Journal of Tropical Ecology

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Cite this article: Habel JC, Schultze-Gebhardt K, Shauri HS, Maarifa AM, Maghenda M, Fungomeli M, and Teucher M (2023). Kaya forests: nucleus of cultural and biological diversity and functionality. *Journal of Tropical Ecology*. **39**(e21), 1–5. doi: https://doi.org/10.1017/S026646742300010X

Received: 12 December 2022
Revised: 17 March 2023
Accepted: 15 April 2023

Keywords:
Biodiversity hotspot; forest conservation; ecosystem services; culture; stakeholders; communication

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Kaya forests: nucleus of cultural and biological diversity and functionality

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Abstract

The Kaya forests in Southern Kenya are valuable habitats for rare animal and plant species and provide various ecosystem services. The Kaya forests are also centres of cultural life and are of great relevance to rites, traditions, and the social order of the community of people. During the past decades, these forest remnants become under extreme pressure due to land use and resource exploitation and are in danger of disappearing completely during the next years. This negative trend is progressing with the increasing population density. In addition, the relevance of the former cultural rites is increasingly being forgotten, and with it the relevance of these places. In order to preserve these forest remnants in the long term, it is important to make the population aware of the numerous and valuable ecosystem services, as well as to bring the former cultural life back into the centre of society. A general prerequisite to efficiently conserve Kayas might be the improvement of communication among generations, such as between the elders of Kayas and the youth, as well as among elders from different Kayas to harmonize conservation strategies and the sustainable use of these forest remnants. In addition, strengthening the communication between state institutions and the elders of the individual Kayas might help to find a common strategy to conserve Kaya forests.

Introduction

The East African (EA) Coastal Forest stretched once from Somalia in the northeast to Zimbabwe in the southwest (Burgess & Clarke 2000). This ecosystem is habitat for various (endemic) animal and plant species (Robertson & Luke 1993, Wass 1995, Burgess *et al.* 1998, Matiku 2005) and provides numerous ecosystem services to people, such as wood, fruits and medical plants, carbon storage, and climate regulation, among others (Glenday 2008, Habel & Ulrich 2020). With increasing demographic pressure changes in land ownerships (e.g. privatization), major parts of the East African Coastal Forest have been destroyed. Today, the remaining forest is highly fragmented but still of high relevance to biodiversity and functions (Mittermeier *et al.* 2011). Some of these forest remnants are protected as forest reserves or National Parks (Wass 1995), such as the Arabuko Sokoke Forest and the Shimba Hills in southeastern Kenya (Fungomeli *et al.* 2020a). In addition, some small and geographically isolated forest patches are protected across southern Kenya, as they host old settlement sites, old burials from former chiefs, and they are also rainmaking sites (Metcalfe *et al.* 2010).

Forest Kayas or Mijikenda sacred forest sites are spread along the Indian Ocean coastline of southern Kenya (Robertson & Luke 1993, Githitho 2003, Matiku 2005, Shepheard-Walwyn 2014, Fungomeli *et al.* 2020b). Most of these ca. 145 forest islands are very small (mean size of 120.4ha, with two larger forest islands – the Arabuko Sokoke Forest with 42000 ha and the Shimba Shills with 25300 ha, 75% smaller than 150 ha) (Nyamweru *et al.* 2008, Shepheard-Walwyn 2014, Fungomeli *et al.* 2020b), and geographically isolated from each other. Since ancient times, they have been managed and controlled by elders and have remained largely intact (Fungomeli *et al.* 2020b). Ecologically, they are of high relevance as they still harbour considerably high biodiversity, including rare forest plant and animal species (Luke & Githitho 2003, Wijtten *et al.* 2011). In addition to local protection, many Kayas are protected as National Monuments or forest reserves; several Kayas are also included in the Mijikenda Kaya World Heritage site (Githitho 2016, Fungomeli *et al.* 2020a).

Despite the cultural and ecological relevance of these forest islands, there exists a lot of pressure on them. Thus, the fast-growing and increasingly ethnically mixed local population collects

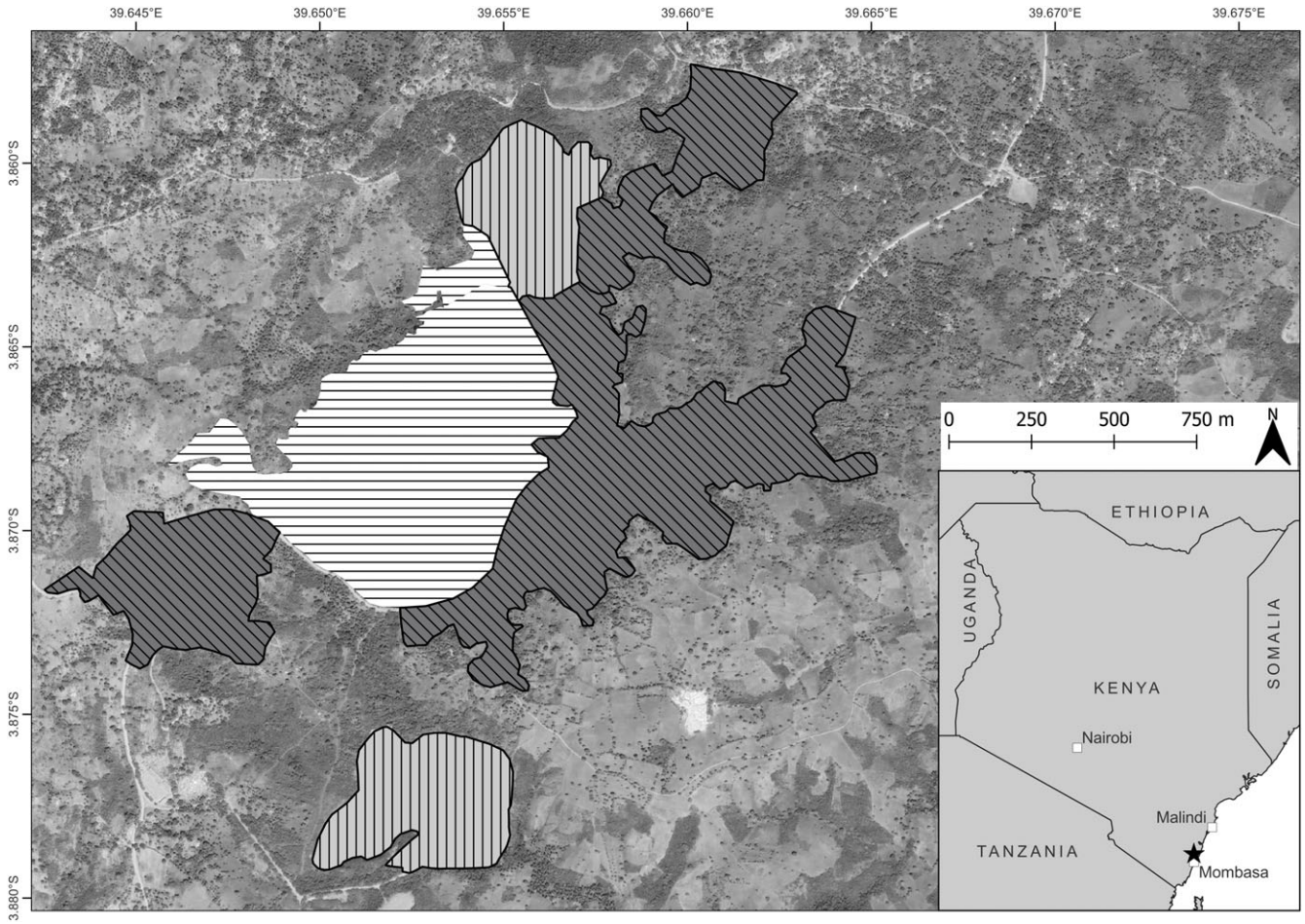

Figure 1. Location of Kaya Kambe forest (star in small inlet map). Forest patch (white-black shaded) embedded in agricultural land and surrounded by settlement area (dark shaded) and quarries (white shaded).

firewood for cooking (deadwood and tree-cutting) and the construction of houses (stems from young re-growing trees), or for sale (alternative sources for firewood and timber are not easily at hand). In addition, cattle grazing takes place inside these forests, as well as illegal hunting (including with traps). These activities lead to the situation that vegetation regeneration can hardly take place for various forest tree species (Kibet 2011). Furthermore, it remains questionable whether wild animal and plant species can persist in such small habitat sites and populations which the Kayas typically consist of in the long run (see Melbourne & Hastings 2008). The protection of these forest islands builds on cross-generational respect for traditions and customary practices – which is increasingly challenged by the mobility and fragmentation of rural life. In addition, the protection status of the Kayas has not been harmonized and clarified in national legislation until today, and there are only limited financial resources available for conservation management. To enhance sustainable conservation, an effective and intensive cross-generational discussion is essential, including representatives of the local community (especially young people and elders), and from various stakeholders and from governmental organizations.

During a workshop with members of GOs, NGOs, representatives of the local community (elders), as well as people from the field of research, we discussed and analysed the current status and elaborated improvements for better protection of the resources of the Kaya Kambe (Figure 1). Out of the 24 participants, there were six from GOs (e.g. Kenya Wildlife Service – KWS, Wildlife Research Training Institute – WRTI, National Museums of Kenya – Coastal Forest Conservation Unit – KWS-CFCU), three of NGOs (Nature Kenya, WWF Kenya, Human Rights Agenda Kenya - HURIA), three representatives of the local community (elders, community forest association), four members from local university, and two teachers. During this workshop, we first defined our general aim (long-term conservation of Kaya forests). We subsequently elaborated potential measures and actions, which can be taken in smaller working groups – for the fields of 'culture and tradition', 'education', 'governance' and 'economic independence'. We visualized all aspects as synergy map, following the leitmotif 'what and who needs to change to create a positive impact for a positive future state'. The outcome of this working process is compiled in Table 1. In the following, we will critically reflect current shortcomings and potential strategies which might be suitable to better preserve nature and ecosystem services in and around Kaya forests.

Cross-generational forest conservation

Kayas represent old settlements with burial places linked to the traditional chiefs of the Mijikenda people. As such, they are tetemonies and heritage of not just the chiefs, but also the people who recognize his authority and rather than spiritual rituals suggest you write out rainmaking and other rituals (Githitho 2003,

https://doi.org/10.1017/S026646742300010X Published online by Cambridge University Press

Table 1. Overview of identified challenges, desired changes, and specific actions to improve the current situation in and around the Kayas. The overarching goal aims for the long-term preservation of an intact forest ecosystem for nature and people.

Challenges	Changes	Actions
Lack of cultural awareness	• Rising the awareness in women, men, the youth, and children on the relevance of intact ecosystems and cultural diversity; • Improve intergenerational exchange (youth and elders)	• Train school teachers; • Train students and pupils; • Open Kayas involve the community (especially the youth); • Invite elders into schools to promote their culture; • Establish cultural days
Lack of documentation and dissemination, weak role of elders	• Documentation of traditions and cultural believes; • Improve the role and relevance of elders	• Data bases and communication platforms to compile and disseminate the culture of Kayas; • Increase the presence and facilitation of Kaya elders; • Kaya open days to involve the local community in Kayas; • Use of up-to-date social media tools; • Increasing the relevance of women in the group of elders
Lack of awareness of nature and forest ecosystem services	• Rising awareness • Change attitudes for forest adjacent communities	• Training of teachers on forest ecosystems and its functions; • Planting of native trees with the community and school classes; • Excursions for environmental education
Livelihood needs	• Diversification of income sources; • Benefit sharing and (immediate) profiting from the forest • Sustainable income to the community	• Establishing activities with a quick return • Establishing value chains to profit from forest resources
Conflicting laws and policies	• Harmonization policies on the use of forest resources; • Hybridization of tradition and modern laws and policies	• Boundaries of forests to be marked and demarcated; • Governmental organizations KFS/County government support with strict management • Implementation of PFM framework
Communication gaps	• Bridging the communication gaps which exist between elders and stakeholders, and among single Kayas; • Improving trans-generational communication (elders and youth)	• Improvement of the communication among elders, governmental organizations, and elders; • Harmonization strategies of elders, i.e. single Kayas; • Clarification of ownership tenure; • Clarification of responsibilities and duties

Shepheard-Walwyn 2014). The Kayas are key in negotiating social identity and belonging and in creating a sense of 'community' (Matiku 2005). Traditionally, the elders have acted as the guardians of the Kayas. They have played a central role in performing rituals, and they have restricted and managed access to the forests. However, the breakdown in traditional beliefs and the increased influence of Christianity and Islam along with the increasing demand for forest products made forest protection less and less efficient (Goldammer 1992, Sayer *et al.* 1992). Today, the elders represent a rather marginal group than the centre of cultural and social cohesion, and in parallel, the pressure on the resources of Kaya forests increased – for private use and for selling on the local market (Peltorinne 2004). The majority of the community does not participate in cultural life and is not allowed to enter the Kayas. However, with this exclusion of people and the entire community from the Kayas, the acceptance and interest to conserve the forest might be rather little. This was shown in a study on the effectiveness of Participatory Forest Management in the Coastal Forest block Arabuko Sokoke; only those residents and groups with a longer-term emotional attachment to the forest campaigned for its protection (Nzau *et al.* 2022). Thus, a cross-generational dialogue is crucial to ensure a common goal and policy for the long-term conservation of these forest remnants and to rise acceptance of forest conservation. To start a lively dialogue between the elders and the (young) local population local meetings (barazas), excursions into the forest, and visits of elders in schools and school visits to Kayas (what partly happened when some Kayas were included in the world heritage site). With this cross-generational exchanges, it will be possible for the younger generation to learn about their heritage and customs, and at the same time the elders to adjust and adapt their teachings.

Strengthen a common policy

The role of elders and the access and use rights of Kayas vary strongly among the single Kayas. Most elders from different Kaya forests do not coordinate with each other. However, common policy formulation through the elders might help to act on par with representatives of governmental organizations (such as the governmental representatives, Chief, County government) or representatives of relevant government organizations (Kenyan Forest Service, Kenya Forest Research Institute, Kenyan Wildlife Training Institute, National Museums Kenya, UNESCO). A harmonization would help

https://doi.org/10.1017/S026646742300010X Published online by Cambridge University Press

to gain more influence and acceptance again and reclaim a stronger role in society and the community.

Today, the management of Kaya forests officially relies on the National Museums of Kenya, through the Coastal forest conservation unit with the help of Kenya Forest Service, and the County government. Control and implementation of forest management should be conducted by a single and central organization in both, the legislative and executive capacity. Utilization should be ecologically sound and sustainable (regeneration capacity of forests, regeneration of vegetation must be guaranteed), such as wood harvest adapted to the ecosystem carrying capacity, leaving dead wood in the ecosystem. In order to protect the forest remnants efficiently, it would be desirable to develop a joint management strategy together with the local community, including elders and the youth. Decentralized, but coordinated action from the community could be most effective in this regard, as numerous studies from Southern Kenya show (Himberg *et al.* 2009). Thus, for effective protection of these forest islands, the rural people living around the Kayas should fully participate both in decision-making and in the implementation of any protective measures.

Profiting from ecosystem services

With the monetary valuation of nature's services, a new acceptance of conservation and resource use (Christie *et al.* 2012) emerged in many areas of human life. Kayas are not only places with exceptionally high biological and cultural diversity but also provide numerous services to humans that lead to an improved quality of life. For example, natural primary forests store a large amount of carbon (Pregitzer & Euskirchen 2004), regulate the water balance (Traore *et al.* 2014) and the mesoclimate (Luyssaert *et al.* 2008). But also on a local level, such small forest fragments have a supportive effect on the surrounding landscape. Studies along the Arabuko Sokoke coastal forest and on forest fragments of the Taita Hills showed that pest infestations in agricultural areas are reduced by increased predation rates from the adjacent forest (Habel & Ulrich 2020, Seifert *et al.* 2022). It is very important to communicate the relevance of kayas as a source of ecosystem services, for example, in schools. This could also lead to increased protection of the forest and a more careful use of nature and resources.

Kayas: Nucleus of diversity

The conservation of Kayas is of utmost ecological and cultural importance, for the entire landscape and population. These forest islands are important habitats for rare animal and plant species and represent valuable stepping stones in a densely populated, highly anthropogenic landscape. Kayas can also provide valuable habitats in the future with positive spill-over effects of services. Furthermore, even culturally, traditions are also a valuable asset to the society in the immediate vicinity of a Kaya. The basis for long-term conservation of these forest islands is much improved communication across generations, as well as alignment of management strategies and objectives between stakeholders. It will be a challenge to reconcile state management with traditional and cultural motivations.

Acknowledgements. We thank all participants of the Biocult workshop (September 18–20), Stephen Katana Kazungu (Kambe Secondary school), Wycliffe Shahati Luvuka (Maereni Primary School), Martin Mjape Tange (Chief Kambe), Francis Wathigu Kagema (Nature Kenya), Asma Awach (WWF Kenya), Mwabim Ilassim Ntindi (Kenyan Wildlife Service), Lynn Njuguna (WRTI – Watamu), Betty Mohamed Sidi (HURIA), Anthony Githitho, Lawrence Tunje Chiro (NMK CFCU), Dubi Dzua, Erastus Kubo (Elder Kaya Kambe), Rose N. Kigathi (Pwani University), and Isaac K. Opilo (Kenyan Forest Service). We thank the German Academic Exchange Service for funding this workshop. We thank xx anonymous referees for fruitful comments on a draft version of this manuscript.

Declarations.

Availability of data and materials. Not applicable.

Authors' contributions. JCH and MT have written a first draft version of this manuscript. All contributed afterwards while writing and finishing this manuscript.

Funding. This study and activity were funded by the German Academic Exchange Service, DAAD.

Competing interest. There are no competing interests.

Ethical approval. Not applicable.

References

Burgess ND and Clarke GP (2000) *Coastal forests of eastern Africa*. IUCN-The World Conservation Union, Publications Services Unit.

Burgess ND, Clarke GP and Rodgers WA (1998) Coastal forests of eastern Africa: status, endemism patterns and their potential causes. *Biological Journal of the Linnean Society* **64**, 337–367. https://doi.org/10.1111/j.1095-8312.1998.tb00337.x

Christie M, Fazey I, Cooper R, Hyde T and Kenter JO (2012) An evaluation of monetary and non-monetary techniques for assessing the importance of biodiversity and ecosystem services to people in countries with developing economies. *Ecological Economics* **83**, 67–78. https://doi.org/10.1016/j.ecolecon.2012.08.012

Fungomeli M, Cianciaruso M, Zannini P, Githitho A, Frascaroli F, Fulanda B, Kibet S, Wiemers M, Mbuvi MT, Matiku P and Chiarucci A (2020a) Woody plant species diversity of the coastal forests of Kenya: filling in knowledge gaps in a biodiversity hotspot. *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology* **154**, 973–982. https://doi.org/10.1080/11263504.2020.1834461

Fungomeli M, Githitho A, Frascaroli F, Chidzinga S, Cianciaruso M and Chiarucci A (2020b) A new vegetation-plot database for the coastal forests of Kenya. *VCS* **1**, 103–109. https://doi.org/10.3897/VCS/2020/47180

Githitho A (2003) *The sacred Mijikenda Kaya forests of coastal Kenya and biodiversity conservation*. In: Lee C and Schaaf T (eds) *The Importance of Sacred Natural Sites for Biodiversity Conservation*. Paris: UNESCO, pp 27–35.

Githitho A (2016) Listing The Sacred Mijikenda kaya Forests as UNESCO World Heritage Sites: "The Long Journey." *africanistes* 198–217. https://doi.org/10.4000/africanistes.4971

Glenday J (2008) Carbon storage and emissions offset potential in an African dry forest, the Arabuko-Sokoke Forest, Kenya. *Environ Monit Assess* **142**, 85–95. https://doi.org/10.1007/s10661-007-9910-0

Goldammer JG (1992) *Tropical forests in transition: Ecology of natural and anthropogenic disturbance processes*. Basel: Birkhäuser Verlag.

Habel JC and Ulrich W (2020) Ecosystem functions in natural and anthropogenic ecosystems across the East African coastal forest landscape. *Biotropica* **52**, 598–607. https://doi.org/10.1111/btp.12780

Himberg N, Omoro L, Pellikka P and Luukkanen O (2009) The benefits and constraints of participation in forest management. The case of Taita Hills, Kenya. *Fennia* **187**, 61–76.

Kibet S (2011) Plant communities, species diversity, richness, and regeneration of a traditionally managed coastal forest, Kenya. *Forest Ecology and Management* **261**, 949–957. https://doi.org/10.1016/j.foreco.2010.11.027

Luke WRQ and Githitho AN (2003) *Biodiversity and the Kaya Forests*. In: Hoorweg J and Muthiga N (eds) *Recent Advances in Coastal Ecology: Studies from Kenya*. Leiden: African Studies Centre, pp 293–301.

https://doi.org/10.1017/S026646742300010X Published online by Cambridge University Press

Luyssaert S, Schulze ED, Börner A, Knohl A, Hessenmöller D, Law BE, Ciais P and Grace J (2008) Old-growth forests as global carbon sinks. *Nature* **455**, 213–215. https://doi.org/10.1038/nature07276

Matiku P (2005) The Coastal Forests of Kenya: Forests data, threats, socio-economic issues, values, stakeholders, challenges, strategies, investment and enabling environment. Nature Kenia

Melbourne BA and Hastings A (2008) Extinction risk depends strongly on factors contributing to stochasticity. *Nature* **454**, 100–103. https://doi.org/10.1038/nature06922

Metcalfe K, Ffrench-Constant R and Gordon I (2010) Sacred sites as hotspots for biodiversity: the Three Sisters Cave complex in coastal Kenya. *Oryx* **44**, 118. https://doi.org/10.1017/S0030605309990731

Mittermeier RA, Turner WR, Larsen FW, ***et al*** (2011) *Global Biodiversity Conservation: The Critical Role of Hotspots*. In: Zachos FE and Habel JC (eds) *Biodiversity Hotspots*. Berlin, Heidelberg: Springer Berlin Heidelberg, pp 3–22.

Nyamweru C, Kibet S, Pakia M and Cooke JA (2008) *The Kaya forests of coastal Kenya, 'Remnant patches' or Dynamic Entities?* In: Sheridan M and Nyamweru C (eds) *African Sacred Groves: Ecological Dynamics and Social Change*. Oxford: James Currey, pp 62–86.

Nzau JM, Ulrich W, Rieckmann M and Habel JC (2022) The need for local-adjusted Participatory Forest Management in biodiversity hotspots. *Biodiversity and Conservation* **31**, 1313–1328. https://doi.org/10.1007/s10531-022-02393-x

Peltorinne P (2004) *The forest types of Kenya*. In: Pellikka P, Ylhäisi J and Clark B (eds) *Taita Hills and Kenya, 2004: Seminars, reports and journal of a field excursion to Kenya*. Helsinki: University of Helsinki, Department of Geography, pp 8–13.

Pregitzer KS and Euskirchen ES (2004) Carbon cycling and storage in world forests: biome patterns related to forest age. *Global Change Biology* **10**, 2052–2077. https://doi.org/10.1111/j.1365-2486.2004.00866.x

Robertson SA and Luke WRQ (1993) *Kenya Coastal Forests: Report of the NMK/WWF Coast Forest Survey*. Nairobi, Kenya: National Museums of Kenya.

Sayer JA, Harcourt CS and Collins NM (1992) *The conservation atlas of tropical forests. Africa*. United Kingdom: Macmillan Publishers Ltd.,

Seifert T, Teucher M, Ulrich W, Mwania F, Gona F and Habel JC (2022) Biodiversity and ecosystem functions across an Afro-Tropical forest biodiversity hotspot. *Frontiers in Ecology and Evolution* **10**, 816163. https://doi.org/10.3389/fevo.2022.816163

Shepheard-Walwyn E (2014) *Culture and conservation in the sacred sites of Coastal Kenya*. Canterbury, UK: University of Kent.

Traore AK, Ciais P, Vuichard N, MacBean N, Dardel C, Poulter B, Piao S, Fisher JB, Viovy N, Jung M and Myneni R (2014) Trends of light use efficiency and inherent water use efficiency in African vegetation: Sensitivity to climate and atmospheric CO_2 concentrations. *Remote Sensing* **6**, 8923–8944. https://doi.org/10.3390/rs6098923

Wass P (1995) Kenya's indigenous forests: status, management, and conservation. IUCN-The World Conservation Union; Overseas Development Administration (UK), Gland; Switzerland: [London].

Wijtten J, Hankinson E, Nuttall M, Gomes I and Lemarkat R (2011) *The coastal forest of Shimoni, Kenya: sacred sites as hotspot for biodiversity*. In: Silva O, Serrano R and Chaves R (eds) *VIII International Ethnobotany Symposium*. Lisbon; Portugal, p 617.

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