



Woody Plants in *Dialan* and other Ritual Practices within the Biocultural Landscape of Niokolo Koba National Park, Senegal

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Abstract

We examine the ritual use of woody species in seven villages near Niokolo Koba National Park in Senegal, focusing on tree-based rituals within the *Dialan* belief system. Local communities reported 41 species used in rituals, with *Khaya senegalensis*, *Piliostigma thonningii*, *Daniellia oliveri*, and *Anogeissus leiocarpa* being the most frequently mentioned. Among these, *Khaya senegalensis*, *Ceiba pentandra*, *Adansonia digitata*, and *Ficus gnaphalocarpa* are the main species venerated as *Dialan* altars. Ritual activities include baths, drinks, fumigation, amulets, mask rituals, sacrifices, offerings, and incantations, often performed in specific areas within villages, their surroundings, or the park. *Dialan* practice is especially prominent among isolated Bassari communities in the southeast. We documented this tradition to deepen our understanding of past and present human–environment interactions, preserve traditional knowledge, and highlight the importance of integrating spiritual and biocultural factors into conservation and land management.

Keywords Biocultural conservation · Ritual practices · Sacred trees · *Dialan* tradition · Senegal · West Africa

Introduction

Plants play a vital role in societies around the world by providing essential functions such as medicine, food, materials, and fuel, while also supporting economies (Diazgranados et al., 2020; Pironon et al., 2024). Beyond their tangible benefits, plants hold significant cultural and spiritual value, playing important roles in rituals and cosmovisions that shape community identities and biocultural landscapes (Dafni, 2007; Dupire, 1976; Melaku et al., 2023; Quiroz & van Anel, 2018). In Africa, a rich historical record shows the deep relationship between people and plants (Mercuri et al., 2018; Stevens et al., 2014), with many communities still relying on trees for both practical and cultural reasons (Burkill, 1985–2000; Lykke et al., 2004; Heubach et al., 2011; Malan et al., 2020). However, many spiritual and ritual interactions with plants are poorly documented and are declining due to social and environmental pressures (Juhé-Beaulaton, 2008; Quiroz & van Anel, 2018).

Trees and other plants are revered as mediators for communicating with ancestors, deities, and sacred beings. They are connected to religious or historical events because of their perceived supernatural roles (Dafni, 2006; Fournier, 2018; Larrue, 2006). The magico-religious use of trees has played an important role in rituals marking major life events,

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such as birth, fertility, rites of passage, marriage, and death (Dafni, 2007; Dupire, 1976; Quiroz & van Anandel, 2018). Such practices demonstrate adaptive socio-ecological strategies in which spiritual beliefs shape how people interact with their environment (Bridgewater & Rotherham, 2019; Dupire, 1976; Faye & Ribot, 2017). Revered trees and related beliefs often transform areas into sacred spaces, connecting humans to the spiritual realm (Dafni, 2007; Juhé-Beaulaton, 2008; Quiroz & van Anandel, 2018; Savadogo et al., 2010). Sacred spaces function as boundaries from the profane world, marked by territorial signs, reverence, offerings, pilgrimages, and specific codes of conduct (Dafni, 2007; Djah, 2009; Yameogo, 2015). However, these practices have declined over the past century due to the influence of monotheistic religions, landscape changes, and globalization (Djah, 2009; Juhé-Beaulaton, 2008; Yameogo, 2015).

Many studies document the role of plants in traditional and religious beliefs of West Africa, highlighting practices involving supernatural mediation in daily life (Bationo et al., 2010; Beneš et al., 2025; Djah, 2009; Ferry, 2003; Fournier, 2018; Larrue, 2006; Quiroz & van Anandel, 2015; Quiroz et al., 2016; Savadogo et al., 2017; Yameogo, 2015). In Senegal, where 94–97% of people identify as Muslim, 3–5% as Christian, and less than 1% as followers of traditional religion (Balonon-Rosen, 2013; Pew Research Center, 2022), spiritual practices remain deeply rooted in folk traditions (Balonon-Rosen, 2013; De Jong, 2013). Many Senegalese communities believe in *beyid* or *jinns* (i.e., genies or supernatural spirits) that are thought to inhabit natural places such as trees, bushes, and forests, and to possess the resources within them (Benoit, 1993; Steger et al., 2023). Rituals, sacrifices, offerings, and incantations are often performed to seek their permission for resource use or to gain their favor (Doumbia & Doumbia, 2004). Although the ethnobotany of southeastern Senegal is well-documented in many aspects (Gueye et al., 2012, 2014; Kerharo & Adam, 1974; Pelmoine & Mayor, 2020), research on the ritual use of plants and their influence on biocultural landscapes remains limited (Dupire, 1976; Ferry, 2003; Larrue, 2002).

Some trees are believed to be inhabited by spirits and supernatural forces. Communities honor them as deities and intermediaries between humans and the supernatural, connecting them to spirits, ancestors, and mythical beings. In Mandinka, these mediators are called *Jalanyo* or *Dialan* (*Dialan* hereafter), meaning "sacred tree," "sacred wood," or "altars" (Larrue, 2006). These trees are revered as protectors and social regulators, with spirits believed to reside within them, invoked or consulted during times of need through rituals, offerings, or chants, reflecting centuries of ancestral heritage (Larrue, 2002, 2006). Practices involving these trees include initiation rituals and passing ceremonies,

during which participants wear elaborate plant-based costumes and perform dances to drum rhythms central to community tradition (Beneš et al., 2025). The performers and their costumes, collectively referred to as "masks," play crucial roles in maintaining social order, dispensing justice, and warding off evil spirits (Bianquinch, 2013; De Jong, 2001, 2013; van Beek, 2024; Weil, 1971). However, these beliefs and traditions are declining due to the rise of monotheistic religions and modernization (De Jong, 2001, 2013; Ferry, 2003; UNESCO, 2006; Weil, 1971).

We examine the traditional beliefs and ritual use of woody plants in communities near the Niokolo Koba National Park (NKNP), focusing on their roles in local culture and the environment. Ethnobotanical surveys conducted in seven villages across two areas near the park document the relationships between people and plants that hold spiritual and supernatural significance. The goals are to: (i) identify the most frequently used woody species in rituals; (ii) describe ritual practices, highlighting the role of *Dialan*; (iii) identify the central locations of ritual activities and interactions with these trees; and (iv) evaluate the current state of traditional ritual practices in local communities.

Materials and Methods

Study Area

The research took place in the southeastern part of Senegal, near Niokolo Koba National Park (NKNP), covering the administrative regions of Tambacounda, Kédougou, and Kolda (Majerovičová et al., 2022). The park is surrounded by 17 rural communes, comprising over 304 villages and hamlets, with a population exceeding 200,000 (Peripheral Office, Direction of NKNP, personal communication). The park, created in 1954, is home to roughly 1,500 flowering plant species, nearly half of Senegal's total plant species (Dupuy, 1971; Gueye et al., 2012; Madsen et al., 1996). Its diverse biodiversity and unique ecosystems led to its designation as a UNESCO World Heritage Site in 1981 (Benoit, 1993; Larrue, 2002; Ministère de l'Environnement, 2000). The region has a diverse ethnic makeup, with the Mandinka being the largest group, followed by Fulani, Bambara, Jakhanke, Wolof, Badiaranké, Jalonké, Bassari, Coniagui, and Bedik (Gueye et al., 2012; Takforyan, 1994). The last five ethnic groups are minorities and are primarily found on the southern outskirts of the park. Economic activities include agriculture, livestock farming, and harvesting forest products. Meanwhile, mining has grown significantly over the past twenty years, attracting young people, especially during the dry season.

Survey

Fieldwork took place in December 2018, November 2019, and March 2022, with approval and permits from the Senegalese Ministry of Environment and Nature Protection and the National Parks Directorate (Permits: 001804; 001573; 002111). Informed consent was obtained from all participants, and the surveys were carried out in accordance with the University of South Bohemia's Code of Ethics (R432), the International Society of Ethnobiology (ISE, 2006), and the recommendations of Brittain et al. (2020).

Interviews were conducted in seven villages around the NKNP: three in the Northwest (Badi Nierico, Wassadou, and Dar Salam) and four in the Southeast (Badon, Sibikiling, Segueko Bassari, and Niemenike) (Fig. 1). One-on-one interviews lasted 1–2 h and were carried out in Mandinka or Fulani, with occasional use of French. Personal details such as gender, ethnicity, social status, and religion were documented. The interviews focused on the ritual use of plant species, their uses and locations, and whether participants believed in and practiced *Dialan* rituals.

We used semi-structured questionnaires with both closed and open-ended questions to identify the woody species that

informants used in ritual practices and the locations where they could be found. Participants freely listed ritual trees and, whenever possible, showed us their locations directly. Ritual use locations were categorized into: (i) the village, including homes and public spaces; (ii) the surrounding area, within 2 km of the village, such as fields and nearby forests; and (iii) the park, where plant collection is regulated or prohibited.

Participants were selected with the help of local authorities, including village chiefs, religious leaders, and teachers. A total of 63 individuals were interviewed, comprising 49 men and 14 women aged 28 to 87 years. Participants included farmers (28), livestock breeders (6), housewives (12), village chiefs (5), tourist guides (3), healers (3), imams (3), schoolteachers (2), and one traditional chief. Most were involved in farming, and the sample covered four ethnic groups: Mandinka (65%), Fulani (19%), Bassari (14%), and Jakhanke (2%). The majority (86%) were Muslim, 13% were Christian, and 1% practiced traditional religions with syncretic beliefs. Most participants were born in the NKNP area but had moved to the outskirts due to evictions. While many were non-literate, they had extensive knowledge of traditional beliefs and plant use. Female participants were

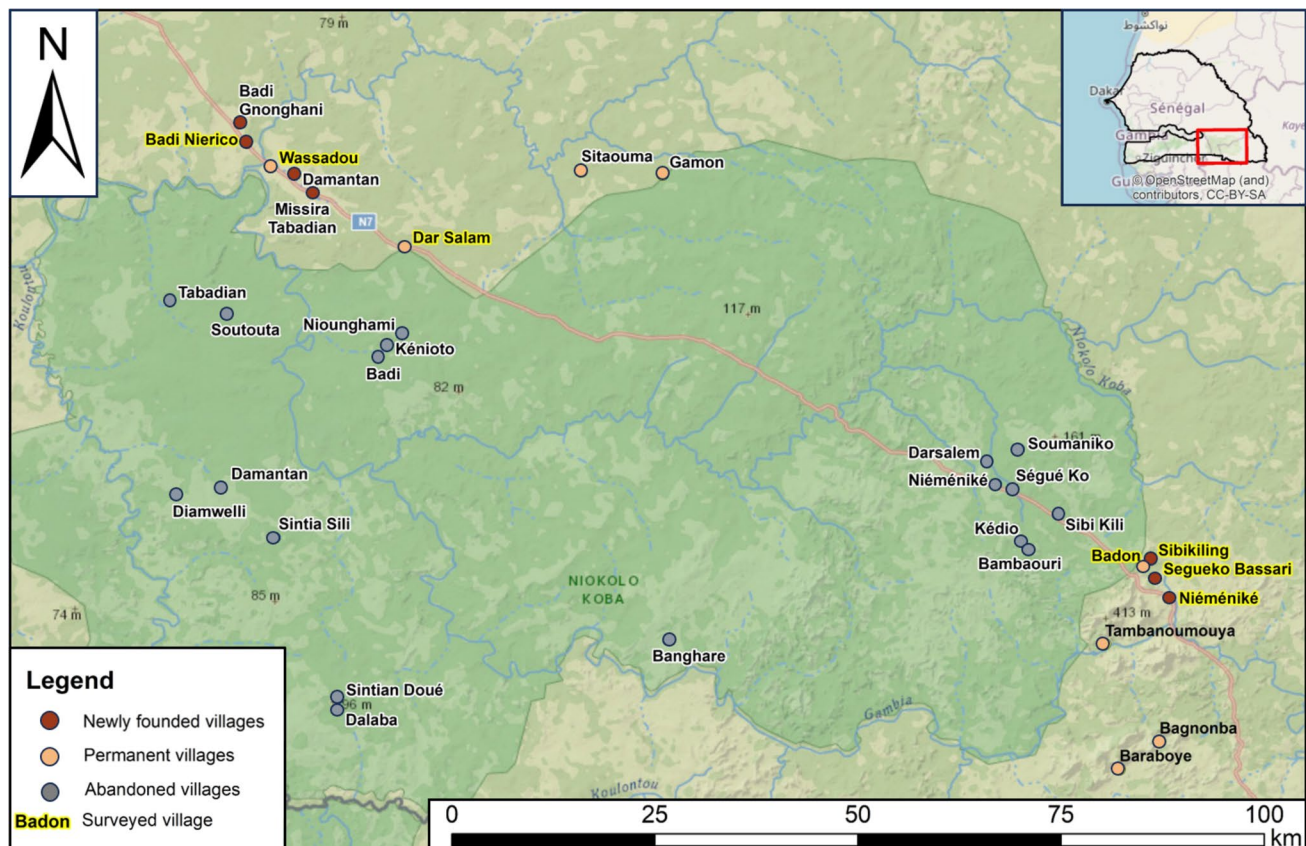


Fig. 1 Study area in Niokolo Koba National Park in SE Senegal (West Africa), showing locations of the main settlements, including abandoned, permanent, and newly established villages. The names of the

seven villages (both permanent and newly established) in the Northwest (NW) and Southeast (SE) of the park, where ethnobotanical surveys were conducted, are highlighted in yellow

underrepresented because women often needed permission from male relatives or household heads to participate. Women generally have limited access to ritual spaces and are not allowed to discuss sacred matters publicly.

We recorded communities' spiritual, ritual, and physical ties to revered woody species and their environment, improving our understanding of their practices within the biophysical context of the NKNP region. Ethnobotanical data were analyzed based on the frequency and percentage of plant reports. Local plant names were collected and cross-checked with Adam (1970a, 1970b). Their scientific identities were confirmed through in situ recognition by participants, and names were validated using online databases, including GBIF (www.gbif.org), PROTA (www.prota4u.org), and IPNI (www.ipni.org). The percentage of participants citing each species was calculated by dividing the number of participants who mentioned a species by the total number of respondents and multiplying by 100 (Tardío & Pardo de Santayana, 2008). Graphs were created using the 'tidyverse' (Wickham et al., 2019) and 'ggpubr' (Kassambara, 2023) packages in R version 4.4.0 (R Core Team, 2024).

We calculated cultural importance (CI) indices based on informant consensus using the R package *ethnobotanyR* (Whitney, 2021). A use report (UR) refers to each instance an informant cited a species for ritual use (Whitney et al., 2018), and CI was calculated by dividing the total number of URs by the number of informants (Tardío & Pardo de Santayana, 2008). To assess the relationship between ritual and medicinal uses, we used data from 36 species for which both medicinal and ritual CI values were available within the same population (Majerovičová et al., 2025), and performed Spearman's correlation and a generalized linear model (GLM) using base R version 4.4.0 (R Core Team, 2024).

Results and Discussion

Ritual Woody Species

Our research documented the ritual use of woody species around Niokolo Koba National Park (NKNP), with many serving multiple purposes and holding significant cultural value for local communities. These findings contribute to a broader biocultural understanding of how folk religion connects the natural world, local landscapes, and community life. Interviews with 63 respondents identified 41 woody species, belonging to 34 genera and 17 botanical families (Supplementary material, Table 1). The most common families were *Fabaceae* (10 species), *Malvaceae* (6 species), *Moraceae* (5 species), *Combretaceae* (4 species), and *Anacardiaceae* (3 species), with other families contributing one or two species each. The ten most frequently cited plants for

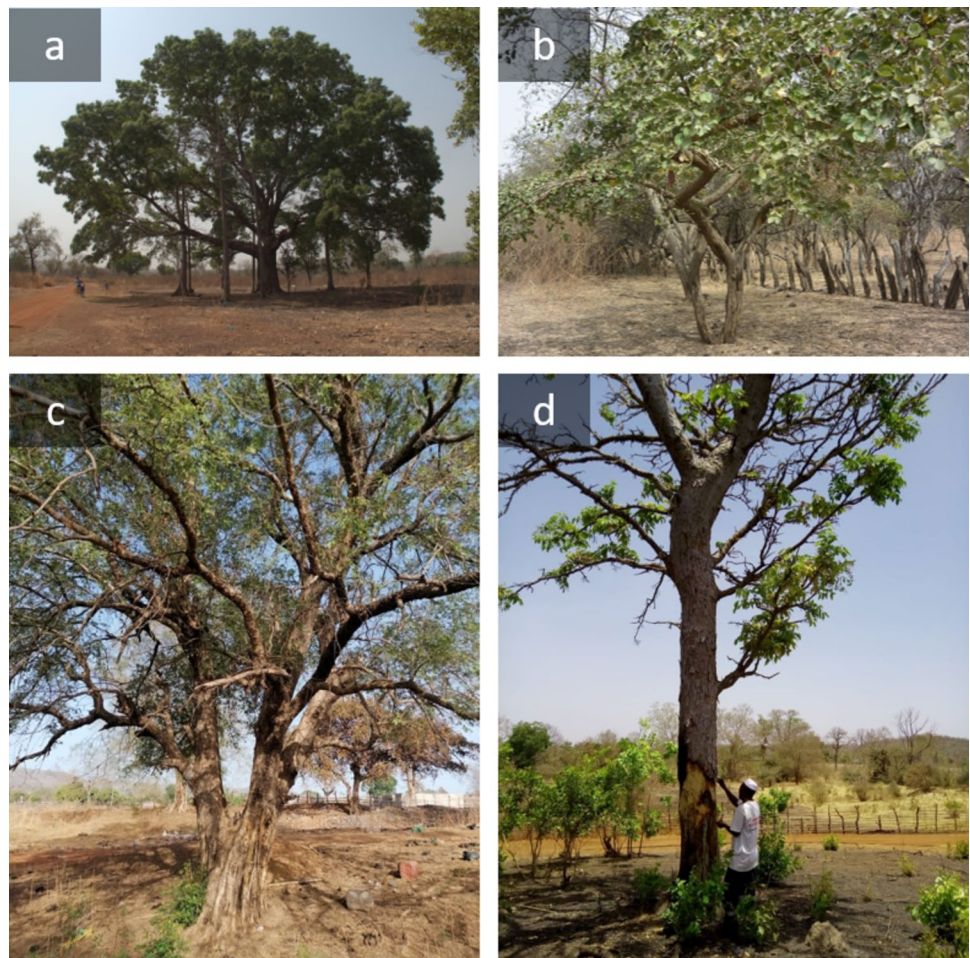
ritual use were *Khaya senegalensis* (CI=0.94), *Piliostigma thonningii* (0.92), *Anogeissus leiocarpa* (0.83), *Daniellia oliveri* (0.78), *Ceiba pentandra* (0.57), *Ficus* sp. (0.44), *Ficus gnaphalocarpa* (0.43), *Lannea acida* (0.43), *Parkia biglobosa* (0.43), and *Adansonia digitata* (0.41) (Supplementary material, Table 1; Fig. 2). Respondents highlighted the cultural importance of these trees over their botanical classification; however, we documented them using scientific names to facilitate the integration of traditional and scientific knowledge.

The importance of certain trees to communities often stems from their unique shapes, large size, age, medicinal qualities, or their links to significant community events and traditions (Dafni, 2006). The revered status of some trees and restrictions on their use are usually associated with their rarity, while common species are more frequently used as resource materials (Quiroz & van Andel, 2015). Although specific species are appreciated for their unique features, this does not imply widespread, systematic reverence across regions. Nevertheless, similar examples can be found in other West and Central African cultures for species like *Ceiba pentandra*, *Khaya senegalensis*, *Adansonia digitata*, *Ficus* spp., *Vitellaria paradoxa*, *Anogeissus leiocarpa*, *Parkia biglobosa*, and *Daniellia oliveri* (Diop, 2011; Quiroz & van Andel, 2015; Salpeteur, 2010; Savadogo et al., 2018; Steger et al., 2023; Yameogo, 2015). Throughout the text, we refer to similar ritual practices documented in Senegal and other countries.

Ritual Practices

The ritual use of trees encompasses various practices that are not mutually exclusive, including body baths, ritual drinks, fumigation, amulets, ritual masks, divination, and veneration (Supplementary material, Table 1). These practices serve different purposes in rituals related to significant life events, such as coming of age, birth, problem-solving, and meeting spiritual or material needs. Offerings to trees symbolize respect, gratitude, and requests for favor, guidance, or permission from the spiritual entities believed to be connected with them (Fig. 3a and f). Plants used in body baths, ritual drinks, and fumigation have several roles: they are used in traditional healing, treating mystical illnesses caused by spirits, protecting against evil-doers (such as enemies, sorcerers, and evil spirits), purifying the body, and promoting social success, good luck, prosperity, happiness, charm, love, or fame. These plants are among the most common, and their ritual use often involves offerings or sacrifices of animals, food, or textiles (see section "Consultation and Invocation of *Dialan* spirits"). Body baths and ritual drinks involve preparing water mixed with herbs or plant parts, a task performed by individuals with spiritual

Fig. 2 The four most frequently mentioned species used in rituals: (a) *Khaya senegalensis*, used in body baths, ritual drinks, fumigation, amulets, ritual masks, and revered as *Dialan*; (b) *Piliostigma thonningii*, widely used in rituals and mask making, revered as *Dialan*, but not reported for ritual drinks; (c) *Anogeissus leiocarpa*, used in body baths, ritual drinks, and fumigation; and (d) *Daniellia oliveri*, used in body baths, fumigation, and revered as *Dialan*. Photos: T. Majerovičová (a) & I. Manka (b-d)



knowledge (Fig. 3b and c). These mixtures are either consumed or applied to the body to meet specific spiritual and physical needs. Fumigation involves inhaling or being exposed to smoke from burning plants for healing, purification, or protection (Fig. 3c).

Amulets are often made from written prayers, plant or animal parts, placed in specific locations or worn on the body to fulfill desires or offer protection (Fig. 3d). Masks, referring broadly to individuals wearing plant-based costumes (van Beek, 2024)—including headpieces, full-body adornments, and handheld accessories—are believed to predict the future and communicate with supernatural protectors or spirits (Supplementary material, Table 2). An example is the full-body mask of *Kankurang* (Fig. 3e), revered as a guardian of peace and safety, a hunter of evil spirits, a judge who punishes customary offenses, and a healer of certain illnesses, particularly among children (Kesteloot, 1994). Wearing these masks—or, rather, being the mask—is reserved for initiates, usually men, and occasionally women with specialized magical-religious knowledge. The uninitiated must not touch the mask, see the wearer's face, or witness the dressing process; such transgressions require ritual

baths, offerings, or sacrifices to prevent consequences like illness, infertility, or death. Additionally, *Dialan* trees are sometimes marked by a pile of lateritic stones at their base (Fig. 3f and 7d), indicating a connection to the supernatural. According to local belief, the roots represent deceased ancestors, the leaves symbolize the sky or invisible world, and the trunk represents the link connecting them.

The practices described are often linked to specific locations within villages, their surroundings, or the park (Supplementary material, Table 1), where communities perform rituals, offer prayers, conduct healing ceremonies, and connect with spirits.

Ethnic and Regional Use

Around the NKNP, 25 species were mentioned in the Northwest (NW) and 36 in the Southeast (SE), with 20 shared across both regions (Supplementary material, Table 1). The SE recorded more than twice the mentions compared to the NW (441 vs. 179 mentions), with most mentions occurring in the surroundings (SE: 406, NW: 145), followed by the park (SE: 19, NW: 32), and villages (SE: 16, NW: 2). The

Fig. 3 Ritual use of woody species: (a) Cotton fibers attached to a *Ficus gnaphalocarpa* tree, used as an offering; (b) crushed leaves of *Scoparia dulcis* used in ritual baths; (c) *Daniellia oliveri* resin used in ritual baths and fumigation; (d) an amulet made from the thorn of *Ceiba pentandra* and square leather pouches containing written prayers; (e) Ritual mask of *Kankurang*, crafted from *Piliostigma thonningii* (red fibers) and *Khaya senegalensis* (leaves). Still holding religious significance in the study area, *Kankurang* displays are increasingly performed as cultural attractions in other regions (De Jong, 2001) and have been recognized by UNESCO (2006). The mask is shown here with the consent of the wearer and local authorities; (f) an offering placed at the base of a *Khaya senegalensis* tree, resting on a pile of stones containing metal objects with symbolic meanings related to good harvests, progress, and prosperity (e.g., hoe, adze, hatchet, door latch, bicycle hub, and pedal partly visible), as part of ritual practices. Photos: I. Manka



Mandinka reported 34 species, the Bassari 25, the Fulani 23, and the Jakhanka 4. Species such as *Khaya senegalensis*, *Piliostigma thonningii*, and *Daniellia oliveri* were frequently cited in both regions (>20 mentions per region), although the SE generally had more mentions. Other relevant species included *Ceiba pentandra*, *Anogeissus leiocarpa*, *Adansonia digitata*, *Parkia biglobosa*, *Combretum molle*, and *Annona senegalensis*. Despite being present in both regions, some species were more commonly reported in the SE, such as *Ficus gnaphalocarpa*, *Ficus* sp., *Lannea acida*, *Hexalobus monopetalus*, and *Ostrya derris stuhlmannii*. Species used exclusively in rituals in the SE included *Vitellaria paradoxa*, *Pterocarpus erinaceus*, *Ficus platyphylla*, *Sterculia setigera*, *Cola cordifolia*, and *Bombax costatum*, each mentioned more than five times. The NW had some exclusive species, but they were mentioned only once or twice, such as *Terminalia macroptera*, *Cassia sieberiana*, *Tamarindus indica*, and *Ziziphus mucronata*. There was a consensus among villages in the same area, with residents mostly mentioning the same species. More remote villages, farther from the national road between Tambacounda and Kédougou, listed a broader range of species.

Some regional differences in reporting higher ritual activity in the SE can be explained by the larger number

of participants (nine more), greater ethnic diversity, and increased availability of ritual flora in the SE. Local plant choices are influenced by the availability of species in villages, surroundings, and the park, as well as by historical interactions with sites and trees and the preservation of traditional knowledge within ethnic groups and communities, with older generations usually playing a key role in passing down this knowledge (Ayantunde et al., 2008).

Our overall findings partly align with those reported by Fulani inhabitants of the nearby Department of Vélingara, who identified 14 “spirit trees” species, 11 of which are included in the 41 species in our study, excluding the minimally reported *Maytenus senegalensis* and *Ziziphus mauritiana* (Steger et al., 2023). Although *Piliostigma thonningii*, which was significant in our study, was not reported in Vélingara, its relative, *P. reticulatum*, was also reported as used to create a full-body covering mask for the *Kankurang* (Steger et al., 2023).

Comparable rituals involving revered trees are documented across many cultural contexts and folk religions in West Africa (Dupire, 1976; Quiroz & van Andel, 2018; Savadogo et al., 2010, 2017). These rituals include petitions, offerings, and sacrifices aimed at securing good harvests, protection from evil spirits, communication with ancestors,

expressing gratitude, and seeking blessings for important life events. Therefore, despite cultural differences, the ritual significance of trees is widely recognized and often extends beyond ethnicity and geographic borders.

Physical Interaction with Sacred Trees and Landscapes

Communities shape their actions not only by utilitarian needs but also by spiritual, ritual, or symbolic connections to the landscape. For instance, settlements have often been located and designed around relationships with prominent trees, such as *Ceiba pentandra*, *Adansonia digitata*, or *Khaya senegalensis* (Fig. 4a, b, and d). Similarly, the convenience of maintaining a distance from specific trees or sacred forests has also influenced village layout. Patches of revered forest have been preserved even within agricultural landscapes due to their spiritual importance and culturally valuable trees (Fig. 4c). Additionally, isolated trees are appreciated or respected for their spiritual significance, so they are preserved in the landscape and sometimes planted. Other practices have altered the appearance of trees through ritual activities such as scarring, bark removal, creating holes, cutting branches, hanging ritual drums (Fig. 5), or using their structure to host tombs—for example, baobabs were traditionally used as tombs for griots, a caste of musicians, poets, and storytellers. These actions generally cause minor damage, especially compared to the destructive harvesting of non-revered trees. However, they can leave visible scars, as shown in Fig. 5.

Plant Collection

The collection of ritual plants involves several steps and recommendations. Specific times of the month, weekdays, and times of day are often determined by traditional beliefs and practices for gathering and using plants in rituals. It is also important to consult with the guardians of ritual spaces or traditional spiritual leaders (Doumbia & Doumbia, 2004; Salpeteur, 2010). Monday and Thursday are generally considered the most auspicious days, while Friday is often regarded as taboo or sacred—except for Muslims, who do not observe specific days.

The collection process may involve simple preparatory steps or more elaborate rituals, such as cues (*Tamansero* in Mandinka), gestures (*Kenia*), behaviors (*Mania*), greetings (*Kontondiro*), prayers (*Doua*), incantations (*Firdio* or *Hirdio*), offerings (*Soro* or *Niro*), or sacrifices (*Sadabo*) (Malgras, 1992). Offerings, serving as forms of compensation, may include items like milk, butter, cereals, pieces of cloth, cotton, or a silver coin or bracelet. For example, harvesting *Annona senegalensis* requires an offering of sorghum (*Sorghum bicolor*), while cotton is offered for many species, such as *Anogeissus leiocarpa*, *Pterocarpus erinaceus*, *Adansonia digitata*, and *Ficus gnaphalocarpa* (Fig. 3a).

In the Niokolo Koba area, ritual practitioners refer to plants by their traditional family names, greet them, and make specific requests (Larrue, 2002). Some ritual customs require silence during plant collection and the use of common Senegalese surnames. In Mandinka and Fulani

Fig. 4 The role of culturally significant trees in shaping village space: (a) Village planning with a large *Ceiba pentandra* in the central area and a sacred forest patch (bottom-right in this panel) on the southeastern border of Badon (SE region); (b) *Ceiba pentandra* as a central element in the village public space; (c) Sacred forest, preserved areas containing revered trees, serving as sites for ritual practices, holding cultural and conservation significance; and (d) Public space in the abandoned village of Damantan within the park (NW region), featuring a large *Ceiba pentandra* that occupies the former communal area. Photos: Google Earth (a); T. Majerovičová (b–d)

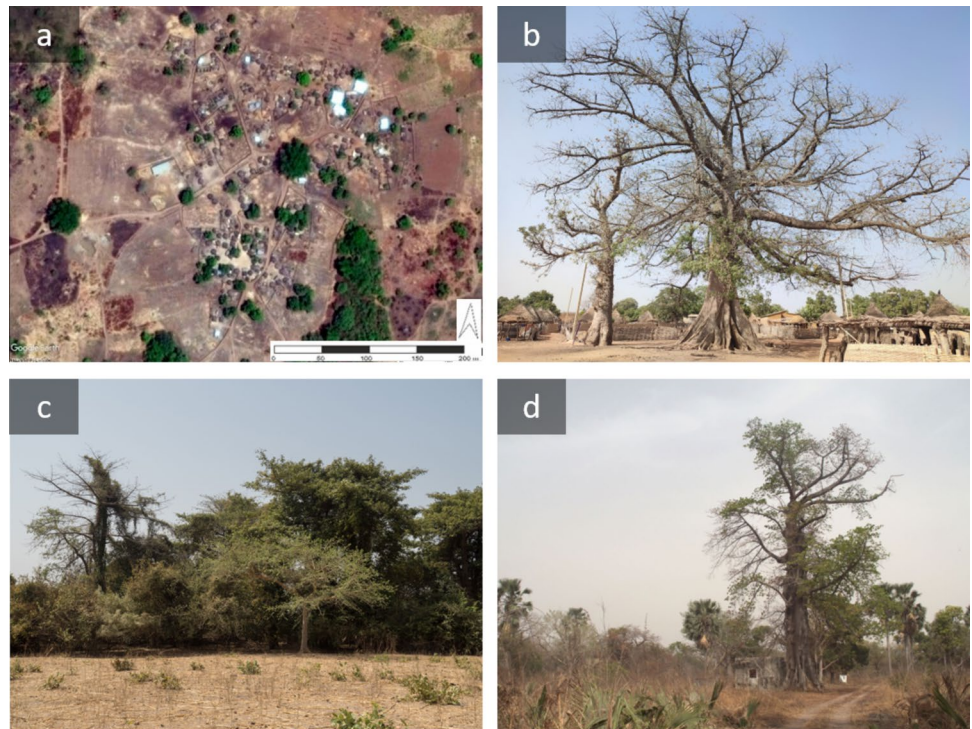


Fig. 5 Ritual practices involve physical interactions with trees, such as scarring, bark removal, and branch cutting. Examples include: (a) *Anogeissus leiocarpa*, where bark is collected for ritual baths; (b) *Adansonia digitata*, with bark removed for use in body protection rituals, purification, and amulets; (c) *Khaya senegalensis*, with bark removed for use in birth rituals, fertility, body purification, and protection; (d) locals removing bark from *Piliostigma thonningii* to create the mask outfit; (e) fibers forming a blanket for the mask outfit; (f) ritual drums (indicated by arrows) hang from a *Pterocarpus erinaceus* tree, following an old Bassari tradition to avoid harmful consequences. In Segueko, these drums are placed after each initiation and are only played during ceremonies. They can also serve as craft beehives, producing honey used to make mead (*Amboko* in Bassari), a sacred drink for initiates that women are forbidden to drink. Photos: I. Manka



communities, *Anogeissus leiocarpa* is known as *Ndiaye* and is harvested on specific days, such as Mondays or Thursdays. Other species, such as *Prosopis africana* (Ley), *Guiera senegalensis*, and *Heeria insignis* (both referred to as *Ly*), as well as thorny plants like *Balanites aegyptiaca*, *Ziziphus mauritiana*, and *Ziziphus mucronata* (known as *Niass*), each hold special cultural and ritual significance.

Trees used for magical and religious purposes are often collected from the eastern side, with their leaves and bark typically gathered by initiated elders and sometimes by young, unmarried women or girls, who are considered pure and innocent. Practitioners, such as traditional priests, spiritual leaders, marabouts, and healers, provide guidance on use through clairvoyance sessions and communication with ancestral spirits to provide specific instructions (Doumbia & Doumbia, 2004).

The Concept of Dialan

The term *Dialan* originates in Mandinka tradition and is derived from *Khaya senegalensis*, known in Mandinka as *Diala* or *Dialo*, a sacred tree central to traditional religion (Larrue, 2006; Niane, 1989). While it initially referred to this particular tree, *Dialan* later came to symbolize spirits, genies, and unseen forces believed to govern both the natural and social worlds (Niane, 1989). The term also

describes the altar or sacred space—often a tree or object used for invocation—where these forces are believed to reside and are venerated to address specific needs (Camara, 2015; D’Avignon, 2022; Larrue, 2006; Niane, 1989). Over time, the concept expanded to include other tree species, animals, objects, and sacred sites, crossing Mandinka culture and integrating into the spiritual practices of various ethnic groups.

Dialan refers not only to a supernatural force, such as spirits, but also to its physical manifestation, like a tree, and its sacred site of veneration, often referred to as an altar (Niane, 1989). These sites, known in Mandinka as *Satekono Dialan* (village altars), *Wulakono Dialan* (forest altars), and *Houre Dialan* (*Dialan* of the Dead), serve as ritual spaces for offerings, prayers, and sacrifices to communicate with the spiritual realm. Spirit worship is no longer limited to the base of *Khaya senegalensis*; altars can also be found at other trees, stones, termite mounds, and natural features (Larrue, 2006). *Dialan* spirits are believed to manifest through or be embodied in trees, animals, rocks, ceramic vessels, sculptures, and other objects, as well as in forests, rivers, ponds, and landscape features (Kesteloot, 1994; Larrue, 2006; Niane, 1989). Therefore, the word *Dialan* may refer to the spirit, its physical form, and the sacred site associated with it. Rituals performed at these sites are called *Dialan* rituals or *Dialan* rites.

Through these rituals, communities connect the spiritual and earthly worlds. Locals invoke spirits through *Dialan*, whether trees or other forms, to address various personal and community concerns, including healing, resolving theft, causing harm, seeking protection or good fortune, succeeding in war, and preventing disasters such as drought, disease, or crop failure (Quiroz & van Andel, 2015; Salpeteur, 2010; Savadogo et al., 2010). As the rainy season approaches, rural populations near NKNP consult *Dialan* spirits to encourage rainfall and avoid poor harvests (Camara, 2015; Quiroz & van Andel, 2015; Salpeteur, 2010; Savadogo et al., 2010). These practices highlight *Dialan*'s vital role in community life.

Dialan Types

The criteria for selecting *Dialan* trees or other entities are not strictly defined but generally depend on symbolic qualities—such as a tree's appearance, size, age, or location—medicinal properties, and spiritual connections with ancestors (e.g., trees growing on ancestral graves) or with events and interactions believed to influence the community's prosperity, health, fertility, or social order.

There are several types of *Dialan*, including private, customary, clan, breeders', women's *Dialan*, and *Dialan* of the Dead (Supplementary material, Table 1). Private *Dialan* caters to individual owners, their families, and visitors, and is typically found within villages, often in houses, and rarely in the forest. Customary *Dialan* belongs to all village members and serves collective purposes, and is typically located in the forest. It is usually invoked or consulted during celebrations and ceremonies, such as initiation and

circumcision. They also address village concerns, including preparation for the rainy season, drought, harvest, hunting, food scarcity, epidemics, conflicts, and warfare. Clan *Dialan* is associated with individuals who share a paternal or maternal lineage, sometimes tracing their ancestry to mythical ancestors (Juhé-Beaulaton, 2008; Savadogo et al., 2017). The breeders' *Dialan* (called *Thianguidoyel* among the Bassari) is invoked in some Bassari and Fulani villages to promote prosperity and abundance and to ward off misfortune affecting livestock (i.e., cows, goats, and sheep). Women's *Dialan* is used exclusively for women's rituals, including initiation, fertility issues, and children's illnesses. It is often located near the village and associated with trees such as *Ceiba pentandra* and *Parkia biglobosa*, which are generally linked to fertility, prosperity, and social success. *Dialan* of the Dead (*Houre Dialan* in Mandinka) is typically situated in a designated area of the household or in the cemetery and is marked by a pile of lateritic stones to honor or worship a deceased mythical ancestor (Camara, 2015).

Diversity, Location, and Cultural Significance of Dialan Trees

Respondents identified 20 plant species used as *Dialan* (Fig. 6), belonging to seven botanical families, with *Fabaceae* (6 species), *Malvaceae* (5 species), and *Moraceae* (4 species) being the most represented (Supplementary material, Table 1). The most frequently mentioned species were *Khaya senegalensis* (100% of respondents), *Ceiba pentandra* (85.7%), *Adansonia digitata* (58.7%), and *Ficus gnaphalocarpa* (55.6%) (Fig. 7), while others, such as *Cordyla*

Fig. 6 Total number of reports for the 20 woody species identified as *Dialan* in the periphery of Niokolo Koba National Park, Senegal. Participants ($n=63$) came from the Mandinka (41), Fulani (12), Bassari (9), and Jakhanke (1) ethnic groups. Overlapping circles indicate an equal number of citations among ethnic groups for each species, while missing circles for a particular group show no mention (e.g., for *Diospyros mespiliformis*). The percentage of citations for each species is shown at the end of each line

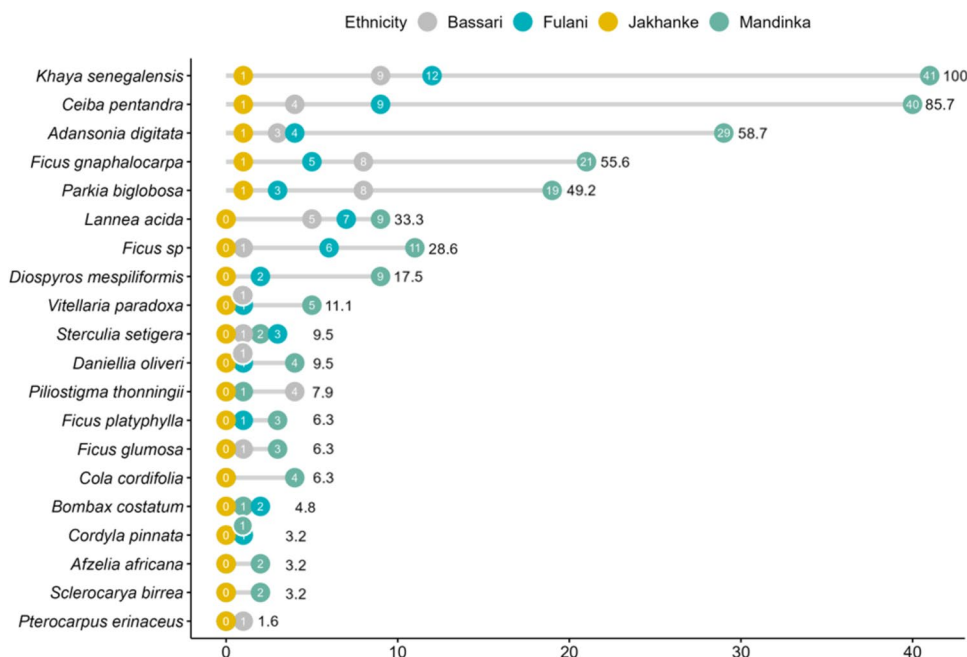


Fig. 7 The four most frequently mentioned species used in rituals and venerated as *Dialan*. These trees, customary in certain villages, serve various roles in local customs and traditions. (a) *Khaya senegalensis* (birth, fertility, purification, and protection rituals); (b) *Ceiba pentandra* (fertility, purification, and protection rituals); (c) *Adansonia digitata* (purification and protection rituals); and (d) *Ficus gnaphalocarpa* (initiation, purification, and protection rituals)—note the pile of lateritic stones at its base, marking the site as revered. All of these species are also believed to harbor spirits or pose risks, such as bringing misfortune or sheltering dangerous animals. Photos: I. Manka

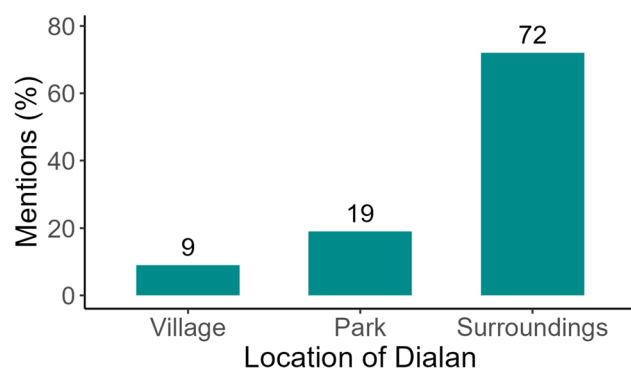
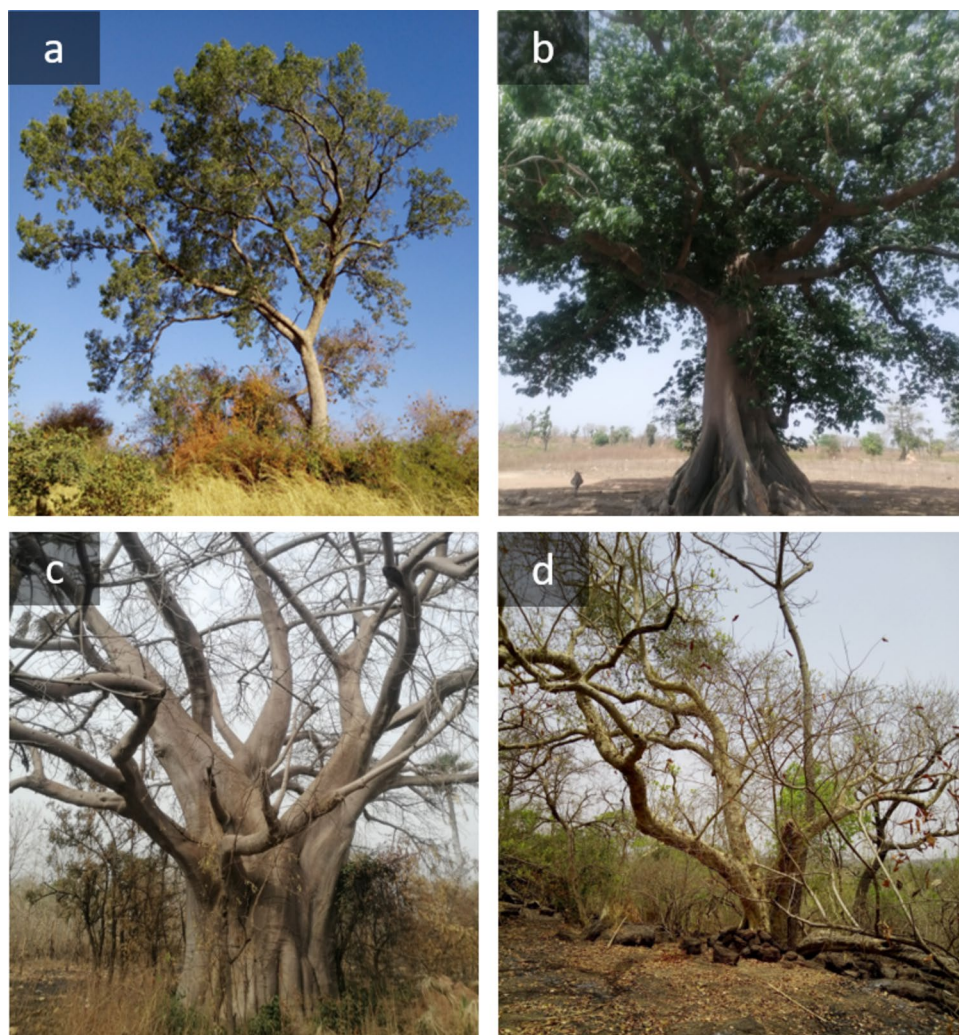


Fig. 8 Distribution of *Dialan* locations based on 32 mentions of revered trees (villages, surrounding areas, and the park area), as reported by participants from seven settlements (in two regions) adjacent to the Niokolo Koba National Park, Senegal

pinnata, *Azelia africana*, *Sclerocarya birrea*, and *Pterocarpus erinaceus*, were only occasionally cited. Regarding their physical location, 9% of respondents placed *Dialan* trees in villages, 19% in park areas, and 72% around villages (31% in the forest) (Fig. 8).

Sacred trees often display notable features such as large size, age, distinctive shape, or rarity in their location. They are often feared, and passing by them at certain times of day—like dusk, night, or midday—is forbidden to avoid encounters with evil spirits or *jinn*s. Cultural restrictions on harvesting sacred plants help protect them from human interference (Yameogo, 2015). According to participants, these trees are regarded as taboo, with strict rules against collecting, cutting, or uprooting any part of the *Dialan* tree. Violating these rules is believed to lead to serious consequences, including personal misfortune, illness, loss of spiritual power, community conflicts, and natural disasters (Savadogo et al., 2010). These consequences can include thunderstorms, fires, famine, drought, disease, death, or epidemics.

Despite the strong influence of monotheistic religions in the region, *Dialan* remains deeply rooted in the biocultural landscape around the NKNP. All participants were aware of it. However, while 49% of participants believed in *Dialan*, only 16% actively practiced it. Among different ethnic

groups, the Bassari had the highest number of practitioners (70%), followed by the Mandinka (30%), mainly in more isolated villages in the southeast of the NKNP. Some Fulani acknowledged believing in *Dialan* but did not practice it due to their religious beliefs. The main reasons survey participants cited for abandoning *Dialan* were Islam (96%), modernization (25%), and Christianity (4%).

The specific tree species identified as *Dialan* varied among ethnic groups (Fig. 6, Supplementary material, Table 1). *Khaya senegalensis* was recognized by all participants. *Adansonia digitata* and *Ceiba pentandra* were mentioned more frequently by Mandinka than by Bassari and Fulani groups. *Ficus gnaphalocarpa* and *Parkia biglobosa* were reported by nearly half of the Mandinka participants and were cited more often by Bassari than by Fulani. *Lannea acida* was mentioned more frequently by Bassari and Fulani participants than by Mandinka participants. Other species, such as *Piliostigma thonningii*, were notably more cited by Bassari. *Ficus* sp. and *Sterculia setigera* were more commonly cited by the Fulani than by Mandinka and Bassari. *Sclerocarya birrea*, *Azizelia africana*, and *Cola cordifolia* were cited exclusively by Mandinka.

The similarity in species choices for *Dialan* rituals shows commonalities among Mandinka and the other three groups studied. More substantial similarities were observed between Mandinka and Bassari, as well as between Mandinka and Fulani, and to a lesser degree between Bassari and Fulani. These similarities likely stem from the long history of coexistence and shared culture between the Mandinka and Bassari communities, which formed alliances to resist Fulani invasions (Lestrangle, 1969; Thiam, 2010). As the original inhabitants of the Sibikiling area, the Mandinka influenced other groups, probably shaping some of their customs—for example, new settlers needed their approval and had to respect their traditions. Conversely, past conflicts and tensions might explain why there is less overlap between Bassari and Fulani practices.

Several *Dialan* species hold deep cultural significance. In the former Kingdom of Gabou (southern Senegal), *Dialan* formed the basis of the official Mandinka religion. The authority of the king (*Mansa*), local chiefs, and Gabou nobles (*Nianthio*) was rooted in belief in these spirits (Niane, 1989). *Dialan* was thus linked to power, resilience, protection, foresight, generosity, and wisdom.

Ceiba pentandra is one of the most revered trees in Mandinka communities. Often planted in public spaces (*Bantaba* or *Bera*) during migrations, it served as a gathering place for community discussions, where royal or local leaders addressed issues, from resolving internal conflicts to planning defenses (Niane, 1989). *Khaya senegalensis* also had similar social and political roles.

Among the Bassari, *Ficus gnaphalocarpa* or *Ficus glumosa* are chosen as the village *Dialan*, serving as sacred trees for initiation ceremonies (*Angap kori* in Bassari). *Piliostigma thonningii* (*Apés*) is used in specific rituals, such as the examination of chicken testes during initiation rites (see the "Consultation and Invocation of *Dialan* spirits" section below). For women's rituals, *Parkia biglobosa* (*Andi-amban*) is regarded as the *Dialan* among the Bassari, while *Ceiba pentandra* holds this role among the Mandinka.

Revered Trees and Naming Customs

The cultural prominence of certain trees is also reflected in toponymy across the Niokolo Koba region. In the park's Northwest, Mandinka villages like Dialacoto and Tabadian are named after *Khaya senegalensis* (*Diala*) and *Cola cordifolia* (*Taba*), respectively (Larrue, 2006). In the Southeast, the villages of Sibikiling and Bantako derive their names from *Borassus aethiopum* (*Sibo*) and *Ceiba pentandra* (*Bantang*) (Charest, 1969; Lestrangle, 1969). Similarly, the Fulani village of Bantigniel, located west of the park, is associated with *Ceiba pentandra*.

This naming tradition extends to individuals, who may be named after revered trees or the rituals linked to them. In Mandinka communities such as Badon, Sibikiling, and Niemenike (southeast of the park), common names include *Bantang* (*Ceiba pentandra*), *Diala* (*Khaya senegalensis*), *Soto* (*Ficus* sp.), and even *Dialan* (named after the ritual altars). In Dienoudiala and Badi Nierico villages (northwest of the park), children born after rituals involving *Khaya senegalensis* or *Ceiba pentandra* are often named *Diala* or *Bantang*. Children born on the day of a ritual are sometimes named after the ceremony itself or the tree associated with it.

Consultation and Invocation of *Dialan* Spirits

Dialan are not merely symbolic entities; they are believed to be conscious agents with real influence over community affairs. They communicate through an occult language deciphered only by initiates, who serve the *Dialan* and act as intermediaries between the spirits and the community (Niane, 1989). Communication with the spirits occurs through incantations or magical speeches, performed exclusively by initiates and those with this specific knowledge.

The methods for consulting or invoking *Dialan* spirits differ by region and village. Rituals may involve sacrificing a cow, sheep, or goat, or offering items such as a chicken, egg, farming tools, beads, a metal object (Fig. 3f), or other appropriate items. Additional offerings could include kola nuts, cereal bouillie, millet galettes, curdled milk, ashes, or rice powder mixed with water, usually placed in calabashes or ceramic vessels. The physical features of sacrificed

animals, such as specific body colors, may also be important. Their blood—and sometimes their bones—may be used in the ritual (Thiam, 2010).

Various procedures are used to assess *Dialan*'s response as a form of divination. A common approach involves examining the rooster's testes after sacrifice: white testes indicate a favorable outcome, while black pigmentation suggests otherwise (cf. Camara, 2015; Charest, 1969; Doumbia & Doumbia, 2004). Other methods include inspecting the liver and heart of the sacrificial animal to see if they retain their original color or lack blood, which are positive signs (Camara, 2015). Additional indicators of *Dialan*'s response may include the posture of a sacrificial chicken lying face down, movement among the leaves of the *Dialan* tree, or if the split kola nuts offered during the ritual fall on their backs.

Trees and other elements can be recognized as *Dialan* after assisting an individual, family, or community by addressing social issues or mediating between the physical and spiritual realms. For example, when people seek help from a particular tree, forest, or stream during difficult times and their needs are met, that element may become venerated, taking on a sacred role in the community's religious and cultural practices. A tree growing on the grave of a mythical ancestor is believed to embody that ancestor's spirit. In some cases, a pile of lateritic stones—called "stones of the Dead" (*Houre kouro* or *Houre Dialan*)—is placed within the household to mark a sacred spot for offerings (Camara, 2015). Sacrifices and libations—such as blood, milk, millet porridge, kola nuts, or local beer—are offered to nourish the ancestors, show reverence, and foster spiritual harmony.

Medicinal Use of Dialan Trees

Medicinal and ritual uses of plants are often linked in traditional biocultural systems (Frazão-Moreira, 2016; Gruca et al., 2014; Quiroz et al., 2016). Analyzing cultural importance (CI) indices (Tardío & Pardo de Santayana, 2008), based on 36 of the 41 ritual species with available medicinal values (Majerovičová et al., 2025), reveals that the overall connection between medicinal and ritual CI is weak and not statistically significant (Spearman's $\rho=0.09$, $p=0.62$; GLM: $\beta=0.64$, $p=0.39$). These findings suggest that ritual value is not solely determined by medicinal utility (Fig. 9).

Nonetheless, several species often used in rituals—such as *Khaya senegalensis*, *Piliostigma thonningii*, *Daniellia oliveri*, and *Ceiba pentandra*—are frequently cited for their medicinal properties (Fig. 9). The following references cover multiple regions, not only our study area. *Khaya senegalensis* bark is used to treat toothache, wounds, skin issues, fever, malaria, diarrhea, parasites, diabetes, and sexually transmitted diseases, while its roots are employed for meningitis and tetanus (Adamu et al., 2022; Laleye et al., 2015; Malgras, 1992).

Piliostigma thonningii bark is used to treat dysentery, malaria, tuberculosis, intestinal worms, and toothache; its leaves are used to treat ulcers, coughs, digestive problems, hemorrhoids, cataracts, and onchocerciasis (Malgras, 1992). *Daniellia oliveri* leaves are used for high blood pressure, headaches, and liver issues; its bark treats tuberculosis and mystical illnesses (such as curses, witchcraft, or syncope attributed to spirits), and its roots are used for diabetes (Diop, 2011; Iwueke & Nwodo, 2008; Malgras, 1992). *Ceiba pentandra* bark is used for toothache, diabetes, asthma, wounds, jaundice, and pruritus, while its leaves are employed for tetanus, dysentery, fever, constipation, diarrhea, coughs, and fatigue (Arbonnier, 2009; Friday et al., 2011; Malgras, 1992). However, despite the medicinal value of these species, only initiates are permitted to harvest from revered trees.

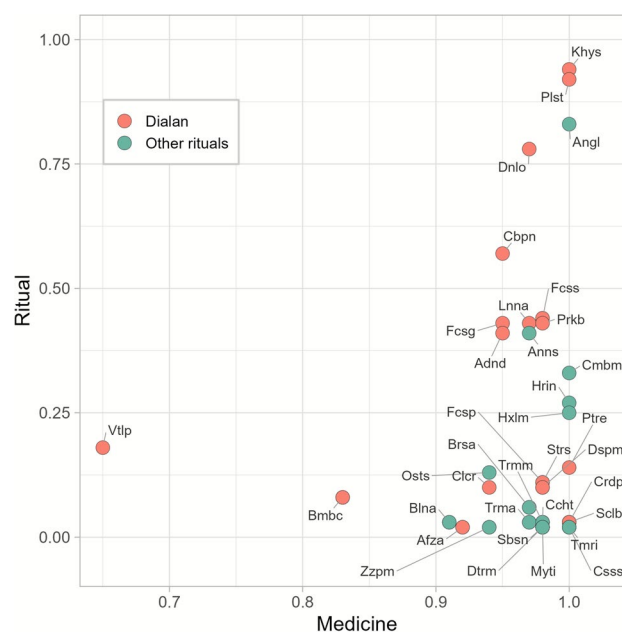


Fig. 9 Relationship between ritual and medicinal Cultural Importance (CI) of species with ritual use. Medicinal CI values are available for 36 species, as reported by Majerovičová et al. (2025). Each point represents one or more species with identical values. All species with ritual use are shown in green, while orange points indicate those also revered as *Dialan* (in bold in this caption). **Species abbreviations:** Adnd (*Adansonia digitata*), Afza (*Azela africana*), Angl (*Anogeissus leiocarpa*), Anns (*Annona senegalensis*), Bmbc (*Bombax costatum*), Brsa (*Borassus aethiopum*), Ccht (*Cochlospermum tinctorium*), Cbpn (*Ceiba pentandra*), Clcr (*Cola cordifolia*), Cmbm (*Combretum molle*), Crdp (*Cordyla pinnata*), Cssh (*Cassia sieberiana*), Dnlo (*Daniellia oliveri*), Despm (*Diospyros mespiliformis*), Dtrm (*Detarium microcarpum*), Fcsg (*Ficus gnaphalocarpa*), Fcsp (*Ficus platyphylla*), Fcss (*Ficus* sp.), Hrln (*Heeria insignis*), Hxlm (*Hexalobus monopetalus*), Khys (*Khaya senegalensis*), Llna (*Lannea acida*), Myti (*Mitragyna inermis*), Osts (*Ostrya dennis stuhlmannii*), Plst (*Piliostigma thonningii*), Prkb (*Parkia biglobosa*), Ptre (*Pterocarpus erinaceus*), Sbsn (*Saba senegalensis*), Sclb (*Sclerocarya birrea*), Strs (*Sterculia setigera*), Tmri (*Tamarindus indica*), Trma (*Terminalia avicennoides*), Trmm (*Terminalia macroptera*), Vtlp (*Vitellaria paradoxa*), and Zzpm (*Ziziphus mucronata*)

Some ritual plants have low ritual cultural importance (CI) because access to knowledge about them is limited, often restricted to initiated practitioners. This does not mean that these plants are less ritually significant; rather, ritual knowledge about them is not widely shared. Contextual factors also influence CI; for instance, *Vitellaria paradoxa*, which is medicinally important in other regions (Odounharo et al., 2022), has low CI locally due to its limited availability (Fig. 9).

In contrast, some ritual knowledge is more broadly shared. *Anogeissus leiocarpa*, known locally as *Dimba Yiro*, is a sacred tree associated with women who give birth and cattle breeders. It is believed to "catch" children, leading to illnesses like fever, diarrhea, or weight loss. Using it as firewood is prohibited because it is believed to transmit diseases to children and animals. To break this taboo, the pregnant or breastfeeding woman must use the ashes or bark in baths for herself or her child. Hanging a piece of the child's clothing on the tree might also be required. Sitting under its shade while breastfeeding is forbidden unless the mother pours some of her milk on the tree as a form of compensation. Leaves and bark are also used in birth rituals for newborns.

Overall, although there is some overlap between ritual and medicinal uses, these areas represent distinct types of knowledge and practice. More research is needed to understand better how local ecological, cultural, and social factors influence these relationships.

Current Practice of Dialan Rituals

Although the practice of *Dialan* rituals is declining among communities of different faiths, it remains an important part of spiritual life for people of all religious backgrounds and social classes, with many individuals occasionally participating in traditional rituals. Our study found that 16% of participants still engage in aspects of this tradition, often in modified forms. Notably, in the southeastern village of Segueko, a predominantly Christian Bassari community, 70% of residents continue to practice this traditional belief despite possible social disapproval. Similarly, in villages like Sibikiling and Badon, also in the Southeast, residents, including Muslims, turn to *Dialan* in times of need or to solve significant issues. These villages maintain oral histories describing *Dialan*'s help during past conflicts against Fulani invasions (Lestrangle, 1969). Likewise, in the Northwest part of the park, residents of Badi Nierico occasionally participate in *Dialan* rituals and proudly acknowledge their ancestral connection to *Dialan*, even though they identify as Muslims. However, the way *Dialan* spirits are consulted has evolved due to various influences and pressures. While *Dialan* rituals were once performed openly, even in public spaces, modern practices tend to be more discreet or secretive to avoid judgment, discrimination, or stigmatization.

Historical Pressures on Traditional Rituals

The influence of modernization and the spread of monotheistic religions has significantly restricted the preservation of traditional ritual knowledge (Juhé-Beaulaton, 2008; Savadogo et al., 2010; Yameogo, 2015). The decline of traditional religious practices has led to the stigmatization of individuals who still visit sacred forests and perform rituals. This decline is partly rooted in historical events that date back to the late nineteenth century, during the period of raids and wars between the Fulani and the Mandinka and Bassari peoples of the Sibikiling territory (Charest, 1969; Lestrangle, 1969). The settlement of Muslim communities, especially the Fulani and Jakhanke, in the region in the mid-twentieth century also contributed to this decline (Lestrangle, 1969).

Similar influences have been seen in other West African countries in the second half of the nineteenth century, such as Benin, where the arrival of missionaries promoted Christianity and led to the abandonment of traditional practices and sacred spaces (Juhé-Beaulaton, 2009). Additionally, social changes since the mid-twentieth century, including centralized resource management and increased commercialization of local economies, have shifted communities' reliance toward broader markets and government policies (Faye & Ribot, 2017; Sène, 2014). These shifts have weakened traditional community structures, such as lineage systems, age grades, and castes (Weil, 1971).

As communities become more dependent on external factors, the influence of masked figures in social control diminishes, leading to their secularization or disappearance (De Jong, 2001, 2013; Weil, 1971). This weakening of traditional structures and roles is further exacerbated by challenges in passing down ritual heritage, significantly contributing to the decline of magico-religious beliefs. Finding suitable successors for customary chiefs after their death becomes increasingly difficult, if not impossible (Juhé-Beaulaton, 2008; Yameogo, 2015). Interviews showed that younger generations have less knowledge of ancestors and participate less in the ritual use of plants. Although they are expected to uphold local culture, they often prioritize economic growth, improved living conditions, and rural-to-urban migration over the preservation of traditional magico-religious plant knowledge (Juhé-Beaulaton, 2009). These shifting priorities cause tensions between generations, with elders worried about losing and devaluing spiritual heritage, while younger people feel less connected to these traditions. The gradual loss of older generations, along with the removal of communities from sacred sites and species due to displacement and modernization, further diminishes the chances of preserving this knowledge.

Environmental Pressures, Management, and Conservation

Traditional ritual knowledge and sacred spaces face threats from various environmental and human-made pressures on species, habitats, and local communities (Faye et al., 2014; Faye & Ribot, 2017). Natural disturbances, such as droughts and grazing, can harm habitats and hinder species conservation. However, human activities—including land-use changes, repeated bushfires, and plant removal—have greatly accelerated the decline of sacred spaces (Atindehou et al., 2022; Faye et al., 2014; Majerovičová et al., 2025). Ritual plants are highly valued economically and commercially because of their roles in purification, protection, healing, and exorcising evil spirits, among other uses. Bark, roots, and leaves are often harvested, fueling trade in traditional medicine markets, as reported in other West African contexts (Quiroz & van Andel, 2015). These ritual and medicinal uses, along with construction, firewood collection, and food gathering, contribute to human pressures that damage vital habitats and threaten their preservation (Majerovičová et al., 2025).

The limited availability of agricultural land in some villages has resulted in farming on sacred spaces. Additionally, transhumant herders—known as *Agga* in Mandinka—arrive around May from neighboring countries, such as Mali (Assani et al., 2017; Steger et al., 2023), causing vegetation damage and disturbing sacred forests, as observed by participants in Segueko Bassari. While some herders focus solely on feeding their animals, disregarding local customs, others unintentionally contribute to the destruction of these forests. In the nearby district of Vélingara, some residents intentionally damage trees to kill them, as dead trees can be legally harvested, thereby circumventing forestry and conservation regulations (Steger et al., 2023). These practices, along with illegal timber harvesting, also threaten sacred spaces and local biodiversity.

Sacred forests play crucial cultural and ecological roles, often serving as refuges for biodiversity through traditional preservation practices (Melaku et al., 2023; Savadogo et al., 2017). However, conflicts frequently arise when local community priorities clash with conservation authorities' goals (Badman et al., 2009). While communities honor these sites through cultural rules such as taboos, restrictions, and prohibitions, conservation policies that focus on resource exclusion can conflict with traditional uses. For example, the people of Sibikiling, Segueko Bassari, and Badi Nierico have sacred sites in their original settlements within the park, which are now abandoned mainly due to displacement caused by conservation efforts. Similarly, certain customary trees remain vital for displaced communities. In Badon and Sibikiling, for instance, a large *Ceiba pentandra* named *Fourba bantang* is valued for addressing fertility issues, illnesses, and child mortality.

Effective strategies for managing protected areas should include local practices and priorities, fostering respect for traditions while ensuring conservation and sustainable resource use (Numbere & Otufu, 2023; Sheppard, 2021). Recognizing traditional ties to sacred spaces has been shown to improve the effectiveness of nature management programs (Ihemezie et al., 2021; Numbere & Otufu, 2023). Therefore, adopting participatory and sustainable approaches is crucial to address both environmental and cultural needs while protecting traditional ecological knowledge from being lost (Majerovičová et al., 2025).

Further Research and Future Directions

Our study documents the relationship between local communities and their landscapes and provides a comprehensive list of species. Including more women and children in future studies could lead to a better understanding of local cultural practices and ecological knowledge (Gallois et al., 2024; Mueller, 2013). Although we aimed for balanced regional representation of ethnic groups, participants, and gender, adding an extra Bassari village in the Southeast without a similar one in the NW might have introduced a slight regional bias. Still, we believe that including this ethnic group greatly improves the study's objectives. Future research could benefit from a larger, more diverse group of participants to better capture a broader range of interactions with the species used in rituals.

Documenting the current uses of woody and non-woody plants is also crucial for preserving and revitalizing traditional knowledge, especially among younger generations (Gallois et al., 2024; Majerovičová et al., 2025). This study focuses on woody species, whose ritual use—particularly regarding *Dialan*—is especially significant. Their longer lifespans allow for lasting relationships, enabling them to become integrated into community life and cultural practices. However, the medicinal and ritual uses of non-woody species require further research. Several trees of cultural, social, and spiritual importance were identified, illustrating the deep spiritual connection between local communities and their environment. Recognizing these relationships with venerated trees can also shed light on past human–environment interactions and inform archaeological and archaeobotanical interpretations of abandoned settlements and displaced communities (Majerovičová et al., 2022). Additionally, these findings can aid biocultural conservation and restoration efforts (Bridgewater & Rotherham, 2019). Participatory mapping can help identify culturally significant sites, including revered trees and sacred forests, fostering inclusive decision-making and incorporating indigenous knowledge into resource management. Protecting these sites not only promotes conservation but also honors and integrates local worldviews into conservation planning (Juhé-Beaulaton, 2008; Melaku et al., 2023; Sheppard, 2021).

Conclusion

Our study documents the magico-religious use of woody species and their ritual roles among communities surrounding Niokolo Koba National Park (NKNP), aligning with broader socio-cultural patterns observed in other regions. These ancestral beliefs define the identity of ethnic groups and form a body of knowledge deeply rooted in specific landscapes and historical events. However, this rich biocultural heritage is currently declining due to environmental and human pressures. The displacement of communities by conservation policies, along with the influence of global monotheistic religions and modernization, has weakened the ties to traditional practices and beliefs over the past century.

Despite these challenges, our study shows that some traditions persist, especially in more isolated communities away from the Tambacounda-Kédougou national road. Nearly half of the population still believes in traditional rites, even though few openly practice them. While ancestral traditions have not been completely eradicated, they face increasing threats from the decline of traditional societies, the rise of monotheistic religions, and modernization. The growing disconnect between modern societies and nature, along with the gradual loss of elders and community leaders, further endangers the transmission of traditional ecological knowledge to younger generations. Therefore, more efforts are needed to document valuable biocultural heritage before it disappears amid modernization in Senegal.

Biocultural diversity is dynamic, reflecting the ongoing evolution and adaptation of human cultures to changing environments. However, ritual knowledge, with its intangible nature, is particularly vulnerable to loss and transformation. Rituals and magico-religious practices, once central to community life, are now increasingly diminished and trivialized due to various pressures outlined in our study. While shifts in belief systems are inevitable in rapidly changing West African societies, documenting these traditions and worldviews remains essential for recognizing biocultural diversity, preserving cultural heritage, and guiding inclusive land management and conservation efforts.

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Data Availability No datasets were generated or analyzed during the current study.

Declarations

Ethical Approval Ethical approval for this research aligns with the University of South Bohemia's Code of Ethics (R432).

Informed Consent/Consent for Publication All interview participants provided verbal consent for their data and selected images to be used anonymously in research and potential publication. We ensure the confidentiality of interview responses and participant information by anonymizing personally identifiable data and securely storing interview materials.

Clinical Trial Number Not applicable.

Conflict of interest The authors declare no competing interests.

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