Many new species of plants are identified each year, and color serves as an important differentiator. Image Credit: Unsplash user Chris Lee

In 2016 alone, 1,730 new species of vascular plants were discovered.[1] While that may seem like a large number, it pales in comparison to the total number of known species, which is on the order of 400,000.[2]

The sheer number of plants makes categorization essential. Of the many characteristics by which we categorize our plants, color is one of the most immediately apparent, and therefore most important. But, of course, your information is only as good as your measurements. The human eye sees color subjectively, which creates issues for scientists attempting to create an objective catalog of plant color. For accuracy and the ability to create a meaningful comparison, it's necessary to rely on a digital instrument such as a spectrophotometer.

Color an Important Tool in Plant Identification

There are many important reasons to be able to distinguish between similarly colored plants. Botanists in the field can turn to color identification to differentiate otherwise similar vegetation or to help identify a new species. Rose breeders and other floriculturists keep a close eye on color in order to improve their husbandry practices, select appropriate flowers for various uses, and distinguish between species of wildflowers. Food processors, such as saffron producers and distributors, can use color to detect supply adulteration. Land managers may rely on color identification to detect invasive species or promote the growth of endangered ones, as well as for simple surveys. Foresters rely on color, among other factors, to differentiate between similar species of trees and other forest vegetation.[3]

Color is can be used to distinguish trees in a forest. Image Credit: Unsplash user Noah Silliman

The Limits of Vision-Based Identification Based on Color Charts

A number of vision-based identification methods have been developed over the years to aid botanists and other professionals who need to identify plants by their color. These methods rely primarily on matching plant color to a standardized color chart. For decades, these charts played a valuable, in imprecise, role in plant identification. However, vision-based plant identification based on color charts is an inherently unreliable method of assessment for a number of reasons:

- The human eye lacks the ability to distinguish fine shades of color beyond a certain point. While the color charts may provide a rough framework for identification, there are only so many shades they can represent, and human observers must turn to guesswork to identify colors which do not match exactly.

- Human perception of color is a highly variable, depending factors such as biological and cultural influences.

- Environmental influences such as background colors and lighting conditions can have a dramatic impact on color perception. As such, observers attempting to match colors under different environmental conditions will be prone to error; plants that appear one color in the field may appear a different color in the laboratory or even under different weather conditions or at different times of day.

- Color charts themselves are vulnerable to variability, as their colors can shift or fade over time, and charts printed by different manufacturers may not be in exact agreement.

Taken together, the imprecision of vision-based color matching renders objective, instrumental comparison necessary.

The brilliant hues of Autumn can be captured with a spectrophotometer. Image Credit: Bernd Schulz

Spectrophotometers Offer Accurate and Precise Color Measurement

Spectrophotometers are able to overcome the shortcomings of vision-based assessment of printed color charts with digital precision. These advanced instruments analyze color in more granular detail than the human eye, allowing them to discern between nearly identical shades with ease and distill chromatic information to objective data. This is possible in part because spectrophotometers use controlled bursts of light to measure samples, meaning that they generate generate accurate and precise results in any environment. Depending on the geometry of the instrument you are using, you also have the option to account for the effects of gloss and texture, which can be useful in identifying rough or oily plants. As such, instrumental measurement ensures that geometric features do not interfere with accurate color determination.

Spectrophotometric technologies represent a significant improvement over older, less precise visual inspection methods, augmenting your ability to correctly identify and classify botanical material. In fact, vision-based plant identification based on color charts seems out of step in our technologically advanced world.

The HunterLab Difference

With over six decades of experience designing spectrophotometers for industrial and scientific applications, HunterLab has developed a reputation for unparalleled color measurement excellence. **Our spectrophotometers**produce rapid, accurate, and repeatable results regardless of environment, and our portable spectrophotometers are durable enough to endure tough field conditions. Contact us today to learn more about our renowned technologies and let us help you select the perfect spectrophotometer for your research needs.

1. "New Plant Discoveries", 2017, https://stateoftheworldsplants.com/2017/new-plant-discoveries.html

2. "Plant Species Numbers", http://www.bgci.org/worldwide/1521/

3. "Tree Identification Keys for Member Trees", 2017 https://www.arborday.org/members/treeIDKey.cfm