Glossary for Geospatial Analysis

with the
TNT products

Before Getting Started

TNTmips is MicroImages' flagship product for geospatial analysis. TNTmips is used in more than 150 nations around the world for geographic information analysis (GIS), advanced image processing, CAD, desktop cartography, electronic atlas preparation, and other spatial database management and visualization applications. TNTmips offers a level of data and process integration that is unmatched in any other professional system. And you can use TNTmips on Windows and Macintosh computers with exactly the same set of features and user interface on each platform. TNTmips is the most technically advanced and easy to use professional system on the market.

This Glossary defines the specialized technical vocabulary that is associated with TNTmips. The staff of MicroImages uses many of the terms included here with slightly different meanings than those in general usage. These definitions establish a common vocabulary for communicating with other TNTmips users and MicroImages' technical support staff. Because this glossary was compiled beginning in 1990, some of the terms may seem distinctly out of date, such as optical disk and WORM drive. Think of this glossary as an historic reference in that respect.

Definitions credited to (*Random House*) are from *The Random House Dictionary of the English Language, Second Edition, Unabridged.*

More Documentation This booklet is adapted from the glossary in the TNTmips reference manual. You may wish to consult the reference manual for additional information.

TNTmips Pro, TNTmips Basic, and TNTmips Free TNTmips comes in three versions: TNTmips Pro, TNTmips Basic, and TNTmips Free. HyperIndex Linker is available only to customers using TNTmips Pro. If you did not purchase the professional version (which requires a software license key), you are using TNTmips Free or TNTmips Basic, which limit the size of your project materials.

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— A —

AAT: ARC/INFO Coverage attribute table; created when vector objects are exported to ARC files.

absolute colorimetric rendering: A rendering intent in which the colors in the source gamut (displayed image) that are available in the destination gamut (printer) are rendered exactly as they are and colors outside the destination gamut are replaced by the nearest available color at the outer limit of the destination gamut. White may or may not be reproduced exactly.

accelerator: A key or key combination that invokes the action of some component (like a push button or menu selection) regardless of the position of the location cursor. An accelerator can activate a menu selection even if the menu is not open.

accuracy: The measurement for an X-Y digitizing tablet of how close the reported coordinates for any given point come to the point's actual location. Accuracy is stated in terms of the possible distance for error (for example, ±.01 or ±.025).

active area: The area on an X-Y digitizing tablet that is sensitive to the pointing device.

active element: The last vector, CAD, or TIN element added to a selection set in single select mode. If the selection set is established using a selection tool that allows multiple elements to be selected at one time, such as the rectangle or circle tool, the active element is the element with the lowest element number among those selected.

additive color: Colors perceived by the human eye that are created by mixing different colors of light, or visible radiation are produced in an additive manner. The colors of the images produced on a color display screen or by a color projection onto a white screen are examples of additive color. When all wavelengths, or colors, of visible light are mixed, white light is produced. That all visible colors are present in white light is easily demonstrated using a prism, which separates white light into the spectrum of colors of which it is composed. White light can also be produced by mixing complementary colors. Absence of radiation or relatively low radiation at all wavelengths of human visual sensitivity will yield black. A predominance of radiation in a particular range of wavelengths will yield a color whose intensity is proportional to the level of radiation. (See also: subtractive color)

aerial photograph: see airphoto.

affine: Transformation of geodata that maps lines to parallel lines and finite points to finite points.

agronomy: The study of crop and soil sciences including crop breeding, genetics, and cytology; plant molecular biology and plant molecular genetics, crop physiology and metabolism; crop ecology, production, and technology; turf grass; crop quality and utilization, agroclimatology and agronomic modeling; soil physics; soil chemistry; soil microbiology; soil fertility and plant nutrition; soil genesis, morphology, and classification; soil mineralogy; and soil management.

airphoto: A photograph taken vertically from the air. Any type of camera may be used, but single-lens frame cameras are most commonly used. Airphoto images can be available to users as paper prints, transparent film, or digital computer files. An airphoto includes significant horizontal displacement introduced by camera characteristics, tilt, nearness to the target scene, and variations in elevation of the target terrain.

airslide: A 35mm slide taken vertically from the air.

airvideography: The growing field of making measurements from digitized frames of vertical airvideo images. These measurements can be used for managing agricultural and natural resources, making tax assessments, and monitoring environmental degradation among other uses.

airvideo image: An image acquired vertically with a color, monochrome, or color-infrared video camera and recorder.

albedo: "The ratio of the light reflected by a planet or a satellite to that received by it" (*Random House*). This definition can be generalized to any object, such as a part of the earth's surface or atmosphere, a leaf, a soil element, and so on.

algorithm: A numerical scheme applied to reach a solution of a problem.

aliasing: (referring to a graphic display of lines) A line that is drawn digitally, cell by cell, with fixed, uniform color and intensity is said to be aliased. The cells are easily resolved by the observer's eye so the line is seen to have a jagged, stair-step appearance. (See also: anti-aliasing.)

allocation: The movement of materials into or out of a number of centers, all of which serve the same purpose, such as schools, fire stations, or warehouses. The Network Analysis process includes an allocate mode.

alphabetic: A written language that uses a fixed, ordered set of phonetically-related characters is said to be alphabetic. Most Western European languages are alphabetic (Latin-based), as are Greek, Hebrew, Arabic, Russian, Turkish, and Indian. Modern Korean (Hangul) is an alphabetic replacement for Chinese-based character writing which was used until the 1500's.

Modern non-alphabetic languages include Chinese and Japanese, in which characters may be syllabic constructs historically derived from pictographic archetypes. While they use a basic set of characters (a few thousand) for most writing, the character set is not strictly limited to a fixed number of characters.

AM/FM: Automated Mapping and Facilities Management. A geographic information system designed for the optimal processing of information about utilities and infrastructures, such as power lines and water and telephone networks.

analog: Information stored and processed as signal intensity or other measurement of a continuous physical variable. Analog information processing translates and represents slight increments in data easily and conveys information by relative position without relying on the numeric value necessary to convey the same information digitally. For example, the second hand on an analog watch "sweeps" around the dial and you can tell time on an analog watch even if it has no numbers on the face. Another example is a thermometer that displays temperature using a needle or liquid can indicate fractions of a degree, as well as provide information about relative warmth by the position of the dial or height of the liquid. On the other hand, this continuous analog information is harder to copy, store, manipulate and reproduce dependably. Anyone who has ever listened to a copy of a copy of a copy of a cassette tape has first-hand knowledge of analog information degradation. For this reason, much analog information (video, audio, or field and laboratory measurements of temperature, pressure, voltage, radiation, and so on) is converted to its digital equivalent. (See also: digital, digitizer)

angle impedance: The opposition to flow around a turn in network analysis. Angle impedance is determined by node properties and your choice of lines for approaching or leaving the node.

anisotropy: A distribution of point geodata in which the probability of encountering other points starting from any given point is not equal in all directions. Anisotropy can apply over short or long distances.

ANSI: American National Standards Institute is a national coordinator of voluntary standards activities and acts as an approval organization and clearinghouse for consensus standards in the USA. ANSI works closely with international organizations, particularly ISO, for the development and approval of international standards.

antarctic circle: A small circle of the earth parallel to the equator drawn on maps at 23° 27' from the south pole (66° 33' S). The exact location of the antarctic circle varies slightly since it is defined by the sun's furthest southern declination (position at winter solstice) from year to year.

anti-aliasing: (referring to a graphic display of lines) Anti-aliasing removes or greatly reduces the jagged, stair-step appearance of a digital line. This stair-

stepping is caused by plotting a uniform color and intensity line on a display device whose minimum resolution or cell size is easily resolved by the observer's eye.

Anti-aliasing smoothes out the jagged edges of the line by filling in some of the intermediate and flanking cells in lower-intensity colors. (See also: aliasing)

API: An Application Program Interface is a set of system calls or routines for application programs to access services from operating systems or other programs. APIs are fundamental to client/server computing.

API key: A mechanism used by Google to authorize users to access the Google Maps API to embed the Google Maps geoviewer in a web page.

APPLIDAT: A unique combination of SML scripts and Project File geospatial data created in TNTmips. An APPLIDAT (APPLIcation plus DATa) can be launched from a desktop icon that opens the preselected geodata and presents a custom icon toolbar.

arbitrary georeference: A georeference that uses a matrix rather than control points. Raster, vector, CAD, or TIN objects can have an arbitrary georeference. An arbitrary georeference is created when an object with no georeference is used as a reference layer for creation of a new object in TNT's Editor or the new object is created in a process such as Auto-Trace from a non-georeferenced object. An arbitrary georeference allows you to correctly display related objects together. This type of georeference is currently referred to in the TNT products as local engineering.

archive: A preserved collection of historical information, such as a backup of your data.

ARC/INFO: A vector-based Geographic Information System (GIS) developed and marketed by ESRI, Inc. for use on workstations.

ARC/INFO extent file: The name of the data file used by ARC/INFO which contains arc, node, and polygon data elements.

arcsecond: "The sixtieth part of a minute of angular measure often represented by the sign ", as in 30", which is read 30 seconds" (*Random House*). (See also: degree, minute.)

arctic circle: A small circle of the earth parallel to the equator drawn on maps at 23° 27' from the north pole (66° 33' N). The exact location of the antarctic circle varies slightly since it is defined by the sun's furthest northern declination (position at summer solstice) from year to year.

Area correlation: A DEM extraction method that methodically traverses a pair of stereo images, working from the initial set of correlation points supplied by the user, and building a correlation model from new points of correlation that it finds.

ASCII: American Standard Code for Information Interchange (pronounced "askee"). The 7-bit (128 characters) used as a computer's alphabet. The Latin alphabet character set encoded into digital values between 0 and 127 includes lowercase and uppercase letters, the numerals 0–9, English punctuation marks, special symbols (such as @#$%^&*) and non-displaying characters often used as printer control codes. The eighth bit, giving values from 128 to 255, is used in a nonstandard fashion and is not part of the standard ASCII code. PCs normally have the "extended" character set in their system font for digital values from 128 to 255. The characters used for values from 128 to 255 for TNTmips display screen fonts are unpredictable but can be displayed in the font style window. Some fonts have no characters in this range while others have characters for some or all of these values. ASCII is a proper subset of Latin-1, Unicode, and ISO 10646, which are the 1-byte, 2-byte, and 4-byte standards for international character encoding.

The term "ASCII file" is often used to mean a text-only file. Documents in most word processors are not text-only files, since they include header information and formatting characters. However most word processors have an export or print-to-file utility that will convert a document into a text-only ASCII format.

ASCII file: A text-only file. Documents in most word processors are not text-only files, since they include binary header information and formatting characters. However most word processors import so-called ASCII files and have an Export, Save/Text-only, or print-to-file utility that converts a document into an "ASCII" format. However, these files are not true ASCII files because they may include the characters from 128-255. The characters in this range are different between platforms such as PCs and Macintoshes and even from font to font with a platform, and are not part of the standard 7-bit ASCII code. (See also: ASCII.)

ASCS: Agricultural Stabilization and Conservation Service. Merged with other agricultural agencies in 1994 to create the Farm Service Agency.

aspect: A parameter that is associated with a feature of a topographic or other three dimensional surface. Aspect is the compass direction (usually from north) for the perpendicular to the tangent to the surface at some selected point. Aspect tells which direction a surface slopes measured in degrees from North in a clockwise direction.

aspect ratio: The ratio of horizontal scale to vertical scale for printing or display. For graphics and image processing, square cells/pixels are best (aspect 1:1). Some display devices have a non-square aspect, which causes images to appear stretched or distorted. Standard broadcast video has an aspect ratio of 4:3, which must be corrected in any framegrabbing or other digitization process.

Assemble Geomashup: The Assemble Geomashup process in TNTmips (Main /Assemble / Geomashup) allows you to mashup your own tilesets with geodata layers from remote sources for viewing in a web brower. You can choose base maps, overlay layers, the web mapping API to use, and the map controls to include. At any time during the assembly of your geomashup you can immediately preview it in any popular Windows or Mac browser (Firefox, Safari, Internet Explorer, Chrome, and Opera) to test the current design and operation. The process also creates the HTML file with Java-Script required for your current layer choices and tools.

assignment statement: A line in a query or script that changes the value of a style drawing variable. Example: size = 5. That statement changes the value of the size variable to 5. (The size variable controls the size at which node elements are drawn). Assignment statements may be used in vector display and several other processes that let you assign drawing styles by query.

attribute: A piece of information describing an element in a coordinate data object or a raster cell. Each element in a vector, CAD, or TIN object may be assigned one or more attributes. Element attributes include internal information and information in an associated database. Attributes can include such qualities as drawing style, element number, and classification category, such as "intermittent stream" or "wetland."

attribute table: A tabular object containing records and fields, or rows and columns. Each record, or row, represents one or more geographic features and each field, or column, represents one attribute of those features.

AutoCAD: The most popular commercial Computer Aided Design (CAD) software package written and distributed by Autodesk, Inc. This software supports the same display boards as TNTmips with its own display drivers.

autocorrelation: "The correlation of an ordered series of observations with the same series displaced by the same number of terms" (*Random House*).

auto-correlogram A process in Hyperspectral Analysis. The Auto-Correlogram process provides an estimate of the spatial-spectral variability of the hyperspectral image on a pixel by pixel basis.

AVHRR imagery: Advanced Very High Resolution Radiometer imagery produced by NOAA satellites.

AVIRIS imagery: Airborne Visible/InfraRed Imaging Spectrometer imagery. Multispectral images of approximately 240 coregistered spectral bands collected by NASA aircraft.

azimuth: The angle defined by the intersection of a map's central line of projection with any meridian. If a map projection uses a central line that is oriented to true north, such as a standard meridian, the azimuth angle is zero.

azimuth angle: Angular displacement from North.

azimuthal projections: (also known as Planar Projections) A class of map projections that are constructed by placing a flat planar surface tangent to a single point on the globe, or by placing the globe to an intersecting (secant) plane. With azimuthal (or planar) projections, lines of equal distortion are concentric around the point of tangency or the center of the circle of intersection. Most azimuthal maps do not have standard parallels or standard meridians. Each map has only one standard point: the center. Thus, the azimuthal projections are suitable for minimizing distortion in a somewhat circular region, such as Antarctica, but not for an area with predominant length in one direction. Azimuthal projections include Orthographic, Stereographic, Gnomonic, Lambert Azimuthal Equal-Area, and Azimuthal Equidistant.

azimuth spacing: The linear distance or image scale in the along-track dimension, which is perpendicular to the range directions in a radar image. The resolution of a synthetic aperture radar (SAR) image in the azimuth direction is constant and independent of range.

— **B** —

backup: A copy of a file, set of files, or whole disk for safekeeping in case the original is lost or damaged.

band or **spectral band:** A range of wavelengths of electromagnetic radiation. Remote sensing devices commonly collect images in discrete bands, such as visible red, green, and blue, and the invisible near-infrared.

band interleaved: A type of geodata storage and reading for multiple bands. The geodata is stored and read line by line. That is, the first line of the first band is followed by the first line of the second band, the first line of the third band, and so forth through all bands . Then the next line stored is line two of the first band followed by line two of the second band and so forth through all lines within all bands.

band mapping: A spectral matching method in Hyperspectral Analysis. The Band Mapping method compares unknown spectra that you are analyzing to spectra in a reference spectral library on the basis of the positions and relative depths of absorption features.

band trailer bytes: Some image bands have trailer information attached to the end of each band image. In the User-defined Raster Import process a user must tell the import process the length of this trailer in bytes so that the import process can import the trailer information correctly.

band variance: One of three noise statistics plots that can be produced in the Hyperspectral Analysis process. The band variance plot shows the proportion of the variance, or noise, that can be attributed to each input band.

bandwidth: A measure of the volume of data that can flow through a communications link, or throughput. Bandwidth is measured in kilobits or megabits per second. (Kb/s, Mb/s). Also, a section of the electromagnetic spectrum between two frequencies. For example, AVIRIS collects 224 contiguous spectral bands with a bandwidth of 0.10 micrometers.

barrier: A node that can not be crossed in the Network Analysis process.

basin: (watershed analysis) The area draining to any particular point in the landscape (called a seed point); a subwatershed or subcatchment. Standard basins in the watershed process are generated using stream junctions as seed points, so a standard basin is the area drained by a particular tributary system of the main stream.

batch: A DOS batch file is a text file with the extension .BAT that contains one DOS command on each line. When you enter the name of the batch file at the DOS prompt, the system performs each command in turn.

batch job: (TNTmips) A process or sequence of processes that is set up with Job Manager or another process to run unattended, requiring no user interaction or supervision.

bathymetry: The science of measuring ocean, sea, and lake depths.

baud rate: The speed of data transmission between a computer and other devices measured in pulses per second.

Bézier curve: A polynomial curve bounded by four points, which form a "bounding box." Manipulating the position of the bounding points lets a user stretch and position a smooth curved line in the design of a graphic shape, such as the irregular curving outline of a font character.

bilinear interpolation: A mathematical method for interpolating a new cell's value within a 2 x 2 neighborhood of cells. Bilinear interpolation is used in resampling a raster object to create a new raster object with a different cell size, orientation, or internal geometry. (See also: interpolation.)

binary: A base 2 number system that uses only the data values "0" and "1." Each place represents a power of 2, so, for example, the decimal number 6 is represented in base 2 as 110 (= 1x4 + 1x2 + 0x1).

binary raster object: A raster whose cells contain only the values "0" (typically displayed as black) or "1" (white). Binary raster objects usually store a scan of black lines on white paper, the results of thresholding a byte-oriented raster object into two data ranges, a threshold of a particular color range, or a data mask.

Bing Maps: Bing Maps is a web mapping service provided by Microsoft with street maps for many cities worldwide.

Bing Maps Custom Tile Overlay: "Custom Tile Layer" is the name Bing Maps uses to refer to the stucture of the tilesets that its API for an overlay. It conceptually emulates the way in which Microsoft stores its proprietary Bing Maps road and aerial layers accessible over the Internet. Tiles for areas of the source image that are to be treated as completely covered by the tile are usually *.jpg. Tiles are *.png where the area covered overlaps the regular or irregular outer edge edge of the source image or an inner edge for missing internal areas. All tiles can also be *.jpg or all *.png depending upon the desired appear of the source image in the application.

biomass or **total biomass** or **total plant material:** The amount of plant material per unit of ground area, recorded either as wet weight or dry weight. It is usually expressed in grams per square meter, tons per acre, or metric tons per hectare.

bit: The smallest unit of computer data having a single value of either "1" or "0". A contraction of the two words "*Bi*nary" and "*digit*". Binary data is 1-bit data. Computers normally manipulate bits at least 8 at time. A group of 8 bits is called a byte. A computer's processing power is often measured by the number of bits it handles at once. The earliest PC's were 8-bit machines. More recently processors and data structures for 16-bit, 24-bit and 32-bit data have become common.

bitmapped font: A font specification in which each character is described pixel by pixel for a particular font size. Thus, bitmapped fonts do not rescale easily: at smaller sizes, pixels are left out, and at larger sizes, pixel reduplication causes a jagged, blocky, low-resolution appearance. (See also: outline font.)

bits per pixel or **pixel depth:** The number of data bits each pixel represents. In 8-bit contexts, the pixel depth is 8, and each display pixel can be one of 256 possible colors or shades of gray. With a 24-bit raster (or with three coregistered 8-bit rasters) the pixel depth is 24, and 16,777,216 colors are possible.

BLM: Bureau of Land Management of the USDI.

BLOB: Bianary Large OBject. The data type of a field in an RDBMS table that can store large image or textual data as attributes.

block: A block is a grouping of CAD elements and attributes that can be manipulated as a whole. All CAD objects contain at least one block, the Main Block.

When a block (such as the detail for a door frame) is used multiple times in a drawing, the block description is stored once, and each insertion point refers to that source.

block insertion element: A block that is inserted into another CAD block and, thus, acts as an element.

board: An electronic circuit board installed in a microcomputer to add hardware features. (See also: display board.)

Boolean expression: A type of expression that reduces to a logical (true or false) condition that contains logical expressions (e.g., Flowrate > 50) and Boolean operators.

Boolean operators: An operator that specified how to combine simple logical expressions into complex logical expressions, such as OR, AND, and NOT. For example, Flowrate > 50 AND Depth < 100. Exclusive Or (XOR) and AND NOT are also Boolean operators.

boxcar classification or **boxcar interpretation:** The simplest form of automated image interpretation whereby three data ranges are selected for three coregistered images (like red, green, and blue). The three data ranges define a boxcar shape if plotted on three dimensional perpendicular axes that represent possible data values in red, green, and blue. The ranges are usually selected to represent the color variation in the three rasters for a feature of interest (like all the dark brown areas representing bare soil).

All of the data triplets in the three raster objects are tested to determine if they represent a cell inside the boxcar. All the inside cells may then be displayed or otherwise recorded as "classified."

Boxcar classification is not restricted to sets of three rasters. It may be used with any number: using 2 rasters designs a 2-dimensional "boxcar" test in a 2-dimensional space, and using "n" rasters defines an n-dimensional "boxcar" test in n-dimensional space.

box cursor or **location box:** Marks the focus for keyboard activity in a window.

breakline: A linear feature that controls the surface behavior of a TIN in terms of smoothness and continuity. Breaklines are always maintained as linear features in a TIN.

brightness: The physical property indicating how much electromagnetic radiation is being reflected or radiated by a chosen point. Brightness is similar to the HIS property of Intensity, and is used in the HBS color model. Brightness is also the property computed from Landsat MSS or TM images by Kauth's greenness, brightness, wetness transformations. (See also: HBS, HIS.)

BSD license: A family of permissive, free software licenses modeled after the Berkeley Software Distribution license.

BSpline : A curved smoothing that can be applied to a line. A BSpline is calculated by a polynomial equation. Different types of BSplines, such as Cubic BSpline and Quadratic BSpline, can be calculated from different types of polynomial equations.

bubble: A small island (often just a cell or two) of background color in the stream of a thinned, binary line in a raster. Bubbles are artifacts of the thinning process and result from binary lines that include unnoticed cells of the background color after thresholding. Bubbles must be repaired by raster editing or else the automatic vectorization process will create small, incorrect polygon elements from them.

buffer: A portion of computer memory set aside for quick temporary storage. A buffer is commonly used to store data on its way to or from a hardware device such as a disk drive. The buffer lets the computer "save up" access operations and not be slowed down by waiting on the hardware to respond at every step.

buffer zone: A border area that acts as a barrier separating or surrounding an area designated for special protection. Some states have legislated buffer zones around certain wetlands to prevent damage to the local ecosystem.

bug: An error in a computer program or in a piece of electronics that causes it to malfunction. MicroImages prefers to call these by their real name—errors.

building points: Creating and/or adding points in a vector object from imported coordi-

nate data (like text files that contain pairs of coordinates, or database files with fields representing pairs of coordinates).

bus: The circuit channel or path a computer uses to move data and send signals between devices. A microcomputer's bus architecture determines what kinds of peripheral circuit cards can be plugged into its expansion slots. DOS and OS/2 computers have four varieties of bus architecture: PC, AT (also called ISA), EISA, and Micro Channel. The original PC bus handles 8-bit data. The AT bus doubled the data width to 16 bits and became the industry standard (thus ISA, for Industry *S*tandard *A*rchitecture). IBM introduced the PS/2 with a proprietary bus, the 32-bit Micro Channel. Other vendors countered with a 32-bit *E*xtended *ISA* (the EISA). The PC/ISA/EISA buses are backward compatible: that is, expansion cards designed for an older bus will normally work in a newer bus slot. Thus, an 8-bit display board from a PC bus works in a 16-bit ISA slot or a 32-bit EISA slot, but a 16-bit display board for an ISA bus does not work in an 8-bit PC slot.

button: A control component in a window that is activated by positioning the mouse cursor over it and pressing the left mouse button. A button may be one of several types: push button, radio, toggle, check, cascade, or option.

B/W photo, B/W image, B/W display, or **B&W:** A black and white photograph or some other monochrome image rendered in black, white, and shades of gray.

byte: A data element made up of 8 bits and having 256 possible values. In text-oriented processes, each byte represents one character of text. In 8-bit raster processes, each byte represents one cell value and may correspond to one pixel on the image display. (See also: bit, exabyte, gigabyte, kilobyte, megabyte, pecabyte, terabyte, yottabyte, zettabyte.)

byte-oriented or **8-bit raster object:** A raster in which each cell is represented by one byte (8 bits) and can therefore assume 256 possible values.

— C —

C and C++: High-level programming languages.

CAD: Computer Aided Design. CAD originated on larger, dedicated workstations and minicomputers and has now migrated to microcomputers. In its simplest sense, CAD is used for computerized drafting. Many CAD systems also provide more advanced features like solid modeling and simulation.

cadastre: "An official register of the ownership, extent, and value of real property in a given area, used as a basis of taxation" (*Random House*).

CAD Editor: The process used in TNTmips for creating and editing CAD objects. Input can be from your computer's mouse or from an X-Y digitizing tablet.

CAD object: A CAD object, in RVC format, like a vector object, is composed of coordinate data, but uses a different data structure. A CAD object has a free-form topology, so it may be useful for applications that do not require an exact description of the relationships between the elements in the object. CAD object topology does not reconcile things like line intersections, polygon overlap, and polygon islands.

A CAD object also allows for descriptions of geometric shapes. For example, in a vector object, a circle is always stored as a polygon, and at a high enough magnification, the discrete point and line elements become visible. By contrast, a CAD object stores a circle by its center point and radius. Thus, at any magnification, it looks circular.

Since they have reduced topological constraints, CAD objects generally require less storage than their vector object counterparts. [See also: element (CAD).]

calibrate or **cell size calibration:** To establish scale or cell size (for a raster) for an object in a project file. Once a raster, vector, or CAD object has been calibrated, accurate measurements can be deter-

mined and displayed. (See also: georeference)

calibrated image map: See: image map.

cap style: The ends of dashed line segments, which are components of line patterns, are caps. You can assign a style to this cap when you are creating or editing a line pattern in the Style Editor. The cap can be round or flat.

capacity: The number that can be accommodated by a center in network analysis, such as the number of students a school can accommodate, the quantity of perishable goods that can be delivered in one day, the number of seats in a theater, or the number of parking spaces at a shopping mall.

Cartesian coordinate system: A two-dimensional, planar coordinate system in which x measures horizontal distance and y measures vertical distance. Each point on the plane is defined by an x,y coordinate. Relative measures of distance, area, and direction are constant throughout the Cartesian coordinate plane.

capture: To freeze and digitize a standard video input signal (such as VHS tape or broadcast video). Some microcomputer display boards offer video capture. (See also: frame-grabbing.)

cartography: The art or science of making maps.

CartoScript: A script written with the cartographic scripting language in the TNT products, which provides a complete and flexible set of drawing functions that allow you to design custom map symbols for many applications.

cascade button: A type of button that displays a cascading menu. A cascade button is typically a selection on a parent pulldown menu. It includes an arrow graphic that points in the direction the cascading menu appears.

cascading menu: A submenu that opens from a selection on a parent pulldown or popup menu that provides selections that supplement the parent selection.

catchment: (watershed analysis) The entire area drained by a stream and all of its tributaries, with all runoff draining to the same outlet. In nature the outlet may be a lake, the ocean, or other water body. In the Watershed process, the outlet may also be the point where a particular flow path intersects the spatial boundary of the elevation raster being analyzed. Synonym: watershed.

categorical data: Data in a raster object is said to be categorical if it cannot be represented by a continuous surface, since intermediate terms cannot be derived with meaningful results. Example 1: soil type data cannot be interpolated, since a soil type 14 and a soil type 15 cannot sensibly be averaged to derive a soil type 14.5. Example 2: feature classification data cannot be interpolated, since a cell assigned membership in the feature "corn" cannot sensibly be used in any process that averages it with a cell assigned membership in the feature "wheat."

Do not confuse the terms "categorical data" and "category"—they have different and distinct meanings.

category: (in Feature Mapping) A subdivision within a region of interest (which also has a particular meaning in reference to Feature Mapping) that lets you divide the study site so that the measurement data in the output text file will be organized geographically. So, if you have defined a region of interest as the wetland duck habitat along a river floodplain, you might want to divide the wetlands into categories: perhaps ownership areas (like refuge lands, private ownership, and easement areas). Then the text output file would break down the wetland feature measurements by ownership area. If you do not define categories, TNTmips treats the entire region of interest as a single category (and does not subdivide the feature measurements in the output data).

Do not confuse the terms "categorical data" and "category"—they have different and distinct meanings.

CAT scan: A medical diagnostic image produced by Computer Aided Tomography.

CCITT Comité Consultatif Internationale de Télégraphique et Téléphonique (International Telegraph and Telephone Consultative Committee)**:** A standards organization that has developed a series of communications protocols for the fac-

simile transmission of black-and-white images over telephone lines and data networks. The CCITT acronym in TNTmips represents a type of lossless raster compression that is used for 1-bit images.

CD-R: Compact Disk-Recordable. A 5" optical disk that can be written to by a CD burner.

CD-ROM: Compact Disk, Read-Only Memory. A 5" optical disk containing prerecorded data sets.

CD-RW: Compact Disk-Rewritable. A 5" optical disk that can be written to by a CD burner in multiple sessions.

cell: One value in a raster that corresponds to a specific area on the ground. A raster cell may contain a value that describes the elevation above sea level at one position in a survey site or the intensity of red radiation for a pixel in a video image. For convenience, a raster cell is usually thought of as square or rectangular, although many image collection devices actually measure circular or elliptical areas. If a raster object is created from a screen image, each cell value represents one pixel.

cell size: The dimensions of the area on the ground to which a raster cell value applies. A cell size of 30 meters signifies that the value in each cell of the raster object applies to a 30 x 30 meter area in the study site.

cell size calibration: The transfer of cell size information to a raster.

center: A point within a network to which materials or people are brought or from which materials or services are distributed.

central meridian: The north-south meridian of a map projection around which the map is centered.

centroid: "The point that may be considered as the center of a one- or two-dimensional figure, the sum of the displacements of all points in the figure from such a point being zero" (*Random House*).

CGA: Color Graphics Adapter. An early microcomputer graphics subsystem developed for the IBM PC. The CGA was hampered by low resolution and limited color selection. It has been superceded by EGA, VGA, SVGA, 8514/A, and XGA. (See also: EGA, VGA)

CGI: Common Gateway Interface.

CGM: Computer Graphics Metafile is a graphic image exchange format.

change image: An image produced using raster algebra that shows change over time between coregistered images.

character: An element used for the graphic representation of data (such as a letter, numeral, or symbol) or control of data (such as a tab, space, return, or enter). Each element has a corresponding character code in the Unicode table.

check button: A square button in a pop-in window that presents one selection in a group of on/off options. When a check button is "on," it appears "pushed in". Clicking on one check button does not effect any other check buttons in the group. (See also: radio button.)

chip: Commonly, any integrated circuit logic component of a computer.

CIR image: Color-infrared image. Color-infrared images may be collected by an electronic scanner or a camera that uses special film with sensitivity from green through infrared. The photographic infrared radiation just beyond the range of human vision is then displayed as red. Normal red from the scene becomes green, and green becomes blue. Normal blue in the scene is filtered out and not recorded. CIR images are used to show the vigor of plant life. Healthy vegetation appears red, while distressed or damaged vegetation may look pink, tan, or yellow. (See also: color-infrared image)

class: (raster) A set of all image features of the same type. As part of the interpretive process, the user names a class to identify the type of material it contains, like "corn," "bare soil," "wetland," or "urban." In a set of coregistered raster objects, a grouping of cells with similar sets of values. A class normally corresponds to a specific land cover type with a restricted set of biophysical properties.

class center The set of raster values that define the mean vector for the class in feature space.

classification: Grouping cells (often by color characteristics) from coregistered rasters to map the location and type of image features (like type of crop, surface cover, and map line type).

class list: A subobject containing a list of classes associated with a vector or CAD object.

client/server: A software system has a client/server architecture when there is a central processor (server) that accepts requests from multiple user processes (clients), such as TNTserver and TNTclient.

clip: Clipping limits the extents of a layer or group for the purpose of display. Clipping extents can match a reference object or use geographic coordinates.

clipping area: The regular or irregular area that will be processed and is defined by drawn polygons or a region.

clip art: Icons, symbols, and drawings distributed in computer-readable format. Computer clip art was popularized by the Apple Macintosh, which can use published clip art for electronic cutting and pasting into drawings or pages of text. TNTmips users can similarly create and share a variety of original symbols, patterns, and line types.

clump: A set of contiguous line, node, and polygon elements in a vector object.

clustering: A process in which multiple, registered, overlapping, rasters are reduced to a single raster, which is referred to as a cluster map. The rasters used in clustering represent analytical data (such as images and elevations). Different clustering methods (such as K-means, Fuzzy C-means, and Isoclass) use varying logic to accomplish this mapping and dimensional reduction. In general, all of the methods use the concept of testing multiple values for each cell against all other cell values to determine which subpopulation each cell is most similar to and should be grouped with. All clustering methods first make a preliminary set of groups by testing all cells or a sample of them. They then proceed by various methods to test individual cells and dynamically redefine the clusters until every cell is satisfactorily assigned a cluster membership in a single cluster, which is recorded at that cell's position in the cluster map. The maximum number of clusters to form and the number of refinement iterations is usually controlled during setup. (See also: labeling, unsupervised classification)

cluster labeling: Identifying and grouping the clusters in the cluster map raster object that result from any kind of automated image interpretation. The user chooses labels (names for types of features) based upon his or her knowledge of the areas or materials in the image. Use the TNTmips Feature Mapping process to label (and possibly combine) the clusters.

cluster map: The output raster created by clustering or by unsupervised classification. The clusters are usually identified or labeled as some useful type of material (for example, an agricultural crop, a body tissue type, or a soil type). It is important to note that this raster does not contain values that can be subjected to further mathematical analysis because the clusters and their reidentification as material or area types do not represent data values that are mathematically continuous. For example, cells in a cluster arbitrarily assigned the value of 4 by the clustering process does not necessarily represent twice as much of something as a cell assigned to a cluster that was given a value of 2.

CMY or **Cyan-Magenta-Yellow:** The standard set of subtractive, processing colors used in printing. Color printing devices use discrete dots of cyan, magenta and yellow to present the appearance of a full-color image to the human eye. The combination of cyan, magenta and yellow produces black. However, some printers include black ink along with the above three colors, which is properly called *CMYK*.

CMYK or **Cyan-Magenta-Yellow-Black:** See CMY or Cyan-Magenta-Yellow.

CMYKcm: Used with six-color printers. Cyan-Magenta-Yellow-Black-Light Cyan-Light Magenta.

codec: Short for compressor-decompressor. The term applies to any technology used for compressing and decompressing data.

QuickTime Player and Windows Media Player use codec technologies.

Codec can also stand for coder-decoder. In this context it refers to an analog to digital and digital to analog converter that converts real-world signals to digital form and back again. Codecs can be implemented in software, hardware, or a combination of both.

coextensive: Covering the same ground area exactly. If two raster objects are both coregistered and coextensive, there is a 1:1 cell correspondence for ground area coverage in each cell of the rasters.

COGO: The Coordinate Geometry (*COGO*) process includes COGO commands that when executed accomplish meaningful functions for professional surveying and civil engineering applications. COGO by definition is a command structured problem oriented language and computer program for the solution of geometric problems. COGO tools are useful for creating or editing vector or CAD objects with land surveying, global positioning system, and other precision data. The COGO approach has been used by surveying and civil engineers since approximately the early 1960's. COGO relates to the LOGO language used in early computing and permits the creation of precise control and descriptive data entry into new or existing objects tied to the ground surface, projection, and datum. COGO points and the objects defined by those points, can be determined in 3D space within the interior of an object (for example rooms and hallways in a building; adits, shafts, and various tunnels in an underground mine; locations in a timber stand; or areas in a hydro-geologic environment) and can be used to define interior surfaces in vector applications and solid objects in vector and CAD applications.

color balancing: Adjusting the intensities and distribution of red, green, and blue to create an image with a particular color appearance for display or printing.

color compression: Removing duplicate (in some cases near-duplicate) colors from a color map to make room for new colors.

color depth or **pixel depth:** The number of data bits each pixel represents. In 8-bit contexts, the pixel depth is 8, and each display pixel can be one of 256 possible colors or shades of gray. With a 24-bit raster (or with three coregistered 8-bit rasters) the pixel depth is 24, and 16,777,216 colors are possible.

color-infrared (CIR): Color-infrared images may be collected by an electronic scanner or a camera that uses special film. Infrared film records the photographic infrared radiation just beyond the range of human vision as red. Normal red from the scene becomes green, and green becomes blue. Normal blue in the scene is usually filtered out and not recorded.

Any physical or biological damage to growing plants which begins to cause a deterioration in their vigor (their water and/or chlorophyll content) causes a rapid decrease in their reflectance of photo-infrared radiation, and increases in their red reflectance. CIR photographs show these changes much sooner and more dramatically than normal photographs or human eyesight. Healthy, green vegetation appears in bright red, while damaged, diseased, or dying vegetation appears in shades of pink, tan, and yellow.

This knowledge was first used during the Second World War when color-infrared film was called camouflage detection film. It provided pre-visual detection of the changes in vegetation cut or damaged by military activity and could very easily separate color-camouflage materials (like olive drab canvas) from live foliage.

color map or **color table:** A color map is the table, or map, used by a computer system to assign display colors to digital values. A color map for an 8-bit raster object can contain a total of 256 colors. A gray scale image may have a color map with 256 shades of gray, ranging from black (0) to white (255). The first 64 places in a color map are normally assigned to the "standard 64" annotation colors. Additionally, certain processes may use 16 values for standard shades of gray. The remaining 176 or 192 colors are then available for the image colors used in the display. Some types of color maps that you will encounter in

TNTmips are optimized color maps and composite color maps.

color palette editor: A TNTmips window which shows a table of the current display colors. With 8-bit data and devices, this palette includes 256 colors in 8 rows and 32 columns of color cells.

color separation: Manipulating a full-color image in order to extract features of one color or range of colors. The color separation process can be used to create a binary raster object from a composite color raster object (or a set of three RGB raster objects) to lift out blue line images, for example, leaving behind background colors and lines images of other colors. Printers use related color separation techniques to prepare process color separates from full-color originals.

column: A vertical list of data values or display cells in a raster object or display.

command: A specific instruction to a computer program entered by the user to perform a desired action.

command prompt: Formerly called the DOS prompt on PCs, it is a path that includes a drive letter followed by a : (colon) that ends in a > (greater than symbol) found in a command shell with each directory level separated by a slash.

component: Any single element in a window, including buttons, fields, scroll bars, sashes, panels, menus, panes, frames, dialog boxes, or separators.

compose sequence: A sequence of two or more keystrokes used to create a single character, as in the case of European languages that have characters with various diacritical marks.

composite color raster object: A raster object in which each cell contains a data value representing one of the colors into which all available color data for that cell has been compressed. For 8-bit raster objects, there are 256 possible colors for each cell; for 16-bit raster objects there are 32,768. Composite color rasters are usually compressed from a red/green/blue raster set that retains a wider range of color information. The composite raster still produces near photographic quality color displays.

composite color video: The standard color video output of a VCR or video camera that adheres to the NTSC video standard. All the color information is contained in one signal (instead of in the three RGB color signals).

computed field: A field in a database table with a value calculated from the values of other fields in the same or different tables of a single database. You define the expression used to generate the values for a computed field using the same language and syntax employed for database queries. The appropriate record values for use in a computed field are determined through primary and foreign key relationships or by element attachment.

conflation: Determining a single resultant line from coincident or nearly coincident lines while merging or editing vector objects.

conic projections: This group includes projections that are constructed by placing a cone tangent to the globe along a standard parallel in the mid latitudes, or in the case of a polyconic projection, placing a cone secant to two (or more) standard parallels. Conic projections are commonly used to depict hemispheres or smaller portions of the earth's surface.

context: A file that describes how to recreate a web map that may be made up of many different layers from many different Web Map Services (WMSs).

continuous data: Data in a raster object is said to be continuous if it can be represented by a three-dimensional surface such that intermediate values can always be derived with meaningful results. Example: an elevation raster has continuous data because an elevation of 400 and an elevation of 500 can fairly be averaged to assign an intermediate elevation of 450.

continuum: Continuous extents with no obvious division into parts.

contour map: A topographic map that uses *contour lines* to portray relief. Contour lines join points of equal elevation.

contours: Lines on a contour map or other isomorphic map that identify levels of a parameter at specified, discrete intervals.

contrast: The difference between bright and dark values in the display or printout of a

continuous tone (usually grayscale) image. The stronger the contrast, the more difference between the brightest and darkest values. Most images benefit from a process of *contrast enhancement,* which artificially increases the contrast.

TNTmips provides different methods of distributing intermediate display or print values. The *Linear* contrast model assigns straight-line increments of intensity. Many images look better when they are produced with the *Normalized* contrast model, which assigns intensity increments according to a normal distribution curve.

contrast table: A contrast table assigns display intensity values to raster object cell values using a specified translation method, such as linear or normalized translation. The type of translation chosen and the limits defined will change the display values but, in general, the result is to increase the apparent differences between the majority of cell values, which usually fall within a narrow range.

control panel or **panel:** An area of a window that holds related buttons, sliders, fields, and other components used to govern the behavior of a process.

control point: Points, elevations, and/or cells which are used to establish map coordinate control for ungeoreferenced objects or objects that are to be used in a process such as Stereo Modeling. In the manual mosaic process, a control point is a feature in a piece of the mosaic (such as a road intersection) for which the map coordinates are known. In the raster-to-vector calibration process, a control point is a feature that is co-located between the ungeoreferenced raster object, and the georeferenced vector object overlay. A control point may be something like a bend in a river or a road intersection that shows on both a raster object and an overlying vector object. Tying control points together lets TNTmips adjust scale, orientation and geometric distortion between rasters and vectors.

TNTmips' georeferencing and registration processes rely on control points introduced and identified on the display with the mouse. (See also: tie points)

control point list: One type of map registra-tion subobject (Regist) that contains a paired list of map coordinates and cell coordinates. TNTmips uses the control point information to derive map calibration for the entire object. (See also: linear transform)

controls window: The TNTmips display and edit processes always include at least two windows: the controls window and one or more view windows. A single controls window can govern multiple view windows.

convolution: Mathematically determining the data value for a new cell in an m x n neighborhood of cells. Raster filtering, resampling, and other raster processes use convolution. Convolution processes should never be applied to raster objects that contain categorical data. Convolution is only appropriate for continuous data.

co-occurrence raster: A raster created in the Color Binarization process. The cell values in the co-occurrence raster are the frequencies of occurrence of the same cell value in adjacent cells in the input raster object. The Color Binarization process analyzes groups of eight neighboring cells in the input raster object to determine the occurrence of the same cell value within the group of cells.

coordinate: A set of numbers that designate position in a given reference system, such as X-Y in a 2D coordinate system and X-Y-Z in a 3D system.

coordinate system: A reference system for defining precise locations on the earth's surface. Coordinate systems may be independent of or tied to a particular map projection.

coprocessor: Older microcomputers used for heavy computational tasks had a second microprocessor, called a *math coprocessor*. To speed things up, the main CPU assigned its tedious arithmetic to this helpful specialist in much the same way that modern accountants use calculators for the computations their grandfathers did by hand. In the Intel CPU series, the main processor's chip number ended with the digit 6 and the coprocessor's chip number is the same

except for the final digit 7: 80286 / 80287; 80386 / 80387. Since the 80486, Intel has included the math coprocessor in the basic design. (Thus there was no 80487).

coregistration: The condition in which associated raster and/or vector objects overlay each other with correct orientation and geometry so that corresponding internal features align.

correlation: The degree of relatedness between two objects; more specifically, the degree to which one value in a set of values can be used to predict the corresponding value in another set of values.

correlation points: (also called tie points). A pair of points collocated on a common feature, such as a road intersection, in a pair of images. A set of correlation points defines the mutual spatial relationship of a pair of overlapping images without regard for their real position in a map coordinate system.

cost raster: A cost raster is a raster object with cell values that represent a price per distance unit; for example, monetary expenditure per meter, fuel usage per mile, traversal time per mile, and so forth.

coverage file: See: pcARC/INFO coverage file**.**

CPU: Central Processing Unit. The main computing engine of a computer.

CRS: Coordinate Reference System.

CRT: Cathode ray tube.

cross validation: An option in the Kriging method of Surface Fitting in the Surface Modeling process. This option is a pre-processing function that calculates the mean error and standard deviation for estimated control points compared to the actual control points.

cubic convolution or **cubic interpolation:** A computationally intense interpolation method used in raster resampling. This method determines a new cell value to produce a smoother result by fitting a cubic polynomial surface to a 4 x 4 neighborhood of cells. Bilinear interpolation normally produces results which are almost as good. Cubic convolution should not be applied where the mean data value for a group of cells is undefined as in categorical data (like an 8-bit color raster object, a classification map, or any raster object containing similar category-type data).

cursor: See: mouse cursor, text cursor.

cursor hot spot: The pixel location on a cursor shape at which the cursor activity takes place. For example, the hot spot on an arrow cursor is at the point of the arrow, while the hot spot for a cross-hair cursor is at the intersection of the crosshairs.

cylindrical projections: This group of projections includes all projections constructed by placing a cylinder tangent to the globe along a standard parallel—usually the equator, or secant to the same standard parallels in opposite hemispheres, respectively.

Cyrillic: An alphabet widely applied to the Slavic languages, as in the case of the thirty-three-letter Russian alphabet. Since the 1930's it has been used for most of the languages of the former Soviet Union. (Attributed to Saint Cyril, a ninth-century Christian apostle of the Slavs.)

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dangling line: A dangling line element intersects another line element on only one end. The unattached end terminates in a node element that is not shared by another line element. Dangling lines may be either overshoots or undershoots. Dangling lines can be avoided by using the snap options when editing.

database form: A database *form* allows you to reorganize the information in a table for display in single record view. This reorganization may include changing the order and placement of fields and / or displaying only selected fields from an existing database table. You can also modify field titles to include spaces, which are not allowed in actual field names, to exceed the 15 character maximum, or you can change the name entirely if the original seems too cryptic for the intended audience. You can also add text that is not

associated with a particular field to provide logical groupings for the information presented in the form. A database form cannot exist without an accompanying database table. Editing in the default table layout or in any of the forms created as an alternate means of viewing the same information alters the single set of values used in all cases. Database forms are stored as subobjects of the database.

database object or **dBASE object:** A *database* is a collection of information related by some unifying theme, such as demographics, epidemiology, or geographic location. There are a number of popular database programs, such as dBASE IV, that assist in the retrieval and management of such information in electronic form. The TNT products also handle databases and use specific terminology for the components that comprise a database. A database in the TNT products can be a main level object or a subobject of a raster, vector, CAD, or TIN object. The object generally defines the "unifying theme" (for example, the soil type polygons for the Crow Butte area). A database is organized into tables, which contain records that store attribute values for an individual example in one or more fields. (See also: external database, field, foreign key, internal database, primary key, record, table.)

database query: The database tables attached to vector/CAD objects can be queried to reveal those elements that meet the criteria specified in the query and drawing styles can be assigned in accordance with query results. Database query can be used to select vector/CAD elements for display and assign their drawing styles.

data mask: A processing barrier that only allows data values in a chosen range to pass. You might choose a data mask to block all values outside a selected color range, eliminating all image features except those of the color you want to use in a process. You can also use a mask to select a processing area from a larger scene. The mask blocks off the parts that you want to exclude from the current analysis.

DataTip: A DataTip contains a raster cell value or element information for vector, CAD, shape, or TIN objects. For all objects except raster objects, you can designate the database table and field for use as a DataTip. Place the cursor over the cell or element for which you want to see a DataTip and wait briefly. DataTips operate in a manner similar to ToolTips. In TNTmips, a virtual field can be used to produce a multiline DataTip. Such DataTips present information from multiple fields in one or more database tables.

datum: A mathematical description of a smooth surface that closely fits the mean sea-level surface for an area of interest, which provides an imaginary, perfectly flat horizontal surface for use as a map base with x,y coordinate measurements. A datum is derived from a chosen ellipsoid, and provides the surface to which a cartographer refers ground control measurements. Maps of large extent must use consistent parameters for ellipsoid and datum to insure consistency between the map projection and ground control. (*Map Projections Used by the U. S. Geological Survey*, Geological Survey Bulletin 1532, Second Edition, U. S. Government Printing Office, Washington, D.C., 1982, pp. 13-15). (See also: ellipsoid.)

daughter object: A completely independent project file object that may be treated by TNTmips as subordinately related to some other object. For example, objects attached by HyperIndex® to some other object are called its daughters and the object used for the primary index layer is called the parent. (See also: HyperIndex, index area, parent object, stack)

decibel rasters: Radar images in which the raster cell values are presented as log scale values based on the power of 2. Users can choose to generate decibel raster objects in addition to raster objects with linear cell values when they import JPL AIRSAR and TOPSAR radar formats.

decision rule: The criterion used to assign cells to a prototype feature in TNTmips feature mapping. Cells in the image are tested against the decision rule, and those that match are highlighted as prototypes. You select the desired decision rule when setting up the raster objects to be ana-

lyzed by feature mapping. A simple decision rule would be to compare the three color values of each cell on the display to three color values known to occur in the target feature.

DCW: Digital Chart of the World was the first digital 1:1,000,000 map of the world in VPF format. This data can be downloaded from the NGA website. This original product has been replaced by the more detailed VMap0 and VMap1 data sets, which are also available for download from NGA.

defaults: The start-up settings for a system or an individual process. In TNTmips the defaults are usually automatically set to be the most probable value desired if the process is to be repeated either immediately or at some indefinite future date. Many TNTmips defaults are set to the last value, raster object, position, or other parameter used. Some defaults are always reset to a selected condition, regardless of the last choice, in order to prevent inadvertent destruction of valuable results and data sets. For example, the location of a new output raster object will not usually default to an existing object to avoid accidentally overwriting it. Well thought out defaults are one of the simplest and most easily incorporated forms of artificial intelligence that can exist in a system.

degree or °: A unit of measurement equal to 1/360 of a circle. A degree of latitude on the earth's surface is about 69 miles. A degree of longitude is about 69 miles at the equator and undefined at the poles, but any point on the surface rotates through a degree of longitude in about 4 minutes of time. (See also: arcsecond, minute.)

Delaunay criterion: A condition that must be met when a TNTmips TIN object is computed. The technique used to generate the TIN object, known as Delaunay triangulation, produces a set of triangles that are as equi-angular as possible. All circumcircles of Delaunay triangles contain no points other than the three that define the triangle and its circumference. Satisfying the Delaunay criterion ensures that any point on the surface is as close as possible to one of the nodes, the number of long skinny triangles is minimized, each sample point is connected with two nearest neighbors to form a triangle, the triangulation solution is unique and independent of the order in which the points are processed, and the solution produced allows easy generation of Voronoi diagrams (Thiessen polygons) for the same set of input points. Voronoi diagrams are widely used in spatial analysis.

DEM: Digital Elevation Model. (Also DTM, "Digital Terrain Model"). A computerized representation of an elevation surface. Specifically, a raster in which the value in each cell represents the surface elevation at that location in the scene. DEMs are USGS geographic elevation data distributed in raster form on open reel magnetic tapes. There are 2 basic types: 1) The DMA type created by the Defense Mapping Agency in both a fixed cell size and a 3 x 3 arcsecond cell size distributed in 1 x 1 degree files. 2) A newer format for those 7.5' USGS quadrangles that have been processed into 1 x 1 arcsecond elevation cells.

demand: The number of something that uses a center in network analysis; for example, the number of students living along a road places a demand on a school (a center). Demand values are necessary before capacity limits can be meaningful.

dendrogram: A tree diagram whose branches depict a hierarchical classification structure, showing the degree of relatedness of different classes.

densification: Densification of vector lines adds vertices to a line to enforce a particular shape generated by splining. TIN densification is the process of adding nodes to a TIN object based on some criterion, such as highest deviation from a planar surface in an underlying DEM or correlation between a stereo pair of DEMs. (See also: TIN densification.)

depression: (watershed analysis) A depression exists when the lowest elevation value within the watershed is lower than the lowest value of the cells that form the watershed boundary. Drainage is inward from the inside perimeter of the depression toward the lowest point.

depressionless raster: An elevation raster created from the original elevation raster with all depressions filled. Such depressions are filled by assigning increased elevation values until a flow direction can be established without going uphill. The depressionless raster is attained when the number of depressions is reduced to zero.

destripe: Procedure that removes systematic striping within an image. This striping typically occurs in an image generated by a multispectral scanner that sweeps multiple scan lines simultaneously.

developable surface: A geometric form capable of being flattened without stretching or tearing, such as cylinder or a cone (both of which can be cut and laid out flat), and a plane (which is already a flat surface).

device independent: Not constrained by idiosyncrasies of hardware environment. All processes in TNTmips function independently of the physical input, output, and display devices. Device independent software is also designed so that all of its procedures look and work the same way across a variety of hardware configurations.

DGIS: Direct Graphics Interface Standard.

diacritic: An accent mark added to a character to distinguish it in pronunciation or meaning from other uses of the same character. Common diacritics, for example, distinguish several versions of the Latin character "a:" á, à, â, ä, ã, and å.

dialog box: A type of subwindow that opens to display a message, warning, processing message or application components that require the user's input. The user must typically make some kind of decision and exit the dialog box before continuing with the process by pressing a button such as OK, Cancel, or Skip.

diapir: An upfolded geologic structure, such as an anticline, in which mobile, plastic core material has broken through or pierced the more brittle overlying rock.

digital: Information stored and processed with numerical digits, often in base 2. Digital information processing is constrained by the finite set of numbers a system uses, such that every data value is forced into its nearest representation. For example, a digital clock may only show hours, minutes and seconds, but not fractions of a second. At some point, every digital system faces the same kind of limit in accuracy. On the other hand, digital information is easy to copy, store, manipulate and reproduce dependably. (See also: analog.)

Digital Elevation Model: See DEM.

Digital Terrain Model: See DEM.

digitize: Convert analog data into a digital form; also, more specifically, use an X-Y digitizing tablet to convert data to digital form.

digitizer: A device that converts an analog signal or representation to a digital one. (See also: scanner, video digitizing board, X-Y digitizer.)

digraphia: Use of two different scripts for the same language, such as Latin and Cyrillic for Serbo-Croatian, Devanagari and Arabic for Hindi-Urdu, and Pinyin and characters for Chinese.

dimensionality: The number of coregistered images in a project file for one site. An image contained in one color composite raster has a dimensionality of one. An image contained in a three-raster RGB set has a dimensionality of three. A Landsat TM image map for a single date will have a dimensionality of up to seven.

If elevation rasters, panchromatic rasters, and multi-date airphotos are added to the project file, the user will likely want to reduce the dimensionality of the image to simplify analysis and manipulation. (See also: dimensional reduction)

dimensional reduction: Reducing the number of coregistered rasters in a project file to speed up their analysis. TNTmips' dimensional reduction techniques include principal components and Kauth's Tasseled Cap.

dimmed selection: A menu selection that is not currently available as indicated by its grayed-out appearance.

directly attached: The relationship of an attribute table to elements when the table attachment type is anything other than Related Only. Directly attached table

types include implied one-to-one (not available for CAD), one record per element, one to one, and no restriction.

directly linked: Directly linked files are files that can be read directly by the TNT products without using the import process to establish the link. Examples of file types supported for direct linking, or direct use, are JPEG2000, MrSID, shapefiles, and DWG. For more information see the Quick Guide entitled *Direct Use of Popular Geodata Formats*.

directory or **sub-directory:** In DOS, Linux, and UNIX, a directory is a logical, user-defined division of a storage device. For example, a user may divide a hard disk into several directories, with each directory used to store files that pertain to a certain task. One directory may contain programs and documents for word processing, another for spreadsheet analysis, and another for database manipulation. Newer operating systems use the word *folder* synonomously with directory.

discrete values: Cell values of rasters that represent discrete data, such as categorical data, for which interpolated values have no meaning.

disk drive: A mechanical component of a computer that allows data to be read from or written to a spinning magnetic or optical disk.

displacement: The difference between the apparent x,y position of a feature in a raw photo and the feature's true position. Displacement is caused by camera characteristics, tilt, nearness to the target scene, and variations in the elevation of the target terrain.

display: Display is used loosely to mean a monitor or what is drawn on it, but in the context of the TNT Display process, a display is a layout or group that is independent of other layouts or groups in the process. A display consists of a list of layers in the Display Manager window and one or more View windows that show the selected layers.

display board or **display card:** An electronic circuit board installed in a microcomputer that translates the computer's display data into signals for the monitor.

display group: A standalone grouping of layers for the purpose of display (may also be a single layer). Groups can be combined in display and page layouts.

display histogram: A graph showing the number of times a data value occurs in a raster display plotted against the range of possible values. For any RGB color the user selects, the TNTmips display histogram shows how may cells there are in the display for each intensity level of that color.

display layout: One or more groups arranged specifically for onscreen purposes. Can be converted to a page, or hardcopy, layout for printing.

Display Manager: The window in the Display process that lists all the layers in all the open displays. It provides the means to open new or existing groups and layouts and to manage their contents.

display monitor or **display screen:** (historical term) One of the two screens in the old DOS MIPS system (v3.3 and earlier). The display monitor showed the image and worked with the mouse. The other screen was the text monitor, which worked with the keyboard and displayed menus and system information.

dissolve: The removal of boundaries between polygons that have one or more specified attribute values in common.

distance raster: An output raster created by certain classification methods which records the Euclidean distance between each cell and its assigned class center. Distances are represented as 32-bit floating point numbers. High distance values may identify cells which were not adequately classified using the chosen method and input parameters.

dither pattern or dithering: An image processing technique that creates the visual illusion of continuous tones when an image is printed. The illusion of shading is obtained by the calculated placement of picture elements that usually can not be resolved by the human eye. The calculated placement of the picture elements is called the dither pattern and creates more colors and shades of color than would be printed otherwise on printers with fixed intensity, fixed size printels.

dithered raster: A printer-ready 4-bit raster object in which each cell corresponds to one dot (printel) on the hardcopy output from the printer.

DLG: Digital Line Graph. A USGS map format usually used to distribute topographic maps in vector form.

DMA: 1) Defense Mapping Agency of the US Department of Defense. 2) Direct Memory Access.

double precision: A high level of accuracy based on the possible number of significant digits that can be stored for each coordinate or raster cell value.

DOS: Disk Operating System. DOS for personal computers was developed and marketed by IBM and Microsoft from 1981 to 1994. It provided management utilities for the files and other resources of the microcomputer. A DOS, or command, shell can still be accessed from Microsoft Windows.

dpi: Dots Per Inch. A measure of scanner, screen, and printing resolution. The more dots per inch, the more detail a device can process for a given area of page or display. On the other hand, the more dots per inch, the higher the demands on machine storage and processing (files get large and processing slows down).

drag: To press and hold a mouse button while moving the mouse.

drag bar: A window's title bar.

drape object: An object that takes its three-dimensional shape from a surface object that is lower in the layer list. Any object type that is usable in TNTmips can be used as a drape object.

drawing order: The order in which layers are drawn during display. The object that is first in the drawing order will appear to be on the bottom when all layers are displayed. The order of objects in the layer list reflects the displayed appearance for a group with the background always at the bottom of the list.

drawing style: The style used to render a screen or hardcopy representation of a vector or CAD element. The drawing style for point features includes size and whether unfilled, filled, or represented by a symbol. The drawing style for line elements includes line width and whether drawn in solid color or using a line pattern. The drawing style for polygon elements includes the border color and whether or not a polygon is filled. Your choice of single color filling or use of a transparent fill pattern and whether to draw the border if filled are also part of the drawing style.

driver: A set of computer commands that control some input or output process for a particular type of hardware. Drivers translate general program features into the specific communication protocol required by a particular device, such as a particular printer.

dropout: A missing piece of an image, or more generally, of a data stream. Dropouts can be caused by the improper use or function of a hardware device, by signal interference or disruption, or by other problems. A dropout in text transmission causes missing letters or words. A dropout in scanning can cause gaps in the image of a line. Scanning a fine line at too low a resolution or with too low a binary threshold is likely to cause dropouts in the resulting raster image of the line.

DTM: Digital Terrain Model. Elevation data in a 3 x 3 arcsecond grid form or a similar rectilinear form created by the Defense Mapping Agency.

DVD: Digital Versatile Disc. A 5" optical disc for video or data with greater storage capacity than a CD-ROM (currently 4.7 Gb).

DXF: Data Exchange Format for storing vector or CAD data in ASCII or binary files, which can be used to interchange AutoCAD files with other CAD software.

— **E** —

easting: A rectangular (x,y) coordinate measurement of distance east from a north-south reference line, usually a meridian used as the axis of origin within a map zone or projection. *False easting* is an

adjustment constant added to coordinate values to eliminate negative numbers.

edge conditions: In agricultural row crop imagery, the biomass values for cells in the middle of a healthy row are high, while the thin plant fringes or bare soil between rows have low biomass values. Low biomass values along the edges of healthy rows are normal and are no cause for concern. But edges cannot be distinguished by value alone from the low biomass values of regions of insect or disease damage which must be identified and given special attention.

EGA: Enhanced Graphics Adapter**.** An early graphics subsystem capable of 64 colors that was widely used in DOS-based microcomputers. The EGA was developed in 1984 to solve the poor resolution and limited color selections of the CGA.

elgenvalues: Values used in the Hyperspectral Analysis and Principal Components processes. The dictionary definition of eigenvalue is: a scalar for which there exists a non-zero vector such that the scalar times the vector equals the value of the vector under a given linear transformation.

eigenvectors: Used in Principal Components calculations and the Hyperspectral Analysis process, eigenvectors have value and direction. Eigenvectors are a mathematical rather than statistical entity.

EISA: Extended Industry Standard Architecture. One of the standard bus architectures for microcomputers. (See also: bus.)

ELAS: A public domain, first-generation mini- and microcomputer image processing system developed by NASA at the Stennis Space Center in Slidell, LA.

elastic box: A rectangle displayed by TNTmips which can be moved or resized with the mouse. Elastic boxes are used to select areas on the display monitor in processes like measuring and drawing.

elastic circle: A circle displayed by TNTmips which can be moved or resized with the mouse. Elastic circles are used to select circular areas on the display monitor in processes like measuring and drawing.

elastic line: A line displayed by TNTmips which can be moved or resized with the mouse. Elastic lines are used to draw segments on the display monitor in processes like measuring and drawing.

electromagnetic spectrum: "The entire spectrum, considered as a continuum, of all kinds of electric, magnetic, and visible radiation, from gamma rays having a wavelength of 0.001 angstrom to long waves having a wavelength of more than 1 million km" (*Random House*). Remote sensing devices typically record electromagnetic bands in the region of optical light and may include the near infrared. (See also: spectral band)

electronic atlas: A HyperIndex created from maps, photos and airphotos, airvideo, and database links. The electronic equivalent of a printed atlas.

element: (CAD) Any defined shape in a CAD object. These include arc, arc wedge, arc chord, box, circle, elliptical arc wedge, elliptical arc chord, ellipse, elliptical arc, line, point, polygon, and text elements. A block inserted into another block also acts as an element at its insertion site. Unlike vector elements, individual CAD elements retain their original shape regardless of what other elements are added and where they are placed.

element: (vector) A vector object is made up of three different types of elements: 1) points, which are single coordinate pairs (or triplets) that define a point (such as a well); 2) lines, which are curvilinear strings of coordinates which define a curved line (such as a stream) and which have nodes at the ends and intersections of lines; and, 3) polygons, which are collections of lines which inscribe an area (such as a lake).

ellipsoid: An ellipse rotated about its shorter axis. In the context of map projections, an ellipsoid is a geometric reference surface that closely approximates the geoid. Since the geoid (that depicts the earth) is an irregular spheroid characterized by polar flattening (or ellipticity), many methods have been developed to describe its ellipsoidal deviations. Cartographers have a selection of ellipsoids from which to choose; most of which have "best-fit"

properties for certain portions of the globe. In 1924, an International ellipsoid was defined which described the earth ellipsoid as a flattening of 1 part in 297. Historically, ellipsoids were derived from careful surface measurements. More recently, satellite data has been used to construct ellipsoid models that relate coordinate measurements to the earth's center of mass. A few common standards: GRS 1980 (North America), WGS 72 (NASA/satellite), Australian (Australia), Krasovsky (Soviet Union), Clarke-1880 (Africa), Clarke-1886 (North America, Philippines), Airy (Great Britain), Bessel (Central Europe, Chile, Indonesia), Everest (India, Burma, Pakistan, Afghan, Thailand, and other southern Asian countries), and International (most other areas).

EO cartridge: See: erasable optical cartridge.

EO drive: See: erasable optical drive.

EOS: The Earth Observation Satellite used to study the earth as a system while tracking long-term, global changes. EOS is a NASA-sponsored mission.

epidemiology: The study of the various factors influencing the occurrence, distribution, prevention, and control of disease, injury, and other health related events in a defined human population.

epipolar: A condition of geometric coplanarity established between a pair of stereo images to give them the same relative orientation. Stereo images that have epipolar orientation can be used to derive a network of correlation points in preparation for DEM extraction.

EPPL7: Environmental Planning and Programming Language. A raster-based GIS system developed and sold by the State of Minnesota.

EPS: Encapsulated PostScript.

EPSG: European Petroleum Survey Group.

equalized histogram: A histogram whose distribution has been mathematically adjusted so as to come as close as possible to having an equal number of cells of each data value.

equator: The great circle that is equidistant from each of the earth's poles and divides the earth into northern and southern hemispheres. Latitude is measured with reference to the equator.

erasable optical cartridge or **EO cartridge:** A two-sided removable storage unit that typically holds between 300 and 500 megabytes per side. Data on EO cartridges can be erased so the cartridge can be updated or re-used.

erasable optical drive or **EO drive:** A 5 1/4" high capacity storage device that uses removable double-sided cartridges which typically store between 300 and 500 megabytes per side. EO drives are similar to WORM drives, with the difference that EO cartridges can be erased and re-used, while data on WORM disks is permanent and cannot be erased. (See also: WORM drive.)

ERDAS: Earth Resources Data Analysis System. A raster-oriented microcomputer image processing and GIS system by Leica Geosystems.

escape code: A code which controls the format of text output. SML supports a set of common escape codes: \t (tab), \b (backspace), \n (newline), \<carriage return> (line continuation: the "stitch" character), and \\ (the '\' character).

ESRI: Environmental Systems Research Institute headquartered in Redlands, CA.

Ethernet: Ethernet is a local area network that uses a bus topology for reliable high speed communications in a limited geographic area, such as an office of university complex.

euclidean distance: The shortest distance between two points in feature space, calculated using the Pythagorean theorem.

exabyte, Ebyte, or **EB:** A computer unit of measurement for 2^{60} (approximately) 1,000,000,000,000,000,000 bytes, 1,000,000,000,000,000 kilobytes, 1,000,000,000,000 megabytes, 1,000,000,000 gigabytes, 1,000,000 terabytes, or 1000 petabytes. (See also: bit, byte, gigabyte, kilobyte, megabyte, petabyte, terabyte, yottabyte, zettabyte)

expansion slot: A socket for an optional circuit card on the main circuit board of a microcomputer (the motherboard).

explicit destruction: When a user action has

irreversible or negative consequences, the process requires the user to take explicit action and to confirm that intent by responding to an appropriate warning message, such as "Are you sure you want to delete selected items?" before destruction is performed.

exporting vector or **raster objects:** Exporting an object from a TNTmips project file converts it to a format recognized by other image processing or GIS software. Color schemes; arc, node, and polygon structure; geographic calibration; and any other supporting data used in the target format is included. The completeness of the conversion is only limited by the extent to which MicroImages can decode the format from the developer's information or determine it from sample files.

expression: A line in a query or script that compares values. An expression evaluates to "true" (1) or "false" (0). Example: numlines < 3. It compares the numlines variable for the current node element with the number 3. The expression is true only if the value of numlines is less than three. Also, an expression can evaluate to a number (for example: 2*YIELD). If such an expression is used where true and false values are needed, 0 is treated as false, and anything else is treated as true.

extents: The geographic extent of data specified by the minimum bounding rectangle.

external database file: A database file that has been linked to a project file and is maintained as a separate file. An external database file may still be processed by your database programs. (See also: database object, internal database file.)

external program: A program that is not part of TNTmips. It may be commercially produced or written by you.

external raster: A raster file that has only been linked to a project file and is being maintained as a separate file. An external raster 1) is stored in a DOS file, 2) follows a very simple format, and 3) is not stored internally in a project file. To all TNTmips processes, this object still appears to be a part of a project file. However, external programs can modify it.

extrema points: The highest and lowest points and flat areas locally as indicated by the elevation raster cell values. Extrema are change points determined by the comparison of each cell to the eight adjacent cells. A cell whose eight boundary cells are all lower than the cell is defined as a single local maximum. A cell whose eight boundary cells are all higher than the cell is defined as a single local minimum. Two or more adjacent cells with the same value whose boundary cells are all lower are defined as contiguous local maxima. Two or more adjacent cells with the same value whose boundary cells are all higher are defined as contiguous local minima. Two or more adjacent cells with the same value whose boundary cells also have the same value are defined as a flat area.

— F —

false easting: An adjustment constant added to easting coordinate values to eliminate negative numbers. (See also: easting.)

false northing: An adjustment constant added to northing coordinate values to eliminate negative numbers. (See also: northing.)

far range: The region farthest from the aircraft in an image created by a synthetic aperture radar (SAR) sensor.

FFT or Fast Fourier Transform: one of the procedures in raster filters. See also: Fourier Transform.

feathering: One of the options available for handling cell values in the overlapping portions of the input objects in the Mosaic process. Two types of Feathering methods are available: Linear and Nonlinear. Each type uses a weighted average of corresponding input cells. The weighted average varies with distance from the image boundaries. The weighting coefficients for each image are zero at the boundary and increase inward to 1.0 at the feathering distance from the edge (feathering distance is specified by the user).

feature: An area in an image that you locate

and map in the TNTmips feature mapping process. A feature is a continuous area (it may have holes in it) that does not touch any other area of the same type. (When two features of the same type touch, they immediately become a single larger feature.) Features may represent anything the user chooses to isolate and identify, like ponds, lakes, agricultural fields, a biological entity in an NMR scan, or bones in a CAT scan.

feature class: The identity of a feature supplied by a TNTmips user. A class is a set of all features of the same material. A class is named to identify the kind of material it contains (for instance "corn").

feature mapping: A TNTmips process for isolating, identifying, and typing areas in multivariable images. TNTmips can do most of the classification automatically when working with high-quality materials like satellite multispectral images. With more input from the user, the process may also successfully map features in images created from 35mm slides or noisy airvideo.

feature space: The theoretical n-dimensional space occupied by n input raster objects. Each raster object represents one dimension, and its cell values represent positions along one of the orthogonal coordinate axes in feature space. The set of raster values belonging to a cell define a vector in feature space.

feature type: The identity of a feature supplied by a TNTmips user.

fiducial marks: (photogrammetry) Index marks, usually four, which are rigidly connected with the camera body and which form images on the film negative and usually define the principal point of the photograph.

field: (database) One component in a database record. Fields report values (either qualitative or quantitative) for the individual represented by that record. For example, a database record in a table concerned with agricultural potential may contain fields that provide qualitative evaluations of a ground areas' production potential for grain, legumes, or trees, while a database record in a table of polygon statistics may contain fields that re-

port quantitative information such as the polygon's area, boundary length, and centroid coordinates. (See also: database object, record, table.)

field: (video) *Background*: The image you see on a TV screen is composed of a set of about 480 horizontal lines. The lines are projected in two passes of the signal beam. Each pass only projects every other line of the image: the odd lines in one pass, and the even lines in the next pass. One scan takes 1/60 of a second, so the whole picture (the frame) is refreshed every 1/30th of a second.

A field contains every other line of the complete video image. The primary field contains the odd lines; the secondary field contains the even lines.

field: (window) An area of a window that allows keyboard entry of text.

field of view: Area visible from a viewers location. In the Viewshed process you can adjust the position of the viewpoint location in relation to the vertical plane of the surface object.

figure-ground separation: Separation of the foreground (figure) from the background (ground) in an image.

file: A stored collection of related material (programs and data) analogous to a physical file folder that is used to store a collection of papers on a particular subject.

file format: A particular, pre-described layout pattern for data in a computer file so it may be used or acted upon by a program. A TNT project file has a complex format recognized only by the TNT family of products and by user programs designed and built with the TNTmips library. Similarly, a commercial database system uses only database files that follow its particular file format.

fill color: A solid color used to fill a closed shaped in a vector or CAD object or an area defined by specified boundary colors in a raster object.

fill pattern: The drawing pattern for the interior of a polygon for display or printing. TNTmips lets you create and assign fill patterns for raster (paint), vector, and

CAD operations. A fill pattern can be as simple as a solid color, or as detailed as a repeated image of a duck or tree. Soil types can be represented by traditional color cross-hatching. Fill patterns can be designed from the 64 standard colors plus transparent (so the underlying image shows through).

film recorder: An output device that works like a printer but produces slides or prints, usually on 35mm film.

filtering: Clarifying detail, sharpening contrast, smoothing edges, and otherwise enhancing image quality.

FIPS code: Federal Information Processing Standards code that identifies each state (2 digits) and county (3 digits). TIGER files are named by incorporating FIPS codes, e.g. TGR + 2-digit state FIPS code + 3-digit county FIPS code or TGR31109 for Lancaster County, Nebraska.

flat: A raster cell that has the same cell value as its eight neighbor cells. Calculated from an elevation raster object, a raster object of flats provides a representation of locations with poorly defined drainage.

flat tileset: A flat tileset is one that has no directory hierarchy. All the tiles are placed in a single directory that might contain millions of tiles required to cover the area of the source images or maps for all the zoom levels available. The naming structure of each tile defines where it occurs on the ground (i.e. its georeference) and its zoom level or scale.

Operating systems have limits on the number of files that can be in a directory. Vista and Windows 7 limit a FAT32 directory to 65,536 files.

flight path: The path taken by aircraft, satellite or other imaging sensor platform. The flight path controls the nadir as well as the area imaged.

floppy disks, floppies, **diskettes**, or **flexible disks:** A thin, flexible magnetic disk for computer program and data files. Floppies are inserted into a computer's floppy disk drive much like a cassette tape is loaded into a tape player. Floppy disks come in different sizes and capacities, and must be used in the right kind of drive and computer. Floppies are slower and hold less data than a hard disk. (See also: hard disk, RAM disk.)

flow accumulation: In a raster-based analysis, the total number of cells, including non-neighboring cells, that drain into a selected cell.

flow direction: In a raster-based watershed analysis, each cell is assumed to drain into one of its eight neighbors (left, right, up, down, plus the four diagonals). The flow direction of a cell is expressed in degrees: up=0, right=90, down=180, left=270; and the diagonals: 45, 135, 225, 315.

flow path: The drainage path through a watershed that begins at a selected point (called the flow path "seed") and runs to one of the outlets of the study site.

flow path raster: A raster that indicates the flow path from one or more seed points to one of the outlets of the study site.

flow path seed point: (watershed analysis) Any point selected to be the origin or highest point in a flow, or drainage, path.

focal length: The distance from the lens at which parallel light rays are focused to a point. Focal length is essentially a measure of the "zoom" level of a camera lens. Longer focal lengths create a higher zoom level, capture a smaller area of the target scene, and introduce smaller displacement errors. 6-inch, 8.25-inch, and 12-inch focal lengths are common for aerial photography done by government surveying authorities in the United States. Focal length affects the geometry of the photo and must be provided as an input to computational orthoimage and DEM processes.

focus: Focus is generally thought of as a photographic term, such that when things are in focus, they are not blurry. In software, however, many actions are defined by which window, field, or item has focus. Focus may be indicated by highlight or text cursor position, and is generally acquired by a mouse click. Focus is sometimes moved from one field to the next using the <tab> key.

folder: A folder contains a set of logically related objects in a Project File that have been organized so they can be accessed

together. A folder is equivalent to a DOS directory. (See also: nested folders.)

font: A single set of glyphs (characters, symbols, numerals, and letters of both upper and lower case) of the same style (such as Times, Helvetica, or Schoolbook). Fonts can be stored and manipulated in computers as bitmapped or vector (outline, or stroke). Font sizes are specified in points. A 72-point font is one-inch high, from the highest ascender to the lowest descender in the set. A 12-point font is 1/6 inch high. (See also: bitmapped font, outline font, point size.)

font set: A collection of one or more fonts that provide all the characters used by a particular language.

foreign key: A primary key in one table that also exists in another table within the same database. A foreign key consists of one or more attributes that can uniquely identify a record in the table containing the primary key. The identification and designation of foreign keys are automatic. (See also: database, field, primary key.)

form: See database form.

format: The preparation of optical, floppy, or hard disk media; a tape cartridge; or other storage media with basic locational information so that the media can be used. Some manufacturers provide preformatted media for their specific devices, such as hard drives. Other generic media, such as floppy disks, are usually not formatted when purchased. Some media, usually those with a serial recording format, such as open reel tape, are automatically formatted as they are used.

Fourier transform: A type of two-way frequency transform for identifying and removing unwanted spatial frequency components in an image. The Fourier process is normally used to identify and remove systematic noise "spikes," such as regular lines that may have been introduced by a faulty image collection device. The process works as a two-way operation. First the forward transform creates a pair of intermediate raster objects that reveal abnormal data variability. After the values in those raster objects have been edited to remove the data

spikes, the inverse transformation creates a raster object with the same image as the original, but with lines or other noise removed. This Fourier Transform process has somewhat the same smoothing effect as the low-frequency TNTmips image filtering process.

frame: (video) A complete video image which consists of two interlaced fields. Odd lines of the frame are contained in the primary field which is alternated with the secondary field that contains the even lines. The primary field lasts 1/60 of a second in standard broadcast video. The secondary field follows in the next 1/60 of a second. The entire frame takes 1/30 of a second to display. There is a difference of 1/60 of a second between alternate lines in the image.

frame: (window) The border around a window in TNTmips. The active window (where any typing or selecting of options will occur) is indicated by a highlighted or different colored frame.

framegrabber and **framegrabbing:** *Background:* Prior to digital broadcasting, composite video and US standard broadcasts repeated each field every 1/60 of a second. Two interlaced fields, each containing alternate lines of the image make up one video frame that lasts 1/30 of a second.

A video framegrabber is a microcomputer interface board that accepts a video input signal and passes it to a color monitor. A program signals the video framegrabber to both freeze and digitize one video frame.

Digitizing a video frame may transform each picture element in the frame to a single byte in the board's memory. More commonly, it simultaneously captures, digitizes, and stores the video's separate red, green, and blue color values. Some framegrabbers can be set to grab only a single field to avoid the relative movement between a frame's two fields. If the video comes from a camera that has high-speed electronic shuttering (like 1/1000 of a second), movement in the 1/30 of a second between the primary field and the secondary field causes sawtoothed edges on alternate lines in straight

features like road edges, and vertical poles.

As soon as the video is saved in the board memory (1/30 or 1/60 of a second), picture motion on the monitor freezes (even if the live video input continues) while the data in the board memory is converted into a display image. Then TNTmips reads the memory of the board and transfers the image into project file raster objects.

Framegrabber boards should not be confused with video digitizing boards, which gradually sample and construct a digital representation of a still scene video image. Sampling video boards represent an older technology, but are still used for non-standard, higher resolution video sources. (See also: video digitizing board.)

FSA: Farm Service Agency.

frequency transform: An operation that breaks down an image into its fundamental spatial frequency components for subsequent analysis or filtering.

fuzzy C-means: An unsupervised classification or clustering process developed by Robert Cannon *et al.* and documented in: Robert L. Cannon, Jitendra V. Dave, James C. Bezdek, and Mohan M. Trivedi (1986) IEEE Transactions on Geoscience and Remote Sensing. GE-24(3):400–408. *Segmentation of a Thematic Mapper Image Using the Fuzzy C-Means Clustering Algorithm.*

G

GAC : Global Area Coverage.

gadget: A graphical X object, like a widget, that does not have a window of its own (as most widgets do) but appears inside a parent window.

gap: A line segment undershoot leaves a blank space in the T-junction of two lines. The raster thinning process often leaves gaps that should be repaired by raster editing before final vectorization.

GEM: A window and mouse desktop operating system developed and marketed in the 1980's by Digital Research, Inc.

genlock: To synchronize two video signals (usually NTSC) to match the color video frames. Genlocking is necessary to mix and combine two signals, like a live video image and a graphic overlay. Some display boards can output an NTSC signal but cannot genlock, or mix, that signal with another video signal.

geocatalog: A geospatial catalog, or geocatalog, gives a geographic overview of all the project materials in a selected directory on your system so that you can find all the objects in the same location as the object in your current view and select them if desired.

geocoding: See: georeference.

geodesy: Investigation of scientific questions connected with the shape and dimensions of the earth.

geoid: The figure that represents the irregular spheroidal shape of the earth is called the geoid. The geoid is an equipotential surface (which means the direction of gravity is perpendicular to all points on the surface) at mean sea level. Because of variations in the distribution of the mass and density of the earth's constituents, the geoid generally rises over the continents and is depressed in oceanic areas ; the geoid also conforms to various lumps and depressions that depart from average smoothness on the earth's surface. For mapping purposes, the attributes found on the geoid must be transferred to a more regular geometric surface, an ellipsoid.

GeoJP2: A file with JPEG2000 compression and self-contained georeference information. No companion files are required to provide without additional files to contain that information. (See also: JPEG2000 compression.)

GeoLock: A standard View window / View menu option that can be used when more than one View window is open. Select GeoLock to open a menu where you can select the position locking feature or the scale locking feature. When one of the locking features is selected, all open View windows change in concert based on your locking choice.

geomashup: A geomashup combines geospatial data (such as maps, images, and point locations) from multiple sources into a single interactive web page display. Geomashups commonly show geodata for a particular area or a particular theme and overlay it on a global reference map or image such as the proprietary map and satellite layers offered by Google Maps and Bing Maps. The Application Programming Interface (API) for Google Maps, Google Earth, Bing Maps, or OpenLayers provides the geomashup with familiar controls for panning the view and zooming through different levels of detail. A tileset structure is the most efficient way to store geodata for a geomashup. You can create geomashups in TNTmips using the Assemble Geomashup process. (See also: Assemble Geomashup, mashup, tileset.)

geometric layer: A vector, CAD, shape, TIN, or LAS layer composed of points, lines, and/or polygons.

geometric transformation (or rectification): A process in which an image is stretched differentially so as to change its internal geometry is said to have undergone *geometric transformation* or *rectification*. A transformation specifically refers to the process of projecting an image from its plane onto another plane by translation, rotation, and/or scale change.

georeference or **geographic calibration:** Information that relates raster cells or vector/CAD elements to a specified coordinate system or map projection. The RVC file format keeps the information needed to relate every raster cell or vector coordinate point to some geographic coordinate system (like a particular map projection) in subobjects associated with the parent object. Geographic calibration may be established when creating an object (like extracting an image map from a Landsat or SPOT satellite image). Calibration can also be added to an existing object either by entering control points or by associating it with some calibrated object (like overlaying a calibrated vector to calibrate a raster). An RVC subobject identifies a calibrated object's map projection.

georeferenced image map: See: image map.

geospatial intelligence: the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the earth.

geoviewer: The viewing component of local and web applications that view geolocated source materials via the Internet, such as Google Earth, Google Maps, Bing Maps, World Wind, and TNTmips.

GIF: Graphics Interchange Format.

gigabyte, Gbyte, or **GB:** A computer unit of measurement for 2^{30} (approximately) 1,000,000,000 bytes, 1,000,000 kilobytes, 1,000 megabytes, or .001 terabytes. (See also: bit, byte, exabyte, kilobyte, megabyte, petabyte, terabyte, yottabyte, zettabyte.)

GIS: Geographic Information System. "A Geographic Information System is a computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data. The major components of a GIS are: a user interface; system/database management capabilities; database creation/data entry capacity; spatial data manipulation and analysis packages; and display/product generation functions." — from *USGS Open File Report 88-105 [A process for evaluating Geographic Information Systems]*. In the broadest sense, a GIS is any integrated system of information that includes a geographic component.

global variable: (SML) All variables not explicitly declared local are called "global variables" and are insulated from the operations of a function or procedure only if the function or procedure declares a local variable of the same name.

glyph: Characters, letters, numerals, and symbols that make up a font typeface. Glyphs can include alpha-numeric characters, ideographs, international currency symbols, and directive symbols and icons such as curved arrows and dingbats.

gnomonic projection: A type of perspective azimuthal map projection. The point

of the projection is the center of the sphere. Gnomonic is the only projection on which all great circles represented are straight lines.

Google Maps: A free, online, 2D, web map service provided by Google. You can view map (roads), satellite, or terrain-with-map base layers. Extensive search capabilities are provided, inclding address search for parts of the world. Route planning is also available from Google Maps. Street View is another Google Maps viewer, which supplies drive-by images for an expanding number of cities (currently in North America, Europe, and Japan).

Google Maps Tile Overlays: A "Tile Overlay" is the name Google uses for the structure of a tileset that is optimized for its API to use as an overlay. It conceptually emulates the way in which Google stores its proprietary satellite, terrain, and roads base layers that are accessible over the Internet. Tiles for areas of the source image that are to be treated as completely covered by the tile are usually *.jpg. Tiles are *.png where the area covered overlaps the regular or irregular outer edge edge of the source image or an inner edge for missing internal areas. All tiles can also be *.jpg or all *.png depending upon the desired appear of the source image in the application.

GPIB: General Purpose Interface Board. An older interface standard for computers and a peripheral devices, such as a scanner, printer, or scientific instrument.

GPS: Global Positioning System. A network of radio-emitting satellites deployed by the US Department of Defense. Ground-based GPS receivers can automatically derive accurate surface coordinates for all kinds of GIS, mapping, and surveying data collection.

gradient filtering: A method of edge detection using two filters. One filter enhances horizontal edges and the other enhances vertical edges. The results are then combined into a single output cell value. Gradient filtering usually produces better results than a single high-pass filter. (See also: filtering)

Grain Shape Index: One of the 12 fuzzy properties that can be calculated for vector objects. The Grain Shape Index measures shape with a minimum value approximating two for long skinny polygons, pi for circles, and four for rectangles. The Grain Shape Index can be very large for fractals. The equation for calculating this property is: Grain Shape Index = Perimeter / Long Axis.

GRASS: Geographic Resources Analysis Support System. A public domain GIS system developed at the U.S. Army's Construction Engineering Research Laboratory in Urbana, Illinois. It is now managed by the GRASS Development Team. The system was designed for minicomputers and has since been implemented on various microcomputers. It is a raster-based system that can interface to vector data sets for data preparation and import/export.

graticule: A network of parallels and meridians for equal intervals of latitude and longitude on the earth's surface. The form and appearance of a graticule depends on the map projection employed. The lines comprising a graticule may form a square / rectangular network; a graticule may also be comprised of two families of curves having variable separation between them. The mathematical framework of a map is comprised of a grid, or a graticule, or both. A *grid* is always comprised of a square network of parallel lines representing particular linear distances on the ground.

gray out: To dim a label that is nonfunctional / unavailable in current context.

graytone or **grayscale:** An image or raster object that contains tone levels and intensities that grade gradually from black (no intensity) to white (high intensity). Differences between one tone level and another correspond to differences between one data level and another.

graytoned image or **raster:** An image or raster object that contains tone levels and intensities that grade gradually from black (no intensity) to white (high intensity). Differences between one tone level and another correspond to differences between one data level and another.

great circle: "A circle on a spherical surface

such that the plane containing the circle passes through the center of the sphere" (*Random House*). For example, the equator is a great circle.

greeking: An on-screen substitution, such as a wide gray line or an empty box, for graphic text that is too small to be drawn and viewed distinctly.

green biomass or **phytomass:** The amount of wet weight or dry weight of growing, chlorophyll-containing plant material per unit ground area. It is usually expressed in grams per square meter, tons per acre, or metric tons per hectare.

greenness: The biophysical property of the surface of the earth that indicates its greenness in a biological sense and gives a qualitative estimate of green biomass. It measures plant vigor, water wellness, and chlorophyll content. Greenness can be computed from Landsat MSS or TM images and stored in a raster object by Kauth's greenness, brightness, wetness transformations.

ground control: Targeted terrain surface features, such as road intersections, of known (surveyed) horizontal and vertical coordinates used to orient and otherwise relate airphotos and satellite images to a map projection.

ground range: The horizontal distance along the ground for the flight path of a side-looking radar system. Ground range is calculated by converting slant range using raster resampling and the flight parameters to correct the geometric distortions in the raw geodata.

ground resolution: The limit of detail clarity in an image of the earth's surface collected by some remote sensing device, usually measured in meters. An image with a ground resolution of 10 meters shows no ground features smaller than 10 x 10 meters. Each data cell in such an image contains a value for a distinct 10 x 10 meter surface area.

ground truth: Information collected at the same site and at the same time as a remote sensing system is collecting data. Ground truth is considered more accurate, and is used to interpret and calibrate remotely sensed observations.

group or **display group:** Each view window in the TNTmips display process can include multiple groups of objects, and each group can contain multiple layers of objects. Groups allow side-by-side display of related items in a single window. TNTview does not provide group handling tools, although you may encounter groups as part of a display layout saved in TNTmips.

group list: A list in the control window of the display process that shows the currently defined groups.

GUI: Graphical User Interface. A system program that provides windows and icons and a way for the user to manipulate them with keyboard and mouse. In the X Window System, the GUI is a client and not part of the X server. Thus several different GUI's are possible under X. TNTmips uses the LessTif GUI.

— H —

handles: A tiny square used to mark a selected graphic (non-textual) element at the corners or along the edges. Handles can be dragged with the mouse to move or resize the selected element.

Hangul: Korean alphabetic system of writing created in the fifteenth century.

hanzi: Traditional written Chinese characters which are not strictly tied to the spoken language to the extent that mutually unintelligible Chinese dialects (such as Mandarin, Wu, Hakka, Cantonese) use the same written forms.

hardcopy layout: A layout designed specifically for printing.

hard disk or **hard drive:** A mechanical, magnetic storage device for computer data and program files. Internal hard disks (sometimes called fixed disk) are mounted inside the computer chassis and so are not removable. An external hard disk is an enclosed unit that is linked to a computer by appropriate connecting cables. Hard disks are much faster and hold much more than a removable floppy

disk, but are slower than RAM disks. (See also: floppy disk, RAM disk.)

hardware key or **software license key:** A small device that contains sealed circuitry and is attached to a microcomputer (as through a USB, parallel, or serial port) to verify and authorize software and hardware system configuration. TNTmips will not run on a microcomputer that does not have a valid hardware key.

hatch pattern: A polygon fill pattern composed of line elements, rather than a bitmap. The line elements can be a simple, solid color or a more complex line pattern. The area between line elements is transparent.

HBS: A method of defining color space, sometimes known as HSV, that combines hue, brightness, and saturation components to produce all colors. An HBS raster set in TNTmips is a set of three rasters with the same dimensions that represent the hue, brightness, and saturation components of an image.

The hue-brightness-saturation model uses a six-sided pyramid (or hexcone) with the apex at the bottom to describe the colors. Black is at the point of the hexcone and the purest, most intense colors are at the top of the hexcone. Like the HIS model, on any horizontal slice of the cone, the hue varies as you move around the slice and the saturation increases as you move outward from the center. The HBS model may be more intuitive than the HIS model, because the Brightness factor is at its most intense at 100%, rather than the Intensity factor which is most intense at 50%. (See also: HIS, RGB.)

HelpTip: Pop-up information that tells a user how to proceed when using an APPLIDAT developed using TNTmips. The text for a HelpTip is stored as a subobject under the SML script for the APPLIDAT. This text file also specifies the delay and color scheme for the HelpTip.

HI: See: HyperIndex.

hierarchical picklist: A picklist that is grouped by the values in another database field.

hierarchical tileset: The common popular web geoviewers use hierarchical tilesets where a collection of subdirectories in each directory contain all the tile files for one prerendered zoom level. These directories are all arranged pyramid-style where each directory at a given level represents a portion of the image at that level's scale or zoom. MicroImages' internal tileset raster objects use a hybrid approach combining both flat and hierarchical structures.

high-boost filter: A process that enhances and sharpens spatial features in a continuously varying raster object. (See also: filtering.)

highlight: A temporary color change to indicate attention to an element, such as mouseover highlight.

high-order characters: Characters in a computer's 8-bit character set above the standard 128 ASCII characters. High-order characters (also called "extended" characters) are numbered 128-255, and most PC's use the IBM extended character encoding scheme (also called the PC-8 character encoding scheme) for screen display of the high-order characters.

The mapping of the high-order characters to the text-mode character encoding scheme of a particular printer is not standard. In order to see what characters a printer provides for the high-order characters, consult the printer's documentation or generate your own test page. In some application software, in order to get a printer to generate a particular character, you may have to use a different character on the screen.

high-pass filter: A process that enhances and sharpens the boundary edges in the spatial features of a continuously varying raster object. (See also: filtering)

hiragana: Cursive form of kana.

HIS: Hue, Intensity, and Saturation. Sometimes called HLS, for Hue, Luminance and Saturation. The system of defining video output color from hue, intensity and saturation characteristics. HIS controls are commonly used with color television sets. Most computer displays use RGB (red/green/blue) color mixing information instead.

The hue-intensity-saturation color model uses a double cone (with its greatest circumference at the midpoint of the z-axis) to describe specific colors. On any horizontal slice of the cone, the hue varies as you move around the slice and the saturation increases as you move outward from the center. Intensity is the z-axis of the model. The shades of gray are found along the z-axis, where hue and saturation equal zero. (See also: HBS, RGB.)

histogram: A graph of the number of times a value occurs across a range of possible values. One axis of a raster histogram shows how many times a cell value is found in the raster. The other axis shows the range of possible data values (like 0 to 255 for 8-bit cell values).

home range: The area defined by a swarm of spatial observation events. Classically, the home range is the area defined by wildlife sightings that an animal or community of animals uses under normal conditions. Environmental stresses may cause a preferred home range to shrink, enlarge, or be abandoned.

horse latitudes: The range of latitudes from approximately 30–35° N and S over the oceans characterized by hot and dry weather and calm or very light winds.

hot spot: See: symbol hot spot, cursor hot spot.

HPGL: Hewlett Packard Graphics Language. A protocol language used by a number of pen plotters.

HTTP: Hypertext Transfer Protocol.

hue: One of the three coordinates needed to specify a color in the HBS and HIS color domain. Hue tells the color such as red, blue, or green. (See also: HBS, HIS.)

hull: A hull is the two dimensional area for which a TIN is generated. Within the hull, including its edges, the Z value at any X-Y position can be interpolated. A hull is convex when all lines that connect two points on the hull boundary fall entirely within the hull. A hull for a U-shaped area, for example, is not convex.

hydrography: The description and study of bodies of water or their representations on a map.

HyperIndex® or **HI:** A TNTmips process that creates and manages large collections, called stacks, of graphically indexed objects (raster, vector, CAD, text and database objects). You can retrieve HyperIndexed images and information from the object hierarchy by selecting a feature of interest (or "index area") in the current display image with the mouse. (See also: index area, stack.)

hyperspectral image: Imagery acquired by hyperspectral remote sensors that collect image data simultaneously in dozens or hundreds of narrow, adjacent spectral bands. (See also: mulispectral image)

hyperspectral object: A hyperspectral image can be stored in a TNTmips Project File in one of two ways: as a set of separate raster objects with one object for each wavelength band or as a single hyperspectral object, or hypercube, that includes raster value and wavelength information for all the bands in a hyperspectral image.

hypsography: Measurement and mapping of the variations in earth surface elevation in reference to sea level, which are often represented by contour lines on maps.

ICC: International Color Consortium. The ICC developed the profile formats used to tell hardware devices how to produce sRGB colors.

ICM: Image Color Matching or Integrated Color Management. Also the file extension used by Microsoft Windows for profile files.

icon: A stylized representation of an object that consists of an image and a label. A window icon is a minimized representation of a window or window family used to help organize windows and tasks in the display. Iconifying a window changes nothing about the state of the active process in the window.

icon button: A button with a simple picture and a ToolTip to identify its function, which is usually found on a toolbar but

may be found in isolation in some software products.

ideograph: A symbol that represents meaning without indicating pronunciation. Often opposed to "phonetic." Chinese is often, but erroneously, called an ideographic language. Its origins (like those of Western alphabets) were ideographic and pictographic, but it is more accurately described as a "morphosyllabic:" a combination of syllabic characters with nonphonetic techniques, such as determinatives, to suggest the meaning category of written items.

IDIMS: A minicomputer, raster-based image processing system originally developed by NASA then sold to TRW and then to Terra-Mar and ported to the PC.

IEEE: Institute of Electrical and Electronics Engineers.

IETF: Internet Engineering Task Force.

Ikonos satellite: A satellite that collects high resolution imagery providing 1m panchromatic or 4m multispectral imagery. A pan sharpened multispectral product is also available.

image: Any analog or digital two-dimensional array of values whose spatial interconnections convey useful information. Image has a wider sense than photographs, TV, or human vision. A photographic print is an image but an image is not necessarily a photograph. What a human sees can be called an image but image is not restricted to describing human vision. The raster scan of a color map is an image until it is reduced to a vector object. However, the display of a vector object on the monitor creates an image of that vector file. Properly, that which is stored in a raster object can be called an image, but that which is stored in vector, text, or database objects cannot.

image map or **georeferenced image map:** An image that has been processed to be like a map in appearance, scale, geometry, boundary, and projection with a degree of precision that satisfies the user. Measurements made from an image map yield results equal to those made from the corresponding planimetric, topographic, or other map. Similarly, either

the image map or the conventional map can be overlaid and matched with the other.

For example, a 7.5' image map prepared in TNTmips from Landsat or SPOT satellite images will accurately match the corresponding USGS topographic map. Similarly, the color scan of a topographic map that has been assembled by tiling and calibrated to map coordinates is an image map. (See also: nominal image map.)

impedance: The opposition to flow along a given line; that is, the cost of traveling along a given line.

impedance limit: The maximum impedance allowed for any path to a center in the allocation mode of the Network Analysis process.

implied georeference: A georeference that uses geographic coordinates as element coordinates (object coordinates = geographic coordinates). Vector, CAD, and TIN objects can have an implied georeference.

importing vector, CAD, or **raster objects:** Decoding the raster data values or the vector/CAD coordinates in another system's format and converting them to TNTmips project file objects. Color schemes; arc, node, and polygon structures; geographic calibration; and all other supporting data is converted into the appropriate subobject as long as their format can be decoded from their developer's information or determined from sample files by MicroImages.

index: Special data structure used in a database to speed searching for records or spatial features in geographic data sets.

index areas: The regions in a HyperIndex parent object linked to a daughter object, which may be rectangular, circular, or quadrilateral in shape. HyperIndex will display the daughter object when the mouse selects a point within the index area. Active index areas can be revealed on the display of the parent object when the option "Show Index Areas" under the View window menu HyperIndex is on. (See also: daughter object, link, parent object.)

infinite loop: see loop, infinite.

INFO: The database program used by ARC/INFO. (See also: ARC/INFO.)

input redistribution: Automatic redistribution (rescaling) of the cell values in each input raster object prior to classification in the Auto-Classify process.

integer: A number without a decimal, such as 0, 8, and -3.

intensity: One of the three coordinates needed to define a color in the HIS color domain. Intensity represents a color's brightness or average radiance level. Intensity data is very similar to the information in black and white representations of color images. (See also: HIS)

interactive line-following: The *Interactive Line-Following* process lets you interactively trace easily distinguishable lines in a RGB, or color separated, type raster object and create vector (or CAD) elements with minimal guidance. Interactive Line-Following is a tool available in the TNTmips Object Editor used to create vector or CAD lines.

interface: The type of signal protocol for connecting computer devices. You can only connect a peripheral device to a microcomputer through a matching interface. Common interface types include serial, parallel, SCSI and GPIB.

interface card: Any electronic circuit board installed in a microcomputer that handles translation between the computer and some particular hardware device. For example, an interface board may translate output data into display signals for an image display monitor, or translate input signals from a color scanner into digital data for the computer.

interlaced video: *Background*: The image you see on a TV screen is made from a set of about 480 horizontal lines. The lines are projected in two passes of the signal beam. Each pass only projects every other line of the image: the odd lines in one pass, and the even lines in the next pass. One scan takes 1/60 of a second, so the whole picture (the frame) is refreshed every 1/30th of a second. There is a time difference of 1/60 of a second between any pair of adjacent lines in a frame.

Thus, a single, still video image of 1/30 of a second duration consists of two interlaced fields of the source video signal. Displaying a single frame of interlaced video causes vertical jitter. This jitter is especially pronounced when an image contains horizontal lines. This is called umpire shirt jitter on conventional broadcast TV and can be seen along the black and white edges of an umpire's shirt or along the sharp horizontal edges of large letters. This effect can cause eye strain. Interlace jitter is best overcome by using a monitor with long-persistence phosphor. This phosphor holds each line longer until it can be refreshed by the next scan.

internal database: A database created by a TNT product maintained in RVC format. (See also: database object, external database file.)

internal tables: Information that is automatically created in the TNT products for vector, shape, and TIN objects and some raster types, but is not shown by default with the user-defined tables. Internal tables include internal object information, which is not actually maintained in tabular form but is provided so that you can view the standard, internal information for each and every element in vector, shape, and TIN objects and for each cell in some raster object types. Each element type in vector, shape, and TIN objects has its internal table. Internal tables are not available for CAD objects because they require referencing by element number

The internal tables keep track of all topology information for vector elements, what elements are connected in TIN objects, and element numbers in directly display shapefiles. To view internal tables, use the Show System Tables right mouse button menu option at the element level of a layer manager window. (See also: system tables.)

internationalized X application: A program for the X Window System that is not "hard wired" to any specific language or culture, and so is capable of operating using a single user-selected language and set of cultural conventions. The TNT

products can be used in any language and script in the world.

Internet: a global comptuer network consisting of thousands of networks typically interconnected by fiber optic cabling. It had two parent networks whose joining began the ongoing evolution: (1) U. S. Military (Tactical communication in the event of telephone downtime during wartime) (2) Academics (Shared information between researchers).

interpolation: Applying mathematical estimation techniques to sets of numbers to find intermediate values. *Interpolation* is a collective term for various techniques of determining an approximate value of a function at a point in the domain between given points at which the function values are known. Bilinear interpolation, for example, is based on the presumption that the value being sought lies on or near a straight line joining two known values. (See also: convolution.)

interpretation: Identifying and grouping classes of features in an image. TNTmips provides three kinds of interpretation processes: Interactive (Feature Mapping), Automatic (simple clustering, K-means, fuzzy C-means, and minimum distribution angle), and Semiautomatic (maximum-likelihood ratioing, stepwise linear discriminant analysis, and Suits-Wagner classification). In a fully interpreted image, every pixel is assigned to a class. In many cases, partial interpretation is adequate, such as just showing cultivated land, or just showing wetlands.

interpreted programming language: (as opposed to a compiled language) A computer language that is evaluated and executed by the system one command or statement at a time. By contrast, a program in a compiled language is completely evaluated and translated into machine code by the system before any of it is executed.

intersection: A merging of two vector objects such that only the elements in the shared area of the two objects are copied to the resulting vector.

inverse distance: Value used in some statistical calculations and equal to one divided by the distance between two points of interest.

ISA: Industry Standard Architecture. One of the bus architectures for microcomputers used in PC/XT and PC/AT. Replaced in 1993 by Plug and Play ISA (See also: bus.)

ISO: International Organization for Standardization. The ISO defines and publishes standards that can be adopted by many manufacturers. For example, one ISO standard defines the format for erasable optical disks, so they can be used on drives from any manufacturer that supports the standard.

ISO 10646: A character encoding scheme that is a super set of the ASCII, Latin-1, and Unicode character sets that has room for 4,294,967,296 characters (a 32-bit or 4-byte character encoding scheme). Ultimately, ISO 10646 will assign codes to every known symbol and character of both modern and ancient languages.

ISODATA: Iterative Self-Organizing Data Analysis. An unsupervised classification method in the Auto-Classify process.

isoline: A line connecting points of equal value. Examples are contour lines and lines depicting ocean temperature gradients.

item: Anything that can be placed on the page in the page layout design process, including rasters, vectors, CAD objects, text files, scale bars, and tick marks. The page layout process provides tools to select, size, and position items.

— J —

Java: A simple, platform-independent programming language for writing applets, which are obtained by a client from the Internet and run on the client's machine.

JavaScript: Netscape's simple, cross-platform, Internet scripting language that runs in a limited number of environments.

JPEG: Joint Photographic Experts Group responsible for the standards for still image compression formats, such as JPEG, JBIG, and JPEG 2000.

jumper: A physical connector on a micro-computer circuit board that bridges two neighboring terminal posts. The jumper is either slid down onto the posts or removed according to the configuration options described in the documentation that came with the device.

— **K** —

K or **KB:** See: kilobyte

kana: Japanese syllabic characters derived from Chinese. There are two varieties: hiragana and katakana.

kanji: Japanese term for Chinese characters.

katakana: Angular form of kana, roughly parallel to Latin block letters, and used much like English italics.

Kauth's Tasseled Cap or **Kauth's greenness / brightness / wetness:** A set of linear combinations of the Landsat TM spectral bands which computationally reduce the images to maps of a site's greenness, brightness, and wetness. Kauth, a scientist at the Environmental Research Institute of Michigan, extended the green biomass concepts developed by Dr. Lee D. Miller, a principal of MicroImages, to extract more biophysical information from Landsat MSS and TM multispectral images. He developed the combinations by carefully correlating ground measurements made by Miller and others with values in the satellite images. The plots of the data distribution in the original spectral bands resemble a tasseled cap — hence the general name by which these transformations are called.

key field: A field in a database table identified as of importance is designated a primary key. There can be only one primary key in a table. A primary key field must have unique entries for each record in the table. A primary key field also may not be blank in any of the records in a table. A foreign key is a field with the same name as a primary key that is located in a different table. Foreign keys are identified automatically when primary keys are designated in other tables attached to the same vector/CAD object. (See also: database, foreign key, primary key.) Primary and foreign key relationships between tables let you establish computed fields that incorporate values from more than one table in their defining expression.

kilobyte: A unit of measure equal to 1024 bytes (2 to the 10th power), but loosely used for 1,000 bytes. So also with its multiples: megabyte (loosely 1,000,000 bytes), gigabyte (loosely 1,000,000,000 bytes) and terabyte (1,000,000,000,000 bytes). (See also: bit, byte, exabyte, gigabyte, megabyte, petabyte, terabyte, yottabyte, zettabyte.)

K-means: An iterative method of unsupervised classification (clustering). The n-dimensional raster space is divided into K clusters. The cluster means are used to determine cluster membership. After all cells are processed, new cluster means are determined and the process is repeated a predetermined number of times or until convergence is achieved.

KML: Keyhole Markup Language. These files are used to provide overlays in Google Earth and Google Maps. You can render any display in the TNT products to KML for viewing in combination with their native imagery.

Kuan (Adaptive Noise Smoothing) filter: Filter that removes speckle from radar images using a minimum mean square error calculation to estimate the value of the true signal for the center cell in the filter window. The filter then calculates the signal estimate from the local mean and variance and the noise standard deviation.

Kuan (MAP): Kuan Maximum A Posteri filter; this filter removes speckle from radar images using a maximum likelihood probability approach to estimate the true signal value for the center cell in the filter window. The filter then maximizes a probability function involving the center cell value, the local mean and standard deviation, and the noise standard deviation.

— L —

label: (CAD context) A CAD element that contains text used to identify a point, line or polygon element.

label: (vector context) Text in a vector object used to identify a point, line, or polygon element. TNTmips can create label text automatically from attached database tables. Also, you can manually assign arbitrary labels independent of class membership that need not be associated with individual elements.

label: (window context) The static text part of a component that presents information to the user about that component, such as the action invoked by a push button or the mode selected by a check button.

labeling: (raster context) Identifying and grouping the clusters that result from any kind of automated image interpretation. You choose labels (names for types of features) based upon your knowledge of the areas or materials in the image. Use the TNTmips Feature Mapping process to label (and possibly combine) the cluster map output of automatic image interpretation processes.

LAI: See: leaf area index.

LAN: Local Area Network.

land cover: The materials that cover a study site, such as vegetation, bare soil, rock, sand, and water.

Landsat satellite: A satellite that collects multispectral images. At various times it uses 1) a Return Beam Vidicon (RBV) device, 2) the Multispectral Scanning (MSS) device, and 3) the Thematic Mapping (TM) scanning device. Landsat also relays data from ground observation stations. Landsat was originally called the ERTS or Earth Resource Technology Satellite.

LAS: The file extension for LiDAR data. Also the file extension for latitude-shift files used in TNTmips by one of the geodetic conversion methods.

Latin alphabet: The character encoding scheme used by most Western nations, based on the alphabet developed in Roman antiquity, itself a derivative of the Greek and Western Semitic alphabets. The Latin alphabet is used by the languages of Western Europe, including English, as well as many other languages such as Turkish, Swahili, and Vietnamese. The Latin alphabet is sometimes referred to as the Roman alphabet, but "Roman" is not used in this discussion so as to avoid confusion, since the term "Roman" is often used in typeface and character style contexts.

Latin-1: (also known as *ISO 8859-1*) A super set of the 7-bit ASCII character encoding scheme that includes various symbols plus letters with diacritics commonly used in European languages. Latin-1 is an 8-bit character encoding scheme, containing 256 characters. Latin-1 makes different assignments for codes 128-255 than does PC-8. Latin-1 is, however, consistent with the Unicode and ISO 10646 standards, and is the common encoding scheme used by Unix systems.

latitude: The angular distance in degrees of a point on the earth north or south of the equator.

layer: A display entity comprised of one or more components that can be manipulated separately from other layers. There is often a one-to-one correspondence between layers and objects in TNTmips, but an individual layer may be comprised of multiple objects, such as the red, green, and blue components used to create a single layer in multiple raster display. Each group in the TNTmips display process may be composed of multiple layers of objects. The background layer may be overlaid by a raster object, such as an airphoto, which may in turn be overlaid by layers of CAD and vector objects which show soil boundaries, roads, or pin-mapping symbols.

layer list: The layer area of the control window in the TNTmips display process shows the objects and drawing order of the current layers.

leaf area index or **LAI:** A unit-less, biological measure equal to the ratio of the one-

sided surface area of the leaves in an in situ crop, forest, or grassland canopy to the ground area.

least squares: A mathematical method for fitting a line or curve to a set of data points. Least squares minimizes the sum of the squares of the error term at each point.

legend: The area on a map that provides a key to the colors, patterns, and symbols used in the map.

level: In HyperIndex, any object or file that is displayed in the Display / Spatial Data window is called a level. A level may originate from a raster, vector, or CAD object. However, in HyperIndex, the level assumes an identity beyond that of the object or file itself, because the level includes the index areas that have been defined and any links to other objects. Thus, in addition to being an image, a level lets you access many different kinds of information. (See also: HyperIndex, index area, link, stack.)

limit line: An adjustable graphic line on a process control screen that defines the boundary between values that are used and values that are not used in the process.

line: (raster) One horizontal row of cells (or pixels) in a raster object (or display image). (vector, CAD) An ordered set of coordinates that represents a linear feature (see: line element).

linear contrast: See: contrast.

linear transform: (map registration) One kind of map registration subobject (Regist) that contains an object's mathematical representation for its calibration solution (least squares) derived from a control point list.

line element: One of the types of elements that make up a TNTmips vector object. A line is defined by an ordered string of coordinates, which define a curved path in space. Line attributes include: Vector element class attributes may be cross-indexed to a list containing the element drawing style, which may include polygon fill pattern, line drawing pattern, point symbol, line width or symbol/point size, RGB color, RGB label color, RGB fill color, label font number, label font size, label font zoom factor, label font style, and label rotation angle.

line pattern: The drawing style of a line for display or printing. TNTmips lets you create and assign line patterns to vector and CAD line elements by class. You can control the width, color, and design (dashes, outlines, center stripes). Line patterns can be designed from the 64 standard colors plus transparent (so the underlying image shows through).

link: (to external database or raster object). A project file link to an external database file contains the file name, device location, and field/record information about the database file. When a TNT product accesses the database, it depends on the link information to find and manipulate the information contained therein. If an external system moves or restructures the database, the project file link must be created again. A project file link to an external raster format contains the file name and path. For the most part, linked raster files are treated just as internal raster objects. Subobjects created for use in the TNT products, such as histograms and pyramids, are stored with the project file link.

link: (HyperIndex). The relational connection between a region (or index area) on a parent object and daughter object in a HyperIndex stack. When a user clicks on an index area on a parent object, the link tells TNTmips how to retrieve the daughter object on the next level. The user who creates the HyperIndex stack defines the links as the stack is built. (See also: daughter object, HyperIndex, index area, parent object, stack.)

list box: A scrollable list of options from which to choose.

local engineering: A type of georeference that relates one obect to another without specifying a Coordinate Reference System or relating it to a position on the Earth.

local variable: (SML) Variables that belong to a function or procedure and exist only for that procedure are "local variables." No variable is local unless it has been explicitly designated so with the "local" statement in the function or pro-

cedure. A local variable may have the same name as a variable used elsewhere in the program without affecting it.

locale: One collection of data that defines the semantics for a specific language and set of cultural conventions. Standard C provides a Locale structure which includes six aspects of the local culture and language: 1) Collation / sort sequence for characters, 2) Character type, 3) Money and currency symbols and formats, 4) Numerical formats: a point or comma for decimal demarcation, 5) Time - names of the weekdays, 6) Messages - yes/no, program status and prompts.

localization: Providing the run-time data that describes the necessary elements of a locale for an internationalized program so it can use the correct character encoding scheme, font, keyboard conventions, collation sequence for the alphabet, and so on.

longitude: The angular distance in degrees of a point on the earth east or west of the Prime Meridian.

look angle: The direction an antenna of a radar sensor is pointing when transmitting and receiving for a particular cell in an image.

loop, infinite: see infinite loop.

low-pass filter: A process that smoothes or reduces the spatial variability or detail in a continuously varying raster object. (See also: filtering)

LSCV: Least-Squares Cross Validation. A statistical method.

— M —

manifold: The 3D surface defined by the 3D control points assigned to the vector or raster object onto which the vector or raster object is then projected. Used interchangeably with manifold surface.

mapping unit: See: soil mapping unit

map projection: "A device for representing all or part of a rounded surface on a flat sheet. Since this cannot be done without distortion, the cartographer must choose the map characteristic (area, shape, scale, direction) which is to be shown accurately at the expense of others." *Map Projections Used by the U. S. Geological Survey*, Geological Survey Bulletin 1532, Second Edition, U. S. Government Printing Office, Washington, D.C., 1982, p. 5. The map projection geometrically or mathematically generates the grid of lines of latitude and longitude.

Every process that establishes or translates map projections offers the same standard selection list of projections. The practical choice of map projections for ungeorefer-enced project materials is normally determined by the kind of projection used by those project materials that are calibrated to a projection. For example, if you have a scanned USGS topo map in the polyconic projection, you may decide to calibrate (or translate existing calibration) satellite images and vector overlays to the same projection. (See also: ellipsoid.)

map quadrangle or **map quad:** The geographic area covered by a map. One kind of map quadrangle is the 7.5' x 7.5' area that is covered by a standard USGS 7.5' topographic map. Referring to a 7.5' map quadrangle does not imply the presence of an actual paper map. The term may simply designate the area covered by electronically stored materials.

map scale: The relationship that exists between a distance on a map and the corresponding distance on the earth. It may be expressed as an equivalence, one inch equals 16 statute miles; as a fraction or ratio, 1:1,000,000; or as a bar graph (stadia bar) subdivided to show the distance that each of its parts represents on the earth.

map scale control: The ability to turn groups, layers, and elements on and off dependent on the map scale of the display.

marking features: Saving prototype areas that have been classified in feature mapping, clustering, or some other TNTmips interpretation process as permanent features. Marked features can be unmarked. (See also: labeling)

mark: To select one or more of a group of elements in preparation for acting upon them by some program operation such as move, copy, edit, open, analyze, display, or delete.

mashup: (software) A web page or application that combines features from more than one source into an integrated experience typically using an API to acquire content developed by others. For example, TNTmap Open that uses an API from OpenLayers and the extended Google Maps that launches from TNTmap Builder and uses the Google Maps API.

mask or **data mask:** A processing barrier or boundary that only allows selected data values (perhaps in a chosen range or area) to pass. Users might choose a data mask that blocks all values outside a selected value range, eliminating all image features except those in the range they want to use in a process. A mask is more often used to confine the effects of a process to a selected area of a raster object. (See also: processing mask.)

matte: The background, surrounding area, and border for a group, primarily legends, in a layout.

maximum-likelihood classification: A supervised image processing routine usually applied to multivariable images that have a dimensionality greater than 3. First, the user selects sample areas, (called prototype or training set areas) for each feature to be mapped. The maximum-likelihood process then computes the statistical properties of these features. Similarly, it determines the statistical characteristics which separate feature types. After this identification model has been built, the process tests each cell to determine in which prototype group it most probably belongs. A threshold can be set so that if the highest probability of a feature match is below the threshold, the cell is designated as unknown. This "catch-all" group insures that a cell representing a feature type not defined in one of the training sets will not be forced into membership.

maximum movement for steadiness: greatest allowable movement of locations of class centers in each iteration of the Auto-Classify process. Specifying maximum movement for steadiness in this process limits the number of iterations of the process.

maximum zoom level: The maximum zoom level or most detailed zoom level contains the tiles that provide the maximum detail in content that is available in the source image or map. It sets the maximum resolution at which the area covered by the tileset can be viewed. A tileset must use predetermined zoom levels and thus the source image or map is unlikely to match any of these zoom levels in detail or resolution. Thus the maximum zoom level is usually set to be the zoom level that is the closest match at a higher resolution or detail to the resolution of the source image or map.

MCA: Micro Channel Architecture. The 32-bit bus architecture introduced for 80386 IBM PS/2 machines in 1987.

medium Average or middle; a choice for smoothing options in some TNTmips processes.

megabyte, Mbyte, or **MB:** A computer unit of measurement for 2^{20} or (approximately) 1,000,000 bytes, 1,000 kilobytes, .001 gigabytes, or .000001 terabytes. (See also: bit, byte, exabyte, gigabyte, kilobyte, petabyte, terabyte, yottabyte, zettabyte.)

menu: A pulldown or popup list of selection options.

menubar: A graphic component at the top of a window that displays the titles of the pulldown menus.

meridian: A great circle on the earth's surface that passes through the terrestrial poles. All locations on the circle have the same longitude.

message box: A type of dialog box that contains a message or warning provoked by a user request or processing condition. The user must respond (for example by selecting the OK push button) before the interrupted process can resume.

metadata Information stored in a subobject attached to an object. This information can includes the source of the geodata in the object, the date the image was cap-

tured, the scale of the image, the location of the image, and so forth.

MI: MicroImages, Inc.

MICROPIPS: An early raster-based microcomputer image processing system.

MIDI: Musical Instrument Digital Interface.

MIME: Multipurpose Internet Mail Extensions.

minimum distribution angle: An unsupervised classification or clustering process developed by Dr. Jack Paris and presented in: Jack F. Paris and Helenann H. Kwong (1988) Photogrammetric Engineering and Remote Sensing 54(8):1187–1193. *Characterization of Vegetation with Combined Thematic Mapper (TM) and Shuttle Imaging Radar (SIR-B) Image Data*.

minimum zoom level: For tilesets, the minimum zoom level, or least detailed zoom level, contains the tiles that provide the most synoptic or overall view of the area covered by the tileset. It is the lowest resolution at which the area covered by the tileset can be viewed.

min/max box: A rectangle that encloses a vector or CAD element such that the edges of the box indicate a minimum or maximum coordinate value for that element.

minute or **':** "The sixtieth part of a degree of angular measurement, often represented by the sign ' as in 12° 30', read 12 degrees, 30 minutes" (*Random House*). USGS quadrangle maps are common in both 15 and 7.5 minute sizes. For example, the 7.5 minute map for Crow Butte, Nebraska covers from 103° 15' to 103° 22' 30" west, and 42° 37' 30" to 42° 45' north. (See also: arcsecond, degree.)

MIPS: Map and Image Processing System from MicroImages, Inc. First marketed for DOS computers in 1986. (See also: TNTmips.)

miter: one of the joining methods for line and polygon segments when creating offsets for vector elements in the Spatial Data Editor. The Miter option creates a single vertex where the segments meet at an angle.

mnemonic: A single keyboard character associated with a labeled component (such as a push button or menu selection). The mnemonic is underlined in the label, or if the mnemonic is not contained in the label, it can follow the label in parentheses. The underscore in the menu selection "*V*iew", for example, indicates that the letter "V" is the mnemonic for that selection, and that pressing the "V" key on the keyboard will activate the View selection. (See also: accelerator.)

model area: The area of overlap in a pair of stereo images that is selected for creation of a DEM.

MODIS: Moderate Resolution Imaging Spectroradiometer that collects multispectral images aboard NASA's Terra (EOS AM) and Aqua (EOS PM) satellites. These satellites view the entire earth's surface every 1 to 2 days with the ability to directly broadcast in real time its raw data to appropriately equipped ground stations.

monochrome image: An image displayed in a single color or shades of a single color.

morphological analysis: A process that alters or extracts shapes within an image. The morphological functions provided in TNTmips are dilation, erosion, opening, closing, clump, and sieve.

mosaic: A large image assembled from segments. Each segment may come from a different source and have a different cell size and angle of orientation, but all the segments must be geometrically rectified and calibrated to a common coordinate framework. The mosaic process rotates and re-scales each piece and creates a single combined object. If all segments are georeferenced to the same map projection, they can be automatically mosaicked based upon their geographic calibration without additional adjustments. Recognized verbal forms of mosaic are mosaic, mosaicked and mosaicking.

MOSS: Map Overlay and Statistical System. A pioneer vector-based geographic information system (GIS) developed and still widely used by groups in the USDI, especially the USF&WS and BLM. MOSS vector data files contain strings of coordinate pairs which describe closed polygonal areas, lines, and single point fea-

tures. Common boundaries between adjacent polygons are repeated twice in this data structure, once with each polygon. Much geographic data is available in this format, especially that portion of the NWI wetland maps which have been digitized.

motherboard: The main circuit board in a microcomputer. The motherboard normally contains the main processor, logic chips, memory, and expansion slots for optional circuit cards.

mouse: A computer graphics pointing device. As you move a mouse across the desktop, the mouse cursor moves across the image display.

mouse cursor: Shows the position of mouse activity or focus on the screen. The mouse cursor changes shapes to show the function currently assigned to the mouse. For example, an arrow pointer indicates that the mouse may be used for selection. An hourglass or clock shape shows that the mouse is inactive during a processing activity.

mouseover highlight: A color or other change to identify the element the mouse is paused over.

mouse pointer: See: mouse cursor

MRI: Magnetic Resonance Imaging. A technique used in medicine to collect computer images of internal organs and systems for examination and evaluation. A device used in medicine.

ms (millisecond): One thousandth of a second. A measure of average disk access time (the time it takes the drive to position the read/write head over the requested track).

MSS: Multi-Spectral Scanner. A sensing device on the Landsat satellite that collects simultaneous images over multiple ranges of the spectrum.

multi-byte strings: Text in some character encoding schemes exceeds the 256-character limitation of single byte encoding. In multi-byte systems, characters are allotted 2 or 4 bytes each.

multi-frame capture: Capture of two or more frames in a video.

multilingual application: A computer program that allows the user to mix multiple languages and character sets is said to be multilingual such as a word processor that allows side-by-side columns of English and Japanese, or even mixture of Latin characters within a longer Japanese text. Multilingualization is more complex than internationalization, which limits the program to one local language at a time. TNTmips offers multilingual support, paticulary with annotation tools for map and poster layout which allow mixing fonts of different character sets. Thus for example, it is possible to create a map that has both Thai and English annotations.

multiple raster set: A set of coextensive raster objects displayed in unison. When the multiple raster display mode is RGB, HIS, or HBS, three objects are included in the set. When the multiple raster display mode is RGBI or RGBB, four objects are included. One object in the set is assigned to each display component.

multisensor images: Coregistered images with the same cell size collected by different sensing devices. For example, a 10-meter SPOT panchromatic image can be coregistered with a resampled Landsat TM image so that their cells correctly match. This combination is called a multisensor image.

multispectral images: Images optically acquired in more than one spectral or wavelength interval. Each individual image is usually of the same physical area and scale but of a different spectral band. The MSS and TM sensors aboard the Landsat satellite both collect simultaneous multispectral images. The TM sensor scans and stores seven individual images in spectral bands ranging from the blue wavelengths up to those in the thermal infrared.

multitemporal images: Coregistered images collected at different times by the same device. For example, airvideo images collected one year apart, digitized, and warped to the same geometry are called multitemporal images and can be analyzed to map the changes between the dates.

multivariable images: An image stored on more than one independent, coregistered

raster. For example, a video frame-grabbed image stored as independent red, green, and blue rasters is a multi-variable image. So too is any multitemporal, multispectral, or multisensor image.

multivolume project file: A project file that is spread over more than one media unit by linking to objects on other devices.

— N —

nadir: The point on the ground vertically beneath the imaging sensor. That is, if you imagine a straight line drawn from a sensor to the center of the earth, the nadir is point where that line intersects the surface of the Earth. For radar imaging, the nadir corresponds to the beginning of the near range.

NAPP airphotos: National Aerial Photography Program airphotos. USGS CIR high altitude airphotos. The NAPP series replaces the NHAP series. (See also: NHAP.)

NASA: National Aeronautics and Space Administration.

navigation: Moving a selection highlight or location cursor with a mouse or keyboard through the levels of a menu and window system.

ND, ND6 and **ND7:** Normalized Difference. Vegetation index computations developed for use with Landsat MSS. These vegetation indices are now commonly used with any image that has the required spectral bands. The bands required are approximately equivalent to the red and the photo-infrared spectral bands measured by color-infrared film. The ND6 index used MSS band 6, and ND7 uses band 7. Since these two Landsat MSS infrared bands are so highly correlated, similar results are possible using either of the computations or with any images that have an equivalent photo-infrared spectral band. Good color-infrared image sources for processing into an ND or green biomass raster include Landsat MSS and TM, SPOT CIR, 35mm CIR film, 9" CIR film, and CIR video.

near range: That portion of a synthetic aperture radar (SAR) image that is nearest the aircraft flight path.

nearest neighbor sampling/interpolation: Resampling a source raster to yield a new raster with a different cell size, raster orientation, and/or internal geometry by computing the distance between the center of each cell in the output raster and the 4 nearest cells in the input raster. The data value for the closest input cell is assigned without alteration to be the data value of the output cell. Therefore, the input value of one input cell may be assigned to more than one output cell. It also means that some input cells may not be transferred at all to the output raster. These undersampling and oversampling situations occur when the cell sizes of the input and output raster are different.

For example, a resampled output raster which is coparallel to the input raster but which has cells half as big, will repeat the input values in a 2 x 2 cell pattern. However, since nearest neighbor resampling does not mathematically compute the new cell's value, it is the only suitable choice for rasters that are not mathematically continuous such as land cover maps. With such maps, mathematical resampling (like bilinear, or cubic convolution) is totally incorrect since mean values cannot be computed.

neatline: A cartographic term that means the border drawn around the perimeter of an object.

nested folders: A set of folders within each other.

Network Analysis: A process that determines the optimal path between two points with any number of stops and route control parameters taken into consideration (route mode). You can also locate centers (points) and identify the linear components of the network that should feed that center or that the center should service (allocate mode). Both modes use the characteristics of the lines and nodes in the network.

NGA: National Geospatial-Intelligence Agency (formerly NIMA).

NHAP: National High Altitude Photography program. NHAP was coordinated by

USGS and operated from 1980-1989 to provide a publicly available collection of black and white and CIR airphotos covering the conterminous United States. The program was renamed NAPP in 1987.

NIMA: National Imagery and Mapping Agency (formerly DMA, now NGA).

nibble: A data element made up of 4-bits and having 16 possible values. Nibbles are stored two to a byte.

NOAA: National Oceanographic and Atmospheric Administration.

node element: A vector element required for topology that has no attributes except position; nodes occur at the ends of all lines and at all line intersections if the vector object has polygonal topology.

nominal image map: A preliminary map form that approximates an image map and that can usually be prepared using fully automated procedures. For example, TNTmips can automatically extract a 7.5' nominal image map from Landsat or SPOT satellite images using the positional and angular properties provided with the images. However, to convert it to an accurate image map, the user must introduce ground control points.

A topographic map that has been scanned (but not yet calibrated) is another example of a nominal image map. Similarly, using TNTmips to mosaic airslides or airvideo images that cover the area of a 7.5' map provides a nominal image map. (By contrast, rectifying and assembling these source images yields an image map, since that process used ground control points in some map coordinates.) (See also: image map.)

non-interlaced video: Video signal formats used in some display boards and monitors. A non-interlaced video display board refreshes the whole display every 1/60 of a second. It does not intersplice fields but paints each successive line from top to bottom of the screen.

normalized contrast: See: contrast.

Normalized Difference: See: ND

normalized histogram: A histogram whose distribution has been adjusted so as to have as close to a normalized (bell-shaped) distribution as possible. The data value that occurs most frequently will be near the center of the histogram. Multimodal histograms are those which have two or more significant peaks in their distribution and cannot usually be satisfactorily normalized.

northing: A rectangular (x,y) coordinate measurement of distance north from an east-west reference line, usually the equator or other parallel used as the axis of origin for a map zone or projection. *False northing* is an adjustment constant added to coordinate values to eliminate negative numbers.

NRCS: National Resources Conservation Service. A service of the United States Department of Agriculture to provide leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment. Formerly SCS.

NTSC video: National Television System Committee video. The standard format used by all American home video equipment (like VCR recorders and television sets). All the necessary color information is encoded in a single interlaced signal which is often called composite color video.

null value: The absence of a value in a raster object. Null values often occur when a raster is extracted or resampled such that the minimum bounding rectangle is not coincident with the raster edges. Null values may also occur within the image. Null is not the same as zero.

number of weighted runs: A type of information provided with a spectrum in a Hyperspectral Analysis spectral library. Each spectrum in the library is generated in a laboratory and is actually the result of multiple runs. The number of laboratory runs is reported as the number of weighted runs.

NWI: National Wetlands Inventory conducted by the USF&WS.

— O —

object: An integrated, organized unit of data stored either in a TNTmips project file or in an external, but attached file. These include raster, vector, database, and text object types.

OCR: Optical Character Recognition.

ODBC: Open Database Connectivity is used to communicate with database management systems.

OGC: Open GIS Consortium.

on-the-fly labels: Labels that are not stored as elements in a vector object but are generated during the display process using specified parameters.

opaque color: When a new color feature completely masks out an earlier feature in an image, the new feature is composed of opaque color. For example, a polygon can be overlaid or drawn in opaque color upon an image so as to completely obliterate the original features in that portion of the image.

open reel tape: (historical term) Medical images and satellite images from mainframe and minicomputers were once commonly distributed on 12-inch reels of magnetic tape in standard format.

operand: A parameter that designates a raster object's identification and location in a raster algebra expression.

operator: The function in a raster algebra expression that describes action upon a raster object or the process by which raster objects, or operands, are to be combined.

optical disk: (historical term) A medium for computer file storage consisting of removable optical disk cartridges. Each side of a two-sided optical disk typically holds from 300 to 500 megabytes of data. These disks havbe been supplanted by CDs and DVDs.

optimization: The process by which TNTmips assigns display colors to the raster object cell values for display of multiple raster objects for 8-bit (256-color) display modes. After TNTmips condenses the values, 4096 possible colors remain. Of the 256 colors that can be displayed on an 8-bit display board, there is a standard set of 64 colors assigned to all raster objects, which are always "known" and available for annotation and vector overlays. The remaining 192 colors assigned to the color map, are those that occur most frequently in the RGB set of objects being displayed. The colors in this RGB set that are not found in the 256-member color map are assigned to be displayed as their closest match in the color map. This process produces a very good natural color image on an 8-bit display board.

option: An item on a menu.

option button: A type of button that opens an option menu. When a new selection is chosen from the option menu, the new selection is displayed as the button label.

Oracle Spatial: A relational database management system from Oracle Corporation that includes spatial elements, which TNTmips can directly display as a shape object or import to a vector object.

orthoimage: An airphoto or satellite image that has been processed to remove perspective distortions and so to have the properties of an orthographic projection. Distortions of tilt and relief are removed so that all features in an orthoimage are in their true orthographic positions.

orthophoto: An airphoto that has been scanned, rectified, and reconstructed so as to represent its features in a map projection or at least in a flat rectangular form without the usual distortions of geometry and perspective. Usually orthophotos are prepared from very high resolution stereo pairs.

outliers: Geodata points that lie far from the regression line. Outliers can be legitimate geodata points that show the extreme variability of the geodata or they can represent errors, such as incorrectly recorded geodata, an instrument malfunction, and so forth. Researchers drop outliers from statistical analyses when the outliers are shown to be errors because the outliers can skew statistical analyses.

outline font: A font in which each character

is described by a set of lines or polygons rather than by individual pixels. Thus, outline fonts can be rescaled to any size and displayed at any resolution with no degradation of appearance. (See also: bitmapped font.)

outline highlight or **location box:** Shows which menu selection or button in a window is the object of keyboard or mouse focus.

out-of-gamut colors: Colors that are not convertible to the "gamut" of colors displayable on a color monitor. Out-of-gamut colors may be encountered when PhotoCD imagery is imported into TNTmips.

overlay: (vector, CAD, shape, TIN) A largely transparent layer placed on an underlying image. The overlay is where symbols, annotations, or image traces can be created or displayed without changing the underlying image. A TNTmips symbol overlay is a vector object with symbol shapes assigned to its nodes so that the symbols line up with features of interest on the underlying image. For example, a duck symbol might overlay a duck habitat feature and be linked to a database record with site specifics.

overshoot: A line that extends beyond an intersecting line where it was intended to end.

OWS: Open GIS Consortium (OGC) Web Services.

— P —

page layout: The process of selecting, sizing, and positioning multiple items to compose a page for printing. Also the result of this process.

PAL: Phase Alternating Line. A video standard generally used by the rest of the world outside the United States and Canada that is not compatible with NTSC.

pan: To move over an area of an image that is larger than the on-screen viewing area.

panchromatic image: An image collected in the broad visual wavelength range but rendered in black and white. The term

has historically referred to a black and white photograph of a color scene. Since the SPOT satellite 10-meter images are collected over this broad visual spectral band and are usually rendered in black and white, these images are called panchromatic.

pane: A resizable subarea of a window containing related options or components and set off from other areas of the window by separators. The Tab key moves the location box from pane to pane. The arrow keys move the location box from component to component within one pane.

panel: A work area in a window composed of basic controls such as an array of buttons and sliders.

panoramic: A type of view in which the viewer has an unobstructed view of an extensive area.

parallax: The apparent change in relative positions of stationary objects caused by a change in viewing position. Parallax displacements in overlapping images only occur parallel to the line of flight.

parallel: Two or more lines that are separated by the same distance at all points. Also a horizontal circle on the globe at a constant latitude.

parallelepiped classifier or **decision rule:** A simple form of automated computer interpretation slightly more complex than boxcar interpretation. For parallelepiped classification, the boundaries between classes need not be rectangular or parallel to the axes. A parallelepiped area representing the location of each material sought is prism-shaped in the 2-, 3-, or n-dimensional distribution of the available multivariable images. (See also: boxcar classifier)

parallel port or **parallel interface:** A physical connection between a computer and a peripheral device, such as a printer. A parallel port uses a connection that has more than eight wires. Eight of the wires simultaneously convey the eight bits in a byte of data, while the remaining lines control status information such as "send me more" and "stop sending." Standard parallel ports in Windows are named LPT1, LPT2, and LPT3.

parallel projection: A visualization of a three-dimensional object as a wireframe object in which parallel lines remain parallel throughout the view.

parallels: Circles on the earth's surface, or lines on a map that are perpendicular to the axis of the earth, and mark latitude north or south of the Equator.

parent object: An independent prime object in a project file related to some other prime object below it in the project file hierarchy. An object linked by Hyper-Index to some other objects is the parent of those objects (referred to as its daughter objects). (See also: daughter object, HyperIndex, index area, link, stack.)

Paris classification: An unsupervised classification or clustering process developed by Dr. Jack Paris and documented in: Jack F. Paris and Helenann H. Kwong (1988) Photogrammetric Engineering and Remote Sensing 54(8):1187–1193. *Characterization of Vegetation with Combined Thematic Mapper (TM) and Shuttle Imaging Radar (SIR-B) Image Data.*

path: A description of the hierarchical chain of directories that define the logical location of a file. A path specifies a location using a string of characters signifying directories, seperated by a delimiting character, most commonly the slash "/" (as in Unix/Linux) or backslash character "\" (as in Windows).

PC ARC/INFO: A vector-based Geographic Information System (GIS) developed and marketed by ESRI, Inc.

PC ARC/INFO coverage file: pcARC/INFO's legacy data directory for the 13 different file types used to store the equivalent of a single TNTmips vector object.

PCIPS: (historical term) A raster-based microcomputer image processing system developed in the early 1990's and distributed by IBM. PCIPS was a menu-oriented entry-level system for systems with CGA and EGA video boards.

PC-8: An 8-bit (256-character) IBM super set of the 7-bit ASCII character encoding scheme that includes various symbols plus Latin characters with diacritics. Printers and other output devices do not deal with the upper 128 characters in a standard fashion. Thus, what looks like an "i" with two dots instead of one (ï, PC-8 character 139) on the screen may print as something completely different. PC-8 makes different assignments for codes 128-255 than does Latin-1, and thus is not a proper subset of Unicode or ISO 10646.

pen: One type of pointing device (sometimes called a "stylus") used with an X-Y digitizing tablet. It has a pencil-like feel which makes it ideal for free-hand drawing. (See also: pointing device, puck.)

pen plotter: An output device for line drawings that mechanically moves an ink pen over the drawing surface.

perceptual rendering: A rendering intent that is best for photographic images when the destination gamut is narrower than the source gamut. Perceptual rendering compresses the entire source gamut while preserving the relationship between colors.

peripheral device: A hardware device that is not part of the computer, such as a printer, scanner, or digitizer.

perspective projection: A visualization of a three dimensional object in which parallel lines converge towards a vanishing point.

petabyte, Pbyte, or **PB:** A unit of computer measurement for 2^{50} (approximately) 1,000,000,000,000,000 bytes, 1,000,000,000,000 kilobytes, 1,000,000,000 megabytes, 1,000,000 gigabytes, or 1000 terabytes. (See also: bit, byte, exabyte, gigabyte, kilobyte, megabyte, terabyte.) Also petabyte.

photogrammetry: Obtaining precise measurements from images.

photointerpretation: Analyzing, measuring, and categorizing chosen features from airphotos.

physiographic: Describing the characteristics of a site's physical geography.

picklist: A defined set of allowable attributes for a particular feature type that is provided as a list.

pictograph: A pictorial sign or symbol, for instance, representing a person with a stick figure.

picture element or **pixel:** "The smallest element of an image that can be individually processed in a video display system" (*Random House*).

piecewise affine: A transformation method for rectifying images that assumes each control point is correctly positioned and then uses these points in groups of three to transform an image by transforming each triangular portion of the total image.

Pinyin: (literally, "spell sounds") The phonetic alphabet based on Latin letters adopted in the People's Republic of China in 1958 based on the Beijing/Mandarin version of spoken Chinese.

pixel or **picture element:** "The smallest element of an image that can be individually processed in a video display system" (*Random House*). The text and images on a computer display are created by combinations of individual dots (pixels). Different display hardware allows for more or fewer pixels on the screen, determining the display resolution that is possible. The more rows and columns of pixels, the finer the image detail that can be resolved.

pixel depth or **color depth:** The number of data bits each pixel represents. In 8-bit contexts, the pixel depth is 8, and each display pixel can be one of 256 possible colors or shades of gray. With a 24-bit raster (or with three coregistered 8-bit rasters) the pixel depth is 24, and 16,777,216 colors are possible.

planimeter: "An instrument for measuring mechanically the area of plane figures" (*Random House*). TNTmips contains the electronic equivalent of a planimeter; you use the mouse to draw around a shape on the display screen and TNTmips calculates and displays its area.

planimetric map: A map designed to portray the horizontal positions of features; vertical information is specifically ignored.

PNG: Portable Network Graphics. An image format for lossless compression developed as a patent-free replacement for GIF.

point element: A single point defined by a set of coordinates in space, and one of the types of elements in a TNTmips vector object.

Vector elements may cross-index their class attribute to a list containing the element drawing style, which may include polygon fill pattern, point symbol, line width or symbol/point size, RGB color, RGB label color, RGB fill color, label font number, label font size, label font zoom factor, label font style, and label rotation angle.

pointing device: A hand-held drawing tool used with an X-Y digitizing tablet to register coordinate data. This can be either a mouse-like puck or a pen. (See also: pen, puck)

point size: The vertical size of a text font is expressed in points. There are 72 points in an inch, so a 12-point font would be 12/72, or 1/6 of an inch tall, while a 36-point font would be 36/72, or 1/2 inch tall. Of course the heights of different letters vary ('L' is taller than 'e'). The point size refers to the distance between the highest ascender in a font's character encoding scheme (the part above the line in a letter like 'l' or 'b'), and the lowest descender in the set (the part below the line in a letter like 'g' or 'y'). (See also: bitmapped font, outline font)

polygon element: A type of element in a TNTmips vector object. A polygon is defined by a list of line elements stored elsewhere, which can be retrieved and assembled to form a closed shape.

Vector elements may cross-index their class attribute to a list containing the element drawing style, which may include polygon fill pattern, point symbol, line width or symbol/point size, RGB color, RGB label color, RGB fill color, label font number, label font size, label font zoom factor, label font style, and label rotation angle.

popup menu: A hidden menu that opens by pressing a mouse button, usually in some specific area of the display, such as over the background. The system gives no visual clues that indicate the presence of a popup menu.

port: A physical and logical interface for a connection device between a computer and another component (such as a printer or a modem).

PostScript®: A standard page-description

language for sending image information from a computer to a printer. PostScript was created by Adobe Systems, Inc., and is used in many computerized phototype-setting systems.

pour point: (watershed analysis) The low point on the boundary ridge between two neighboring watersheds. It is the point through which water from one water-shed would begin spilling over into its neighbor if it were completely filled.

precomputed: An object saved in the format in which it will be viewed, such as a tile-set.

prerendered: An object saved in the format in which it will be viewed, such as a tile-set.

primary key: An important field within a database record. Each table may have only one primary key. Designation as a primary key requires that all records have an entry for the field and that each record's entry for this field be unique. (See also: database object, field, foreign key, record, table.)

primary object: One of the basic types of project file objects with which a TNT-mips user works: raster, vector, CAD or database. (See also: project file.)

Prime Meridian: The meridian on the earth's surface from which longitude is mea-sured; generally the meridian of Green-wich, England. This meridian divides the earth into eastern and western hemi-spheres.

principal components: A statistical tech-nique for reducing an image's dimen-sionality. Principal components chooses uncorrelated linear combinations of a set of rasters in such a way that each succes-sively extracted linear combination, called a principal component, has a smaller variance. If the rasters have sig-nificant linear intercorrelations, the first few components will account for a large part of the total variance.

principal point: (photogrammetry) The foot of the perpendicular from the inte-rior perspective center to the plane of a photograph. The principal point is physically located at the center of the photograph by intersecting the lines that connect opposite fiducial marks.

printel: The smallest element a printer can print, or a single "dot" on a printed page. The printed equivalent of a pixel.

print-file: A file created from a TNT page layout that includes all information nec-essary for a designated printer to print the file. Unlike print-rasters, print-files are not viewable in the TNT diaplay pro-cess. Print-files created using the TNT print drivers are actually a pair of files: one with the name you assign and a .prf extension (small file), the other with the name you assign and a .p1 extension (large file). If the layout is printed with TNT drivers and covers multiple pages, there will also be a *.p2 file and so on. There is just one *.prf file regardless of the number of pages. Print-files created using the Windows printer driver have a .prn extension and there is only one print-file regardless of the number of pages. Print-files are supported on the Macintosh but only using TNT printer drivers.

You may want to create print-files when you will be printing at a later time par-ticularly if the printer is attached to a machine that does not have TNT installed. Print-files can be printed from within TNT (Main/Print From/Print-File) or by copy-ing the file to the port for the printer des-ignated when the print-file was created.

print-raster object: A raster that contains a dot-by-dot representation of a color print page that is viewable and can be manipu-lated in the TNT products like any other raster object. Print rasters are either 4-bit (dithered) or 24-bit (undithered). Each cell in a dithered print-raster object is a nibble (1/2 a byte or 4 bits), which can specify 16 data levels. The 8 values cur-rently used define one color composite dot on the printed page. Printers create each color composite dot from dots of cyan, magenta, and yellow (and possibly black) or red, green, and blue (and possi-bly black). Combinations of the three colors together with black and white are specified by each nibble's 8 possible data levels.

You may want to create print rasters when you are planning additional modifications of the raster or you want to be able to

view it before printing. You specify the desired printer at the time you print a print raster (Main/Print From/Print-Raster).

probability: "A statistical description of the relative possibility that an event will occur. Probability is expressed as a ratio of the number of actual occurrences to the total number of possible occurrences" (*Random House*).

processing mask: You define a processing mask in the Feature Map process to identify which portions of an image to include in the Feature Mapping analysis, and which to exclude. The processing mask can be as complex as you like. For instance, you can outline an irregular area in an airphoto to include, but exclude lake surfaces in that area, and yet include islands in the lakes. (See also: mask)

processing raster(s): TNTmips image interpretation processes can use either a single raster object or a set of raster objects. That is, you can use one raster object for the *display*, and another raster object or set of raster objects for *processing*. In the simplest case, you use the same raster object for both the processing raster object and your reference on the display. In a more complex case, you use one raster object for the display image, and a whole set of raster objects for processing. (The processing set may include the display raster.) For instance, you could use a raster object with a composite natural-color image of the study site for the display, while using the seven raster objects containing the spectral bands of the Landsat Thematic Mapper data for processing. (See also: reference image.)

profile: XY plot of values, such as elevation / distance.

profile format files: These files tell printers, monitors, and other hardware devices how to provide sRGB colors. Profile format files go by two names: ICC on the Macintosh and ICM on WIndows platforms.

Project File: TNTmips' integrated data structure for large, user-defined collections of objects and subobjects. This single structure allows for the creation and manipulation of rasters, vectors, database files, and text files. A Project File is a single, conventional Windows, Macintosh, Linux, or Unix file that may be as large as 4 gigabytes for Windows 98 and XP, and up to 16 terabytes for newer operating systems.

projection or **map projection:** "A device for representing all or part of a rounded surface on a flat sheet. Since this cannot be done without distortion, the cartographer must choose the map characteristic [area, shape, scale, direction] which is to be shown accurately at the expense of others." *Map Projections Used by the U. S. Geological Survey*, Geological Survey Bulletin 1532, Second Edition, U. S. Government Printing Office, Washington, D. C. , 1982, p. 5.

Every process that establishes or translates map projections offers the same standard selection list of projections. The practical choice of map projections for ungeoreferenced project materials is normally determined by the kind of projection used by those project materials that are calibrated to a projection. For example, if you have a scanned USGS topo map in the polyconic projection, you may decide to calibrate satellite images and vector overlays (or translate existing calibration) to the same projection. (See also: ellipsoid.)

prompt: A screen display, such as a blinking underline or a question mark that may be accompanied by a beep, indicating the need for a keyboard response by the user.

prototype or **training set:** Sample cells in an image known to represent a feature type or ground cover of interest that you define from ground visitation, detailed airphoto interpretation, or other personal experience.

prototype cell or **training cell:** One sample cell that you select as belonging to a feature type. May also be called a "training cell."

proximity map: A map that shows the distance from selected features by gradient shades of color. TNTmips can produce a "distance raster" that shows distances from vector elements. Cells that are close to the vector elements have low values,

and cells that are farther away have higher values. When displayed such raster objects show greater distances with greater display intensities.

pseudo-color image: A color image that does not directly render the colors of the original image from individual red, green, and blue color values. A pseudo-color image could result from such processes as assigning colors to the gray levels in a grayscale image or assigning colors to a cluster map. A color map pairs a display color with each possible cell value in a pseudo-color image. (See also: composite color raster object.)

puck: One type of pointing device (sometimes called a "cursor") used with an X-Y digitizing tablet. It has a crosshairs lens which allows for precise placement of digitized points. (See also: pen, pointing device)

pulldown menu: A menu that opens under a menu title on the menu bar.

push button: Button that starts the operation indicated by the button's label. A push button cannot be left "on" or "off." (See also: toggle button.)

— Q —

quad, quadrangle, map quad or **map quadrangle:** The geographic area covered by a map. One kind of map quadrangle is the 7.5' x 7.5' area that is covered by a standard USGS 7.5' topographic map. Referring to a 7.5' map quadrangle does not imply the presence of an actual paper map. The term may simply designate the area covered by electronically stored materials.

quadkey: Short for quadtree key. This term is used by Microsoft in connection with Bing Map tilesets to index the positions of individual tiles.

Quadratic BSpline: A curved smoothing that can be applied to a line. A BSpline is calculated by a polynomial equation. Different types of BSplines, such as Cubic BSpline and Quadratic BSpline, can be calculated from different types of polynomial equations.

quadtree: A method of representing two-dimensional space by recursively breaking a square of space into four squares half its size, which are made its children in a tree data structure.

quantization: Dividing a continuous range into a finite set of discrete values called quantization levels. If too few quantization levels are used, false contours may appear in an image. Quantization levels are often referred to as "gray levels," but the concept can also apply to color images.

query: A query, or database query, is a set of instructions defining attribute criteria that are used to select records from a database. The specific spatial elements (such as lines or polygons) to which those records are attached are then automatically selected for the current process.

— R —

radar image: An image composed of many pixels, each of which represents the radar back scatter for that area on the ground. Darker areas have less back scatter than brighter areas. Bright features in an image are those that return a large fraction of the radar energy to the sensor, while dark features reflect little or no energy to the sensor.

radiance: "Radiant brightness or light: the radiance of the tropical sun" (*Random House*).

radio button: A type of toggle button in a group of toggle buttons where only one of the toggle buttons can be on at a time. A radio button is preceded by a graphic indicator of the state of the button.

RAM: Random Access Memory. Read/write memory for programs and data that the computer uses as a general work area. The more RAM in a computer, the more general work space it has and the larger the projects it can handle.

RAM disk: RAM that is reconfigured to work like a very high speed disk drive.

The system uses a RAM disk just as it does any other disk drive. But since a RAM disk is not a true magnetic storage device, its contents are lost when the computer is rebooted. Any permanent files must be copied from a RAM disk to permanent storage before turning off or rebooting the computer.

range extraction: A method of converting a grayscale raster object into a binary version. In range extraction, two boundary values are selected to bracket the desired range of grayscale values. Everything above and below the boundary values is set to 0 (black), while everything between the boundary values is set to 1 (white).

raster or **raster object:** A single, related, two dimensionally grouped set of numbers of a single data type. Each number represents the value of some parameter. Its position in the group represents its relative position to the other values. A raster object is a raster that is stored in an RVC project file.

raster algebra: Manipulations and functions that operate on raster objects cell by cell. Any raster object can be used as a variable, or operand, in a raster algebraic expression. You just set up a combination of operands in an equation and then assign a raster object to each operand. The result of the operation is stored in a new raster object.

raster cell: One value in a raster. If the raster contains geodata, such as an image or elevation surface, each raster cell corresponds to one specific area on the ground. A raster cell value may be the elevation above sea level at one position in a survey site or the intensity of red radiation for a pixel in a video image. For convenience, a raster cell is usually thought of as square or rectangular, although many image collection devices actually measure circular or elliptical areas.

raster space: The area of a raster object stored in an RVC Project File. This area can be very large, up to 2,000,000,000 by 2,000,000,000 cells.

RDBMS: A Relational Database Management System has data organized in tables that can be related to each other using primary/foreign keys.

record: A database in TNTmips is organized into tables, which contain records. Each record supplies information gathered for an individual example. Records contain one or more fields related to the topic of the table in which they are found. For instance, the Crow Butte soil polygon database has a table of crop potentials, and there is a record for each soil type. (See also: database, field, table.)

rectification: Removing geometric distortion from a raster or a vector object. Rectification is usually achieved by aligning raster features or vector coordinate positions with features in a base map or other coordinate reference framework. Rectification may be used to bring several distorted image segments into a common framework so they can be combined into a larger image.

reference image: An image on the display used for visual reference that is generated by (or otherwise corresponds to) a raster object or set of raster objects. For instance, TNTmips image interpretation processes can use either a single raster object or a set of raster objects. That is, you can use one raster object for the *display*, and another raster object or set of raster objects for *processing*. In the simplest case, you use the same raster object for both the processing raster object and your reference on the display. In a more complex case, you use one raster object for the display image, and a whole set of raster objects for processing. (The processing set may include the display raster.) For instance, you could use a raster object with a composite natural-color image of the study site for the display, while using the seven raster objects containing the spectral bands of the Landsat Thematic Mapper data for processing. (See also: processing rasters.)

region: A simple object used to define a complex geographic area of interest. Regions have rudimentary topology in that alternating nested polygons are inside then outside the region. Regions provide sophisticated and powerful selection capabilities for analytical tasks.

region of interest: (Feature Mapping) Defines the area of the input raster objects to be considered for all subsequent pro-

cessing while that region is selected. A selected region of interest affects the categories that can be defined, limits the area in which cells that satisfy the decision rule are searched for, and defines the region of the feature mapped raster for which measurements are tabulated in Feature Mapping's statistical report. Feature marking is also limited to the region of interest. (See: categories, feature mapping.)

registration: Geometrically aligning sets of image data such that corresponding features are coincident. (See also: coregistration.)

regression line: A line that best describes all the data points using a particular method of error estimation, such as least squares.

relative colorimetric rendering: A rendering intent in which an exact color match is required in everything but brightness, which may be modified so that the range of brightness matches that of the destination gamut. The source white is transformed into the destination white, and all other colors are shifted accordingly.

relief: (as in shaded relief) The variation in a raster object's values that shows differences between a surface's higher and lower parts in elevation and slope.

render: Create an electronic or hardcopy representation, particularly of an outline font. When an outline font is rendered, it assumes a fixed size and shear angle on the screen, raster, or hardcopy to which it is rendered.

rendering intent: Determination of how to handle colors that are available in the source image that are not available for printing from the following choices: absolute colorimetric, relative colorimetric, perceptual, and saturation.

reproject: To change an object from one map projection to another. In the TNT products, reprojection can be done on-the-fly in the Display Spatial Data process, or it can be used to create a new object with the desired projection using the resampling or warping processes.

resample: To interpolate cell values in a raster object and create a raster with larger or smaller cells. TNTmips resamples ras-

ters "on-the-fly" to change their scale or orientation for display purposes. The means to save raster objects with changed scale, orientation, or geometric proportions is also provided. (See also: interpolation.)

residual: The difference between a value computed by a model and the value entered by a user such as is found in the Georeference process.

resize: To change the height and/or width of a window.

resolution: The level of object detail or sharpness determined by how many picture elements compose an area of a display or corresponding raster. Resolution may refer to sensors, raster objects, or displays. Low resolution display devices produce images with a grainy visual texture. High resolution displays use such small picture elements that they can produce a near-photographic quality image. (See also: ground resolution.)

resolution: (digitizer) The smallest movement that can be detected by the digitizer. Resolution is usually expressed in either measurement units (.001") or dots-per-inch (1000 dpi).

restitution: The determination of the true (map) position of objects or points; the image appears distorted or displaced on unprocessed aerial photographs. Restitution corrects for displacement resulting from both tilt and relief displacement. Restitution in classic photogrammetry is commonly achieved by analytical methods or through the use of stereoscopic plotting instruments. The orthorectification processing step in TNTmips applies elevation information from an elevation raster object to an image to produce an orthoimage output raster object.

RGB: Red, Green, and Blue. The red-green-blue color model uses position within a cube to describe colors. The axes of the cube are the red, green, and blue values. The shades of gray are found along the diagonal from the origin of the cube, where red, green, and blue values are zero and the apparent color is black, to the opposite corner, which appears white (red, green, and blue values are 100%).

RGB is generally used in reference to the separated spectral bands of an image so that the red, green, and blue bands taken together create a natural color image. (See also: HBS, HIS.)

RGBB: A display method that converts an RGB raster set into an HBS raster set and then substitutes a fourth coextensive raster object for the brightness component before conversion back to RGB components for display. The object selected for the brightness component is generally of higher resolution than the objects selected for the RGB components and imparts a higher pseudo-resolution to the displayed image. (See also: HBS, RGB.)

RGBI: A display method that converts an RGB raster set into an HIS raster set and then substitutes a fourth coextensive raster object for the intensity component before conversion back to RGB components for display. The object selected for the intensity component is generally of higher resolution than the objects selected for the RGB components and imparts a higher pseudo-resolution to the displayed image. (See also: HIS, RGB.)

RGB set: A set of coregistered, coextensive rasters that represent the red, green, and blue bands of an image.

RGB video: A video image composed of separate red, green, and blue signals. RGB video is a general term that applies to different technologies (analog or digital) and standards (like TTL and RS-170).

RMBM: right mouse button menu.

root table: A table at the root of the hierarchical database tree (left-most side of the tree) in the Database Editor.

root window: The main window of the X server in X desktop mode. Each client process runs as a subwindow within the root window. On Windows systems, you can choose to display the MicroImages X Server title bar if desired. Besides identifying the MicroImages X Server, this title bar provides access to preferences, the overview window, the X server version number, and MicroImages' technical support email address

row: A horizontal list of data values or display cells in a raster object or display.

RPC: Rational Polynomial Coefficient used for producing an orthorectified satellite image.

RS-170 video: An historical standard for RGB analog video in the USA that governs the form of the RGB color signals. RS-170 video has a 15.7 kHz horizontal scan rate and a 30-cycle per-second frame rate. It is not modulated with a carrier as is broadcast video.

rubbersheeting: Any process in which a raster is stretched differentially to match a new set of geometric constraints. This shape change could be defined by any one of many transformations such as changing a map projection, trilateration to change the absolute position of cells within a raster, fitting a polynomial to a surface, least squares movement of control cells, and so on.

run-length encoding: A compression method for raster data stored by row with two or more adjacent cells being recorded as a single value and its run (number of cells with that value).

RVC file: Raster/Vector/CAD formatted file. The extension for the TNTmips format for Project Files is .RVC. These files incorporate the benefits of a 32-bit compiler. (See also: Project File.)

RVF file: Raster/Vector Format(ted) file. The DOS extension for all MIPS (v3.3 and earlier) Project Files was .RVF.

— S —

samples: Groups of cells in an image selected to represent one feature type or land cover of interest. You define samples from your knowledge of the site. (See also: prototypes, training sets.)

sample set: For unsupervised classification processes, a set of sample cells that is selected from the input raster set and used to automatically define classes. The selection of the sample set during processing is controlled by a sampling interval (in line and column directions).

sampling: The process of approximating an image using a subselection of pixels.

Sampling is usually done at constant intervals though this is not required. Generally, as the number of samples increases, the quality of the image increases. (See also: resample.)

SAR: Synthetic Aperture Radar. SAR uses a microwave instrument that sends pulsed signals at targets and processes the return signals that it receives. The SAR sensor can function day or night and regardless of weather conditions. SAR differs from other radar imaging processes because it synthesizes a greater antenna length than actually exists. Signals received and recorded by the radar system as it moves along its flight path are Doppler-shifted. By comparing the Doppler frequencies to a reference frequency, many of the returned echoes are focused on a single point effectively increasing the length of the antenna that is imaging on that point. Very precise knowledge of the relative motion between the sensor platform and the imaged objects is required.

sash: A small graphic control component on the separator between two panes. A sash moves the separator to change the size of the panes. Drag the sash with the mouse to make a pane larger or smaller.

saturation: One of the three coordinates that the HBS and HIS color domains use to define a display color. Saturation designates how far away a color is from a gray or neutral color of equal intensity. (See also: HBS, HIS.)

saturation rendering: A rendering intent in which the original colors are modified to exactly fill the destination gamut while preserving the saturation of the colors such that some parts of the color space are expanded and others are compressed. No other rendering method can expand a narrow gamut to be wider.

scalar: An SML variable for numeric values. The SML naming conventions presume any variable that begins with a lower case letter is a scalar value or a string.

scale bar: A map component that shows the map scale graphically. Also called a stadia bar.

scale-lock: A GeoLock option; adjusting the map scale of one View window in a set of open View windows changes to the new map scale all View windows for which you set up scale-locking.

scale value: A number used as a multiplier to translate a set of numbers from one range of values into another. For example, a set of decimal values that range between 0 and 2 could be projected into the numeric range of 0 to 100 by multiplying each number in the set by a scale value of 50.

scanner: A digitizer that produces an image (raster object) from flat input material such as photographs, maps, and drawings.

scatterplot: A graph of point geodata.

script: An uncompiled program written with SML. A script may define styles, create a new display layer, perform custom processing, or a define a tool or macro.

scroll: "To move the current text or image up, down, or across the monitor so that new text or image appears on one edge of the screen as it disappears from the other" (*Random House*). Scrolling is controlled in TNTmips with the mouse and the arrow keys. For example, a list of objects in a project file which is too long to fit on the text screen can be scrolled up and down with the vertical arrow keys.

scroll bar: Indicates position of current view in relation to the whole, and used to change the user's viewpoint. The scroll bar consists of a slider, scroll area ("trough"), and scroll arrows.

SCS: Soil Conservation Service. A service of the United States Department of Agriculture. Now called the NRCS.

SCSI port: Small Computer Systems Interface (SCSI is pronounced "skuzzy"). A physical connection between a computer and a peripheral device, such as an external hard drive or optical drive. Now largely supplanted by USB connectors.

seam: The junction in the area of overlap between raster objects combined by tiling or mosaicking in TNTmips.

SECAM: *Sequential Couleur à Memoire.* A video standard used in France and the former USSR.

sections of land: The U.S. Public Land System divided much of the U.S. into square sections of land with an area of approximately 1 square mile (sides 1 mile long). Since most of this survey was completed in the late 1800s, these sections vary greatly in area and shape. In some areas survey adjustments have created sections as big as 2 square miles. Sections are the basic unit of land ownership in the central and western U.S. They are usually bounded by roads that give rise to the checkerboard land patterns characteristic of these areas.

seed point: (watershed analysis) Any specified point in the landscape used to determine the upslope area (basin) that drains to that point.

segment: A segment is a line or polygon that forms part or all of a glyph. A glyph made from polygons will be filled when printed but may optionally be displayed in outline form. A glyph made of line segments rather than polygons is known as a stroke font. It is faster for the computer to draw a stroke font than a font made of polygons.

select: To choose objects or element types for display or other operations.

select button: The mouse button used to make a selection. TNTmips assigns the select function to mouse button one, which is generally the left mouse button unless you have reconfigured your mouse setup.

selection box: (more properly called the *location box*) A graphical symbol that marks the current location of keyboard focus for an operation. Moved with Tab and arrow keys.

selection highlight: An item displayed in reverse video in a text list, that indicates which member of the list is selected. You complete the selection by pressing the <Enter> key (or double clicking with the left mouse button).

selection query: (in database queries) A selection query is constructed from one or more comparison expressions. Only if the entire query evaluates to "true" (non-zero) for an element, is the element included.

selection set: All elements currently selected by the Element Selection tool for viewing or editing make up the selection set. One element in the selection set, generally the last element selected, is the active element. Attribute assignments and editing changes can be applied to just the active element or to all elements in the selection set. (See also active element.)

semivariance: Statistic that compares adjacent cells and calculates their relatedness.

semivariogram: Plot of semivariance values.

separator: A dividing line that marks a logical division between areas of a window or menu.

serial port: A physical connection between a computer and a peripheral device, such as a plotter. The eight bits in a byte are transmitted serially, or end to end, through a single line while the remaining lines contain status information such as "send me more" and "stop sending." Windows standard serial ports are named COM1 and COM2.

serpentine order: A grid cell numbering scheme found in the Polygon Grid analysis process. When a user selects the Serpentine Order scheme, the sequential numbering proceeds from the lower left cell upward to the top of the first column; numbering then proceeds downward through the second column, and so forth.

shaded relief: See: relief.

shapefile: a popular geospatial vector data format developed by ESRI that can be used by a number of different software products. Shapefiles contain only one element type and have only one attribute table, which has an implied one-to-one attachment type. A shapefile is actually a collection of same-named files with different extensions, some of which are required and some are optional. The file with the spatial elements has a *.shp extension. The other required files are the index file (*.shx) and a database file (*.dbf).

shape object: A coordinate data object with no topology used for direct display of ESRI shapefiles and Oracle Spatial layers.

shear: Angular slant given to a vector font to produce the effect of italics.

shift sequence: A keyboard technique for text entry in a language that uses more than one character set, such as Japanese which uses a mix of ideographs, Latin characters, and Japanese phonetic characters. The user enters a shift sequence to switch from one character encoding scheme to another. Electronically, each character is preceded by a shift sequence byte that identifies its character set.

slant range: The distance measured along a line between the radar antenna and each target (that is, each reflecting point in the illuminated scene). The measurement is perpendicular to the line of flight.

slider: A graphic control component that controls the setting of a variable. Move the slider by dragging it with the mouse to make its associated value larger or smaller.

sliver polygon: A polygon with a very high perimeter to area ratio or simply very small area. Such polygons are often formed when vector objects are merged.

slope: A measure of how steeply a surface or line inclines. Slope is computed by dividing a line's vertical rise or fall by the distance the line travels on the surface (the "rise over the run")—usually expressed as a percent.

smart line following: An interactive process for converting raster line images to line elements in a vector object. The user clicks on a line image, and the process follows the line, over-tracing a vector line. The process stops at the edge of the raster, at the end of the line, or at a spaghetti junction of lines that the user must guide it across.

SML: Spatial Manipulation Language. A programming language for manipulation of the geospatial objects in the TNT products. SML allows you to enter either immediate commands or to write a full program. To use SML interactively, you enter single commands from the keyboard and SML executes each command as it is entered. To use structured programs with SML, you prepare a script ahead of time.

soil association: A soil mapping unit containing adjacent soils, but the survey did not take the time and effort to delineate them. Soil association information is suitable for general planning only: to compare areas, to locate refuge tracts, and certain kinds of land use.

soil complex: A soil mapping unit with two or more soils so intricately mixed that they cannot be shown separately on the map.

soil group: (undifferentiated) A soil mapping unit with two or more soils. For the purposes of the map, there was little value in separating them.

soil mapping unit: An area on a soil map with a complete, closed border drawn by a soil scientist, usually representing an area of one type of soil. A mapping unit is nearly equivalent to a soil phase with the exception of small scattered bits of other soils that are not worth showing.

soil phase: A subset of a soil series differentiated by slope, stoniness, or other characteristics that affect the soil's usefulness.

soil profile: The sequence of natural layers, or horizons, in a soil. A profile extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

soil series: A U.S. category of soil classification including soils that have similar profiles (thickness, arrangement) named for a town or geographic feature near its first observation. Soils in a series are essentially alike in characteristics that affect their behavior in an undisturbed landscape.

solid modeling: The process of rendering a 3D surface from vector type data. This process is widely used in CAD software packages to prepare a realistic color presentation of a component part, a building, or other solid object from complex vector-oriented engineering drawings. In GIS vector-oriented software, contours of the surface of the land stored as vectors might be used to render a solid model of the land's surface.

spaghetti digitizing: Entering line data in no particular order using a digitizer.

SPANS: The *SP*atial *AN*alysis *S*ystem from

TYDAC AG.. SPANS was developed and marketed in the 1990's.

spatial: An adjective applied to objects that vary in space in two or three dimensions.

Spatial Manipulation Language: See: SML

speckle: The image noise typically found in radar images. Radar images with speckle have a grainy appearance that comes from random variations in the strength of the back-scattered signal.

spectral band or **spectral region:** A well-defined, continuous wavelength range in the spectrum of reflected or radiated electromagnetic energy. Red, green, and blue are all spectral regions within the portion of the spectrum that is visible to humans as light. Color-infrared images are composed of red, green, and a spectral region commonly called the photoinfrared, which is not in the visible portion of the electromagnetic spectrum. (See also: color-infrared, electromagnetic spectrum.)

spherical web mercator: Google and Microsoft tilesets structures were designed for global coverage using a spherical adaptation of the Mercator projection called the Spherical Web Mercator (EPSG code 3785). Google Earth and NASA World Wind tilesets use Plate Carrée (Equirectangular). TNTmips tilesets can use any projection and datum defined by EPSG and projections defined by other sources.

spheroid: Any shape that closely resembles or approximates a perfect sphere. In the context of map projections, a spheroid is an *ellipsoid of rotation* that is flattened at the poles, like the earth.

spline: An interpolating polynomial for a set of coordinate points used to fit a curve that connects the points. (See also: Bézier curve)

SPOT: The French *Systeme Probatoire d'Observation de la Terre* from Spot Image S.A. SPOT 1 was launched in 1986 The SPOT 5 satellite, launched in 2002, provides panchromatic images with synthetic 2.5 meter resolution. They can be color-enhanced with SPOT 10-meter color images. SPOT satellites may be pointed at an angle off-axis or off-nadir to collect forward and rearward images: a technique that yields stereoscopic image pairs from which accurate elevation rasters can be computed.

spread: The spread operation changes the colors between two selected tiles in the Color Map Editor window. TNTmips takes the colors in the starting and ending tiles and assigns even color gradations to each tile between them. You can select different spread types to tell TNTmips which way to traverse the color space between the endpoints. (See also: HBS, HIS, RGB.)

sRGB: The standard color space developed by Hewlett-Packard and Macintosh.

spur: A false line segment that extends a short distance beyond a T-junction of two lines. Binary raster thinning processes often leave spurs that should be erased by raster editing before final vectorization.

SQL: Structured Query Language. An ANSI standard for accessing and manipulating databases.

stack: A hierarchical arrangement of images and other information used by HyperIndex that graphically links logically related objects or files. A stack has the inverted tree form of a genealogy chart. (See also: HyperIndex, link.)

stack profile: A series of profiles for visualizing a three-dimensional surface. The stack profile is saved as CAD object.

standard attribute tables: standard attributes can be calculated for geometric lines and polygons in Project File format and for line- and polygon-containing shapefiles that are directly used. The attributes calculated depend on the element type. For example, length and the center point for x, y, and z are determined for lines; and area, and the centroid x, y, and z are determined for polygons, among other properties. Standard attribute tables can be created and maintained in TNT's Editor or created in a separate TNT process (Geometric/Attributes/Standard).

standard lossless: A raster compression method. The compressed output from this method maintains 100 percent fidelity to the colors of the uncompressed

input raster object. Standard Lossless is best for objects that have good pixel-to-pixel correlation in the image.

standard parallel: A parallel of latitude used as a control line in the computation of a map projection, and which is therefore, true to scale. Some map projections have no defined standard parallel, others have one, while others have two.

standard 64 annotation colors: In 8-bit contexts the Color Palette Editor window normally reserves the first 64 colors for a standard set of user annotation colors for text and overlays. That leaves 192 colors for the image itself - ample color space for representing most natural color images to the human eye. The 64 standard colors are chosen at fixed intervals in the RGB color model. They generally appear brighter and purer than the subdued natural tones of the underlying image.

State Plane Coordinate System or **SPCS:** The State Plane Coordinate System (SPCS) defines map coordinates by zone for the United States. Each zone has one central meridian and scale factor, which permits all USGS quadrangle maps in a zone to be mosaicked exactly. Zones with greater north-south extent use the Transverse Mercator projection, while those with greater east-west extent use Lambert Conformal Conic. (The panhandle of Alaska is the only exception, and uses Oblique Mercator).

stepwise linear classification: A supervised image processing routine applied in the same fashion as maximum likelihood classification using training sets, or prototypes. This method applies the classical techniques of stepwise linear discriminant analysis to set up the classification model and map the materials desired from the input raster objects. (See also: maximum likelihood classification)

stereo elevation: An elevation surface derived from stereo pairs of remote sensing imagery. For example the SPOT satellite can collect an "off nadir" image and then in a subsequent fly-over collect its counterpart to make a stereo pair. The stereo elevation process takes the 3D effect of that stereo pair to derive an accurate raster object of elevation values.

stereo viewing: An elevation raster and an image overlay are combined to produce a 3D effect when viewed with a stereo viewing device (e.g., anaglyph glasses).

style query: (in database queries) A style query is constructed from a combination of comparison expressions, which examine values of element and database variables, and assignment statements, which set the values of drawing variables.

stop: (also called a waypoint) an intermediate point along a route that must be visited and is consequently included in your network analysis.

Sub-extremum: A method for calculating important points in the Irregular 3D Points method of the Extract Important Points process.

subobject: A component of a TNTmips project file attached to a primary object. A subobject contains data that describes some aspect of the primary object. Examples: 1) map registration information is kept as a subobject (Regist) under the raster object it calibrates; 2) a pseudocolor table is kept as a subobject (ColMap) under the raster object it describes; 3) a HyperIndex subobject attached to a vector overlay polygon maintains the links TNTmips uses to retrieve that polygon's associated daughter objects.

subtractive color: Creating color by using absorption or scattering to selectively remove some of the colors of light, or radiation, reaching the human eye is a subtractive process. The use of pigments, such as color printing or a painting, demonstrate this subtractive color process. The greater the number of different colored pigments mixed together, the darker a pigmented object appears. This darkness results from an increased absorption of visible light by the pigments and, consequently, less light reflected to the eye. The presence of fewer pigments or their absence altogether results in greater reflectance of visible light. Selective absorption removes a color(s) from the reflected radiation and results in the perception of the complementary color.

subwindow: An auxiliary window that opens as the result of some user action in the parent window (such as pressing a but-

ton), or of some processing condition (a dialog box subwindow might open with a message or warning.)

Suits' Maximum Relative classification: A supervised Auto-Classify method that is computationally quicker than the other methods. The algorithm for this process computes the composite brightness and the ratio of each band brightness to the composite brightness. The mean and standard deviation of each of these parameters is then calculated for a class and used to define the class boundaries.

Suits-Wagner classification: A simple form of supervised or semiautomatic classification that operates similarly to a boxcar or parallelepiped classification. This method defines the sides of the box for each class as plus and minus one standard deviation from the mean of the values of the prototype, or sample, values selected to represent that class. This method has the advantage that like a simple boxcar classifier, it is very fast to apply the resulting decision rule to the unknown pixel values. More information on this process can be found in: H.L. Wagner and G.H. Suits (1980) Proceedings of the 14th International Symposium on Remote Sensing of the Environment, vol. III pp. 1525–1529. Environmental Research Institute of Michigan, Ann Arbor Michigan. *A Low Cost Classification Algorithm for Developing Countries.*

supervised classification: A type of automatic multi-spectral image interpretation in which the user supervises feature classification by setting up prototypes (collections of sample points) for each feature, class, or land cover to be mapped. TNTmips statistically analyzes these collections of points to characterize each feature and then maps them by mathematical comparison.

surface fitting: Techniques that use 3-dimensional vector point data to create a raster object containing an elevation surface. Various methods can be used to fill the gaps between the vector points and derive the elevation values for the intermediate raster cells.

surface object: A raster object whose cell valuae are used as elevation values to de-

fine a three-dimensional surface over which other objects can be draped.

SVG: Scalable Vector Graphics. A W3C standard for vector graphics based on XML.

S-video: Separate video. S-video maintains the video in two separate signals: luminance and color.

symbol hot spot: The place on a TNTmips symbol that controls its position. TNTmips locates a symbol by putting its hot spot on the point that provides its coordinates. Every symbol has a hot spot: it defaults to the center of the symbol design area, but may be relocated. The hot spot is also called the origin.

symbol overlay: A vector object can have symbol shapes assigned to some or all of its point features. When this vector object is displayed over (or overlaid on) an image, you can also choose to display the symbols over the top of the features in the underlying image. Such symbols may also be attached to database records and used to graphically retrieve such reference information. For example, a symbol overlay that uses ducks to represent nesting sites could be shown over a habitat map. A click on a particular duck symbol could retrieve a record from an associated database and display it on the text screen to provide such information as the date of first occupancy, number of eggs, number of fledglings, and so on. (See also: overlay.)

symmetric minima: A raster cell that has a value less than two opposite neighbors in any direction. A raster object of symmetric minima is calculated from an elevation raster object and provides a representation of the relative roughness of terrain. TNTmips includes symmetric minima and flats (see above) in the same output raster object.

synthetic resolution: An apparent increase in spatial resolution achieved either by resampling image rasters or by combining images from different sensors of varying resolutions (such as SPOT panchromatic and TM multispectral).

system table: one of a few table types not shown to the user by default. System tables include style assignment tables for all geometric object types and internal

tables for vector, shape, and TIN objects. Some raster object types also have an internal table. You can show system tables from the right mouse button menu at the element level in a layer manager window (See also: internal tables.)

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tab group: (also, "Field") A component of a window such as a button, list, scroll bar, pane, sash, or slider (sometimes "scale") that can be selected with the location box by pressing the Tab key. Some tab groups, such as a selection list, can be composed of multiple items through which the location cursor can be moved by the arrow keys.

table: A database is organized into tables that contain records. Tables cover different topics related to the same common theme. The theme and its extent of development determine the number of tables that comprise the database. For example, the Crow Butte soil polygon database contains twelve tables, in such areas as yield, crop potential, and statistical information. (See also: database object, field, record.)

tag: A temporary number that can be assigned to a class in the Training Set Editor of the Auto-Classification process. For example, you import a set of classes into the Training Set Editor. Each class has a value when it is imported. If a class does not have the value that you want to use, you can assign a tag number to the class. You can assign different tag numbers to as many different classes as you wish. When you assign the same tag number to more than one class, the Training Set Editor merges the classes.

tail: The portion of a distribution curve that has few values and extends away from the peak area of the curve where most values are located.

TARGA file: Truevision Advanced Raster Graphics Adapter file. The TGA format supports color maps, alpha channel, gamma value, postage stamp image, tex-

tual information and developer-definable data.

Tasseled Cap A transformation that rotates four LANDSAT MSS bands such that the majority of information is contained in two components or features that are directly related to physical scene characteristics, brightness and greenness. The tasseled cap transformation is used for agricultural crop monitoring.

TCP/IP: Transmission Control Protocol/Internet Protocol are low-level communication protocols that allow computers to send and receive data.

template: A hardcopy layout with designated constant and changing layers and groups. A template automatically prompts for replacement layers for those designated as changing when opened.

terabyte, Tbyte, or **TB:** A unit of measurement for 2^{40} (approximately) 1,000,000,000,000 bytes, 1,000,000,000 kilobytes, 1,000,000 megabytes, or 1000 gigabytes. (See also: bit, byte, exabyte, gigabyte, kilobyte, megabyte, petabyte, exabyte, zettabyte, yottabyte.)

terrain: The elevation raster used to provide surface values for a 3D simulation, such as in TNTsim3D.

terrain scene: A rendering of geometric representations of geographic entities upon a land surface in such a way as to simulate the view of a human observer. (OpenGIS Consortium)

Terra-Mar: An early vendor of a raster-based microcomputer image processing and GIS system.

text: A string of characters grouped in a file.

text cursor: A graphic mark such as a blinking underscore, vertical line or character-sized box on the screen that indicates the focus of keyboard text entry and editing.

text field: A component of a window that can be selected with the location box for textual information that can be entered and edited from the keyboard.

text monitor or **text screen:** (historical term) In the old DOS MIPS (v3.3 and earlier) The B/W or color monitor used to display text materials (like menus, database records, and keyboard input). MIPS used

a second screen (the display monitor) for images and maps.

text object: Anything from a simple string of ASCII characters to a more complex, formatted page description. A text object may be output from some TNTmips process, reference information created by a text editor, or a file generated by a word processing program.

texture: The raster used as a surface drape in a 3D simulation, such as in TNTsim3D.

theme: The common property used to organize vector data into separate objects, such as soils, hydrology, and roads.

theme map: A map that uses a color gradient to illustrate the variation of a quantitative attribute, such as population or income.

Thiessen polygons: Polygons that bound an area closest to the points that form the boundary than to any other points. TINs are more efficient than other data structures at generating Thiessen polygons. They are also known as Voronoi diagrams.

thinning: (rasters) To remove cells from wide line images in a raster object. When a scanner creates a raster object, the lines in the drawing typically are several cells wide in the result. Some automatic vectorization techniques work on the data after the line images in the raster object have been thinned to make the line images just one cell wide.

thinning: (vectors) Reducing the number of coordinate pairs that describe a vector's line and polygon elements. Some of the coordinate pairs will be discarded when straight line lengths replace curved or noisy segments in the original lines.

threshold: (binary) The separation point for converting grayscale raster cell data into binary (black and white) data. For a raster object scanned with 256 levels of gray, a threshold might be set at 180. Then the output binary raster object would have a 1 for every cell in the input raster object that had the value 180 or higher, and 0 everywhere else.

thresholding: Setting a data conversion separation limit such that any incoming value above the designated limit, or threshold, is assigned one value (in binary thresholding, a "1") and any incoming

value below or equal to the limit is assigned another value (in binary thresholding, a "0"). Thresholding can be used to generate a binary raster from a 16-gray-level scan, or to find feature edges during the steps of raster to vector conversion.

tick mark: A line that sticks out or in along a map grid boundary that may also occur internally at specified intervals.

tie point: A point that is co-located on two raster objects that have an overlapping geographic extent. Tie points are used in the manual mosaic process to establish the relationship between adjacent pieces of the mosaic that provide no absolute ground control information, but do show some common ground feature in each piece. For example, multiple frames of airvideo can be tied together with tie points (farm buildings, field corners, bushes, rock outcroppings, bends in streams) even if the map coordinates are not known for such features. Then, the map calibration for the entire sequence can be established from control points sparsely located in the mosaic sequence (such as road intersections) for which the map coordinates are known. (See also: control point**.**)

TIFF: Tag Image File Format. A series of image file formats designed to transfer images between different software packages. .TIF files are wildely used for lossless 24-bit color images.

TIGA: (historical term) Texas Instruments Graphics Architecture. An early software interface that standardized communication between application software and display boards that used one of the TMS340 chips. TIGA divided tasks between the TMS340 display processor and the CPU of the host microcomputer to improve performance and generalize display driver requirements.

TIGER files: topologically Integrated Geographic Encoding and Referencing files compiled and distributed by the U.S. Census Bureau.

tile column and row numbers: tiles in Google Maps, Bing Maps, and World Wind tileset structures are aligned to a predetermined global grid at each zoom level.

The position of each tile within the grid is indicated by its tile column number (east-west position) and tile row number (north-south position). Tile rows are numbered from top to bottom and tile columns from left to right, each beginning with 0 in the upper left corner of the global grid. In tilesets using the Bing Maps flat quadkey structure and the World Wind structure, tile column and row numbers are encoded into the filename for each tile file. In the hierarchical tileset structures created for use in Google Maps and Bing Maps, tile files are named by their tile column number and grouped in directories named for their tile row number.

tile format: The formats that can be used in each type of tileset structure are dictated by the application that that will use the tileset and the specific uses within that application. Although the allowed formats vary, Google, Bing Maps, and World Wind tilesets all support the use of JPEG and PNG tile file formats.

tiles: Rectangular areas of defined size in a raster object used for storage of the information. Storing raster objects in tiled format generally increases display speed when viewing less than the entire object.

Also, raster object image pieces that are assembled and trimmed in the TNTmips mosaic process or one of the other processes on the Tileset menu. (See tilesets for more on this use of the term.)

A third usage of the word tiles occurs in the Color Map Editor where the upper part of the window displays the colors in the map with small sample squares, or tiles. The active or selected tile is outlined in white, and its cell value and a larger sample is displayed below.

tileset: A multifile object in a predefined structure designed for very efficient viewing of geodata particularly over the Internet. A tileset can range from a few tiles covering a local project to 100s of million tiles covering a continent or the globe. TNTmips can generate tilesets in its own structure and in Google Maps, Google Earth, Bing Maps, and World Wind structures.

A tileset structure is the most efficient way to store each image for use in a geomashup. Its hierachical directory structure and small compressed tiles, which are precomputed at each available zoom level, permit an image of any size to be efficiently viewed in a geomashup. Viewing or adding any part of a tileset to a geoviewer requires reading only a few small tiles from any available Internet source that is hosting it.

tileset size: The time it takes to view or refresh a view of a tileset is independent of its size. Any view always directly accesses and reads the few tiles that are required at the view's scale or zoom level. The tileset's directory hierarchy means that any individual tile can be directly located. The small tiles, made even smaller by lossy compression, insure that they can be rapidly read even when they are read over the Internet or a local network or even from a DVD. A single tileset can contain a few thousand or 100s of millions of tiles in a single directory structure.

tileset structure: A tileset can be flat, with all tile files in a single directory, or use a scale-pyramided hierarchical directory structure of tile files. MicroImages' tileset raster objects are also hierarchical tileset structures.

tiling: Assembling large images from smaller segments that have common angular orientations, cell sizes, and map projections. The process is similar to that of assembling floor tiles, except that the raster tiles may overlap at the onset. (See also: montage, mosaic.)

TIN Densification: A DEM extraction method that builds a TIN surface from the initial set of user-supplied tie points, and then iteratively densifies the TIN object. The process looks in the middle of each existing triangle and adds a new node when it finds a point of high correlation. Then it recomputes the local topology and goes on to the next triangle.

TIN elements: TNTmips TIN objects contain four element types: nodes, edges, triangles, and hulls. Nodes are the most fundamental element of a TIN and the only element type that references spatial coordinates (x,y,z). An edge is an oriented line seg-

ment that connects two nodes. Three edges connect three nodes to form a triangle that satisfies the Delaunay criterion. Triangles represent elementary areas of the surface that describe topological relationships between all other elements of the TIN data. A hull represents the area covered by a TIN structure. Interpolation of z-values is only valid within a hull region.

TIN object: A TIN, or Triangulated Irregular Network, object represents a continuous surface as a set of conterminous triangles computed from irregularly spaced 3D points. TIN topology is more restrictive than the topology of other coordinate data objects; every node is part of some polygon, every polygon is a triangle, and every triangle satisfies the Delaunay criterion. (See also: Delaunay criterion.)

title bar: The area across the top of a window that displays the name of the window, the resize graphic, the iconifying button, and the close button.

TM: Thematic Mapper. A sensing device on the Landsat satellite that scans and stores 7 individual images in spectral bands ranging from the blue wavelengths up to those in the thermal infrared.

TNTatlas®: A free product in the TNT family for publication of spatial data that is graphically organized into stacks for point-and-click navigation through all information of interest. An atlas may also be a single display or page layout with or without layer visibility controlled by map scale.

TNTbrowser™: A free, standalone Java applet for use with TNTserver. This product has been supplanted by TNTmap Builder and TNTmap Viewer.

TNTclient™: MicroImages' free applet for web browsers that works with TNTserver. TNTclient can be requested in Java or HTML versions. This product has been supplanted by TNTmap Builder and TNTmap Viewer.

TNTedit™: Provides professional, interactive tools to create, georeference, and edit project materials consisting of vector, raster, CAD, TIN, and relational database products.

TNTlite®: A free version of TNTmips for small-scale projects. TNTlite is not a demo, but a full-featured geospatial analysis software package (now called TNTmips Free).

TNTmap Builder: Lets you select and arrange map layers from any number of WMS sources. Launches views of selected layers in your choice of TNTmap Viewer or other WMS viewers, such as Google Earth, Google Maps, or NASA's World Wind.

TNTmap Viewer: Lets you view map layers from any number of WMS sources. This viewer is launched from the layers selected in TNTmap Builder.

TNTmips®: The latest, full-featured version of the Map and Image Processing System from MicroImages, Inc.

TNTmips® Basic: A very low cost version of TNTmips for small-scale projects. TNTmips Basic is not a demo, but a full-featured geospatial analysis software package with support for larger images than allowed by TNTmips Free.

TNTmips® Free: A free version of TNTmips for small-scale projects. TNTmips Free is not a demo, but a full-featured geospatial analysis software package.

TNTsdk®: A software development kit for computers equipped with a full TNTmips license to create custom products for distribution and use with the TNT products.

TNTserver™: Lets you directly publish over an intranet or the Internet your geodata (raster, vector, CAD, relational database, and other layer types) from TNT Project Files and other popular geodata formats.

TNTsim3D™: A free, standalone program for Windows that lets you fly over 3D terrains with keybord or joystick controls.

TNTview®: Provides the visualization capabilities of TNTmips and some interpretive abilities for those who do not require the full set of features included in TNTmips.

toggle button: A toggle button offers an on/off control option for the current process. A toggle button's label tells what state it controls, and it is preceded by a

graphic indicator of the on/off state of the button.

toolbar: Row of icons appearing below the menubar that provides direct access to tools and other actions.

ToolTip: A ToolTip pops in naming the menu item selection that duplicates the function of the icon button when the mouse cursor pauses over an icon button.

topographic map or **topo map:** A map that uses colors and symbolic patterns to represent the general surface features of the earth, such as grassland, forest, marsh, agricultural, urban, and barren rock.

topography: The features of the actual surface of the earth, considered collectively according to their form (for example, grassland, cultivated, desert, forest, swamp). A single feature, such as one mountain or one valley, is called a topographic feature.

topology or **vector topology:** A description of the relationship between node, line, and polygon elements in a vector object. Three levels of vector topology are available for RVC vector objects: polygonal, planar, and network. Polygonal topology is the highest, or strictest, level of topology. Polygonal topology requires that no two nodes have the same X and Y coordinates, all lines start and end in nodes, lines do not intersect without separation by nodes, enclosed areas are defined as polygons, and any point can be in at most one polygon. Planar topology requires that all lines start and end in nodes and lines do not intersect without separation by nodes, just as for polygonal objects. However, polygon information is not maintained (which means planar objects have no polygons). Network topology places nodes at the start and end of all lines, but lines may cross themselves or other lines and there are no polygons. All three topology types may be either 2D or 3D. Topology for polygonal and planar 3D objects is maintained in the X-Y plane, which means that polygon dimensions and the location of nodes separating lines that would otherwise cross are determined by projecting onto the X-Y plane. The con-

straint imposed by 2D topology on 3D objects is eliminated by network topology, which allows two nodes to have the same X and Y coordinates.

Polygonal topology is necessary for objects such as soil maps and property ownership maps. Planar topology may be suitable for hydrology in the absence of lakes or road systems that lack underpasses and overpasses or other features that require network topology for correct representation.

topology errors: Violations of the TNTmips vector topology, such as line elements with polygonal or planar topology that are missing nodes at the point of intersection, or polygons with polygonal topology that overlap without defining an intersection polygon. TNTmips processes that refer to the vector topology information either will not work, or will return erroneous results if the input vector object has topology errors.

trace: To create a vector line element by manually or interactively tracing over line images in a raster object.

training set or **prototype:** A group of sample cells in an image known to represent a feature type or ground cover of interest defined by the user from his or her knowledge of the site (perhaps through ground visitation or detailed airphoto interpretation).

transcoder: A device that converts video signal formats from an input type (like SVHS) to an output type (like RGB analog).

transfer rate: The number of XY coordinate pairs produced per second when you are digitizing with the streaming method.

Transformed Vegetation Index: A commonly used vegetation index derived from images of certain spectral bands. The TVI is equal to the square root of the quotient of the photo-infrared minus the red band, and the photo-infrared plus the red band {SQRT[(IR - red) / (IR + red)]}. Common color-infrared image sources that TNTmips uses to compute TVI index rasters include Landsat MSS and TM, SPOT CIR, 35mm CIR film, 9" CIR film, and CIR video.

translation curve: The curve used to adjust a raster object's cell values to the brightness values used for display. TNTmips offers a selection of different translation curves (including linear) that are normally selected to strengthen the visual contrast in the display representation.

transliterate: To represent the words of one language, with the alphabet of another language. Usually the language is foreign to the reader, and the alphabet is familiar.

transparent color: The ability to overlay one color image over another image or map so that the spatial details of both are revealed for comparison is achieved with transparent color. The colors that result from such an overlay depend on whether the color in the images is additive or subtractive.

transparent patterns: Patterns that only partially obscure the image upon which they are superimposed are transparent. For example, a pattern could consist of a drawing of a duck that leaves the remainder of the pattern tile transparent. When this pattern is used to fill a polygon that contains a lake, the lake colors and features will be visible through the transparent portions of each tile.

trend: A steady change in contrast across an image. The change is introduced by the collection device or by the geometric orientation of the instrument in relation to the Earth's surface.

tropic of Cancer: the parallel 23° 27' north of the equator that marks the position at which the sun is directly overhead at the summer solstice. This latitude is the northernmost latitude reached by the overhead sun.

tropic of Capricorn: the parallel 23° 27' south of the equator that marks the position at which the sun is directly overhead at the winter solstice, which is the southernmost latitude reached by the overhead sun.

true scale: At large sizes, every map projection distorts the scale of distance, especially towards the edges. The location of the true scale of a projection identifies the position where map measurements correctly correspond to actual surface distances.

TSD: Tileset definition file extension. A tileset definition file defines the location and properties of a tileset. This definition may be for a local tileset (both the TSD and tileset files reside on an attached storage device or a local network), a remote linked tileset (TSD resides on a local drive but the tileset is on the Internet), or an Internet tileset (TSD and tiles reside on the Internet).

TSR: (historical term) Terminate and Stay Resident. Under DOS, a software process that became resident in memory when executed and performed some special activity when the appropriate conditions were detected. For example, A TSR program could be loaded to memory and wait for a particular non-standard series of keystrokes to initiate printing a text screen out on paper.

TVI: See: Transformed Vegetation Index.

TYDAC: Formerly, a raster-based commercial GIS system. More recently, a provider of ESRI and MapInfo software along with consulting and related services.

— U —

underlay: To place a raster object so that it appears to be behind an existing object or image and will show around the perimeter and through any internal data holes in the object on top.

undershoot: A line that does not quite meet the line it was intended to intersect with leaving a gap.

Unicode: A character encoding scheme that is a super set of ASCII and Latin-1 with room for 65,536 characters (a 16-bit or 2-byte set). The Unicode standard is still in committee; it is in the care of the International Organization for Standardization (ISO) and Unicode, Inc. (formerly the Unicode Consortium). Unicode itself is a subset of ISO 10646, and in terms of ISO 10646, Unicode is the "Basic Multilingual Plane." Unicode is designed to include all characters needed for the written languages of the modern world.

union: A merging of two vector objects such that all the elements from two objects are copied to the resulting vector.

unsupervised classification or **automatic interpretation:** The operation of a group of multispectral image interpretation functions (such as K-means) that statistically cluster cells into similar collections. When the classification procedures are complete, you identify and label the ground features or conditions that the clusters represent.

URL: Uniform Resource Locator.

USB: Universal Serial Bus. An external peripheral interface standard that uses biserial transmission created in January 1996.

USDA: United States Department of Agriculture.

USDI: United States Department of the Interior.

USF&WS: United States Fish and Wildlife Service of the USDI.

USGS: United States Geological Survey.

UTM: Universal Transverse Mercator map projection.

— V —

variable: (in database queries) A named entity that has an assigned value. There are four kinds of query variables: (1) those are associated with the *vector elements* (like numlines, class, and startnode); (2) those which are fields from a *database* (perhaps Name, Acres, and Yield); (3) those which control the *drawing styles* of vector elements (like size, color, and fillcolor); and (4) the ten *temporary* user variables for numeric operations (temp0, temp1, temp2 … temp9). For example, the point element variable "size" can have a value from 1 to 64. It controls the size at which a point element is drawn. An assignment statement can change only the values of drawing style and temporary variables; it cannot change the value of variables that are associated with a vector element or a database.

variogram: A plot of the degree of spatial continuity based on the control points, that is points of known value in a vector or database object with continuous geodata. Variograms are used by the Kriging method in the Surface Fitting operation of Surface Modeling.

vector: "A quantity possessing magnitude and direction, represented by an arrow, the direction of which indicates the direction of the quantity and the length of which is proportional to the magnitude" (*Random House*). In connection with GIS and computer graphics, this term is used more loosely to refer to a set of vectors joined end to end to make an arc or irregular line with a uniform set of properties. TNTmips uses this looser definition and also imposes topology and attaches a set of attributes to the vector in place of the magnitude in the Random House definition.

vector element: A vector object is made up of three basic types of elements that can have associated attributes 1) points, which are single sets of coordinates that define a point feature (such as a well); 2) lines, which are curvilinear strings of coordinates that define a curved line (such as a stream); and 3) polygons, which are collections of lines that inscribe an area (such as a lake). A fourth type of element, nodes, are necessary to maintain vector topology.

vector format: A data structure for representing point and line data by means of 2- or 3-dimensional geometric (Cartesian x,y or x,y,z) coordinates with topological requirements (see the following definition for vector topology). In connection with GIS and computer graphics, "vector" can refer to a set of line segments joined end-to-end to make a curved path in space. Vector objects also have a set of attributes (such as ID number, color, drawing style) attached to them.

vectorize: A general term for any technique that converts raster data into vector data.

vector object: A collection of vector elements and attributes stored in a complex topology as one entity in a TNTmips project file. (See also: vector topology).

vector topology: A description of the relationship between node, line, and polygon elements in a vector object. Three levels of vector topology are available for RVC vector objects: polygonal, planar, and network. Polygonal topology is the highest, or strictest, level of topology. Polygonal topology requires that no two nodes have the same X and Y coordinates, all lines start and end in nodes, lines do not intersect without separation by nodes, enclosed areas are defined as polygons, and any point can be in at most one polygon. Planar topology requires that all lines start and end in nodes and lines do not intersect without separation by nodes, just as for polygonal objects. However, polygon information is not maintained (which means planar objects have no polygons). Network topology places nodes at the start and end of all lines, but lines may cross themselves or other lines and there are no polygons. All three topology types may be either 2D or 3D. Topology for polygonal and planar 3D objects is maintained in the X-Y plane, which means that polygon dimensions and the location of nodes separating lines that would otherwise cross are determined by projecting onto the X-Y plane. The constraint imposed by 2D topology on 3D objects is eliminated by network topology, which allows two nodes to have the same X and Y coordinates.

Polygonal topology is necessary for objects such as soil maps and property ownership maps. Planar topology may be suitable for hydrology in the absence of lakes or road systems that lack underpasses and overpasses or other features that require network topology for correct representation.

vector units: The units in which vector coordinates and vector object extent are expressed. These units are specific to individual vector objects and are dependent on how the vector was created. The unit size may be a screen pixel and the object extents the same as the drawing area in pixels if the vector object was drawn without a reference object. The unit size is related to the number of raster cells if the vector is created using an ungeoreferenced raster for reference; the object extents equal the number of raster cells times the cell size. The units correspond to geographic coordinates and the object extents correspond to the geographic extents if the vector is created over a georeferenced object.

vegetation index: The output from standard manipulations of multispectral image raster objects. The system processes the input spectral information and creates output raster objects whose cell values represent the site's biophysical properties: amount of vegetation, leaf area, greenness, brightness, and wetness.

VersaCAD: A popular, commercial microcomputer Computer Aided Design (CAD) software package developed and marketed by Archway Systems, Inc.

vertex: The point at which a line changes direction or terminates.

VESA: Video Electronics Standards Association. An international standards organization for computer graphics founded in 1989.

VGA: Video Graphics Array. A microcomputer video subsystem introduced by IBM with the PS/2 microcomputer in 1987 with support for 256 simultaneous colors. The VGA was an enhancement of the older EGA. (See also: CGA, EGA.)

VHS: Video Home System. A popular format for low-cost video recording and playback, common in home video systems.

video capture: Some image display boards have the ability to display live broadcast or taped programming and then freeze and grab an image, storing it in the computer's memory or on disk.

video digitizing board: A video interface circuit board installed in a PC that samples or frame-grabs a video frame and constructs a digital image. Video digitizing boards can be used for nonstandard, higher resolution video sources. (See also: frame-grabbing.)

video field: The image you see on a standard TV screen is composed of a set of about 480 horizontal lines. The lines are projected in two passes of the signal beam. Each pass only projects every other line of the image: the odd lines in

one pass, and the even lines in the next pass. One scan takes 1/60 of a second, so the whole picture (the frame) is refreshed every 1/30th of a second.

A field contains every other line of the complete video image. The primary field contains the odd lines; the secondary field contains the even lines.

video frame: A complete video image, which consists of two interlaced fields Odd lines of the frame are contained in the primary field which is alternated with the secondary field which contains the even lines. The primary field lasts 1/60 of a second in standard broadcast video. The secondary field follows in the next 1/60 of a second. The entire frame takes 1/30 of a second to display. There is a difference of 1/60 of a second between alternate lines in the image.

view: The current contents of the view canvas.

view canvas: The area of the View window used for layer display.

viewshed: The boundaries of sight from a single vantage point, assuming an unobstructed surface (disregard trees and buildings). The TNTmips Viewshed process takes an elevation raster object, and computes the viewshed for selected points in the area.

view window: The TNTmips display process always works with at least two windows: the control window and one or more view windows. The control window presents process options and controls, and the view window displays the images.

vignetting: Darkening at the edges and corners of an optical image. Vignetting occurs because lenses are physically unable to pass as much light to the fringe of an optical field as they do to its center. Several techniques compensate for vignetting, but it is almost always present to some degree. For color rasters, vignetting means that the color of a feature at the edge or corner of an image may not match the color of that same feature in the center.

virtual display: A display management scheme that displays as much of an image as will fit on the monitor, while buffering the rest of the image in a temporary file from a RAM disk or the hard drive. The user never needs to give new file information in order to access another portion of the image. A virtual display works like a window that can slide anywhere on a raster object. How quickly it moves depends on the hardware available.

virtual field: A TNTmips database field that draws information from other database fields. This information can be used directly or combined with the information from other fields or additional components. There are two types of virtual fields: numeric, which are referred to as computed fields, or strings, which are called string expression fields. An example of a computed field is population density, which may take population from one table, area from another, make the division and apply appropriate conversion factors for the desired output units. A string expression field might concatenate the contents of separate fields, such as section, township, and range or create a multiline DataTip from a number of different fields, such as address, owner name, and property value for a parcels vector object.

virtual process: (for MIPS v3.3 and earlier) An operation performed on a raster or vector object that is bigger than the display screen (rasters up to 32,000 x 32,000 cells and vector collections of up to 2 billion coordinate pairs). You set up and guide the process on the display screen, and the system applies the procedure to the whole image.

VMap0: An improved version of the DCW, also distributed by NGA. VMap1 is a higher resolution of VMap0 and is also publicly available. VMap2 is classified.

volume: An individual storage device such as a tape or floppy disk.

VPF: Vector Product Format is used by NGA for the digital distribution of its map products (DCW, VMap0...)

VQ Filtering: An image transformation procedure in Hyperspectral Analysis. This procedure is related conceptually to the Self-Organizing Map (SOM) classifier.

The VQ Filtering procedure applies the SOM classifier to the image to derive 256 spectral classes and assigns each image cell to the class with the closest mean value in spectral space. The resulting residual (filtered) image of each input band shows how well each cell fits its assigned class at that wavelength.

— W —

warping: Any process in which an object is stretched differentially so as to change its internal geometry. This shape change could be defined by any one of many transformations, such as changing a map projection, trilateration to change the absolute position of specified nodes in the vector object, fitting a polynomial to a surface, least squares movement of control nodes, and so on.

watershed: The entire area drained by a stream and all of its tributaries, with all runoff draining to the same outlet. In nature the outlet may be a lake, the ocean, or other water body. In the Watershed process, the outlet may also be the point where a particular flow path intersects the boundary of the elevation raster being analyzed. Synonym: catchment.

watershed basin: The area draining to any particular point in the landscape (called a seed point); a subwatershed or subcatchment. Standard basins in the watershed process are generated using stream junctions as seed points, so a standard basin is the area drained by a particular tributary system of the main stream.

watershed outlet: The lowest point in a watershed toward which all water drains. In nature the watershed outlet may be a lake, the ocean, or other water body. In the Watershed process, the outlet may also be the point where a particular flow path intersects the spatial boundary of the elevation raster being analyzed.

watershed seed point: Any specified point in the landscape used to determine the upslope area (basin) that drains to that point.

waypoint: (also called a stop) an intermediate point along a route that must be visited and is consequently included in your network analysis.

WCS: Web Coverage Service.

website: A virtual location on the World Wide Web consisting of a collection of interlinked pages that collectively represent a company, organization, or individual. A website is located by its URL.

Web Map Service: Produces views of georeferenced data dynamically from spatial data. This specification standardizes the way in which clients request views and servers describe their data holdings.

Web Terrain Service: Produces views of georeferenced data over the Internet. Can provide 3D perspective views in a 2D pictorial format, such as PNG, GIF, or JPEG. This specification standardizes the way in which clients request views and servers describe their data holdings.

wetness: The physical property mapped by Kauth's greenness, brightness, wetness transformations on Landsat TM images. It measures how wet the combined vegetation and soil surface is, including the water suspended in the vegetation biomass.

WFS: Web Feature Service.

widget: An interface component; that is, a graphical X object such as a button, separator, menu bar, or scroll bar. Widgets are composed of data structures and procedures. Widget manipulations are supported by Xtoolkits; in particular by GUI libraries such as the one from OSF/Motif.

window manager: A special client application in X that provides user controls for window size and position. Several window managers are available for X. TNTmips under MI/X with X Desktop uses the TWM window manager.

wireframe: A graphical representation of a two-dimensional or three-dimensional solid or surface by means of regularly-spaced, connected line segments. The wireframe surface looks as if it had been molded by a flexible wire mesh. Computer systems use wireframe representations for many intermediate 3D render-

ings because they take much less processing time to create and manipulate than a continuous-surface representation.

WMMR-MED: Weighted majority with minimum range-median. This is one of the raster enhancement filters. The WMMR-MED filter is a nonlinear edge-enhancement filter that also suppresses image noise (outlier values).

WMS: Web Map Service.

WORM drive: (historical term) Write Once, Read Many drive**.** A type of drive that reads and writes to non-erasable optical disks, which are used for permanent, file storage. Data is recorded with reflective pits in the coating laid on the surface of a glass or metal disk. Once the pits have been burned into the coating, they cannot be removed, which makes this medium non-erasable. (See also: erasable optical cartridge, erasable optical drive, optical disk)

W3C: World Wide Web Consortium.

WTS: see Web Terrain Service.

— X —

X client: A program that uses the X server's services, including applications programs, which may run either on the same machine or elsewhere on the network. The GUI itself is a client. TNTmips is a client. NOTE: an X client is software, not hardware as the term "client" is used in other networking contexts.

X display: A keyboard, mouse, and one or more screens.

X font: A file in the X Window System that contains the bitmapped character descriptions for a particular font.

Xlib: A C library of low-level X commands at the heart of the X Window System. Xlib commands do things like draw lines, open and close windows, fill polygons, and track the mouse and other user events. It is possible to write X applications completely from Xlib commands (just as it is possible to write complicated software in Assembler), but it is easier to use higher-level commands, such as those in various Xtoolkits.

XML: Extensible Markup Language.

XNP: X Network Protocol. A high-level protocol that defines data structures for communicating between clients and servers.

X server: The X program that manages the display and runs locally on the terminal or computer on the desktop. The server controls output to the display, handles input, and manages the windows, draws two-dimensional graphics as needed, and sends messages. For Mac OS X machines, the X server for TNTmips is provided by the system vendor. For Windows machines, MicroImages supplies its own X server.

Xtoolkit or **Xt Intrinsics:** Any subroutine library that contains higher-level mechanisms than Xlib for generic tasks like drawing window borders, scroll bars, and buttons.

X Window System: A standard method of handling displays that can be used to build a windowing environment. Two popular GUI's, Motif and OpenLook, have been built on the X standard.

X-Y digitizing tablet: A peripheral device for manually translating line and point data (like engineering and technical drawings) into some computer format (usually vector or CAD). The drawing is secured to the tablet, and the operator positions the device's cursor (which may look like a pen or a computer mouse with a crosshair lens) over lines and other elements, clicking a button or pressing a key to record a coordinate.

— Y —

yottabyte, Ybyte, or **YB:** A unit of measurement for 2^{80} (approximately) 1,000,000,000,000,000,000,000,000 bytes, 1,000,000,000,000,000,000,000 kilobytes, 1,000,000,000,000,000,000 megabytes, 1,000,000,000,000,000 gigabytes, 1,000,000,000,000 terabytes, 1,000,000,000 petabytes, 1,000,000 exabytes, or 1,000 zettabytes. (See also:

bit, byte, exabyte, gigabyte, kilobyte, megabyte, petabyte, terabyte, zettabyte.)

— Z —

zettabyte, Zbyte, or **ZB:** A unit of measurement for 2^{70} (approximately) 1,000,000,000,000,000,000,000 bytes, 1,000,000,000,000,000,000 kilobytes, 1,000,000,000,000,000 megabytes, 1,000,000,000,000 gigabytes, 1,000,000,000 terabytes, 1,000,000 petabytes, or 1,000 exabytes. (See also: bit, byte, exabyte, gigabyte, kilobyte, megabyte, petabyte, terabyte, yottabyte.)

zoom level: A tileset can have one or many zoom levels. The maximum zoom level is the most detailed, or highest resolution, zoom level. The minimum zoom level may be the full view **of** an image. A particular tileset may have a limited number of zoom levels when it is displayed in combination with other tilesets. The prerendered zoom levels for a tileset determine its zoom level range,

Zoom Transfer Scope or **ZTS:** An optical-mechanical device produced and marketed by Bausch and Lomb. With it you can view and overlay two images through separate optical paths. Usually one eye views a reference map and the other a portion of a color airphoto. The scale, position, and orientation of either optical path can be changed so that the airphoto matches the map in some local area. You then refer to the airphoto and mark interpretation lines on the map or a transparent overlay. As the airphoto is moved slightly to register another subsection, you compile a map that has a minimum amount of distortion induced by the airphoto.

— 1, 2, 3 —

16-bit raster object: A raster in which each cell is represented by two bytes (16 bits) and can therefore assume 65,536 possible values. Elevation data commonly is ex-

pressed in 16-bit data. When color composite images are stored in 16-bit rasters, 5 bits represent the intensity level for red, 5 bits green, and 5 bits blue (the 16th bit is typically unused). With this scheme (32 possible levels for each color), each cell in a 16-bit composite color raster can take any one of 32,768 possible colors.

2D histogram: A two dimensional histogram can be created from two single histograms to give a visual sense of the similarity between the source raster objects.

24-bit raster object: A raster in which each cell is represented by three bytes (24 bits) and can therefore assume 16,777,216 possible values. When color images are stored in 24-bit rasters, 8 bits represent the intensity level for red, 8 bits green, and 8 bits blue. With this scheme (256 possible levels for each color), each cell in a 24-bit color raster can take any one of 16,777,216 possible colors.

3D surface modeling: Rendering a 3D surface from raster objects. Either a single object can be used to control both the height and the graytone in the display, or an elevation raster can be matched with a set of color image rasters for a real-world 3D image. (See also: solid modeling.)

3DMax™: Stereo shutter glasses for 3D viewing.

3D scene: A 2D projection of three dimensional features into a viewing plane located at an arbitrary position and angle in 3D space, in such a way as to preserve the visual appearance of a third spatial dimension. (Open GIS Consortium)

4-bit raster object: A raster in which each cell is represented by a nibble (half a bite) and can therefore have 16 possible values. The TNT products use 4-bit raster objects for class rasters having 16 or fewer classes and for dithered print-rasters.

5-5-5 composite color conversion method: 16-bit color data uses 15 of the 16 bits to store the color intensity information: 5 bits to represent the intensity level for red, 5 bits for green, and 5 bits for blue (the 16th bit is typically unused). With

this scheme (32 possible levels for each color), each cell in a 16-bit raster can take any one of 32,768 possible colors. Therefore, display boards that handle 16-bit color display data do not use color tables, since they have no need to map all the actually occurring colors into a limited set of 256 display colors. When TNTmips displays three 8-bit raster objects that are used as an RGB set on 16-bit devices, it only needs to scale each 8-bit value into a 5-bit range. (See also: color map, RGB.)

64 standard annotation colors: In 8-bit contexts the Color Palette Editor window normally reserves the first 64 colors for a standard set of user annotation colors for text, overlays and patterns. That leaves 192 colors for the image itself — ample color space for representing most natural color images to the human eye. The 64 standard colors are chosen at fixed intervals in the RGB color model. They generally appear brighter and purer than the subdued natural tones of the underlying image.

7.5' map: A standard topographic map quadrangle size that covers 7.5 minutes of latitude and 7.5 minutes of longitude. For example, the 7.5' map for Crow Butte, Nebraska covers from 103° 15' to 103° 22' 30" west, and 42° 37' 30" to 42° 45' north (about 8.6 x 6.4 miles or 55 square miles at that latitude). USGS quadrangle maps are common in both 15' and 7.5' sizes. (See also: minute.)

8-bit context: You are working in an 8-bit context whenever a color map is involved in display, which occurs if you have an 8-bit display board or if displaying 8-bit raster objects on display boards that can accommodate greater pixel depths.

8-bit raster object: A raster in which each cell is represented by one byte (8 bits) and can therefore assume 256 possible values. Multi-spectral imagery uses 8 bits to represent the intensity of each spectral band. A TNTmips project file may contain such a set of 8-bit raster objects of multi-spectral imagery. Each 8-bit band can be displayed by itself in 256 levels of gray or in individual, complete colors from a 256-color map. Three 8-bit bands can be selected and used for Red, Green, and Blue intensity values in a composite color image. With 8-bit display hardware, TNTmips optimizes the color information and displays the composite image in 256 colors. With 16-bit hardware, TNTmips displays the composite image in 32,768 possible colors. 24- and 32-bit display hardware can directly handle all 16 million actual colors.
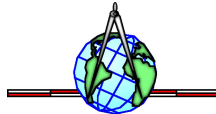
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