



## **West Virginia Firewise in the Classroom**

***Firewise Communities: Reducing the Risk of Wildfire***

## Glossary

### Lesson 1

**Fire Behavior Triangle:** A diagram that illustrates the factors that influence fire behavior.

**Fire Triangle:** A diagram that illustrates the factors necessary for combustion and flame production.

**Geographic Information System (GIS):** A collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analyzing and displaying all forms of geographically referenced information.

**Topography:** The shape or configuration of the land.

**Wildfire:** An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.

### Lesson 2

**Arson:** A wildfire willfully ignited.

**Incendiary:** Of or involving arson.

**Minnesota Interagency Fire Center: Minnesota's support center for wildland firefighting.**

Located in Grand Rapids, MN.

**National Interagency Fire Center:** The nation's support center for wildland fire fighting.

Located in Boise, Idaho.

### Lesson 3

**Concept map:** A technique for representing knowledge in graphic form.

**Firewise:** A national and Minnesota program whose goals are to educate homeowners and developers about the risk of wildland/urban interface fire, and steps they can take to make homes safer and more likely to survive a wildland/urban interface fire.

**Firewise Community Assessment:** An assessment of the fire risk of a community utilizing aerial photos, a Geographic Information System (GIS) and home surveys.

**Wildland Urban Interface (WUI):** Any area where development meets or mingles with wildland vegetation.

### Lesson 4

**Access:** Characteristics of a property that make the structures difficult or easy for emergency vehicles to reach.

**Composting:** The decomposition of plant remains and other once-living materials to make a substance that can provide enrichment to houseplants and garden soil.

**Defensible space:** An area within 30 feet of a structure from which combustibles have been removed.

**Density Surface Model (DSM):** An AtlasGDS function that allows you to identify areas of concentration of specific elements.

**Fire ladder fuels:** Grass, brush or vegetation that is within a few feet of the lower branches of trees.

**Fire risk factors:** Access, Site, Structure and Fire Use Practices.

**Fire Use Practices:** Outdoor burning or the lack of a spark arrestor on an indoor fireplace.

**Firewise Community Plan:** A plan for community, homeowner, future development and educational activities to reduce wildfire risk.

**Flammables:** Materials that ignite and burn easily.

**Home ignition zone:** The area within 30 feet of a home.

**Site:** Characteristics of a property that create more or less of a fire risk, including trees, fire ladder fuels and flammables.

**Soffit:** The exposed underside of a building's roof overhang or eave.

**Spark arrestor:** A chimney cap that prevents the escape of stray sparks from an indoor fireplace.

**Structure:** Characteristics of a structure that create more or less of a fire risk, such as building materials and design.

**Wildfire Hazard Zone:** In West Virginia, structures located within ¼ mile of conifers.

## *Firewise Communities: Reducing the Risk of Wildfire*

### Glossary (Continued)

#### Lesson 5

**Choropleth map:** A thematic map in which areas are colored or shaded to reflect the density of the mapped phenomenon or to symbolize classes within it.

**Demographic data:** Data about statistical characteristics of a human population.

**Graduated color map:** A map that uses a range of colors to indicate a progression of numeric values.

**Population projection:** An estimate of the population for future dates, based on assumptions about future births, deaths, international migration and domestic migration.

**Population pyramid:** A bar chart, arranged vertically, that shows the distribution of population by age and sex.

#### Lesson 6

**AtlasGDS:** Atlas Geospatial Decisions Support. A desktop GIS software program.

**Background File:** A file “behind” the active layer that can be queried.

**Buffer:** A polygon enclosing a point, line, or polygon at a specified distance.

**Color File:** A file that stores color data for a layer.

**Latitude:** The angular distance along a meridian north or south of the equator, usually measured in degrees.

**Layer:** A file that contains data for a specific theme.

**Longitude:** The angular distance along a meridian east or west of a prime meridian, usually measured in degrees.

**Map Elements:** Basic map elements (Title, Orientation, Date, Author, Legend, Scale, Source).

**Metadata:** Information about a data set.

**Pedigree File:** A file that stores metadata for a layer.

**Raster:** A spatial data model made of rows and columns of cells.

**Reclass:** In AtlasGDS, a function that allows the user to simplify complex data sets or to identify data that meets two sets of criteria simultaneously.

**Scale:** The ratio or relationship between a distance or area on a map and the corresponding distance or area on the ground.

**Speed button:** A short cut to a mapping or analytical function.

**Study Area:** A file that covers a specific geographic area, and includes data layers.

**TODALSS:** An acronym for basic map elements (Title, Orientation, Date, Author, Legend, Scale, Source).

**UTM coordinates (Universal Transverse Mercator):** A commonly used projected coordinate system that divides the globe into sixty zones.

**Vector:** A spatial data model made of points, lines or polygons.

#### Lesson 7

**Digital Orthophoto Quadrangle (DOQ):** An aerial photograph from which distortions owing to camera tilt and ground relief have been removed.

**Dtag:** A new way of storing labels.

**Label File:** A file that stores labels, or tags, for a layer.

**Legend File:** A file that stores legend data.

**Level 1 Assessment:** A Firewise assessment utilizing aerial photos and Geographic Information Systems (GIS).

**PLS Section:** The division of U.S. land into one-mile square sections.

**PLS Township:** The division of U.S. land into six-mile square townships.

**Public Land Survey System:** The division of U.S. land into regular rectangular areas called townships and sections. Initiated by the Land Ordinance of 1785.

**Tag Editor:** A function that allows you to add, delete or edit labels for a layer.

**Tag File:** A file that stores labels, or tags, for a layer.

**WMS:** A web mapping service.

## ***Firewise Communities: Reducing the Risk of Wildfire***

### **Glossary (Continued)**

#### **Lesson 8**

**Access road:** The road which vehicles travel to reach a subdivision and homes.

**Attic vent:** An opening along the eaves of a house for ventilation.

**Cul-de-sac:** The circular turn around area on a dead end street.

**Evergreen tree:** A tree that remains green all year.

**GPS waypoint:** A geographic location determined by a GPS receiver.

**Hardwood tree:** A tree that loses its leaves at the end of the growing season.

**Ladder fuels:** Grass, brush or vegetation that is within a few feet of the lower branches of trees.

**Open foundation:** A foundation of wood posts or cement block pillars with no skirting.

**Slope:** The variation in terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

**Soffit:** The exposed underside of a building's roof overhang or eave.

**Tree crown:** The primary and secondary branches growing out from the main stem of a tree, together with the twigs and foliage.

**Unskirted deck:** A deck with open area between it and the ground.

**Vinyl siding:** A tough exterior plastic material.

#### **Lesson 9**

**GPS or Global Positioning System:** A network of earth orbiting satellites established by the U.S. Department of Defense.

**GPS receiver:** A device that locates GPS satellites and uses trilateration to determine location.

#### **Lesson 10**

**Geocaching:** An adventure game for GPS users, similar to a GPS "treasure hunt".

### **Geographic Concepts – Foundation Concepts for Mapping and GIS**

**Airborne Control System (ABC)** - a survey system for fourth-order horizontal and vertical control surveys involving electromagnetic distance measurements and horizontal and vertical measurements from two or more known positions to a helicopter hovering over the unknown position. Also known as ABC system.

**Atomic Clock** is a type of clock that uses an atomic resonance frequency standard to feed its counter. Today's best atomic frequency standards (or clocks) are based on absorption spectroscopy of cold atoms in atomic fountains. National standards agencies maintain an accuracy of  $10^{-9}$  seconds per day. The clocks maintain a continuous and stable time scale, International Atomic Time (TAI). For civil time, another time scale is disseminated, Coordinated Universal Time (UTC). UTC is derived from TAI, but synchronized with the passing of day and night based on astronomical observations.

**Azimuth** - the horizontal component of a direction (compass direction), measured around the horizon, from the north toward the east (i.e., clockwise) in astronomy and geodesy and from the south toward the west (i.e., clockwise) in surveying. It is usually expressed in degrees.

**Bearing** - the clockwise angle between a reference direction (or a datum line) and the direction to an object. Unless otherwise specified, the reference direction is generally understood to be magnetic North, in which case the term *compass bearing* is also used.

**Builder's Level** - often mistaken for a transit, but is actually a type of inclinometer. It measures neither horizontal nor vertical angles. It simply combines a spirit level and telescope to allow the user to visually establish a line of sight along a level plane. Some levels do have a horizontal circle by which horizontal angles can be measured.

## ***Firewise Communities: Reducing the Risk of Wildfire***

### **Glossary**

#### **Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**Cardinal direction** - the four principal directional indicators are marked as points or arrowheads on a traditional magnetic compass rose. Called cardinal directions, they are north, east, south and west. Though the names may seem arbitrary, there are simple specific means to establish each direction, which should work anywhere on Earth where there is a view of the sky. North and south are oriented toward the respective poles of the Earth. The Earth's rotation defines the orientation of east and west.

**Choropleth map** - a thematic map in which areas are shaded or patterned in proportion to the measurement of the statistical variable being displayed on the map, such as population density or per-capita income. It provides an easy way to visualize how a measurement varies across a geographic area.

**Compass (or mariner's compass)** - a navigational instrument for finding directions on the Earth. It consists of a magnetized pointer free to align itself accurately with Earth's magnetic field, which is of great assistance in navigation. The cardinal points are north, south, east and west. A compass can be used in conjunction with a marine chronometer and a sextant to provide a very accurate navigation capability. This device greatly improved maritime trade by making travel safer and more efficient. Two early forms of the compass were invented in China in the 11<sup>th</sup> century. The familiar mariner's compass was invented in Europe around 1300.

**Coordinates** – a system for defining points in space or on a particular surface by means of distances from a point of origin, a datum, a standard parallel or a meridian. The concept can be expanded to include the definition of areas in reference to a rectangular grid. Cartesian coordinates relate to a two dimensional plane in relation to two intersecting straight line axes. The coordinates are rectangular if the axes intersect perpendicularly. Geographic coordinates define a point on the Earth's surface by measures of latitude and longitude with reference to a spherical or ellipsoidal earth model. Grid coordinates define a point or an area on a rectangular grid. If the grid is composed of matrix of squares, such as cells, or Townships and Ranges, areas can be defined by a grid coordinate code. Universal Transverse Mercator (UTM) coordinates are a worldwide system based on the UTM projection, whereby the Earth's surface between 80 degrees South and 84 degrees North is divided into equal zones and bands, each bearing a unique two letter code. Points are referenced in terms of distance in meters east of an origin lying to the west of each zone, and (in the northern hemisphere) in terms of distance in meters north from the equator.

**Datum** – a control point or set of parameters used to define the horizontal or vertical position of other points on the Earth's surface.

Vertical location within a limited region can be related to mean sea level at a specific location or to an agreed upon arbitrary level.

The term also applies to control points such as North American Datum (NAD83) which is a point established by satellite and terrestrial survey that defines a model shape of the Earth on which all points are imagined to lie. WGS84 redefined the model as Earth centered, slightly shifting latitude and longitude location.

**Digital Elevation Model (DEM)** - a digital representation of ground surface topography or terrain. It is also widely known as a digital terrain model (DTM). A DEM can be represented as a raster (a grid of squares) or as a triangular irregular network. DEMs are commonly built using remote sensing techniques, however, they may also be built from land surveying. DEMs are used often in geographic information systems, and are the most common basis for digitally-produced relief maps.

**Glossary**

**Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**Digital Orthophoto Quad (DOQ)** - a photographic quad map prepared from perspective aerial photography in which the displacements of the perspective photographic images due to both the tilt of the camera and the variation of ground elevation, are removed.

**Direction** - the information contained in the relative position of one point with respect to another point without the distance information. Directions may be either relative to some indicated reference (the violins in a full orchestra are typically seated to the left of the conductor), or absolute according to some previously agreed upon frame of reference (New York City lies due west of Madrid). Mathematically, direction may be uniquely specified by a unit vector in a given basis, or equivalently by the angles made by the most direct path with respect to a specified set of axes.

**Distance** - a numerical description of how far apart objects are at any given moment in time. In physics or everyday discussion, distance may refer to a physical length, a period of time, or an estimation based on other criteria (e.g. "two counties over"). In mathematics, distance must meet more rigorous criteria.

**Doppler Effect** - named after Christian Doppler, is the change in frequency and wavelength of a wave as perceived by an observer moving relative to the source of the waves. The total Doppler effect may therefore result from either motion of the source or motion of the observer. Each of these effects is analyzed separately.

**Elevation** - of a geographic location is its height above a fixed reference point, often the mean sea level. Elevation, or geometric height, is mainly used when referring to points on the Earth's surface, while altitude or geo-potential height is used for points above the surface, such as an aircraft in flight or a spacecraft in orbit. Less commonly, elevation is measured using the center of the Earth as the reference point. Due to equatorial bulge, there is debate whether the summits of Mt. Everest or Chimborazo are at the higher elevation, as Chimborazo is further from the Earth's center while Mt. Everest is higher above mean sea level.

**Ellipsoid** – a solid geometric figure of the Earth whose mathematical surface best approximates the shape of the Earth -- also called a spheroid. It is generated by an ellipse revolving about its minor axis which can be considered to be the Earth's polar axis. Latitude, longitude and all planar coordinate systems are determined with respect to the ellipsoid.

**Flat file** - a computer file that can only be read or written sequentially. It consists of one or more records. Each record contains one or more field instances. Each field instance can contain a data value, or be omitted. Some definitions state that all records must be of the same type. This restriction is usual when discussing a flat file database. However, most usages allow a flat file to have more than one record type. A flat file database describes any of various means to encode a data model (most commonly a table) as a plain text file.

**Geoid** – the figure of the Earth considered as a mean sea level surface extended continuously through the continents. It is a theoretically continuous surface that is perpendicular at every point to the direction of gravity (the plumb line). It is the surface of reference for geodetic leveling as its variation is far less than that of the ellipsoid from a true sphere.

**Geographic Information System (GIS)** - an information system comprised of computer hardware, computer software and procedures designed to support the capture, storage, management, manipulation, analysis, modeling and display of spatial data. GIS is used for identifying, developing strategies and providing decision support for complex planning and management problems.

## ***Firewise Communities: Reducing the Risk of Wildfire***

### **Glossary**

#### **Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**Global Positioning System (GPS)** - a precise location and navigation information technology using orbiting satellites which was developed by the U.S. Department of Defense for military applications. GPS technology employs a constellation of 24 NAVSTAR satellites orbiting the Earth twice a day transmitting highly precise timing data generated by on-board atomic clocks. A GPS receiver picks up this timing information and satellite location information from at least four of the satellites and mathematically computes latitude, longitude and altitude information, or converts these to UTM coordinates.

**GPS, Differential** - a relative navigation or survey positional technique which removes the effects of Selective Availability (SA) and other GPS errors by using a reference station which monitors GPS transmissions and broadcasts corrections to other GPS receivers in the vicinity.

**GPS, Selective Availability** – a GPS mode in which the satellite location and atomic clock information were intentionally corrupted by the Department of Defense for national security reasons. With this switched on, a varying random error was introduced in GPS transmissions thus degrading the real time accuracy of civilian GPS receivers to  $\approx$  100 meters. SA was turned off in 2000, opening full GPS capability to all.

**GPS, Receiver** – the mobile handheld or mounted unit that receives GPS satellite signals and computes the distance from the satellites to the unit, and by multilateration determines the XY location of the unit with reference to the World Geodetic System (1984).

**Isoline map** - a map with continuous lines joining points of the same value. In 1584 Peter Bruinss drew a chart with lines showing equal depths of water. This may be the first isogonic chart, but it was not published. In 1701 Edmond Halley published the first such map, a chart of the Atlantic Ocean showing lines of magnetic deviation. Perhaps the most common isoline map is one which shows lines indicating equal elevation (isohypse), a contour map.

**Law of Cosines (also known as the cosine formula or cosine rule)** - a statement in trigonometry about a general triangle which relates the lengths of its sides to the cosine of one of its angles. The law of cosines states that

$$\begin{aligned}c^2 &= a^2 + b^2 - 2ab \cos(\gamma), \\b^2 &= a^2 + c^2 - 2ac \cos(\beta), \\a^2 &= b^2 + c^2 - 2bc \cos(\alpha).\end{aligned}$$

Note that  $c$  is the side opposite of angle  $\gamma$ , and that  $a$  and  $b$  are the two sides enclosing  $\gamma$ . All three of the identities above say the same thing; they are listed separately only because in solving triangles with three given sides one may apply the identity three times with the roles of the three sides permuted.

**Law of Sines (or sine law, sine formula)** is a statement about arbitrary triangles in the plane. If the sides of the triangle are  $a$ ,  $b$  and  $c$  and the angles opposite those sides are  $A$ ,  $B$  and  $C$ , then the law of sines states:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$$

where  $R$  is the radius of the triangle's circumcircle. This law is useful when computing the remaining sides of a triangle if two angles and a side are known, a common problem in the technique of triangulation.



**Glossary**

**Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**Location** is a position or point in physical space expressed relative to the position of another point or thing. A real location can often be designated using a specific pairing of latitude and longitude, a Cartesian coordinate grid, a spherical coordinate system, or an ellipsoid-based system (e.g., World Geodetic System). A location may be described as either absolute location, meaning the exact location of an object, or relative location, meaning the location of one object relative to another.

**Magnetic North** - the wandering point on the Earth's surface at which the Earth's magnetic field points vertically downwards (i.e. the "dip" is 90°). The North Magnetic Pole should not be confused with the lesser known North Geomagnetic Pole, described later in this article. As of 2005 the North Magnetic Pole lay near Ellesmere Island in northern Canada at 82.7° N 114.4° W. Its southern hemisphere counterpart is the South Magnetic Pole. Because the Earth's magnetic field is not exactly symmetrical, the North and South Magnetic Poles are not antipodal: a line drawn from one to the other does not pass through the centre of the Earth (it actually misses by about 530 km).

**Map** – a representation of a portion of the earth's surface (or the whole) on a planar surface, using an established projection and scale, that shows selected features of the earth's surface by means of signs and symbols.

**Map Projection** - a systematic transformation of the locations (i.e. latitudes and longitudes) on the surface of the Earth (spherical or ellipsoidal) to planar coordinates. That is, locations in three-dimensional space are made to correspond to two-dimensional representation. All map projections distort areas, shapes, angles, distances or directions to some degree. Certain map projections attempt to minimize the distortion or preserve one or more of these variables.

**Map Reference System** – a system whereby individual maps in a national map series is coded with a unique numerical, alphanumeric or named code such that both map cataloguing and ease of location and use is facilitated.

**Map scale** - is the ratio of a single unit of distance on the map to the equivalent distance on the ground. The scale can be expressed in four ways: as a ratio, a fraction, in words and as a graphical (bar) scale. A scale expressed as a ratio of say 1:25,000 means that one unit on the map represents 25,000 units on the ground, ie 1 millimeter represents 25,000 mm, expressed better as 25 metres. The statement 'one millimeter represents 25 metres' is an expression of scale in words. Scale expressed as a fraction, 1/25,000, means that any distance on the map is 1/25,000 th the distance on the ground. It expresses the amount of reduction of distances used to represent detail on the map. The 25,000 value is called the scale denominator. Due to showing the curved surface of the earth on a flat map surface, the scale varies from place to place. Thus a representative fraction is stated for scale which is correct at the centre of the map and which varies elsewhere. While called representative fraction, it really is the representative ratio. A graphical (bar) scale is a ruler with ground distances added, included in the margin of most maps. The graphical scale is used to measure distances on the map. The distance on the map is marked on the edge of a sheet of paper, which is then placed over the graphical bar scale and the distance read. Maps are usually produced at standard scales of 1:10,000, 1:25,000, 1:50,000, 1:100,000, 1:250,000, 1:500,000. The distance on the ground equals the distance measured on the map multiplied by the scale denominator.

**Matrix** – in math, a rectangular table of numbers or, more generally, a table consisting of abstract quantities that can be added and multiplied. Matrices are used to describe linear equations, keep track of the coefficients of linear transformations and to record data that depend on two parameters. Matrices can be added, multiplied, and decomposed in various ways, making them a key concept in linear algebra and matrix theory.

## ***Firewise Communities: Reducing the Risk of Wildfire***

### **Glossary**

#### **Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**Multilateration** – a variant of Trilateration involving more than three lines along which distance is measured by electronic distance measurement (EDM). Initially used by the ABC system, the Global Positioning System in effect uses multilateration, computing location from 4 or more orbiting satellites.

**Polygon** - is a plane figure bounded by a closed path or *circuit*, composed of a finite sequence of straight line segments. These segments are called its *edges* or *sides*, and the points where two edges meet are the polygon's *vertices* or *corners*. The interior of the polygon is its *body*. In computer graphics (image generation), the term has taken on a slightly altered meaning, more related to the way the shape is stored and manipulated within the computer.

**Public Land Survey System (PLSS)** - established in 1787 by the Continental Congress for the purposes of land division. In Minnesota, the PLSS is the rectangular system of township, range and section references used for land descriptions, transactions and adjudications. Also often used as a location reference for geographic data.

**Pythagorean Theorem** - is a relation in Euclidean geometry among the three sides of a right triangle. The theorem is named after the Greek mathematician Pythagoras, who by tradition is credited with its discovery, although knowledge of the theorem almost certainly predates him. The theorem states that 'the sum of the areas of the two squares on the legs (*a* and *b*) equals the area of the square on the hypotenuse (*c*)'. If we let *c* be the length of the hypotenuse and *a* and *b* be the lengths of the other two sides, the theorem can be expressed as the equation:-

$$a^2 + b^2 = c^2$$

**Raster data structure** - a cellular or grid data structure composed of rows and columns in which individual cells are assigned a numerical value. Groups of cells represent data features which can be displayed on the pixels of a computer monitor either as shades of gray or colors. Groups of cells having the same value represent the same feature. Image data from satellites and aerial photos are stored using this structure. In GIS, raster attribute data is associated with a grid cell or pixel, versus a Vector data structure which associates attribute data with the feature itself.

**Region** - a geographic term that is used in various ways among the different branches of geography. In general, a region medium-scale area of land or water, smaller than the whole areas of interest and larger than a specific site or location. A region can be seen as a collection of smaller units or as one part of a larger whole. A region can be defined by physical characteristics, human characteristics and functional characteristics. As a way of describing spatial areas, the concept of regions is important and widely used among the many branches of geography, each of which can describe areas in regional terms.

**Reference Ellipsoid** - in geodesy, a mathematically-defined surface that approximates the true shape of the Earth. Because of their relative simplicity, reference ellipsoids are used as a preferred surface on which geodetic network computations are performed and point coordinates such as latitude, longitude, and elevation are defined. Before the development of the World Geodetic System, individual national mapping agencies used different locally derived reference ellipsoids for their mapping systems.

**Retrodeformation** – a term describing computer software aided removal of deformation from a deformed feature, most often applied in paleontology to the restoration of fossils, but also applied in structural geology, engineering and terrain studies.

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### Glossary

#### Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)

**Spatial Analysis** - spans many related disciplines and brings together many tools for analysing spatial data. Spatial analysis provides the quantitative tools that have formed the bases for modern quantitative analysis in fields such as geography, location analysis, regional economics, and many physical sciences requiring the analysis of spatially-separated phenomena.

**Stadia lines** – the lines inscribed on the objective lens of a survey telescope, at an equal distance from the center crosshair, such that the distance subtended on a stadia (topographic) rod will be of a ratio of 1:100 with the distance of the center of the telescope from rod.

**Subtended** - In mathematics, 'subtended' usually refers to the direct relationship between an angle and its arc length. For example, according to circle geometry, in a circle, equal angles subtend equal arc lengths. The term is generally used in leveling to describe the distance spanned on a stadia (topographic) rod between the upper and lower stadia lines, as seen through a telescope.

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### Glossary

#### Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)

**Theodolite** - is an instrument for measuring both horizontal and vertical angles, as used in Triangulation . It is a key tool in surveying and engineering work.. A theodolite consists of a telescope mounted movably within two perpendicular axes, the horizontal or trunnion axis, and the vertical axis. When the telescope is pointed at a desired object, the angle of each of these axes can be measured with great precision, typically on the scale of arc seconds.

**Transit** - is a specialized type of theodolite that was developed in the early 19th century It featured a telescope that could "flop over" ("transit the scope") to allow easy back-sighting and doubling of angles for error reduction. Some transit instruments were capable of reading angles directly to thirty arc-seconds. In the middle of the 20th century, transits came to be known as a simple form of theodolite with less precision, lacking features such as scale magnification and mechanical meters. The importance of transits waned when compact, accurate electronic theodolites become widespread tools, but transits still find use as a lightweight tool for construction sites. Some transits do not measure vertical angles.

**Transverse Mercator Projection** - equivalent to the regular Mercator projection with the cylinder's tangency turned (transversed) 90 degrees along a meridian. The central meridian, each meridian 90 degrees from the central meridian and the Equator are represented by straight lines.

Universal Transverse Mercator (UTM) - special case of the transverse Mercator projection used as the basis for UTM grid and coordinates.

**Triangulation** – is the process of finding coordinates and distance to a point by calculating the length of one side of a triangle, given measurements of angles and sides of the triangle formed by that point and two other known reference points (or baseline) using the law of sines.

**Trilateration** – is a method of determining the relative positions of objects using the geometry of triangles in a similar fashion as triangulation. Unlike triangulation, which uses angle measurements (together with at least one known distance) to calculate the subject's location, trilateration uses the known locations of two or more reference points, and the measured distance between the subject and each reference point.

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### **Glossary**

#### **Geographic Concepts – Foundation Concepts for Mapping and GIS (Continued)**

**United States National Grid** - officially known as the United States National Grid for Spatial Addressing (USNG), is a system of geographic grid references commonly used in United States, different from using latitude or longitude. It is similar in design to the national grid reference systems used throughout other nations. The USNG was developed by the United States Department of Homeland Security (DHS), and is administered by the Federal Geographic Data Committee.

**UTM latitude zone** - the UTM system segments each longitude zone into 20 latitude zones. Each latitude zone is 8 degrees high, and is lettered starting from "C" at 80° S, increasing up the English alphabet until "X", omitting the letters "I" and "O" (because of their similarity to the digits one and zero). The last latitude zone, "X", is extended an extra 4 degrees, so it ends at 84° N latitude, thus covering the northern most land on Earth. Latitude zones "A" and "B" do exist, as do zones "Y" and "Z". They cover the western and eastern sides of the Antarctic and Arctic regions respectively. A convenient trick to remember is that the letter "N" is the first letter in the northern hemisphere, so any letter coming before "N" in the alphabet is in the southern hemisphere, and any letter "N" or after is in the northern hemisphere.

**UTM longitude zone** - the UTM system divides the surface of the Earth between 80° S latitude and 84° N latitude into 60 zones, each 6° of longitude in width and centered over a meridian of longitude. Zones are numbered from 1 to 60. Zone 1 is bounded by longitude 180° to 174° W and is centered on the 177th West meridian. Zone numbering increases in an easterly direction.

**Vector data structure** - a coordinate based linear data structure in which lines are represented by a directed or ordered list of XY coordinates. In GIS, attribute data is associated with the linear feature itself, versus a Raster data structure which associates attribute data with a grid cell or pixel.

**Waypoints** - sets of coordinates that identify a point in physical space. For the purposes of terrestrial navigation, these coordinates usually include longitude and latitude, and sometimes altitude. Waypoints have only become widespread for navigational use by the layman since the development of advanced navigational systems, such as the Global Positioning System (GPS) and certain other types of radio navigation. Waypoints located on the surface of the Earth are usually defined in two dimensions (*e.g.*, longitude and latitude); those used in the Earth's atmosphere or in outer space are defined in at least three dimensions.

**Wide Area Augmentation System (WAAS)** - an extremely accurate navigation system developed for civil aviation by the Federal Aviation Administration (FAA). The system augments the Global Positioning System (or GPS) to provide the additional accuracy, integrity, and availability necessary to enable users to rely on GPS for all phases of flight, from en route through GLS approach for all qualified airports within the WAAS coverage area.

**Note:** A variety of sources was used to compile this specialized glossary, but special acknowledgement of Wikipedia is made.