

Vector Format Options

ESRI uses two file-based storage formats for vector data; the coverage and the shapefile. Coverages and shapefiles both employ a georelational data model which stores the vector information ("the geography") in sets of binary files.

ESRI Coverage

A coverage is a proprietary vector format used by ESRI software. Coverages are the original storage format for ArcInfo and are still the standard format for complex geo-processing and spatial analysis.

Coverages are a collection of files located in multiple directories. Because of this layout, special utilities must be used to relocate, copy, rename, delete and reformat the data.

The multiple directory and file structure of a coverage can make transferring (e.g. ftp, email attachments) and archiving cumbersome. ESRI provides the export format (e00) which allows all spatial and descriptive information for a coverage to be combined into a single ASCII file. The reverse operation of import recreates the original coverage from the e00 file with no loss in accuracy or detail or topology.

Coverages can contain feature classes which are classified as either primary, composite or secondary. Primary features include arcs (lines), nodes, polygons and label points. Composite features such as routes and regions are built from primary features. Secondary features include ground-registration TIC marks and annotation.

Multiple features classes can be contained within the same coverage. For example, line and point and route and annotation features could all exist in the same coverage.

Perhaps the most useful characteristic of a coverage is the ability to maintain and store topology. Topology is the spatial relationships between vector features within the data structure. These relationships include;

- Line Connectivity (i.e. to and from),
- Line Contiguity (i.e. adjacency and direction), and
- Area Definition

Topology is stored very efficiently in the ESRI coverage structure (i.e. no redundant coordinates) and is considered essential for advanced spatial analysis.

ESRI Shapefile

Shapefiles were introduced with ArcView2 as a more convenient and simpler format than coverages. (i.e. "the lightweight coverage"). The shapefile format has not replaced coverages but has become very popular since the specification is published.

A shapefile consists of a set of 3 mandatory files, along with several optional files. Each file in the set shares the shapefile name with a different extension. The main file (*.shp) stores the geometry and must always have an index file (*.shx). A dBASE file (*.dbf) stores all the attributes of the shapes in the main file.

ESRI does not provide an export format for shapefiles. Instead, ESRI recommends that you package the shapefile (e.g. "ZIP & SHIP") for transfers, archiving and internet access.

Like coverages, shapefiles can support point, line and area features. Unlike a coverage however, only a single shape type can be contained per shapefile. More importantly, a shapefile is a non-topological data structure which can limit spatial analysis since connectivity and adjacency information is not explicitly recorded.

In keeping with the concept of a “lightweight coverage”, shapefiles have the following characteristics;

- Faster drawing speed and quicker edit ability (since there is none of the processing overhead required by a topological data structure)
- Require less disk space and are easier to read and write
- Polygon shapes can overlap
- Shape types are never associated
- Redundant coordinates are not eliminated along shared edges

Conversions Between Coverage and Shapefile

Utilities are provided to convert between the two ESRI vector formats.

The conversion from coverage to shapefile is relatively straightforward since topology relationships do not need to be maintained in the output structure. However, there are some restrictions related primarily to the dBASE format used by the shapefile e.g. a 10 character limit on column names, only 255 columns per table, etc.

Shapefiles can also be converted into coverages but there are more significant limitations. For example, shape polygons can not be converted directly to coverage polygons since there is no way to insure that the polygon shape features do not overlap.

There is invariably some additional processing required when converting from a shapefile to a coverage, whereas the output from a coverage to shapefile conversion can be used immediately.

As a general rule, an exported coverage is a good format for data sharing since it is a single file which can be transferred easily and converted to a shapefile when necessary.

Support for Coverage and Shapefile Formats

The primary GIS applications from ESRI support the vector formats as follows;

ArcInfo 7 and 8

- Access coverages - read, create and edit
- Access shapefiles - read, create and edit (ArcEditor)
- Convert from shapefile to coverage
- Convert from coverage to shapefile
- Export coverage to e00 file
- Import coverage from e00 file

ArcView 3.x and 8.1

- Access shapefiles - read, create and edit
- Access coverages - read
- Convert from coverage to shapefile

- Import coverage from e00 file (Import71 utility)