Software for Simple Image Analysis

Software for Simple Image Analysis—New tools for new questions.

Free Image Analysis Software

There are a number of free image analysis programs available for both Macintosh and Windows computers that make use of digital images in the science classroom a powerful teaching tool.

We have used three in particular: Digital Earth Watch software (elementary to intermediate level), ImageJ, and Multispec (advanced). If considering projects requiring a number of high-end mathematical/statistical functions with nearly unlimited analyses options, use ImageJ (http://rsbweb.nih.gov/ij/) or Multispec (http://cobweb.ecn.purdue.edu/~biehl/MultiSpec/).These programs are fast, powerful, and designed for sophisticated scientific research. The learning curve is not trivial, in particular because terms are more likely to contain jargon, but once mastered, they are wonderful programs.

The Digital Earth Watch software suite consisting of *ColorBasics*, *DigitalImageBasics*, and *AnalyzingDigitalImages* (http://www.globalsystemsscience.org/software) was designed for educational use. *ColorBasics*, *DigitalImageBasics* are introductions to the fundamentals of digital images in terms of what color is, how it is displayed on a computer screen, the difference between pigment color and color of light, what pixels are, what resolution is, and how invisible wavelengths of light can be displayed as representative colors. In *AnalyzingDigitalImages,* measurements can be made and data can be saved and tracked to see how the data were measured, allowing users to monitor the quality of their work. This is particularly important for when first learning how to collect and analyze data. The software has supporting guides and help movies and activities to learn the basics of color and digital images to allow create explorations of digital images.

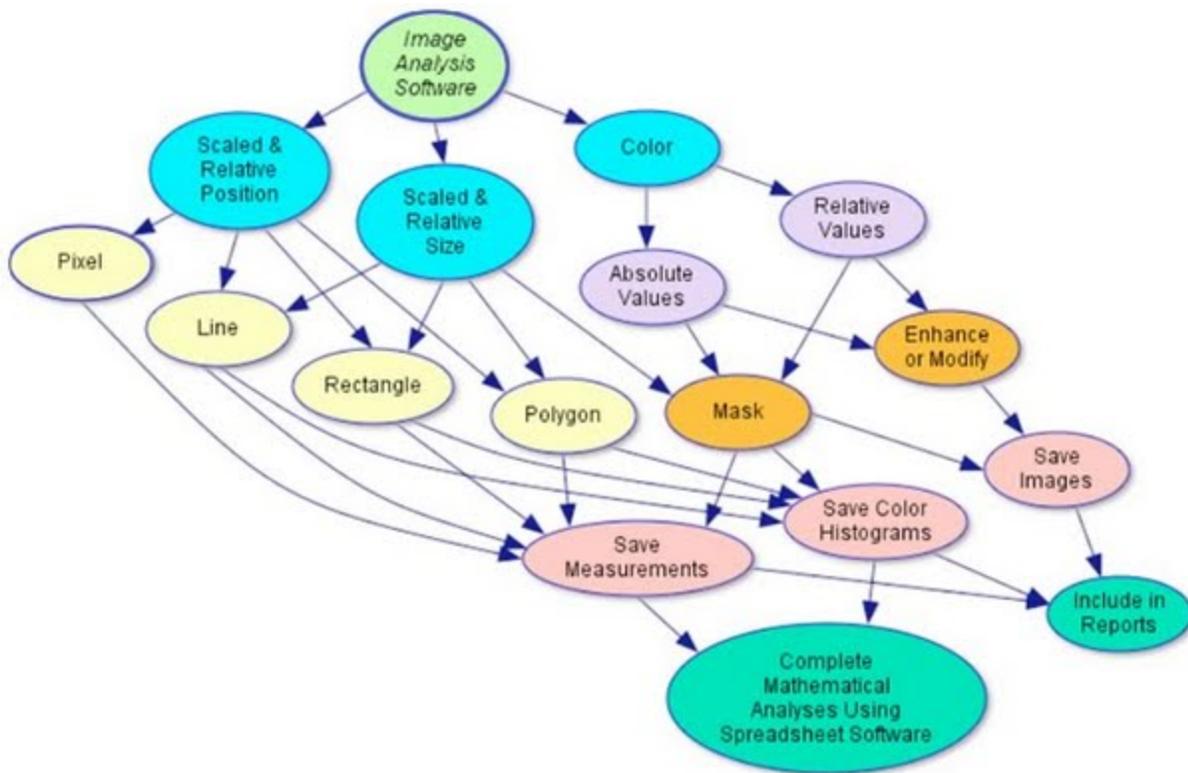Basics features of *AnalyzingDigitalImages* are summarized in the following diagram.

Fig. 3.1 Diagram of the features of AnalyzingDigitalImages software.

Special features include scaleable length and area tools, provided an object of known length is visible in the image, which allow objects to be measured to a calibrated scale. The mask tool combines color modification and size analysis tools. After one selects a range of color, the pixels meeting the criteria are turned black, and those outside the range are turned white. The size tools may be used to count the black pixels in a selected region, thus providing an efficient tool to calculate the area of irregular shaped objects. All measurements are saved to a tab-delimited text file, which all spreadsheet analysis software can import. This allows numerical analysis to be completed with tools familiar to most students.
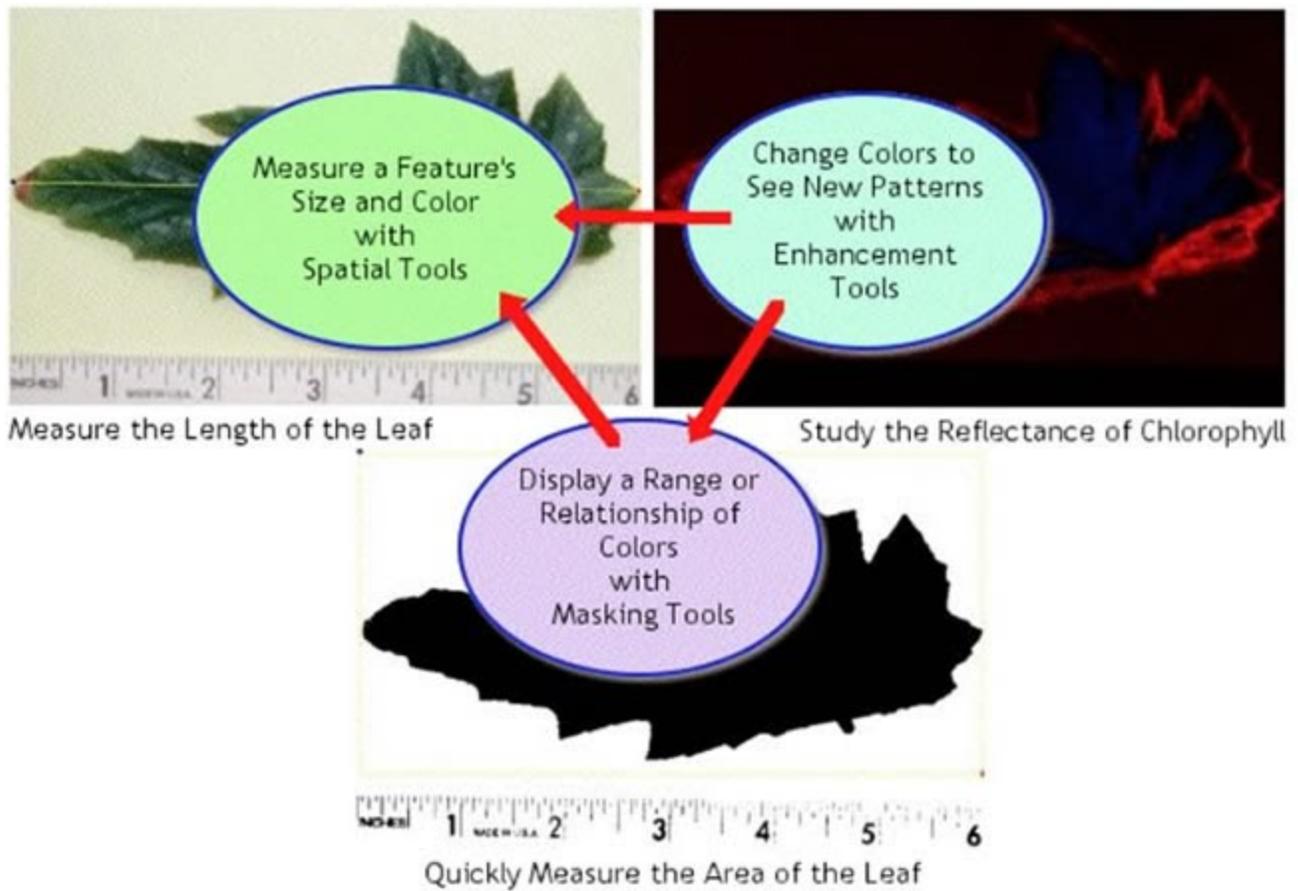
Fig.3.2. Example of how the image analysis tools in *AnalyzingDigitalImages* software allow measurement of a variety of parameters of a leaf.

A good introduction to using Digital Earth Watch software may be found in the ABCs of Digital Earth Watch Software, in the Global System Science (GSS) series. It is now available on the GSS website as html pages at http://www.globalsystemsscience.org/studentbooks/dew or as PDF at http://www.lawrencehallofscience.org/gss/licenseaccess/ Also on the GSS software download page (http://www.globalsystemsscience.org/software/download) you can find DEW software User Guides, Help Videos, and Image sets.

Whichever software you choose, the program should contain easy to use tools to measure color of selected areas, measure the size (length and area) of objects in the image, and manipulate the layers of color to see subtle patterns for additional measurements - and the tools should be integrated to allow a degree of creativity in your analyses (Figure 3.2).