

# UC Santa Barbara

## GIS Core Curriculum for Technical Programs (1997-1999)

### Title

Unit 16: Planning a Scanning Project

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# UNIT 16: PLANNING A SCANNING PROJECT

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## Context

Scanning is a method for transferring analog (paper) maps into a digital format the computer can read. Scanners use CCDs (charge coupled devices) to read reflectance values from a surface. Specialized electronics then transform the values into digital format. Reflectance is the how the light, consisting of different wave lengths which distinguish different colors, bounces from the object being scanned.

The result of scanning is an electronic image composed of pixels ("picture elements") that can be viewed on a computer monitor. Each pixel has a number assigned that represents the reflectance that was collected by the CCDs. The number is then assigned a color or shade of gray that you will observe on the computer monitor.

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## Example Application

**A forester needs to determine the amount of timber that can be harvested. She has acquired recent airphotos of the area. The job will be easier if she can use a software package designed to interpret remotely sensed images. Before she can use the software she must transform the hardcopy photographs into a useable electronic image.**

**The manual for the GIS software indicates that it will except most types of TIFFs. The resolution needs to be sufficient to distinguish stands of trees rather than individuals so 300 dpi will be sufficient.**

**The airphotos are 8"X10" so they will fit on a bed scanner. By using the bed scanner any distortion of the image should be uniform in one direction. Our forester put the image on the bed and proceeds according to the instructions for scanning with software on the computer attached to the scanner. She saves the image as a tiff which can be**

**imported to the GIS software package she will be using.**

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## Learning Outcomes

The following list describes the expected skills which students should master for each level of training, i.e. Awareness/Competency/Mastery.

### Awareness:

Understanding the mechanics of scanning and the concepts of resolution behind sampling at specific dpi's so they can plan a project effectively.

### Competency:

Selection of appropriate source materials and determination of needed resolution for a project.

### Mastery:

Understanding the concepts of resolution as they pertain to scanning so they become natural.

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## Preparatory Units

None

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## Awareness

Types of scanners

1. Drum- Used to scan maps. An entire map sheet is attached to a rotating drum. Light is reflected off the map surface as the drum rotates under the CCDs. The CCDs move across the drum as the drum rotates.
2. Bed- Used for smaller sources, a bed scanner consists of a glass bed that supports the image. The CCDs and light source moves back-and-forth over the surface of the image collecting reflectance.
3. Back-lit- Used for negatives. In this case, the CCDs collect the information about the light that passes through the negative.

The materials most commonly scanned for GIS are maps or air photos. Materials must be in pristine condition. Any crease or mar will be scanned along with the relevant information.

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## Competency

After acquiring the materials to be scanned, you must then choose an appropriate resolution for scanning. Scanned image files can become very large very quickly. You need to decide between the desired resolution and the desired size of the file. To determine the needed resolution, identify the smallest object you wish to include from the image. The pixel size must be equal in width to the smallest object. A pixel can only have one value and that value will be an average of all values collected. For a single object to be the determining factor for the value of a pixel it must cover at least half of the area of that pixel. For example, if a line half as wide as a pixel straddles two pixels, only 1/4 of each pixel will be covered by the line. The line will not be recorded.

Scanning determines pixel size by dpi (dots per inch). If an image is scanned at 150 dpi, a linear inch has been sampled 150 times. To effectively scan at 150 dpi, any attribute you wish to include must be at least 1/150 of an inch wide. It is important to choose a resolution that will effectively convey the information on the map but not to such a high degree it becomes hard to manage. For example, an image scanned at 150 dpi and using 5 Mb of will require 334Mb of storage if scanned at 1200 dpi.

Once the image has been scanned it must be saved in an image format. There are many formats for storing images. The most important consideration is compatibility with the software package you plan to use. TIFFs are the most common format for saving images but a variety of TIFF formats exist and no package will read them all. JPEG is another format that is used. It saves the information in a compressed format that loses very little information.

## Mastery

You will thoroughly understand the concepts of reflectance and resolution which will enable you to choose the correct materials for your project. You will be able to successfully reproduce them electronically with the correct resolution using a minimum of resources. Mastery will ensure a successful integration between electronic image and GIS software.

**Glossary:** Resolution- Image resolution refers to the smallest identifiable piece of an image. In scanning it is defined by dpi or dots per inch. Scanning at 350 dpi means that the image was sampled 350 times in one inch of scan line.

Pixel (picture element)-The smallest unit of resolution on a display; often used to display one grid cell at the highest display resolution.

TIFF- A commonly used image file format, the Tagged Information File Format was developed by the Aldus Corporation and Hewlett Packard. There are 32 TIFF formats that have undergone five revisions. As a result, virtually no programs can read or write all TIFF formats.

JPEG- is a standard format developed by the Joint Photographers Experts Group. It allows

transfer of files between many platforms. JPEG uses compression techniques that allow for very little loss of information.

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## **Follow-up Units**

- Unit 17 - Scanning Maps
- Unit 18 - Scanning Air Photos

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