The Sanctuary's Flourishing Ferns

Introduction

It is hard not to be impressed by the abundance and luxuriant growth of ferns in the Morrell Nature Sanctuary, particularly sword fern (*Polystichum munitum*, family Dryopteridaceae) which often dominates much of the forest floor along with salal and dull Oregon grape. Other ferns represented in the sanctuary are licorice fern (*Polypodium glycyrrhiza*, family Polypodiaceae), deer fern (*Blechnum spicant*, family Blechnaceae), bracken fern (*Pteridium aquilinum*, family Dennstaedtiaceae), and lady fern (*Athyrium filix-femina*, family Dryopteridaceae).

Ancient Plants

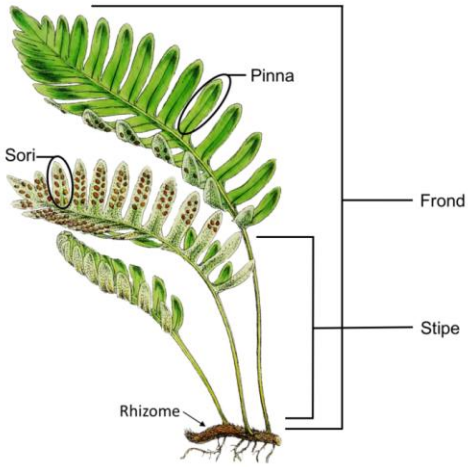
Ferns are among the oldest groups of plants on Earth, with fossil specimens dating back to the middle Devonian period (about 390 million years ago). Most of the earliest ferns have become extinct, but today ferns are the second-most diverse group of vascular plants, outnumbered only by flowering plants. With around 10,500 living species, ferns eclipse other non-flowering vascular plants such as gymnosperms by a factor of 4 to 1.

Adapted to Shade

Plants compete for sunlight, nutrients, and moisture. Trees are highly successful in the competition for sunlight, rising in height to capture the radiant energy in the sun's rays and shading the plants living below the tree canopy. In contrast to sun-loving "heliophytes," most ferns are "sciophytes" (shade-loving) and have adapted to the lower light conditions of the understory by utilizing a special protein called neochrome. Neochrome enables ferns to absorb both red and blue light instead of just blue light like many of the other plants that grow above them. While blue light has the most energy, there is less competition for red light giving ferns an advantage over rival plants. Neochrome is abundant in the Polypodiales, a taxonomic group encompassing more than 80% of all fern species and which includes the four fern families found in the sanctuary. During the wet winter months, with a more open canopy due to leaf fall from maples, alders, and other deciduous trees, the ferns flourish with plenty of moisture and less competition for light.

Morphology and Reproduction

Most ferns have rhizomes, which are underground stems from which leaves are produced. These rhizomes form maze-like networks in the soil and, while leaves may drop off due to age or cold weather, rhizomes can persist indefinitely and generate new leaves year after year. An entire leaf is called a frond and is subdivided into pinnae (first division) and pinnules (subsequent divisions). Pinnae grow along the main stem or rachis. The part of the rachis without pinnae is called the stipe and attaches directly to the rhizome (see illustration on the next page).



Ferns reproduce through the production of spores. The term spore derives from the ancient Greek word ("spora"), meaning a seed. In biology, a spore is a reproductive structure that is adapted for dispersal and surviving for extended periods of time in unfavorable conditions. Spores form part of the life cycles of many bacteria, plants, algae, fungi and some protozoans. A chief difference between spores and seeds as dispersal units is that spores have very little stored food resources compared with seeds. Once conditions are favorable, the spore can develop into a new organism. Spores are found on the underside of the frond, as shown in the sword fern below.

Spores are the units of asexual reproduction, because a single spore develops into a new organism. Spores are produced in large numbers to increase the chance of a spore surviving. In the case of spore-shedding vascular plants such as ferns, wind distribution of very light spores provides great capacity for dispersal. Also, spores are less subject to animal predation than seeds because they contain almost no food reserve; however they are more subject to fungal and bacterial predation. Their chief advantage is that, of all forms of progeny, spores require the least energy and materials to produce.

The dots you see on the back of the frond (see photo on left) are not one big spore; they are spore cases called sori (singular: sorus). They are fruit dots (more like a bag) containing microscopic spore cases on the undersides of some of their leaves. Other fern species produce spores on separate stems or specialized leaves. When the single–celled spores are ripe, and the air is dry, the walls of the spore cases burst open, casting the spores into the air, ideally on a breeze that will carry them away from the plant. When a spore lands at a suitable warm, moist, and shaded location, it begins to develop into a gametophyte (reproductive phase of plant), putting out first a rhizoid—tiny roots like hair that secures it in the soil. It then develops into the familiar looking fiddlehead (photo on right) that unfurls to become the ferns we see in the forest.

Bob Harvey and Lance Nordstrom, November 2020
Photos by Bob Harvey
Fern illustration from American Fern Society
[https://www.amerfernsoc.org/about-ferns]