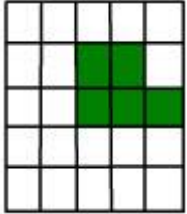


## Raster Data Structure

In a simple raster data structure the geographical entities are stored in a matrix of rectangular cells. A code is given to each cell which informs users which entity is present in which cell. The simplest way of encoding a raster data into computers can be understood as follows:



(a) **Entity model:** It represents the whole raster data. Let us assume that the raster data belongs to an area where land is surrounded by water. Here a particular entity (land) is shown in green color and the area where land is not present is shown by white.

0	0	0	0	0
0	0	1	1	0
0	0	1	1	1
0	0	0	0	0
0	0	0	0	0

(b) **Pixel values:** The pixel value for the full image is shown. Cells having a part of the land are encoded as 1 and others where land is not present are encoded as 0.

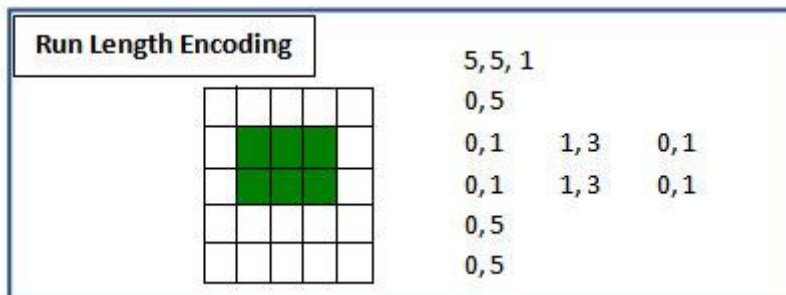
5,	5,	1		
0,	0,	0,	0,	0
0,	0,	1,	1,	0
0,	0,	1,	1,	1
0,	0,	0,	0,	0
0,	0,	0,	0,	0

(c) **File structure:** It demonstrates the method of coding raster data. The first row of the file structure data tells that there are 5 rows and 5 columns in the image, and 1 is the maximum pixel value. The subsequent rows have cells with value as either 0 or 1 (similar to pixel values).

The huge size of the data is a major problem with raster data. An image consisting of twenty different land-use classes takes the same storage space as a similar raster map showing the location of a single forest. To address this problem many data compaction methods have been developed which are discussed below:

### Run length encoding

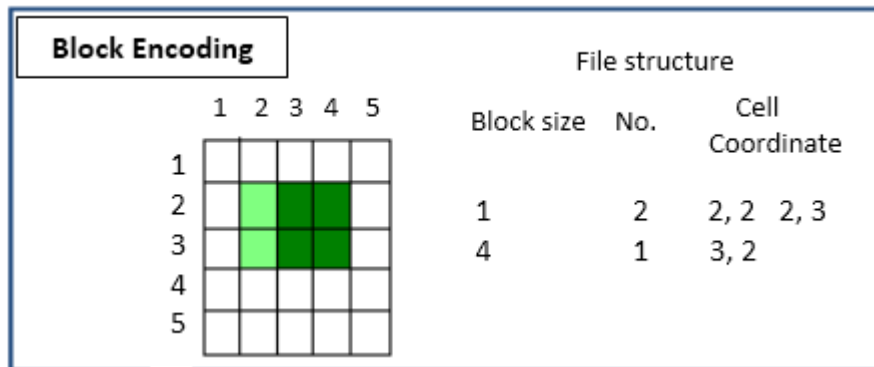
- Reduction of data on a row by row basis
- Stores a single value for a group of cells rather than storing values for individual cells
- First line represents the dimension of the matrix (5×5) and the number of entities (1) present. In second and subsequent lines, the first number in the pair represents absence (0) or presence (1) of the entity and the second number indicates the number of cells referenced.



### Block encoding

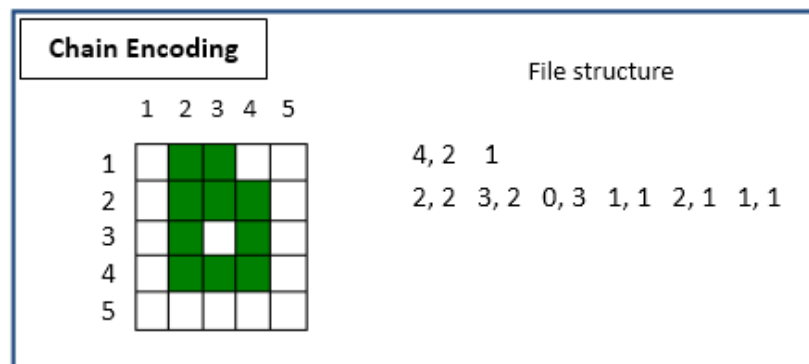
- Data is stored in blocks in the raster matrix.

- The entity is subdivided into hierarchical blocks and the blocks are located using coordinates.
- The first cell at top left hand is used as the origin for locating the blocks



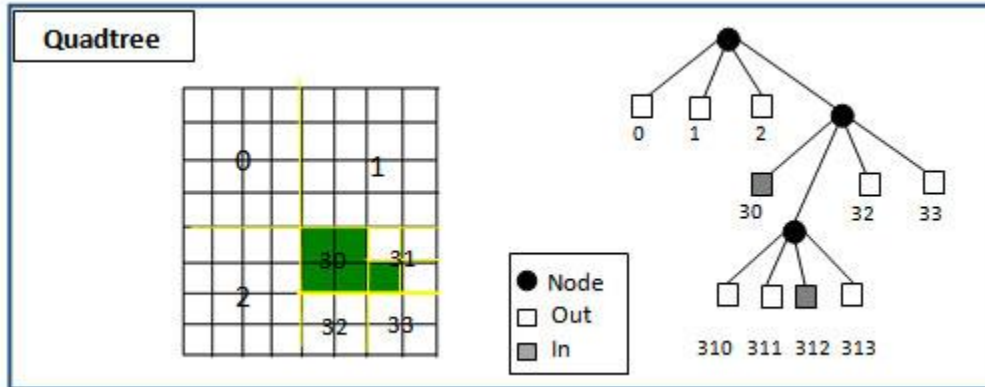
### Chain encoding

- Works by defining boundary of the entity i.e. sequence of cells starting from and returning to the given origin
- Direction of travel is specified using numbers. (0 = North, 1 = East, 2 = South, 3 = West)
- The first line tells that the coding started at cell (4, 2) and there is only one chain. In the second line the first number in the pair tells the direction and the second number represents the number of cells lying in this direction.



### Quadtree

- A raster is divided into a hierarchy of quadrants that are subdivided based on similar value pixels.
- The division of the raster stops when a quadrant is made entirely from cells of the same value.
- A quadrant that cannot be subdivided is called a leaf node.



A satellite or remote sensing image is a raster data where each cell has some value and together these values create a layer. A raster may have a single layer or multiple layers. In a multi-layer/ multi-band raster each layer is congruent with all other layers, have identical numbers of rows and columns, and have same locations in the plane. Digital elevation model (DEM) is an example of a single-band raster dataset each cell of which contains only one value representing surface elevation.

A single layer raster data can be represented using

**a. Two colors (binary):** The raster is represented as binary image with cell values as either 0 or 1 appearing black and white respectively



**Grayscale:** Typical remote sensing images are recorded in an 8 bit digital system. A grayscale image is thus represented in 256 shades of gray which range from 0 (black) to 255 (white). However a human eye can't make distinction between the 255 different shades. It can only interpret 8 to 16 shades of gray.



A satellite image can have multiple bands, i.e. the scene/details are captured at different wavelengths (Ultraviolet-visible- infrared portions) of the electromagnetic spectrum. While creating a map we can choose to display a single band of data or form a color composite using multiple bands. A combination of any three of the available bands can be used to create RGB composites. These composites present a greater amount of information as compared to that provided by a single band raster.

Comparison between Vector and Raster Data Models

<b>Data Model</b>	<b>Advantages</b>	<b>Disadvantages</b>
Raster	Simple data structure	Cell size determines the resolution at which the data is represented
	Compatible with remote sensing or scanned data	Requires a lot of storage space
	Spatial analysis is easier	Projection transformations are time consuming
	Simulation is easy because each unit has the same size and shape	Network linkages are difficult to establish
Vector	Data is represented at its original resolution and form without generalization	The location of each vertex is to be stored explicitly
	Require less storage space	Overlay based on criteria is difficult
	Editing is faster and convenient	Spatial analysis is cumbersome
	Network analysis is fast	Simulation is difficult because each unit has a different topological form
	Projection transformations are easier	

