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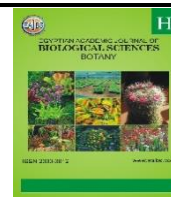
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Sacred Groves and the Conservation of Forest Genetic Resources: a review

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ABSTRACT

Sacred groves are found globally with evidence of distinct belief systems. They are sacred tracts of forests safeguarded by religious beliefs as the home of Gods and Goddesses. The importance of forests for maintaining societies is reflected in the important cultural values attributed to the forests by different cultures. This review paper contributes to the conservation of these forests for forest genetic resources. Some sacred groves are seen as protectors of wildlife, where both hunting and felling of trees are forbidden, some provide many useful goods such as fuelwood, medicine, vegetables, and edible fruits. As a result, these groves play an important role in the survival of plants and animal species that have become extremely extinct elsewhere. In some localities, sacred groves are protected because they provide shade to protect structures and farms. Some are reserved for elephant fodder. The sacred locations are the final refuge for numerous species that are already endangered. Homes to trees, climbers, shrubs and other plants forms for medicinal purposes. There is a need to integrate traditional knowledge with modern conservation practices or create legal frameworks to strengthen conservation efforts.

INTRODUCTION

Conservation of forest genetic resources is regarded as intentional or deliberate activities and policies that secure the existence, evolution and availability of these resources for the present and future generations (FAO, *et al.*, 2004). Conserving forest genetic resources is vital, they are unique and irreplaceable resources for the future. This diversity in forest resources and their functions constitutes vast social, economic and environmental importance. Various practical guides and texts have extensively examined the best practices and practical ways for managing and conserving forest and plant genetic resources (Young *et al.* 2000; Heywood and Dulloo 2005). The sustainable use of this genetic makeup can be *in-situ* or *ex-situ*, depending on the conservation objectives. According to Frankel (1976), *in-situ* conservation means that a population is kept within the community of which it is a part, in the environment in which it has evolved. The conservation of biodiversity in their ecosystem is known to be *in-situ* conservation. Protected sites have a high potential for protecting rare and endangered species. According to Stratum (1999), just 12% of the 8750 tree species that are threatened with extinction are found in protected areas. Sacred groves as protected areas are noted to be the reservoir of native biodiversity, a refuge for endemic and endangered species and to represent biodiversity hotspots (Myers *et al.* 2000, Onyekwelu & Olusola 2014).

Sacred groves are one of many forms of protected areas and have been recognised as an example of *in-situ* conservation (Oyelowo, 2014). Africans regard forests, rivers, streams, and mountains as sacred because they believe them to be centers of power, sources of blessings, and the

resting places of divine ancestors and the deceased (Bernbaum, 1996). Biological materials were protected and conserved by the traditional Africans using cultural and religious rules and laws enshrined in folklore, stories and beliefs and using a host of other practices such as totemic and sacrificial animals. Different landscapes of various ecological formations have been known or protected by the efforts of Africans which have strengthened the conservation of forest genetic makeup especially, the threatened, rare or exotic species of biodiversity. The preservation of the sacred groves in Africa over the years lies in the belief of the people that they are the habitations of their gods or ancestral spirits. The objective of the paper is to review the contribution of sacred groves to the conservation of forest resources in Africa.

Forest Conservation:

Forests are essential to life and are especially significant in Africa, where quite a few people live in rural areas (IPBES, 2018). They offer ecological services such as pollination (Potts *et al.*, 2016). They contribute to the formation of soil and the control of erosion (Bennett *et al.*, 2009). The products and services ecosystems provide are essential to more than 62% of the people in Africa (IPBES 2018b).

In 2000, it was projected that there were 650 million hectares of forest cover in Africa. This amounts to about 22% of Africa's land area and 17% of the world's forest cover. Africa is home to 14 distinct types of forests, albeit the amount of forest cover varies throughout sub-regions. Approximately 45% of Central Africa's land area is covered by forests, making up 37% of all of Africa's forest cover. In contrast, the extent of forest cover in Northern African countries is only 8%, with most of this occurring in Sudan (Sayer, 1992).

It was estimated that there are 726 million ha of forest in protected areas worldwide. Of the six major world regions, South America has the highest share of forests in protected areas, at 31 percent. The area of forest in protected areas globally has increased by 191 million ha since 1990, but the rate of annual increase slowed from 2010–2020 (FAO, 2020). The Forest Resources Assessment in 2020 obtained information on the quantity of forest assigned primarily for biodiversity protection in 2020 from 165 countries, accounting for 91% of the world's forest area. The area so classified is estimated to be 424 million hectares, or 11% of the forest area in the reporting countries (**Table 1**). Africa has the largest forest designated for biodiversity protection, with 107 million hectares; this represents 24% of the forest area, the highest proportion among regions. The lowest share is in Europe, at 4%, however, this rises to 12% when the Russian Federation is excluded.

Table 1. Forest area designated primarily for biodiversity conservation, by region and subregion, 2020.

| Region/subregion | Forest designated for biodiversity conservation | |
|---------------------------------|---|------------------|
| | Area (1,000 ha) | % of forest area |
| Eastern and Southern Africa | 38,192 | 27 |
| Northern Africa | 7,810 | 29 |
| Western and Central Africa | 60,583 | 22 |
| Total Africa | 106,585 | 24 |
| East Asia | 16,547 | 6 |
| South and Southeast Asia | 69,091 | 24 |
| Western and Central Asia | 3,653 | 7 |
| Total Asia | 89,292 | 15 |
| Europe excl. Russian Federation | 20,337 | 12 |
| Total Europe | 38,919 | 4 |
| Caribbean | 855 | 18 |
| Central America | 2,324 | 36 |
| North America | 71,760 | 10 |
| Total North and Central America | 74,939 | 10 |
| Total Oceania | 30,752 | 17 |
| Total South America | 83,883 | 11 |
| WORLD | 424,370 | 11 |

Source: FAO, (2020)

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Dudley *et al.* (2008) emphasized using protected areas as an 'emergency' food supply in particular sections of northern and eastern Africa. In some ecosystems, forests can retain more rainfall in the watershed than cleared land, lowering water export and increasing aquifer storage (Siriwardena *et al.* 2006). Various protected areas have been specifically created to preserve natural resources, including priceless flora and wood. Food security is greatly enhanced by well-managed natural ecosystems, especially for the most impoverished people in society, many of whom still live subsistence lifestyles and rely on a variety of edible crops from protected areas. For instance, coastal mangroves, freshwater and marine protected areas, and fish breeding sites are important for maintaining fish populations and preventing fish overpopulation in neighbouring seas (Roberts and Hawkins 2000).

Numerous protected areas have been the site of ethnobotanical investigations, which demonstrate not only the diversity of values found there but also the increasing isolation of species and sometimes even the knowledge derived from them in various regions of the world. In several nations, like Nepal, access to medicinal herbs has decreased to such an extent that the only remaining alternative is to enter into management agreements to harvest just a fraction of the plants in National Parks (Stolton and Dudley 2010b). Thus, protected areas support ecosystems by sequestering more carbon and reducing future carbon losses to the atmosphere (Dudley *et al.* 2009). According to studies made by the UN Environment Programme's World Conservation Monitoring Centre (UNEP-WCMC 2008), at least 15% of the world's stored carbon has been confined within protected areas. Natural ecosystems are also cost-effective means of reducing the effects of large earth movements and a variety of extreme weather events, many of which are becoming more frequent and intense as a result of climate change.

Protected areas are locations of cultural and religious significance, which is essential to the customs and way of life of Indigenous peoples and the surrounding community. Any type of protected area can be run and administered by local authorities, state governments, nonprofit organizations, or alliances between different parties. Nonetheless, numerous conserved areas have been created in the past 40–50 years by local communities, Indigenous peoples, environmental charities, private citizens, businesses, and other organizations. There has been an increase in the use of community-based conservation in certain nations, like Namibia and Kenya, where communities are legally entitled to administer and profit directly from these conservancies.

The world's first method for conserving habitat is through sacred natural sites. Sacred natural locations have long served as essential conservation sites in addition to offering spiritual services to believers. This has been the case for thousands of years. Nevertheless, the right kinds of protected areas may add value to these traditional conservation techniques, which are becoming more and more in jeopardy. African traditional people maintained biological resources by using cultural and religious norms and rules that were ingrained in folklore, myths, and beliefs.

Sacred or fetish groves are the aggregate terms for these protected places or sites. According to Godson (1998), the usage of the resources of these highly representative geographical areas was restricted and controlled due to the influence of traditional religious and cultural traditions. If properly cared for, they can support these kinds of activities and offer extra security as well as a peaceful setting for prayer and meditation. Residents of Amber Mountain National Park in northern Madagascar have access to a revered waterfall (Stolton *et al.*, 2015).

Sacred Groves As Natural Sites:

Sacred groves can also be referred to as forest areas that have been declared holy and are guarded by fervent religious beliefs. Sacred groves have endured in India across a range of ecological conditions, in spite of the country's growing human population (Ramakrishnan *et al.*, 1998). There are places in the world where people consider natural areas to be sacred. This is a common occurrence that occurs in practically every nation. There is proof of different perspectives and conservation-related ethics globally. Dudley and Stolton (1999) reported that links between faiths and the conservation of land and water were found in every belief system. In Ghana, there are at least 1,430 sacred groves (Oteng – Yeboah, 1996). The Kikuyu people have protected at least 200 holy woods in the Kirinyaga district of Kenya, with an extent ranging from 0.1 to 1.3 hectares (Brokensha and Castro, 1988). A sacred grove, according to Kokou (1997), is a forest where the locals carry out certain rituals to communication with the spirits and ancestors. Areas that hold spiritual value for individuals and groups can also be referred to as sacred sites.

Sacred natural places are generally divided into two categories: those developed by organized religions or faiths, and those established by indigenous and traditional people within the framework of their spiritual beliefs and customary structures. IUCN prioritizes natural regions since they are central to its goal, but it also generally promotes the preservation of monumental and natural sacred places as important components of human civilizations. Natural sites like mountains, volcanoes, rivers, lakes, springs, caves, forest groves, ponds, coastal waters, and entire islands have been given a special status by many traditional communities around the world due to their spiritual beliefs (**Table 2**). A great number of these have been designated as sacred sites for any number of reasons, including being thought of as the homes of gods and ancestral spirits, as well as sources of healing water and medicinal plants, as sites of revelation and transformation, as well as places of contact with the spiritual realm or communication with a reality that is "more than human." Some communities may also view specific plant and animal species as sacred over larger landscapes.

Table 2: Classification of Sacred sites.

| Type of sacred site | Examples |
|---------------------|--|
| Grove or woodland | Sacred groves are found in virtually all tropical and many temperate and boreal countries and can either be distinct areas of woodland or part of a larger forest. A survey of 4875 sacred groves in India, for example, is believed to include only a small percentage of the total sites, which the authors estimate to be between 100,000 and 150,000 (Chatterjee <i>et. al.</i> 2004, Oyelowo, 2014). |
| Individual trees | The totara (<i>Podocarpus totara</i>), the sacred tree of the Maori people of New Zealand, is believed to have a spirit and a common ancestry with the Maori people, and thus to be an elder of living Maoris. The oldest known specimen, on North Island, is 1800 years old (Lewington and Edward, 2000). |
| River | Some rivers are considered sacred, however attention is typically concentrated on specific areas. The Ganges River, which flows from the Himalayas to the wide delta between India and Bangladesh, holds great significance for Hindus, because bathing in it cleanses the bather of sin. Ramakrishnan (2000) describes it as a cross-cultural religious location. |
| Pond or lake | Many small ponds and lakes are sacred, often because they contain specific species like crocodiles. However, even large freshwaters can have sacred value. For example, many places around Lake Baikal in Russia are regarded as sacred by the Buryats, and many shrines along the shores receive regular offerings (www.sacred-sites.org). |
| Spring | Springs are generally considered sacred, and in the Christian tradition, several are associated with certain saints or are said to have healing abilities, most notably at Lourdes in France. The Suttasaja spring in Finland is a historic sacred location for the Sámi people of northern Europe, and it is currently under threat due to proposals to sell bottled water from the area. |
| Mountain | Sacred mountains exist in many civilizations and are frequently virtually no-go places, ensuring complete protection from disturbance (Bernbaum, 1997). Sacred mountains include the holy hills of Xishuanbanna in Yunnan, China (Sochaczewski, 1999), Hua Shan (Daoist) and Omeislan (Buddhist) in China, Venezuela's central range of mountains, and Nepal's Gauri Shanker peak (Hamilton and Linda McMillan, 2003). |
| Volcano | Volcanoes, particularly ones that are still active, are likely to be designated as sacred natural sites, such as Ngauruhoe in New Zealand. |
| Rock formation | Aborigines in Australia sometimes attribute their creation stories to "dream lines," which are ancient paths connected to certain geographical objects such as rocks. Uluru, also known as Ayers Rock, is a spiritual location in the central Australian desert. According to Mountford and Ainslie (1965), spirit children are believed to be related to their aboriginal mothers. It is also a protected area. |

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| Island | Islands have traditionally maintained spiritual value, especially if they are isolated, as Easter Island demonstrates, but even those closer to shore can be significant. The island of Nosy Vey in northern Madagascar, an almost perfect conical form covered in forest, is so sacred that no humans are allowed to land, and locals ask that it be designated as a closely controlled protected area ⁵³ . In China, Pu To Shan Island is sacred to Buddhists and dedicated to Guan Yin. |
| Beach | Varkala sacred beach in Kerala, southwest India, is an important Hindu pilgrimage site despite an increasing number of tourists. St Ninian's cave and beach in southwest Scotland are considered sacred sites in the Christian faith. |
| Landscape | Even huge landscapes can hold spiritual values. Yosemite Valley in California, now one of the world's oldest national parks, has long been a sacred site for the region's First Nations communities, and these qualities are increasingly being recognized by other Americans. |

Contribution of Sacred Groves to Local People:

It has been said that human culture began with the first tree and will end with the last one. There is no doubt that the environment particularly forests has played a significant role in determining the pattern of human evolution and development of our culture and societies (Von Droste and Screckenberg, 1991). The importance of forests for the maintenance of societies is reflected in the important cultural values attributed to the forests by different societies.

The ancient Greeks worshipped the Goddess Artemis (called Diana by the Romans) as the Goddess of conservation. She was generally portrayed as both a hunter and protector of wildlife. She also permitted the hunt, provided that the hunter obeyed the rules and rituals that justified a man's obtaining nourishment by the sacrifice of animal life (Hughes, 1987). As protector of wildlife, she was also responsible for protecting the wilderness and in many of her sanctuaries both hunting and felling of trees were forbidden (Hughes, 1987). In many villages in Africa, there is often a huge tree or a small forest rising in the boundary savanna in which local people perform their cult. In Ghana, there are at least 1,430 sacred groves (Oteng-Yeboah, 1996). In the Ivory Coast, 5,549 sacred groves were censused in 1988 (NGO, Green Cross of Ivory Coast technical report, 1998). In the district of Kirinyaga (Kenya), there are at least 200 sacred groves of which the area varies between 0.1 and 1.3 ha, preserved by the Kikuyu (Brokensha and Castro, 1988). Little and Brokensha (1987) mentioned that the colonial administration had censused more than 100 sacred groves (area between 0.25 and 3ha in the Mbeere district in Kenya).

In general, the forest is considered a place frequented by different types of supernatural creatures, deities who may look human, and they differ in their mystical abilities and immortality. It is also thought that the ghosts of ancestors live in the forest (Aumeeruddy and Bakels, 1992). According to Kokou (1997), a sacred grove is a woodland where locals do rituals to communicate with spirits and ancestors. Sacred groves of Benin contain various valuable items such as hardwood and poles, fuelwood, medicine, vegetables, and edible fruits, except for the mystic club forests (Oro, Kouvito, and Zangbeto), which are strictly banned to the uninitiated. Women collect old, dead wood to use as fire. Everyone who travels into the forest collects edible fruits (women, men, children, hunters), and women frequently pick leaves for wrapping meals (e.g., *Thalia welwitschii*, *Cola gigantea*). Many locals use the roots, barks, fruits, and leaves of several plants as medicine (Agbo *et al.*, 1993).

According to Shiva (1989), forests have always been vital to Indian civilization. Aranyami, the Goddess of the Forest, was revered as the major source of life and fertility, and the forest as a community was considered a model for societal and cultural progress. Turnbull (1960), in his classic description of life among the pygmies of Congo, relates their belief in the forest as a world which, in return for their affection and trust, supplies them with all their needs. In Mali, with the Malinke people, forests contain bad spirits and djinns (Son and Anderson, 1996).

Traditional Laws of Conservation and Their Effectiveness in Forest Conservation:

"Taboo" as defined by the Oxford Advanced Learner Dictionary of the English Language means "a cultural or religious custom that does not allow people to do, use or talk about particular things as people find it offensive or embarrassing". Taboos represent unwritten social rules that regulate human behaviour (Colding and Folke, 1997). The laws and regulations which man instituted

were aimed at allowing the Earth to continuously play its mothership role and to enhance biodiversity (Abaye-Boaten, 1997).

Using cultural and religious rules and laws enshrined in folklore, stories and beliefs, the traditional Africans did not only protect biological resources but also conserved them. They set aside, small patches of forest and wooded savanna lands, usually closed to settlements as sacred lands into which entry was strictly either prohibited or regulated. These protected areas or lands are collectively referred to as sacred or fetish groves. Traditional religious and cultural practices consequently had an important role in constraining and controlling the use of resources in these highly representative land areas (Godson, 1998). He further stated that the traditional rules and laws enshrined in taboos, beliefs, and so on, which were once very effective tools in biodiversity conservation, have gradually eroded from people's minds and culture, resulting in the encroachment and degradation of once well-guarded groves, ecologically sensitive, and other protected areas.

The traditional moral teaching of the West, Christianity, has always taught men that they should not act in such a way that they harm their neighbours. We have now discovered that dumping waste into the sea or air, destroying the ecosystem, raising huge families, and depleting resources are all harmful to our fellow citizens, both now and in the future. To that degree, conventional morality alone is sufficient to justify our ecological concern, and our need for action against polluters, natural resource depletion, and the destruction of species and habitats (Passmore, 1985). According to (Okali and Amubode, 1991), the Oboto community's effective management of flora and fauna is attributed to four core elements; a strong adherence to traditional village organization, with its clear chain of command and distribution of duties; a high level of respect for the traditional law; increasing understanding of the local ecology and conditions, incorporating this understanding into local land use, game-hunting and conservation practices; and a high value attached to medicinal plants. Traditional religious beliefs and practices have resulted in the preservation of sacred groves throughout Ghana, especially in the savannah region because of the degraded vegetation. The sacred groves are protected, conserved and maintained through a combination of taboos, prohibitions, beliefs and restrictions (Dorm-Adzobu *et al.*, 1991).

In other cases, rivers and their biological entities are protected by forbidding people from cutting trees along their banks under the pretext that the rivers must not be allowed to go naked by stripping them of their clothes (Godson, 1998). Many people believe in different trees for different thunder (natural or "sent by an enemy") from hitting a building and destroying the occupants. Many people plant *Hura crepitans*, *Newbouldia leavis*, *Sanseria trifasciata* and many species of cactus of the *Opuntia* genus, in their compound to purportedly, ward off witches and wizards (Etukudo, 1998).

According to Okali and Amubode (1995), there are five annual festivals in Oboto Village of Ondo State. Orisa-Lerinla is the goddess of children, worshipped annually around July in Odo-Orisa when barren women are brought before the goddess and a special appeal is made. Those afflicted with the disease come forward to be cleansed of their iniquities. The festival provides a forum for stock-taking and rededication to doing well.

Our forefathers and traditionalists have been true naturalists. They have been close to nature with all the elements of the environment and are meticulously observant of the natural cycles. The importance that traditionalists attached to the natural world made plants gain a position as objects of worship and some plants were declared sacred. For example, *Adansonia digitata* is used to erect shrines. Devotees of *Ficus religiosa* use the shade under the canopy for medication (Godson, 1998).

Forest Genetic Resources of Sacred Forests:

The study carried out by Sukumaran *et al.* (2008) revealed that the sacred groves in India's Kanya Kuri area are remnants of relics and rare plants from tropical forests. The floristic composition of the sacred groves suggests the presence of climax vegetation in the area (Vartak *et al.*, 1986), as a result, these groves play an important role in the survival of plant species that have become extremely rare or extinct elsewhere.

Alabi (1992) explained that natural forests are set aside as sacred groves primarily for medicinal herbs, watershed preservation, hunting, cultural and religious practices. The results of comparative plant density analysis in his study showed richer floristic composition and more complex structure in the sacred groves than in the surrounding areas (Alabi, 1992). In a cursory inspection of some fetish groves in southern Nigeria by Okafor and Fernandes (1987), 120 species

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of flowering plants covering 99 general and 49 families were identified (certain fruit trees like Dawa Dawa” *Parkia biglobosa* and shea butter *Vitalaria paradoxa* have been protected throughout northern Ghana (Telly, 1997).

Aniah and Yelfaanibe (2016) described sacred groves in Ghana that protect uncommon, threatened, or endangered species. In the central part of the Republic of Benin, sacred forests have a greater diversity of tree species than rural residential regions (Ceperley et al. 2010). The Idanre Hills Sacred Grove in Nigeria is home to 174 insect species, four fish, and 13 mammal species, including monkeys (*Cercopithecus* sp.), bats (*Rousettus aegyptiacus*), and hyraxes (*Dendrohyrax dorsalis*) (Bai et al., 2018; NCMM, 2007). *Adansonia digitata*, *Albizia lebbek*, *Anogeissus leiocarpus*, *Azadirachta indica*, *Balanites aegyptiaca*, *Combretum ghasalense*, *Cyperus articulatus* (grass), *Detarium macrocarpa*, *Diosperos mespiliformes*, *Ficus gnaphalacarpus*, *Gardenia erubescens*, *Grewia mollis*, *Khaya senegalensis*, *Lannea acida*, *Mangifera indica*, *Mimosa pigra*, *Mitragyna inermis*, *Nauclea latifolia*, *Parkia biglobosa*, *Piliostigma thonningii*, *Pterocarpus erinaceus*, *Saba senegalensis*, *Senna siamea*, *Sterculia setigera*, *Tectona grandis*, *Vitellaria paradoxa*, *Vitex doniana*, *Ximenia americana* are example of tree species encountered in the Tolon district, Northern region, Ghana (Poreku, 2014).

Oyelowo, (2014) reported tree species distribution in 5 sacred groves in Southwestern Nigeria. Igbo-Olua with tree species of 208 trees/ha, Igbo-Olodumare (100 tree/ha), Igbo-Ile (96 trees/ha), Igbo-Gbopo (76 trees/ha) and Igbo-Oba (72 trees/ha). Some of the species reported are: *Entandrophragma angolense*, *Khaya grandifoliola*, *Albizia ferruginea*, *Ceiba pentadra*, *Celtis brownie*, *Celtis mildbreadii*, *Celtis whitii*, *Celtis zenkeri*, *Cola gigantean*, *Lecaniodiscus cupanioides*, *Trichilia monadelpha*, *Morus mesozygia*, *Newbouldia laevis*, *Olex subscorpioidea*, *Pycnanthus angolensis*, *Terminalia ivorensis* etc. Burgess et al. (1998) found that the fraction of endemic species in Kenya, Tanzania, and Northern Mozambique's south forests is consistently high across all species categories. Examples include millipedes (about 80% of those found in the Kayas are endemic), molluscs (68% are endemic, or 86 species), forest reptiles (51% endemic, 24 species), vascular plants (37% endemic, 554 species), and birds (10.5 percent endemic, 9 species). Coastal forests are home to 782 species from eight ecological groupings that are unique.

There are an estimated 14,000 sacred groves in India, which provide as habitats for uncommon flora and animals in both rural and urban areas (Malhotra, 2001). Naiola (2002) revealed that eleven species of traditional medicines from eight genera and eight families were cultivated in a sacred geological feature in Fatu, Indonesia. Sacred trees exist worldwide, and their cultural importance is shown in Table 3.

Table 3: Some of the sacred trees around the world:

| Country | Species | Details | References |
|---------|-----------------------------|---|---|
| Nigeria | <i>Newbouldia laevis</i> | This is another ritual tree known for its power for ritual cleansing. It is also useful for marking boundaries and graves. It is ageless and can outlive many generations. The leaves are a favourite for herbalists. | Onwudufor (???) |
| | <i>Okoubaka aubrevillei</i> | It is known for its ability to keep other trees from growing close since spirits are thought to live in it. It is revered in a few places, especially Iwara town, Nigeria. | Oyelowo (2022) |
| Kenya | <i>Ficus natalensis</i> | The spirit of their ancestors finds their abode in the branches of the tree. | WWF (2005) |
| | <i>Adansonia digitata</i> | It is believed to possess protective powers and is an essential element in warding off malevolent spirits in their rituals. | https://paukwa.or.ke/kenyan-myths-sacred-trees/ |

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| China, Korea and Japan | <i>Gingko (Gingko biloba)</i> | Buddhists in China and Korea adore the tree, which has long been planted as a temple. The species was introduced to Japan less than a millennium ago. A gingko tree survived 800 metres from the nuclear bomb's epicentre in Hiroshima. | Pakenham (2002) |
| India, Nepal, Sri Lanka etc | <i>Banyan tree (Ficus benghalensis)</i> | It is protected both because it is regarded as sacred and because it provides shade. Strict controls govern its use; portions are set aside for elephant fodder. Some academics believe that the Tree of Life in the Garden of Eden was a banyan. | Ingles (1995) |
| | <i>Bodhi tree (Ficus religiosa)</i> | The tree beneath which the Buddha attained enlightenment, which is the most sacred tree to Buddhists, is equally sacred to Hindus. | WWF (2005) |
| Japan | <i>Several species</i> | Many Shinto shrines protect ancient trees on their grounds, which are often covered with cloth and other ornaments. Since most of the native lowland forest has been destroyed, such trees now have a high conservation value. | WWF (2005) |
| Mongolia | <i>Tamarisk (Halaxylon ammodendron) and others</i> | The Gobi Buddhists worship the tamarisk. It is common to honour specific trees, known as Udgan Mod (meaning "sacred"), by placing Khadak and offerings at their base. It was forbidden to cut these trees down, and in certain locations, even to approach them. | Urtnasan (2003) |
| | <i>Birch (Betula)</i> | Birch trees were seen to be faithful to humans and livestock because they were often utilized as poles for gers (yurts), saddles, loops, and other structures. | WWF (2005) |
| Madagascar | <i>Baobab (Adansonia digitata)</i> | Considered holy and the home of spirits, these areas are frequently protected even after the rest of the forest has been cut or cleared. | WWF (2005) |
| Europe | <i>Yew (Taxus baccata)</i> | Sacred to early Celtic and Nordic cultures, considered to be immortal and a sign of eternal life. Some churchyard yews are so ancient that they predate Christianity. | Pakenham (1996) |
| | <i>Oak (Quercus robur)</i> | Sacred to the ancient Norse, Germanic, and Celtic peoples, as well as the Greeks and Romans; linked with thunder gods and fertility. Individual trees have become shrines. | Paterson (1998) |
| New Zealand | <i>Kauri (Agathis australis)</i> | Maori worshipped the tree, believing it to be endowed with a spirit. The oldest known living specimen is 2100 years old. | WWF (2005) |
| | <i>Totara (Podocarpus totara)</i> | Believed to have a common ancestor with the Maori and hence to be an elder among live Maori. | WWF (2005) |
| Chile | <i>Monkey puzzle tree (Araucaria araucana)</i> | Sacred to the Pehuenche people, who consider it a "mother" and believe that God created the trees for them to guard. | WWF (2005) |

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| Mexico | <i>Montezuma Cypress (Taxodium mucronatum)</i> | Sacred to Mexico's ancient peoples and tied to Zapotec origin stories, the oldest are thought to be between 2-4000 years old, with the greatest having a girth of more than 30 metres. | WWF (2005) |
| United States | <i>Giant redwood (Sequoiadenron giganteum)</i> | American redwoods are sacred to the Tolawa people of coastal California and Oregon. The oldest known specimen is thought to be around 2,700 years old. | WWF (2005) |

Conclusion:

Sacred groves are rich locations of forest genetic resources that have been conserved by community efforts through religious beliefs. Despite the significance of these sacred groves that provide many useful biodiversity, they are under human pressure of encroachment and shift to Western culture. As a matter of urgency, there is a need to integrate traditional knowledge with modern conservation practices or creating legal frameworks to strengthen the conservation efforts.

Declarations:

Ethical Approval: No animal model(s) or human subjects were recruited directly for the current study. Consequently, no ethical considerations are necessary.

Conflict of interest: The authors declare no conflict of interest.

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