero & Switsun, 2009; Lewis, 2008; Ogunbode & Arnold, 2012). However, there does not appear to be a systematic positive link between poverty and lack of environmental concern: Givens and Jorgenson (2011), in a study of 38 countries, showed that in fact a country's wealth is associated with less environmental concern.

Indeed, difficult financial conditions can sometimes make people more vulnerable to environmental problems, such as bad air quality or proximity to waste disposal (Chatterjee, 2008; Krieg & Faber 2004). This situation can encourage some people to preserve their environment, even if they are constrained by other issues such as poverty. We think this could apply to Dakar, where the disengagement of politicians from urban management has led to the degradation of public services such as sanitation and refuse collection (Minviell et al., 2005) and an increase in pathogenic sources such as pollution, flooding, and stagnant

water (Fall, 2007). The development of international exports has also contributed to an increase in malnutrition in Dakar (Leport, 2011; Minviell et al., 2005). In this uncertain health and food context, some people may resort to plant medication to avoid the high costs of modern medicine (Minviell et al., 2005).

A second explanation for the dynamics of involvement of Dakar residents may be the desire to reappropriate the environment. Moreover, we believe that the communities of Dakar's historic inhabitants, whose natural resources and land have been heavily impacted by French colonization and subsequent policies favoring private investment, see the management of their local natural heritage as an opportunity to reclaim their environment. However, institutional discourse on the environment remains weak, with very little training in environmental law (Bonnin, 2015), and the state budget for the environment has decreased significantly since the 1970s (Germain, 2012). To compensate for this disengagement, the state encourages local initiatives to assume responsibility for urban management via associations (Minvieille, 2005). The management of environmental problems is thus based on a decentralized approach (MEPN, 2005; Ndiaye, 1992).

In addition, in Dakar, certain communities participate in nature protection because they regard it as preservation of their patrimony. For example, the *penc*, a public square traditionally dominated by a massive baobab tree, the *palaver*, continues to be the place where political decisions are made by influential people within Lebou communities (Hane, 2022). This illustrates how the imagary linked to plants survives in Dakar through the role they play in community identities. Thus, if for Van Brocklin (2009) the sense of belonging to the community of origin rather to Dakar leads to a disengagement from the management of the city, this disengagement is called into question when the public space is taken over by the community. The desire to preserve nature in Dakar therefore stems from its importance in terms of identity, as nature can also provoke an emotional bond (Ninot, 2010).

However, these local initiatives remain limited in the face of private investors who are taking over the available spaces as well as resources, such as fish (Leport, 2011, 2017). It is in this context that a discourse of powerlessness is expressed, relating to the state and wealthy investors on the one hand, but also to divine will on the other. Macia et al. (2010) showed how the importance of religion in Dakar can be part of an assimilative coping mechanism to better accept difficult conditions and hope for a better future. In our study, trust in the decisions of God is so important that environmental changes likely to worsen the living conditions are sometimes accepted philosophically. In addition, spirituality is used as an accommodative coping mechanism to reject responsibility for the difficulties experienced. It seems that this phenomenon captures the discourses of the powerlessness of the people of Dakar with regard to the environment, even though local actions are being taken to adapt to the urban context.

Conclusion

We explored the presence and modes of expression of environmental memory in Dakar. Our results indicate that there is a widespread memory of past environmental conditions, which is expressed through memories of past experiences or through intergenerational transmission. Moreover, we highlight the different dimensions through which these memories are expressed: these are the uses and practices of the past environment, personal experiences, stories, and the importance attached to nature. While these dimensions were noted a range of our respondents, there were variations in the ways they were expressed according to individuals' background and age. As every respondent remembered their personal experiences, environmental memories do not seem in danger. But these four dimensions are evolving, as urban, demographic, and cultural dynamics, as well as the advent of economy-based lifestyles lead to alienation from nature in Dakar and, therefore, fewer opportunities to experience natural environments. These phenomena could moreover endanger practical and oral memory transmission and thus favor generational environmental amnesia. As some practices have already disappeared in Dakar, the persistence of environmental-relationships and their adaptation in an urban context for economic, health or heritage reasons, or out of a desire to reappropriate it, might be crucial in addressing future environmental changes in Dakar and in preserving experiences of nature.

Our study sheds light on the factors influencing environmental memories and highlights a few trends among our respondents. Thus, despite differences in age and origin, all the respondents testified to the loss of nature in their environment. Some spoke of even very recent losses, showing very local knowledge and the worrying persistence of the loss of nature over time. In addition, the transmission of old memories, and the transformation of practical knowledge into theoretical knowledge, were addressed above all by the older respondents, showing a potential loss of intergenerational transmission. Finally, variations were expressed in the emotions associated with elements of nature, depending on personal meaning, without it being possible to define associated profiles. Indeed, the semi-structured interviews were not able to make significant distinctions in the knowledge held by the different generations, nor by the different communities according to the length of their residence in Dakar. Future research should address how this diversity impacts relationships with the environment as well as environmental memories. Furthermore, the persistence of oral transmission and the potential importance of environmental amnesia in a Senegalese context are topics needed further study. The latter would also make it possible to explore a possible relationship between environmental memories and concern for the environment in the Dakar populations.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10745-024-00514-4.

Acknowledgements We would like to thank all the people from Dakar who kindly took part in the interviews, as well as our interpreter Abdourahim Ly.

Authors' Contributions All authors participated to the conceptualization. The methodology was designed by E.M and P.D. L.J carried out the data collection. L.J. and E.M analyzed the datas. L.J. wrote the main manuscript and E.M and A.C. reviewed the manuscript. A.C, E.M and L.J edited the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding This research was made possible with the financial support of the Prime 80 project led by the French National Center for Scientific research (CNRS).

Availability of Data and Materials Not applicable.

Declarations

Ethical Approval Data was collected following the semi-structured interview method. Anonymity was respected for all respondents.

Competing Interests The authors declare no competing interests.

References

Agence Nationale de la Statistique et de la Démographie (ANSD) (2014). *Recensement général de la population et de l'habitat, de l'agriculture et de l'élevage (RGPHAE), 2013*. Dakar: Agence Nationale de la Statistique et de la Démographie. https://www.ansd.sn/index.php?option=com_ansd&view=titrepublication&id=29&Itemid=421

Agence Nationale de la Statistique et de la Démographie (ANSD) (2021). *Situation économique et sociale régionale de Dakar, 2019*. Dakar: Agence Nationale de la Statistique et de la Démographie. https://www.ansd.sn/ressources/ses/SES-Dakar-2019.pdf

Antoine, P., & Fall, S. (2008). Population et pauvreté à Dakar. In G. Daffé & A. Diagne (Eds.), *Le Sénégal face aux défis de la pauvreté: Les oubliés de la croissance* (pp. 29–50). Karthala.

Auyero, J., & Swistun, D. A. (2009). *Flammable: Environmental suffering in an Argentine Shantytown*. Oxford University Press.

Ba, A., & Cantoreggi, N. (2018). Agriculture urbaine et périurbaine (AUP) et économie des ménages agri-urbains à Dakar (Sénégal). *International Journal of Environment, Agriculture and Biotechnology, 3*, 195–207.

Barlow, C. R., Piot, B., & Bargain, B. (2018). Little Grebe Tachybaptus ruficollis now a breeding resident in The Gambia, with an expanded breeding range in Senegal. *Malimbus, 40*, 47–54.

Barthel, S., Folke, C., & Colding, J. (2010). Social-ecological memory in urban gardens. Retaining the capacity for management of ecosystem services. *Global Environmental Change, 20*, 255–265.

Basden, B. H., Basden, D. R., Bryber, S., & Thomas, R. L. (1997). A comparison of group and individual remembering: Does collaboration disrupt retrieval strategies? *Journal of Experimental Psychology: Learning Memory and Cognition, 23*(5), 1176.

Berkes, F., & Folke, C. (2002). Back to the future : Ecosystem dynamics and local knowledge. In L. Gunderson & C. Holling (Eds.), *Panarchy: Understanding Transformations in Human and Natural Systems* (pp. 121–146). Island Press.

Blancou, L. (1933). *Contribution à l'étude des oiseaux de l'Oubangui-Chari. L'oiseau et la revue française d'ornithologie*. Société ornithologique de France.

Bless, H. (2000). The interplay of affect and cognition The mediating role of general knowledge structures. In J. P. Forgas (Ed.), *Feeling and thinking The role of affect in social cognition* (pp. 201–222). New York: Cambridge University Press.

Bonnin, M., Ly, I., L., Diedhiou, M. (2015). Un premier pas vers la représentation de la nature devant le juge sénégalais : la reconnaissance des dommages à l'environnement marin. *VertigO - la revue électronique en sciences de l'environnement*, n° Hors-série 22 (10 septembre 2015). https://doi.org/10.4000/vertigo.16340

Bousquet, F., Quinn, T., Jankowski, F., Mathevet, R., Barreteau, O., & Dhenain, S. (2022). *Attachements et changement dans un monde en transformation*. Quae.

Boykoff, M. T. (2008). The cultural politics of climate change discourse in UK tabloids. *Political Geography, 27*, 549–569.

Bréchon, P. (2015). Enquêtes qualitatives : les principes. In P. Bréchon (Ed.), *Enquêtes qualitatives, enquêtes quantitatives*. Grenoble: Presses Universitaires de Grenoble.

Brown, O., Hammill, A., & McLeman, R. (2007). Climate change as the 'new'security threat: Implications for Africa. *International Affairs, 83*(6), 1141–1154.

Buell, L. (2017). Uses and abuses of environmental memory. *Contesting Environmental Imaginaries* (pp. 93–116). Brill.

Carvalho, A., & Burgess, J. (2005). Cultural circuits of climate change in U.K. broadsheet newspapers, 1985–2003. *Risk Analysis, 25*, 1457–1469.

Chatterjee, D. P. (2008). Oriental disadvantage versus occidental exuberance: Appraising environmental concern in India—a case study in local context. *International Sociology, 23*, 4–33.

Chawla, L. (1986). The ecology of environmental memory. *Environments Quarterly, 3*, 4.

Chawla, L. (1999). Life paths into effective environmental action. *Journal of Environmental Education, 31*, 15–26.

Chokor, B. A. (2004). Perception and response to the challenge of poverty and environmental resource degradation in rural Nigeria: Case study from the Niger Delta. *Journal of Environmental Psychology, 24*(3), 305–18. https://doi.org/10.1016/j.jenvp.2004.08.001

Clayton, S., Colléony, A., Conversy, P., Maclouf, E., Martin, L., Torres, A. C., Truong, M.-X., & Prévot, A. C. (2017). Transformation of experience: Toward a new relationship with nature. *Conservation Letters, 10*(5), 645–651.

Cissé, O. (2007). *L'Argent des Déchets: L'économie informelle à Dakar*. Karthala Editions.

Cissé, A., Samb, T., Gueye, M., Ndiaye, F., Koma, S., & Akpo, L. E. (2019). Ethnobotanique des plantes utilisées contre les rhumatismes chez les Peuls. In G. Boëtsch, P. Duboz, A. Guisse, & P. Sarr (Eds.), *La Grande Muraille Verte* (pp. 319–341). CNRS Editions.

Crumley, C. (2000). *From garden to globe : linking time and space with meaning and memory* (pp. 193–208). Social Memory.

Dalecky, A., Bâ, K., Piry, S., Lippens, C., Diagne, C. A., Kane, M., Sow, A., Diallo, M., Niang, Y., Konecny, A., Sarr, N., Artige, E., Charbonnel, N., Granjon, L., Duplantier, J.-M., & Brouat, C. (2015). Range expansion of the invasive house mouse Mus musculus domesticus in Senegal, West Africa: A synthesis of trapping data over three decades, 1983–2014. *Mammal Review, 45*, 176–190.

Daigle, J. J., Michelle, N., Ranco, D. J., & Emery, M. R. (2019). Traditional lifeways and storytelling: Tools for adaptation and resilience to ecosystem change. *Human Ecology, 47*, 777–784.

De Rochebrune, A. T. (1884). *Faune de la Sénégambie* (1). O. Doin.

Deme, M., Badiane, S. D., & Thiaw, D. (2020). Caractéristiques actuelles et fonctions des plantations en alignement à Dakar (Sénégal). *Géovision, 2*, 278–289.

Descola, P. (2005). *Par delà nature et culture* (p. 640). Gallimard.
Desprez, Victorine, mikolasek, Margot, & Sella, Louise. (2021). Quel état des lieux de l'éducation pour toutes et tous au XXIè siècle?. À propos des rapports de l'UNICEF et de l'UNESCO. *La Revue des droits de l'homme. Revue du Centre de recherches et d'études sur les droits fondamentaux*.
Diagne, M. (1998). *Le végétal en milieu traditionnel dakarois : Perceptions et utilisations possibles dans les stratégies de conservation*. Master's thesis, Département de Géographie, Université Cheikh Anta Diop de Dakar.
Diop, S. (1995). *The oral history and literature of the Wolof people of Waalo, northern Senegal: the master of the word (griot) in the Wolof tradition*. PhD thesis.
Diop, M., Sambou, B., & Ly, B. (2012). Représentations de la forêt et répercussions sur la gestion des ressources forestières au Sénégal. *VertigO - la revue électronique en sciences de l'environnement*, n° Volume 12 Numéro 2 (12 septembre 2012). https://doi.org/10.4000/vertigo.12319
Duboz, P., Boëtsch, G., Gueye, L., & Macia, E. (2017). Self-rated health in Senegal: A comparison between urban and rural areas. *PLoS ONE, 12*(9), e0184416.
Duboz, P., Macia, E., Diallo, A. H., Cohen, E., Bergouignan, A., & Seck, S. M. (2021). The good life in rural and urban Senegal: A qualitative and quantitative study. *PLoS ONE, 16*(5), e0252134.
Ducarme, F. (2019). Qu'est-ce que la nature qu'on cherche à conserver? Une approche sémiologique de l'action écologique. *Nouvelles Perspectives En Sciences Sociales, 14*(2), 23–60.
Endfield, G. H. (2014). Exploring particularity: vulnerability, resilience, and memory in climate change discourses. *Environmental History, 19*(2), 303–310.
Fall, P. D. (1986). *Du village à la banlieue: l'évolution des villages Lébou du rivage méridional de Dakar*. Ph. D. dissertation, Paris.
Fall, A. S. (1998). Migrants' long-distance relationships and social networks in Dakar. *Environment and Urbanization, 10*(1), 135–146.
Fall, A. S. (2007). *Bricoler pour survivre: perceptions de la pauvreté dans l'agglomération urbaine de Dakar*. Karthala Éditions.
Faure, C. (1914). *Histoire de la presqu'île du Cap Vert et des origines de Dakar*. É. Larose.
Faye, C. (2019). Changement climatiques observés sur le littoral sénégalais (Région de Dakar) depuis 1960: Étude de la variabilité des tendances sur les températures et la pluviométrie. *Environmental Sciences, 20*, 65–78.
Faye., M., Thiaw I., Ahamada S., B. (2022). Impacts of the covid-19 pandemic on air quality in Dakar : Analysis of pollutants PM 2.5, PM10 and NO2 during the pre and post state of emergency period. *Espaces Africains, 1*, 22–37.
Folke, C., Colding, J., & Berkes, F. (2003). Synthesis : Building resilience and adaptive capacity in social-ecological systems. *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change, 9*(1), 352–387.
Galaup, A., and Aly T. (1988). *Rôle des petites villes dans le développement économique régional* (Conference presentation). Ecole nationale d'Economie appliquée, collège aménagement du territoire, Dakar, Sénégal.
Geoghegan, H., & Leyson, C. (2012). On climate change and cultural geography: Farming on the Lizard Peninsula, Cornwall. *UK. Climatic Change, 113*(1), 55–66.
Germain, M. E. (2012). *Les représentations sociales et les préoccupations en matière d'environnement chez les jeunes du Sénégal: une étude comparative en milieu urbain chez les jeunes scolarisés de Dakar*. Université de Montréal.
Givens, J. E., & Jorgenson, A. K. (2011). The effects of affluence, economic development, and environmental degradation on environmental concern: A multilevel analysis. *Organization & Environment, 24*(1), 74–91.
Gorman-Murray, A. (2010). An Australian feeling for snow: Towards understanding cultural and emotional dimensions of climate change. *Cultural Studies Review, 16*(1), 60–81.
Granjon, L., Ba, K., Diagne, C., Ndiaye, A., Piry, S., & Thiam, M. (2019). La communauté des petits rongeurs du Ferlo: Tendances historiques et caractéristiques du peuplement actuel. *La Grande Muraille Verte: Une réponse africaine au changement climatique, 384*,
Guarnieri, F., Garbolino, E., Weill, A., & Matarasso, P. (2003). *Contribution à la définition opérationnelle et à la modélisation de la mémoire environnementale des zones ateliers* (p. 296). Quelles natures voulons-nous?
Halbwachs, M. (1950). *La mémoire collective*. Paris: Les Presses universitaires de France.
Hall, A., & Endfield, G. (2016). "Snow scenes": Exploring the role of memory and place in commemorating extreme winters. *Weather, Climate, and Society, 8*(1), 5–19.
Hane, F. (2022). *Territorialités et religiosités à Dakar : Le pencc, un espace identitaire à l'épreuve des politiques publiques. Séminaire annuel de l'équipe Santé et Transitions en Afrique, 3 et 4 novembre 2022, Dakar*.
Heise, U. K., Christensen, J., & Niemann, M. (2017). *The Routledge companion to the environmental humanities*. Taylor & Francis.
Hollander, E. P. (1958). Conformité, statut, et crédit d'idiosyncrasie. *Psychological Review, 65*(2), 117–127.
Horsin, M. (1923). *La destruction des oiseaux en Afrique Occidentale Française*. Bulletin de la ligue française pour la protection des oiseaux.
Huitric, M. (2005). Lobster and conch fisheries of Belize: A history of sequential exploitation. *Ecology and Society, 10*(1), 21. https://www.jstor.org/stable/26267709
Hyman, Jr., Ira, E., & Pentland, J. (1996). The role of mental imagery in the creation of false childhood memories. *Journal of Memory and Language, 35*(2), 101–117. https://doi.org/10.1006/jmla.1996.0006
IPBES. (2019). The IPBES global assessment: Pathways to action. *Trends in Ecology & Evolution, 35*(5), 407–414.
IPBES Core Glossary. (2021). *Intergovernmental panel of biodiversity and ecosystem services*. https://www.ipbes.net/glossary-tag/nature
IPCC (2022)*:* Summary for Policymakers. In: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (Eds). Cambridge University Press, Cambridge, UK and New York, NY, USA. https://doi.org/10.1017/9781009157926.001
Juillard, L., Prévot, A-C., Duboz, P., Macia, E. (2024). *Les mémoires environnementales peuvent promouvoir la conservation de la nature*. Nature, Science, Sociétés. Accepted: March 2024
Kahn, P. H., & Friedman, B. (1995). Environmental Views and Values of Children in an Inner-City Black Community, *Child development*, 66.
Kaufmann, J. C. (1996). *L'entretien compréhensif*. Armand Colin.
Kingdon, J. (2015). *The kingdon field guide to African Mammals* (2nd ed.). Princeton Nature.
Krieg, E. J., & Faber, D. R. (2004). Not so black and white: Environmental justice and cumulative impact assessments. *Environmental Impact Assessment Review, 24*(7–8), 667–694.
Lacombe, B., Vaugelade, J., Dliouf, B., Baviere, M., Bertrand, A., & Dauchy, S. (1977). *The rural exodus and urbanization in Senegal. A sociology of the migration of the Serer from Niakhar to Dakar in 1970*. Travaux et documents de l'O.R.S.T.O.M, no 73, 206

Leport, J. (2011). *Les changements alimentaires à Dakar. Le cas du poisson*, Master's thesis, Toulouse, CETIA, Université de Toulouse II - Le Mirail.

Leport, J. (2017). *Dynamiques de changement des modèles alimentaires : le cas du poisson à Dakar*. Université Toulouse le Mirail - Toulouse II.

Lévêque, C., & van der Leeuw, S. (Eds.). (2003). *Quelles natures voulons-nous?: pour une approche socio-écologique du champ de l'environnement*. Paris: Elsevier.

Lewis, T. (2008). Environmental movements in the Global South. In K. Gould & T. Lewis (Eds.), *Twenty lessons in environmental sociology* (pp. 244–254). Oxford University Press.

Loftus, E. F. (1979). *Eyewitness testimony*. Harvard University Press.

Loftus, E. F. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning & Memory, 12*, 361–366.

Macia, E., Duboz, P., & Gueye, L. (2010). Les dimensions de la qualité de vie subjective à Dakar. *Sciences Sociales Et Santé, 28*(3), 41–73.

Macia, E., Duboz, P., Montepare, J. M., & Gueye, L. (2015). Social representations of older adults [magget] in Dakar. *Ageing and Society, 35*, 405–427.

Marquis, G. (2001). Les representations sociales de l'environnement: Une comparaison des jeunes du Quebec et du Senegal. *Canadian Journal of Environmental Education, 6*, 158–177.

Mason, J. (1997). *Qualitative researching*. London: Sage.

Mattalia, G., Sõukand, R., Corvo, P., & Pieroni, A. (2021). "We became rich and we lost everything": Ethnobotany of remote mountain villages of Abruzzo and Molise, Central Italy. *Human Ecology, 49*, 217–224.

MEPN (Ministère de l'Environnement et de la Protection de la Nature),. (2005). *Rapport sur l'état de l'environnement au Sénégal* (p. 231p). CSE (Centre de Suivi Écologique): Sénégal.

Minvielle, Jean-Paul., Ahmadou, Fatim Diop, & Aminata, Niang. (2005). *La pauvreté au Sénégal: des statistiques à la réalité*. Karthala Editions.

Mulligan, N. W. (1998). The role of attention during encoding in implicit and explicit memory. *Journal of Experimental Psychology : Learning, Memory, and Cognition, 24*(1), 27.

Ndao, M. (2012). *Dynamiques et gestion environnementales de 1970 à 2010 des zones humides au Sénégal: étude de l'occupation du sol par télédétection des Niayes avec Djiddah Thiaroye Kao (à Dakar), Mboro (à Thiès et Saint-Louis)*. Doctoral dissertation, Université Toulouse le Mirail-Toulouse II, France.

Ndiaye, P. (1992). *La politique de l'environnement: analyse d'une gestion. Sénégal: Trajectoires d'un Etat* (pp. 137–176). Paris: Karthala.

Ndiaye, S., & Ayad, M. (2006). *Enquête Démographique et de Santé au Sénégal 2005*. Calverton, Maryland, USA: Centre de Recherche pour le Développement Humain (Sénégal) et ORC Macro.

Ndour, C. T. (2006). *La rue, espace prépondérant de loisir à la Médina, Dakar*. Doctoral dissertation, Université du Québec à Trois-Rivières.

Ndoye, M. (2023). *Dakar-Diamniadio motorway* (p. 67). Corporate Capture of Development.

Nicolson, P., & Anderson, P. (2003). Quality of life, distress and self-esteem: A focus group study of people with chronic bronchitis. *British Journal of Health Psychology, 8*, 251–270.

Ninot, O. (2010). Des moutons pour la fête: l'approvisionnement de Dakar en moutons de Tabaski. *Les Cahiers d'Outre-Mer. Revue de géographie de Bordeaux, 63*(249), 141–164.

Ogunbode, C. A., & Arnold, K. (2012). A study of environmental awareness and attitudes in Ibadan, Nigeria. *Human and Ecological Risk Assessment: An International Journal, 18*(3), 669–684.

Papworth, S. K., Rist, J., Coad, L., & Milner-Gulland, E. J. (2009). Evidence for shifting baseline syndrome in conservation. *Conservation Letters, 2*(2), 93–100.

Pauly, D. (1995). Anecdotes and the shifting baseline syndrome of fisheries. *Trends in Ecology and Evolution, 10*, 430–430.

Pilgrim, S. E., Cullen, L. C., Smith, D. J., & Pretty, J. (2007). Ecological knowledge is lost in wealthier communities and countries. *Environmental Science and Technology, 42*(4), 1004–1009.

Piot, B., Bacuez, F., Bargain, B., Barlow, C. R., Dobbs, G., Lecoq, M., & Robinson, P. (2021). The Black-winged Stilt Himantopus himantopus in Senegal and The Gambia: Notes on its breeding ecology. *Wader Study, 128*(2), 137–144.

Prévot, A. C., Servais, V., & Piron, A. (2016). Scientist and non-scientists share a diversity of dimensions in their relations to urban nature. *Urban Ecosystems, 19*, 1787–1799.

Pyle, R. M. (2003). Nature matrix: Reconnecting people and nature. *Oryx, 37*(2), 206–214.

RGPHAE. (2014). *Rapport définitif RGPHAE 2013*. Dakar, Sénégal: Agence Nationale de la Statistique et de la Démographie.

Robert, S. (2011). Le wolof. In E. Bonvini, J. Busuttil, & A. Peyraube (Eds.), *Dictionnaire des langues* (pp. 23–30). P.U.F. Quadrige.

Rosa, H. (2013). *Social Acceleration*. Columbia University Press.

Salah, R. (1999). *La foresterie urbaine et périurbaine en Afrique. Une étude de cas sur le sahel (Dakar, Niamey, Nouakchott et Ouagadougou)*. Archives de documents de la FAO.

Schooler, J. W., & Loftus, F. (1993). Multiple mechanisms mediate individual differences in eyewitness accuracy and suggestibility. In J. M. Puckett & H. W. Reese (Eds.), *Mechanisms of everyday cognition* (pp. 177–203). New-York: Wiley.

Sinou, A. (1990). *Dakar*. Institut français d'architecture.

Strauss, S., & Orlove, B. S. (2021). *Weather, climate, culture*. Routledge.

Sylla, D., & Juillard, L. (2023). *Evolution of land use between 1972 and 2021 (map)*. Dakar, Sénégal: UCAD.

Tengö, M., & Hammer, M. (2003). *Management practices for building adaptive capacity : a case from northern Tanzania. Building resilience and adaptive capacity in social-ecological systems* (pp. 132–162). Cambridge University Press.

Thiollay, J.-M. (2017). The decline of an urban Hooded Vulture *Necrosyrtes monachus* population in Dakar, Senegal, over 50 years. *Ostrich, 88*, 131–138.

Trape, J. F., & Mané, Y. (2006). *Guide des serpents d'Afrique occidentale: savane et désert*. IRD éditions.

Tremblay, R., & Ndiaye, E. M. (2008). Les caractéristiques du secteur du transport urbain à Dakar. *Perspective Afrique, 3*(1–3), 1–19.

Van Brocklin, E. (2009). *Environmental conscience and comportment of youth in dakar.*

Van Praag, L., Lietaer, S., & Michellier, C. (2022). *A qualitative study on how perceptions of environmental changes are linked to migration in Morocco, senegal, and DR congo* (pp. 1–5). Human Ecology.

Vernière, M. (1977). Dakar et son double dagoudane pikine. *Paris Imprimerie Nationale, 278*, 31.

Weldon, M. S., & Bellinger, K. D. (1997). Collective memory: Collaborative and individual processes in remembering, *Journal of Experimental Psychology: Learning. Memory and Cognition, 23*, 1160–1175.

Werner, J. F. (1997). Itinéraires individuels à la marge. Etudes de cas sénégalais. In A. Marie (Ed.), *L'Afrique des individus* (pp. 367–403). Paris: Kharthala.

Whyte, K. (2017). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. *English Language Notes,* 55(1), 153–162.