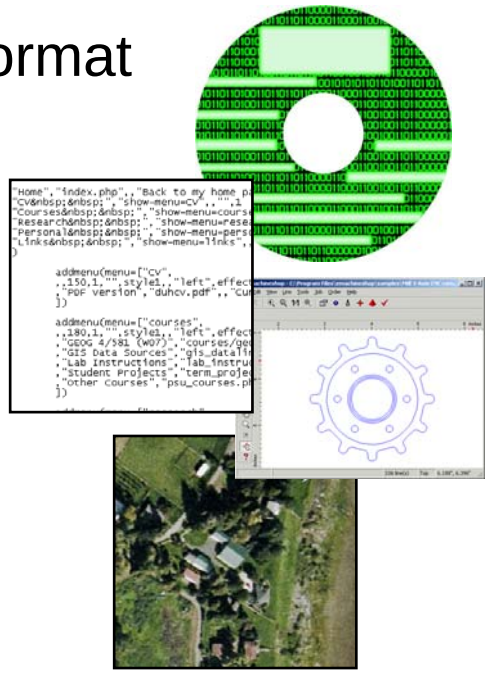
Digital Data Format

- Bit
- Byte = 8 bits
- Word = 2 or 4 bytes
- Block = 512 or 1024 bytes
- 1 KByte = 1024 bytes



Binary and Decimal Numeral Systems

Decimal	Binary
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111 $= 1*2^3+1*2^2+1*2^1+1*2^0$

ArcGIS Variables - Data types

- Text: ASCII (American Standard Code for Information Exchange)
- Binary

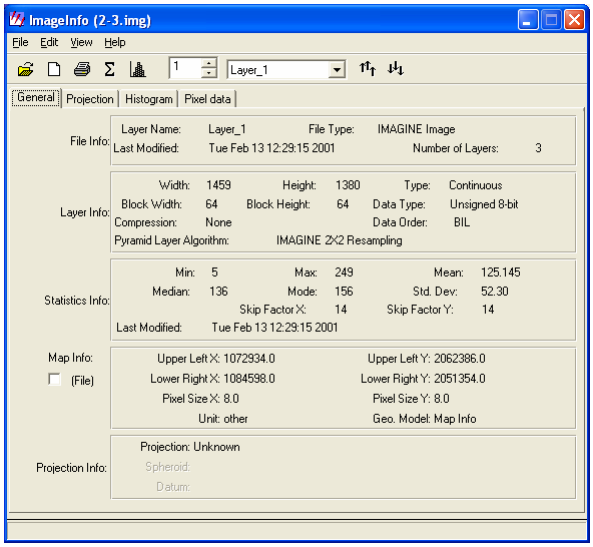
Name	Specific range, length, or format	Size (Bytes)	Applications
Short integer	-32,768 to 32,767	2	numbers without fractions within specific range; coded values
Long integer	-2,147,483,648 to 2,147,483,647	4	numbers without fractions within specific range
Single-precision floating point number (Float)	approx. $-3.4E^{38}$ to $1.2E^{38}$	4	numbers with fractions within specific range
Double-precision floating point number (Double)	approx. $-2.2E^{308}$ to $1.8E^{308}$	8	numbers with fractions within specific range
Text	up to 64,000 characters	varies	names or other textual qualities
Date	mm/dd/yyyy hhmmss AM/PM	8	date and/or time
BLOB	varies	varies	images or other multimedia
GUID	36 characters enclosed in curly brackets	16 or 38	customized applications requiring global identifiers

Raster Data Structure

- Header
  - Dimension and spatial resolution
  - Projection and coordinates
  - Thumbnails
- Data
  - Types: ascii, binary (1-bit), integer (8-bit), floating-point (4-byte)
  - Single- and multi-band structures (BSQ, BIL, BIP)
- Trailer
  - Color look-up table
  - Statistics

Raster Data Structure (cont.)

- Uncompressed/ lossless compression
  - Cell-by-cell encoding
  - Run-length encoding (RLE)
  - Quad Tree
- Lossy compression
  - JPEG
  - MrSID (Multi-resolution Seamless Image Database)



LAN and GIS Files - Image Data

LAN and GIS image files are stored in the same format. Each file contains a header record, followed by the image data. The image data are arranged in a Band Interleaved by Line (BIL) format. Each file is virtually unlimited in size - the file structure allows up to 274 billion bytes. The only size constraint is the capacity of the particular storage medium. The file consists of 512-byte records. The first 128 bytes of the first record contains the header information which consists of the following:

Name	Byte(s)	Description
HDWORD	1:6	A 6 byte array containing 'HEAD74'. (Pre-7.4 files say 'HEADER'.)
IPACK	7:8	An integer value which indicates the pack type of the data:
		0 = 8 bit
		1 = 4 bit
		2 = 16 bit
NBANDS	9:10	An integer that indicates number of bands/channels per line. (Always 1 for GIS.)
	11:16	Unused.
ICOLS	17:20	An integer*4 number specifying the width of the file in pixels.
IROWS	21:24	An integer*4 number specifying the length of the file in lines of pixels.
XSTART	25:28	An integer*4 number specifying the database x-coordinate of the first pixel (upper left) in the file.
YSTART	29:32	An integer*4 number specifying the database y-coordinate of the first pixel (upper left) in the file.
	33:88	Unused.
MAPTYP	89:90	An integer which indicates the type of map projection associated with the file. See PRO files for a complete list.
NCLASS	91:92	An integer which indicates the number of classes in the data set.
	93:106	Unused.
IAUTYP	107:108	An integer which indicates the unit of area associated with each pixel:
		0 = NONE

Raster Header Information

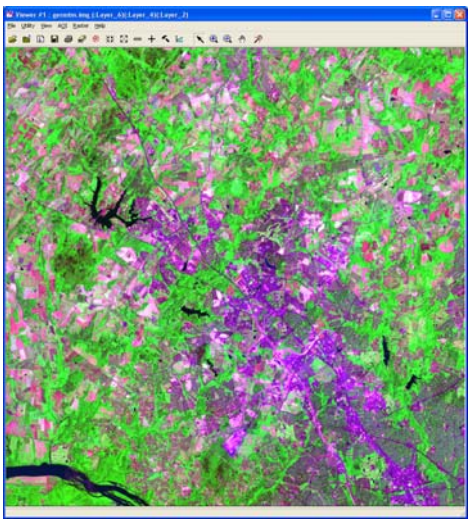
Image Display

- Display size
- Radiometric resolution (range of brightness)
- Color rendition
  - D-to-A conversion (Analog CRT)
  - RGB-channels
  - Grey scale, pseudo color, and true-color
  - Color look-up table
    - 4-bit, 8-bit, 24-bit, 32-bit, …

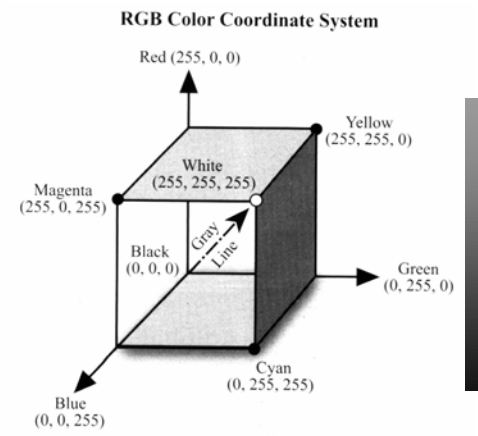
Display Modes

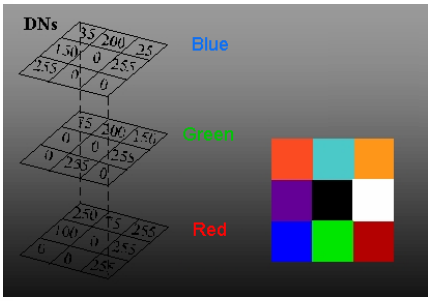
- Binary (B&W 2 colors)
- Gray scale (B&W with various tones)
- True-color
  - Natural color
  - False color
- Pseudo-color (Color)
  - Natural color
  - False color
- Relief (Gray scale with relief shading functions.)

Natural- & False-Color Composite

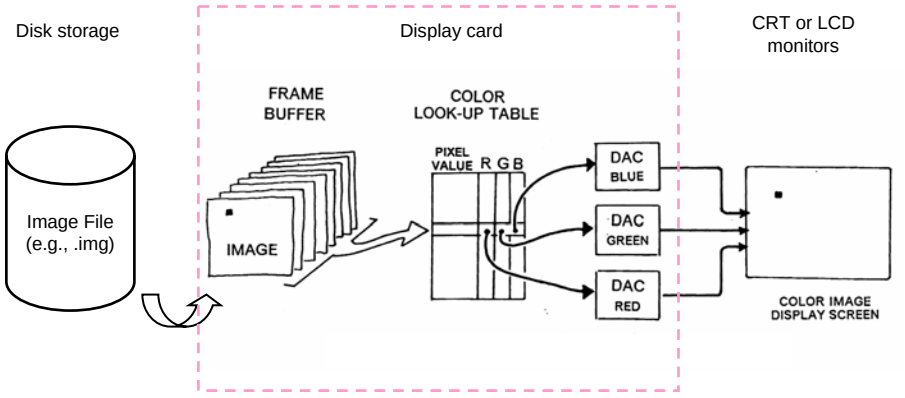


Cathode-Ray Tube (CRT) & RGB Color





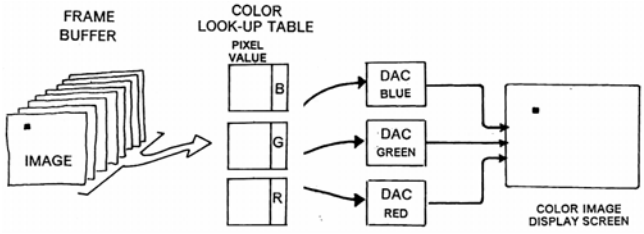
Display Images on a Computer Screen



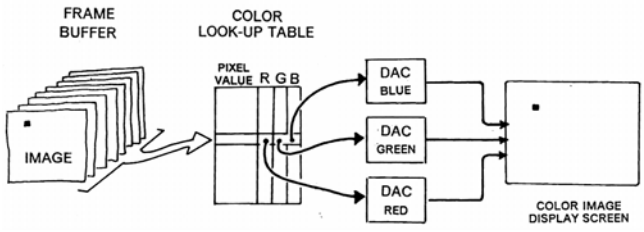
See to Figure 3.4 in Mather.

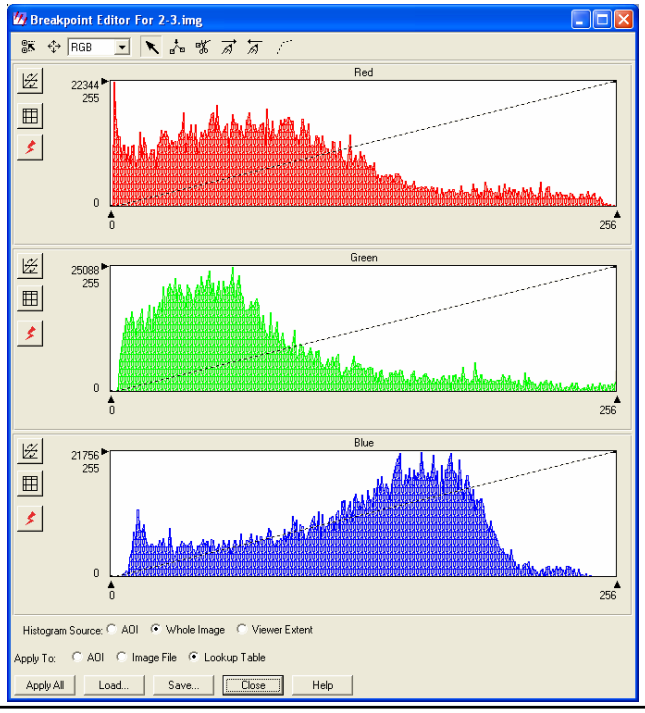
Pseudo and True-color

True-color display



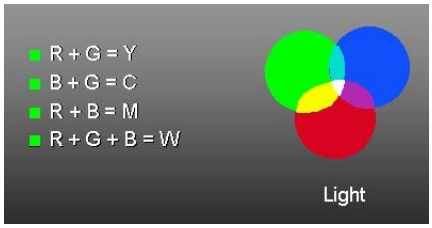
Pseudo-color display





Color Mixing

Light:
Additive color system
(Primary colors: R,G,B)



Pigments:
Subtractive color system
(Secondary colors: C, M, Y)