



Review Article

**Aesthetic Values and Significance of Ferns to Landscaping Industries - A
Taxonomic Review**

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A b s t r a c t	K e y w o r d s
<p>Ferns and fern allies belong to the order Filicales. They are homosporous leptosporangiate Pteridophytes, seedless (cryptogamic), flowerless, vascular plants found mostly in the humid areas. Ferns are selected for their unique foliage color, upright habit, round, delicate beauty and excellent garden performance and are cultivated as ornamental plants. These species are distributed all over the world. In Nigeria, Ferns are mostly located in the wild and in few cities. They are most times neglected, less cultivated, underutilized, unrecognized plants and there is lack of awareness of the importance of ferns as ornamental, medicinal, food, dyeing, for environmental protection and management. The ferns as ornamental plants can be retained in the environments for years producing fronds for various economic importances such as medicinal, research, food, for sale and environmental beautification purposes. There is the need therefore to provide detailed information on the position and morphology of ferns and prospects, values and significance of using ornamental ferns in landscape industry. More so, advocate massive collection and cultivation of ferns.</p>	<p>Environment Ferns Landscape industry Ornamental plants</p>

Introduction

Ornamental plants are plants that are grown for decorative purposes in gardens and landscape for their beautiful flowers and/or elegant leaves (Kochhar, 2009). They are grown for the display of aesthetic features like flowers, leaves, scent, overall foliage texture and fruit; the purpose of which is for the

enjoyment of gardeners, visitors and the public. The beauty of offices of corporate organisations like banks, industries, schools, shopping complexes and religious buildings are enhanced by the ornamental plants such as ferns, flowers of different varieties, shrubs and trees planted within their surroundings. These have,

therefore, made the demand for ornamental plants to be on the increase (Wikipedia, 2014). They have wide spectrum of uses in environmental management; the most obvious among them are landscape, aesthetic, control of wind and water erosion, they also serve as sources of income to the people. Ornamental plants also provide attractive environments for human enjoyment (Sonia et al., 2012).

Aesthetic value of ferns

Everyone is different and so are their needs when it comes to what they expect from their outdoor areas, offices, schools, hospitals, parks, streets etcetera. Your garden is the first thing that any visitor will see when approaching your house. Choosing the right garden design and the ornamental plants will help to make your garden stand out from the crowd. Your garden is a place where you can enjoy spending time with nature enjoying your property to the fullest - live in your garden! Each garden that is design is tailored to suit a specific space and the requirements, taste and lifestyle of a specific client (Pryer et al., 2004).

The advantage of ferns as ornamental plants is that they can be retained in the environments for years producing fronds for various economic importances such as medicinal, research, food, for sale for landscaping, as ornamental plants and environmental beautification purposes. Few places in Nigeria where ornamental plants have been used for environmental improvement are Lucky Fibres and Chevron in Lagos and International Institute for Tropical Agriculture (IITA) Ibadan (Oloyede et al., 2012). Ferns are neglected, less cultivated, underutilized, unrecognized plants and there is lack of awareness of the importance of ferns as ornamental plants and for environmental management most especially in Nigeria. This review is therefore designed to provide detailed information on the position and morphology of ferns and prospects of using ornamental ferns for environmental protection, improvement and management in Nigeria (Oloyede et al., 2012).

About ferns

Ferns are widely distributed throughout the world especially in the tropics and with emphasis to Nigeria (Oloyede and Odu, 2011). There are no fewer than 90 species in 42 genera that affect man in one way or another (Jim, 1999). Ferns and fern allies belong to the order Filicales. They are homosporous

leptosporangiate pteridophytes, seedless (cryptogamic), flowerless, vascular plants found mostly in the humid areas (Fern, 2009). They require water to grow, survive and at least during sexual reproduction for male gamete to swim to the nonmotile female gamete (Sporne, 1975). They can be perennial, annual, terrestrials, aquatics or epiphytes (growing on the tree trunks, walls, dead wood or rock crevices). Their stems are called rhizomes; fronds are made up of leaflets arranged oppositely or alternately on the rachis. Sori containing numerous tiny spores are found on the abaxial surface of the leaflets. In ferns, the leaflets are referred to as pinnae with or without petiole while fronds petioles are called stipes. Growth pattern is described in terms of frond position as erect, open, drooping or bushy

Fern plants add a nice touch to any garden. There are fern plants that are vividly colored and most will survive best in shaded regions. Fern plants differ from other kinds of plants in several ways. One way that ferns differ is how they propagate. Instead of growing from a seed or a flower, fern plants reproduce sexually using spores. Another difference between fern plants and other plants is that they grow in different conditions than most other vascular plants. Fern plants prefer areas that are wetter and shadier than many other plants.

Distribution and habitat

Species of fern grow in almost any climate (Oloyede and Odu, 2011). Most occur in wetter tropics and subtropics, for example: *Pteridium*, *Cheilanthes*, *Pteris*, etc. Families such as, Grammitidaceae, Schizaeaceae, Cyatheaceae, Blechnaceae, and Davalliaceae are almost exclusive to the tropics, and the genera *Athyrium*, *Cystopteris*, *Dryopteris* and *Polystichum* are exclusive to temperate and Arctic regions (Plyer et al., 2004). Some occur in arctic regions and few in deserts. E.g.: *Astrolepis cochisensis ssp. arizonica* (Web 1).

There is a species of fern that can inhabit nearly every condition on the planet but most of the fern species prefer shaded areas with moist soil, and these can be combined underneath a shade-giving tree for a spectacular look. There are fern species that will grow in deserts, tolerating extreme heat and drought. Other types of fern will grow only in the deepest areas of the rainforest. Basically, the habitat of ferns can be categorised as terrestrial, aquatic, epiphytic and epipetric (Table 1).

Table 1. Basic habitat categories of ferns (Web 1).

Habitat	Examples
Terrestrial ferns	<i>Dryopteris</i> , <i>Cycosorus</i> , <i>Adiantum</i> and <i>Striatus</i>
Aquatic ferns	<i>Azolla</i> , <i>Marsilea</i> and <i>Salvinia</i>
Epiphytic ferns	<i>Polypodium</i> and <i>Platyserium</i>
Epipetric ferns (growing on rocks)	<i>Notholaena neglecta</i> , <i>Argyrochosma jonesii</i> and <i>Cheilathes eatonii</i>

Ferns and beauty

Plants generally and ferns in particular add beauty to the earth’s surface and contribute a great deal to man’s pleasure (Kochhar, 2009). They are the ornaments of our gardens, offices, schools, hospitals, parks, streets, houses, etc. (Biplab and Subir, 2007; Oloyede et al., 2012; Oloyede et al., 2010). These ferns are good for both indoor and outdoor purposes to beautify homes and offices; for landscaping, aesthetic and for environmental protection and management. In New Guinea ferns are used to decorate both houses and grounds, and bodies for ceremonial purposes (Jim, 1999). In the central highlands of Papua New Guinea it is quite common for the basket-like clumps of the epiphytic fern *Drynaria rigidula* to be impaled on a wooden spike arising from the centre or end of the thatch roof. Unintentional decoration occurs in the wetter areas at middle altitudes where the thatch roofs support a luxurious crop of such ferns as *Belvisia mucronata*, *Microsorium cromwellii*, *Selliguea wernerii*, etc., and assorted mosses (Sonia et al., 2012).

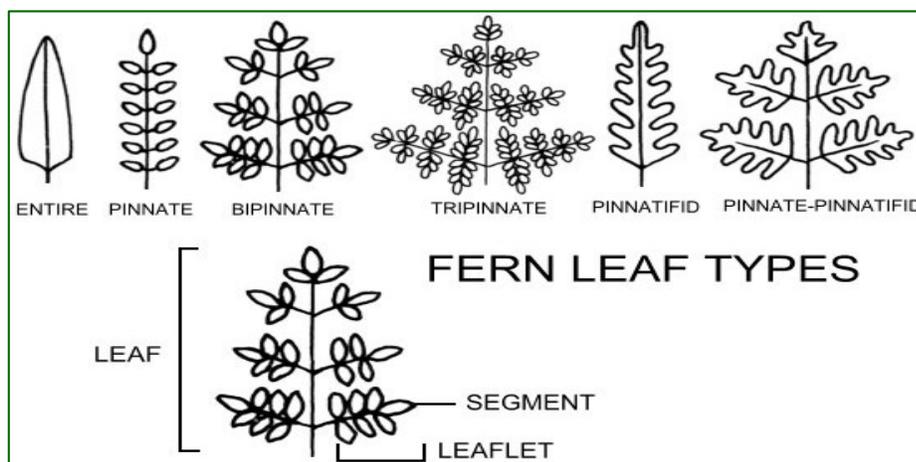
Ferns are often used as personal decoration, either casually or for ceremonial occasions. Research by Sonia et al. (2012) revealed that *Selaginella* being used as casual adornment by carriers on Manus and there

are apical branches of *Dicranopteris* used there for the same purpose. Reports from the Huli region of the southern highlands a species of epiphytic *Lycopodium* is used as head-dress ornamentation on ceremonial occasions, and notes that species of *Lycopodium* are used elsewhere on ceremonial occasions In the Mt Wilhelm area of the Chimbu Province the villagers collect the elongate scaly fronds of the alpine fern *Polystichum linearis* and tie the apical part into a tight flat coil which is used to decorate the hair. The silver-backed fern *Pityrogramma calomelanos*, with its striking contrast between the dark green upper surface and the bright white under surface, is also used for body decoration.

Ferns leaf structure and identification

Fern identification is often hard to do, as many species of fern look very similar. The easiest type of fern identification is close inspection of the orientation of the fronds and the leaves growing off the sides. Many types of ferns, while looking similar at first glance, will become very different indeed when inspected thoroughly (Web 1). The morphological features of some of the Mexican xerophytic ferns leaf types are given in Fig. 1.

Fig. 1: Mexican xerophytic ferns in the Herbarium of George B. Hinton.



In ferns, variations in the vegetative features are good diagnostic characters for separating and delimiting species. The differences in the sori arrangements, sizes, locations, presence or absence of stalk on the sporangia in ferns have taxonomic values (Oloyede and Odu, 2011). Often several species will be found growing together, especially on shady north-facing slopes with plenty of rock outcrops. When you find an unfamiliar fern, note the following: substrate (rock type), exposure (sun, part shade, etc.), leaf shape and color, leaflet shape and arrangement and the presence or absence of hairs, scales, and/or waxy coatings on the leaflets. Look carefully at the underside of the leaf, since this is often essential to identification. Use care when examining living ferns - they are extremely brittle.

Types of ferns

There are many types of ferns in the world (Fern, 2009). Several types of fern can be added to the same garden, for a dramatic look. Most species of fern are purely green, while other types of fern, such as cinnamon and Japanese painted, and offer vivid colors to a shady garden (Plyer et al., 2004).

In urban gardens ornamental ferns are especially common. Occasionally tree ferns (*Cyathea contaminans* and *C. felina* in the lowland areas and *Cyathea magna* in the highlands areas) are grown, or at least encouraged. The magnificent staghorn fern (*Platycerium wandae*) is grown in low to middle altitudes in areas wherever the species occurs naturally. The common bird's nest ferns, *Asplenium nidus* and *A. musifolium*, are present in most gardens in lowland areas. Similarly nearly every garden has plants of *Nephrolepis* (several species) and *Pityrogramma calomelanos* (the silver-backed fern), although these are present as reasonably attractive weeds rather than actively encouraged. Many gardens support introduced ornamentals such as the maiden-hair ferns (*Adiantum cuneatum*, *A. tenerum*, *A. trapeziforme* and cultivars), and various cultivars of *Nephrolepis* and *Phlebodium aureum*.

Ferns, the flowerless plants have got great aesthetic value due to their grace and delicate beauty and are cultivated as ornamental plants. As is recorded earlier, by far the maximum of these tropical plants are known and are used as ornamentals. The ferns have been successful in acclimatizing and propagating of these

species in favourable conditions. The ferns can grow well in such moist and shady places in the gardens where other plants generally cannot grow. The ferns can very well be grown on ground or in pots, as epiphytes on tree trunks or in hanging baskets. The ferns are cultivated as ornamentals either indoors in the houses or outdoors in the botanical gardens due to their delicate beauty and grace. Several species of *Lycopodium* Linn. are used in the decoration. Mostly these are used in Christmas Wreaths and are popularly known as "Christmas green". *Lycopodium volubile*, a beautiful forest species, keeps well after being collected and is generally used for table decoration. Some *Selaginella* species have got feathery moss-like foliage and are greatly admired when grown in pots for table decoration. Many species have various shades of green. Some ferns have metallic and many hued tints particularly uncommon bluish and bronze colours. The leaves of *Selaginella serpens*, which in the morning are bright green in colour and during the day they gradually become paler and in the night they again resume their green colour. The species of *Drynaria* can also be grown as ornamentals in the gardens in ground or as epiphytes. They can also be grown in baskets for indoor decoration which can be kept on stands or as hanging baskets. The *Pteris vittata* Linn. popularly known as "The Brake" is commonly cultivated as a potted plant in the house and in the botanical gardens. *Adiantum species* is also cultivated for decoration purposes. The "Golden fern" *Pityrogramma chrysophylla* and "Rabbits Ear Fern" *Hemionitis arifolia* are cultivated for their splendid beauty and grace. *Ceratopteris* and *Marsilea* ferns can also be used as ornamentals by growing them in pots and keeping them inside the pond. Some *Diplazium species* have a gregarious trunk and become tree like in nature and are of great aesthetic value. Some *Dryopteris* and *Asplenium species* are cultivated in some botanical gardens due to their grace (Mannar et al., 2008). The common ferns of potential ornamental value in Nigeria are given in Table 2.

Ferns in the desert?

Desert ferns are true xerophytes and have evolved several strategies to thrive in the warm, dry climate of the desert. Xerophytic ferns are the "resurrection ferns" e.g. *Astrolepis cochisensis ssp. Arizona*. They have the ability to shrivel and go dormant for months. During this time, they curl up and look quite brown and dead. But they revive and turn

green again when rain arrives. They begin life in rock fractures, beside boulders, under shrubs, or in other sheltered areas that provide a microclimate that is cooler, shadier, and more humid than the surrounding environment. Most species have additional adaptations that are very similar to those seen in flowering desert plants. These features are especially well-developed on the underside of the

leaflet, which holds the spores and is often exposed to the sun when the plant is dry. Adaptations include Reduced Surface Area, Leathery Leaflets, Thickened Leaf Margins, Waxy white coating, Hair or fuzz, and Scales. Most desert ferns are small (many have leaves only 10-15 cm long or less) and it is not unusual to find only one or two plants in a given area (Wikipedia, 2014).

Table 2. Common ferns of potential ornamental value in Nigeria.

Name	Family	Ornamental characteristics
<i>Actiniopteris radiata</i> (Sw.) Link	Actiniopteridaceae	“Fan fern” – These are highly decorative small fern with its palm-like attractive fronds. Best suitable for rockeries and can also used as pot plants.
<i>Adiantum lunulatum</i> Burm.	Adiantaceae	“The maiden hair fern” – It has short creeping rhizomes, black wiry stems with delicate triangular to oval leaves. It is suitable to grown as pot plant. Grow in partial shade in moist well drained soil.
<i>Adiantum poiretii</i> L.	Adiantaceae	Its fronds are erect, tall, and solid without nodes, polished brown towards the top but become black at the middle and towards the lower parts. The fronds possess dichotomous branches and compound unipinnate leaves (Oloyede, 2012).
<i>Asplenium nidus</i> L.	Aspleniaceae	“Bird’s nest fern” – This is used as house plant and also grown in gardens for its attractive shape of the leaves and grows well in moist shady places which need little care.
<i>Asplenium normale</i>	Aspleniaceae	Dark green, shade-loving fern which can be grown in small pots as an indoor ornamental plant.
<i>Cyathea nilgirensis</i> Holtt.	Cyatheaceae	“Tree fern” – It is a large tree fern with attractive fronds and it is suitable to grow in the centre of the lawn and gardens.
<i>Cheilanthes swartzii</i> Webb. et Benth.	Cheilanthaceae	Plant with small, green attractive fronds and black brittle stipe is best suitable for rockeries. It can also be grown in small pots.
<i>Deparia petersenii</i> (Kunze) M. Kato	Athyriaceae	A medium sized fern, grown in shady places and well-suited for indoor gardens.
<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Grown as pot plant under moist, well drained soil. The faded fronds should be removed frequently to avoid drying. Proper care is must.
<i>Doodia dives</i> Kunze	Blechnaceae	This fern attractive for its shape of fronds and it is well suited for growing in gardens as potted plants. Also suitable for gardens with rock and soil.
<i>Dryopteris concolor</i> (Langsd. et Fisch.) Kuhn	Sinopteridaceae	Ferns with attractive palmate shape fronds which can be grown in rockeries.
<i>Drynaria quercifolia</i> (L.) J. Sm.	Polypodiaceae	“Oak leaf fern” – This can be grown in gardens in ground or as epiphytes. An outstanding plant to grown as pot plant in indoors.
<i>Lycopodium brachystachys</i> (Baker) Alston	Schizaeaceae	“Climbing fern” – Climber with attractive foliage, suitable for growing on walls and trellis.
<i>Marsilea minuta</i> L.	Marsileaceae	“Water fern” –These ferns grow well in moist part of the garden, around or in water features or floating attractively in shallow ponds or streams. They can be also grown in aquarium or shallow water containers.
<i>Nephrolepis exaltata</i> (L.) Schott	Nephrolepidaceae	Its common names are Boston fern and Boston sword fern. It is a terrestrial, perennial, short, ever green, herbaceous fern with curled leaflets. Rhizome is glabrous, erect with long creeping stolons; stipe is polished shining black without ramenta and indusim. Fronds are sterile, short, erect and bushy with bipinnate leaves (Oloyede, 2012).

Table 2. Contd.....

Name	Family	Ornamental characteristics
<i>Nephrolepis furcans</i> (Sw.)	Nephrolepidaceae	It is called lemon button fern because its leaflets are lemon color it grows well on the soil in re-growth forest and inside the pots at homes and offices (Oloyede, 2012).
<i>Odontosoria chinensis</i> (L.) J. Sm.	Lindsaeaceae	This is a beautiful fern with thin fronds, suitable for hanging baskets.
<i>Ophioglossum reticulatum</i> L.	Ophioglossaceae	“Adder’s tongue plant” – This pretty fern is well suited for outdoor in cool climates and it can be planted beneath trees. Excellent for potted plant.
<i>Osmunda huegaliana</i> Presl.	Osmundaceae	The foliage of the fern is very attractive and it can be grown as pot plant in indoors.
<i>Parahemionotis cordata</i> (Roxb. ex Hook. & Grev.) Fras. Jenk.		“Rabbit’s ear fern” – This attractive dwarf fern is ideal for rockeries.
<i>Pityrogramma calamelanos</i> var. <i>aureoflava</i> (Hook.) Weath. ex Bailey	Hemionitidaceae	“Golden fern” – This can be grown as a potted plant in indoors. Fronds are much attractive with the golden-yellow powder beneath it.
<i>Phymatodes scolopendria</i> (Bunm. F.).	Polypodiaceae	It is called golden rod fern or wart fern. It is epiphytic, growing on the palm tree or wood in wet shaded forest or secondary forest naturally but become terrestrial as a cultivated potted plant. Fronds are deeply pinnatifid, glabrous and fertile with simple biforked shining fronds (Oloyede, 2012).
<i>Pteris argyrea</i> T. Moore	Pteridaceae	This is an excellent fern suitable for indoor decoration. It is a beautiful fern with several variegations and has lengthened leaflets with silvery white band in the centre. The plant grows well in shady and moist places. It can be grown in small pots (Oloyede, 2012).
<i>Pteris acanthoneura</i> .	Pteridaceae	Its fronds are erect, tall (able to check wind erosion), polished brown stripes (petioles) and compound unipinnate leaves. Leaflets are coarse, hard, deeply serrated margins, acute/acuminate apex with sori on the abaxial surfaces. Indusia present, cover the sori while ramenta covers the base of the frond. The shape of the apex, the forked base and margins of the leaflets are added advantages to its beauty.
<i>Stenochlaena palustris</i> (Burm.) Bedd.	Blechnaceae	Beautiful climbing fern which is suitable for trellis arches and trailed around tall trees.

Care for ferns

- Ferns need partial or no sun to be able to survive.
- Require soil to thrive except in some species.
- Require constant moisture in both the soil and the air in order to grow properly.
- Ferns will often not survive harsh frosts.

Conclusion

The aesthetic values of ferns are for their elegant fronds and a large number of them are cultivated as ornamental plants in houses, offices, schools, hospitals, corridors, streets, parks and botanic gardens. Ferns are mostly located in the wild and in few cities in Nigeria. There is a need for massive collection and

cultivation of ferns for their ornamental, aesthetic and landscaping, environmental protection, food and medicinal values. Therefore, mass cultivation and campaign for the awareness of the use of ferns as ornamental plants is hereby advocated.

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