

1. Spatial Data

Real World to a Map



www.bing.com/maps



www.openstreetmap.org

GIS Data Modelling: Basic Principles



Physical Reality

Actual phenomenon as observed

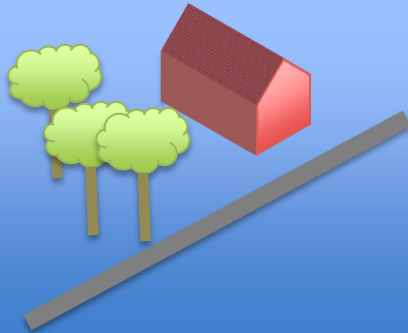
1

Map with symbols

Lines, text, colour, etc.



5



Real world model

Entity:

- type
- attributes
- relationships

2

ID	Type	Coordinates	Lot_no	Owner
1	House	109,100, 109,200 200,300 300,109	A092002	Janssen
2	School	234, 450 450,700 700,409 409,234	B092007	St. Jozef
3	House	678,987 987,431 431,560 560,678	A092012	Smit

Buildings
-categories: house, church, retirement home, school -situated at: address / cadastral lot no. -represented by: polygon (footprint)
Trees
-categories: oak, maple, birch -situated at: cadastral lot no. / metres from public road -represented by: single point

3

Data model

Object:

- type
- attributes
- relationships
- geometry

Database

Object:

- type
- attributes
- relationships
- geometry

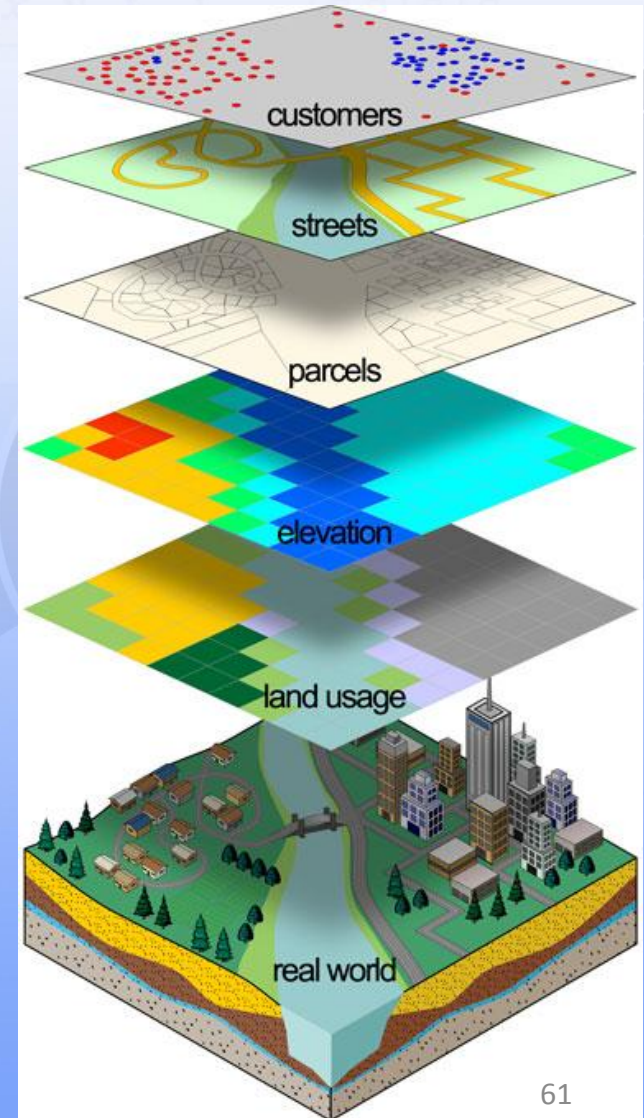
4

What Techniques and Concepts Does GIS Use to Represent Spatial Data?

- Layers
- Spatial data vs. Attribute data
- Different data models for different types of entities (layers)
- Spatial reference system (coordinate system)
→ next week

Layers

- GIS stores similar data (features types (~ entity)) in separate layers
- The location, expressed as $x, y, (z)$ coordinate, is a unique identifier to link the different layers

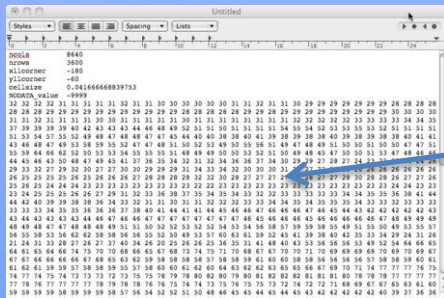
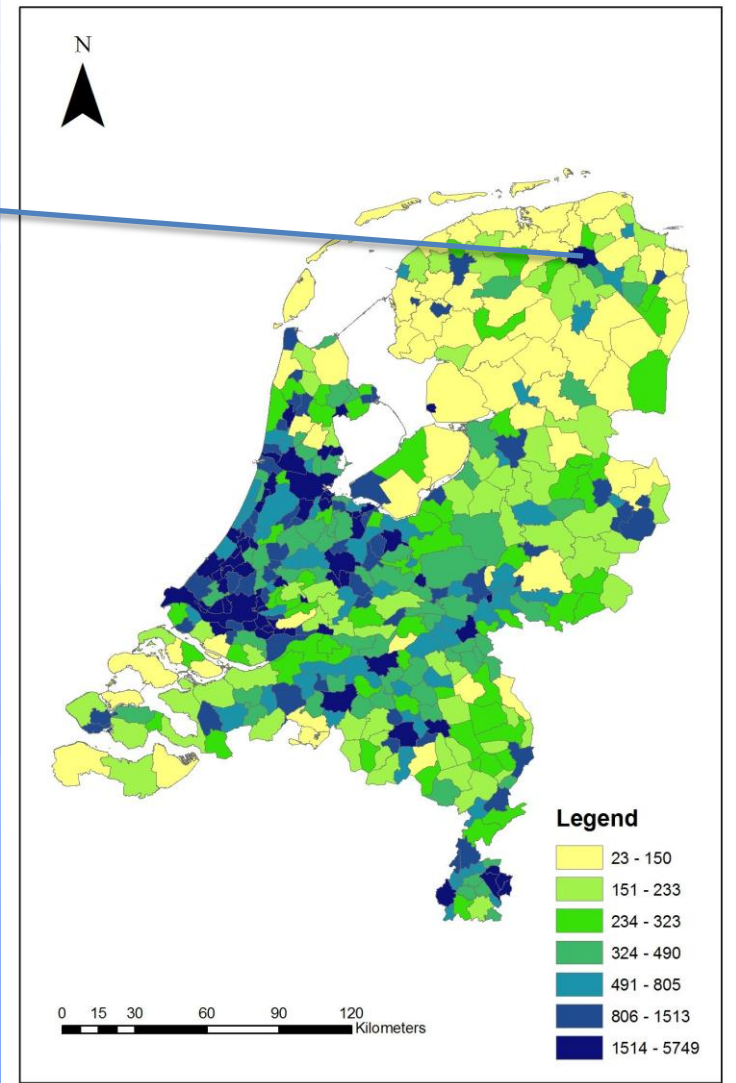
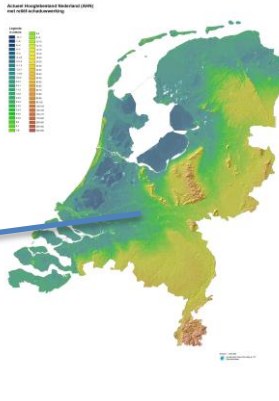


Spatial and Attribute Data

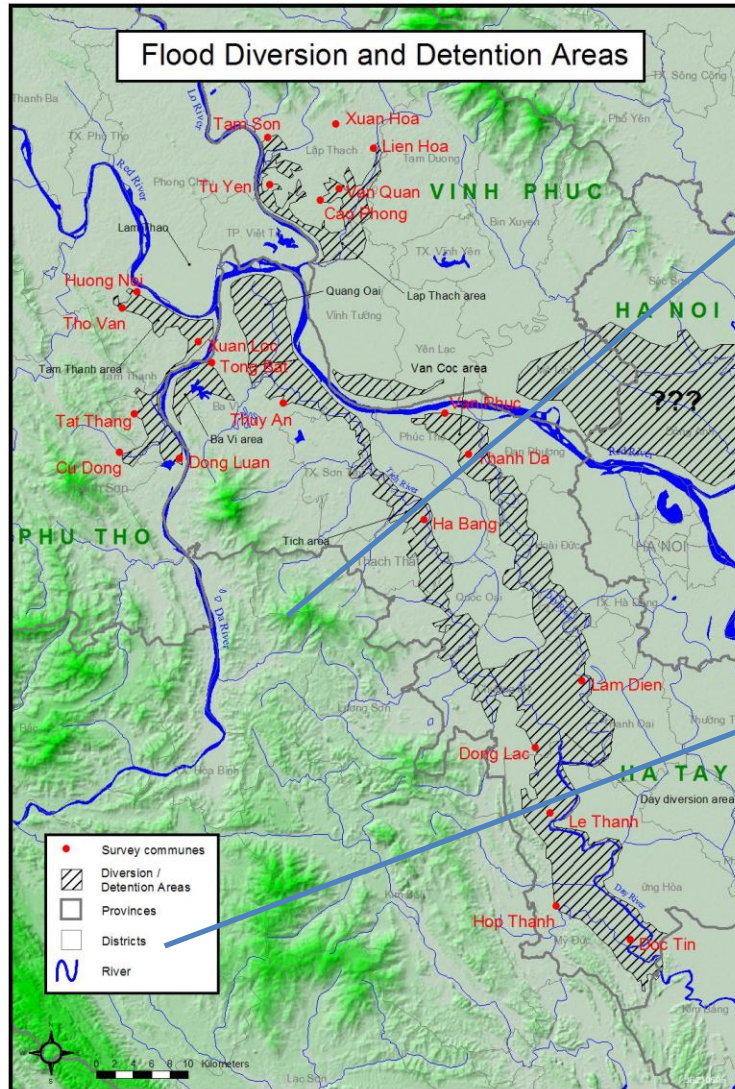
- Geographically referenced data consists of two parts:
 1. Spatial data: describes the location of spatial features
 2. Attribute data: describes the characteristics of spatial features

Spatial and Attribute Data

GEMNAAM	OPP TOT	BEV DICHTH	AANT INW	PROVNR	PROVCODE	PROVNAAM
Appingedam	2462	511	12190	20	20	Groningen
Bedum	4496	238	10600	20	20	Groningen
Bellingwedde	11007	88	9510	20	20	Groningen
Ten Boer	4571	160	7250	20	20	Groningen
Delfzijl	22748	208	27650	20	20	Groningen
Groningen	8369	2327	181610	20	20	Groningen
Grootegast	8778	140	12150	20	20	Groningen
Haren	5070	412	18810	20	20	Groningen
Hoogezand-Sappemeer	7305	512	34390	20	20	Groningen
Leek	6427	303	19190	20	20	Groningen
Loppersum	11199	97	10780	20	20	Groningen
Marum	6488	156	10070	20	20	Groningen
Almere	24877	1388	180920	24	24	Flevoland
Stadskanaal	11996	290	34120	20	20	Groningen
Scheemda	11746	123	14120	20	20	Groningen
Slochteren	15884	100	15190	20	20	Groningen
Veendam	7871	369	28120	20	20	Groningen
Vlagtwedde	17051	99	16600	20	20	Groningen
Zeewolde	26897	79	19700	24	24	Flevoland
Skarsterlân	21689	145	27050	21	21	Friesland
Vinschoten	2224	854	18480	20	20	Groningen
Winsum	10253	139	14000	20	20	Groningen
Boarnsterhim	16859	127	19310	21	21	Friesland
Zuidhorn	12837	147	18460	20	20	Groningen
Dongeradeel	26694	149	24860	21	21	Friesland
Achtkarspelen	10399	274	28140	21	21	Friesland
Ameland	26850	58	3460	21	21	Friesland
het Bildt	11651	119	10960	21	21	Friesland
Bolsward	942	1054	9600	21	21	Friesland
Dantumadeel	8749	227	19460			
Franekeradeel	10916	200	20570			
Harlingen	38767	618	15460			



Raster Data and Vector Data



Continuous features
(background
elevation)

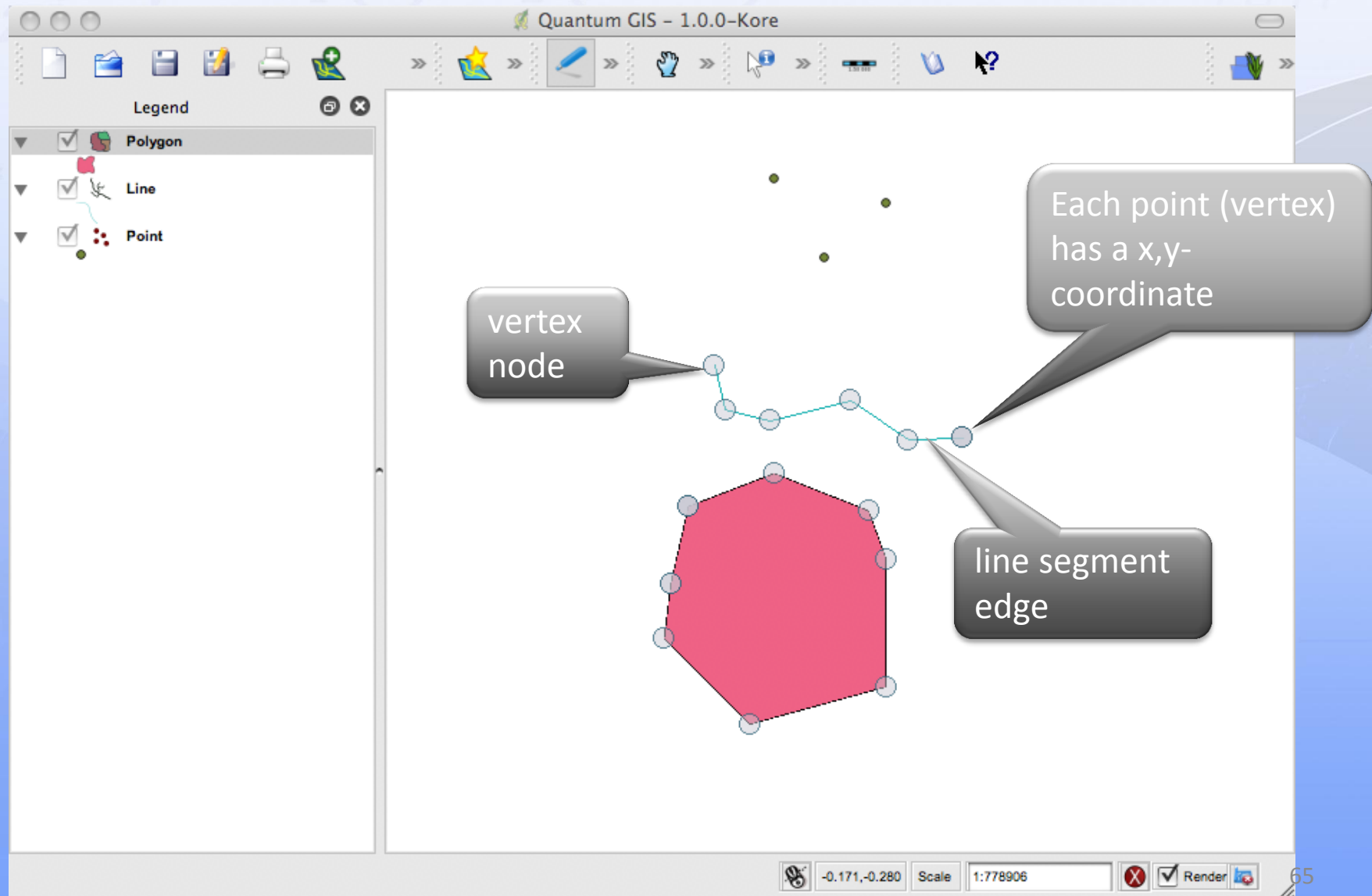
Raster Data Model

Discrete features:

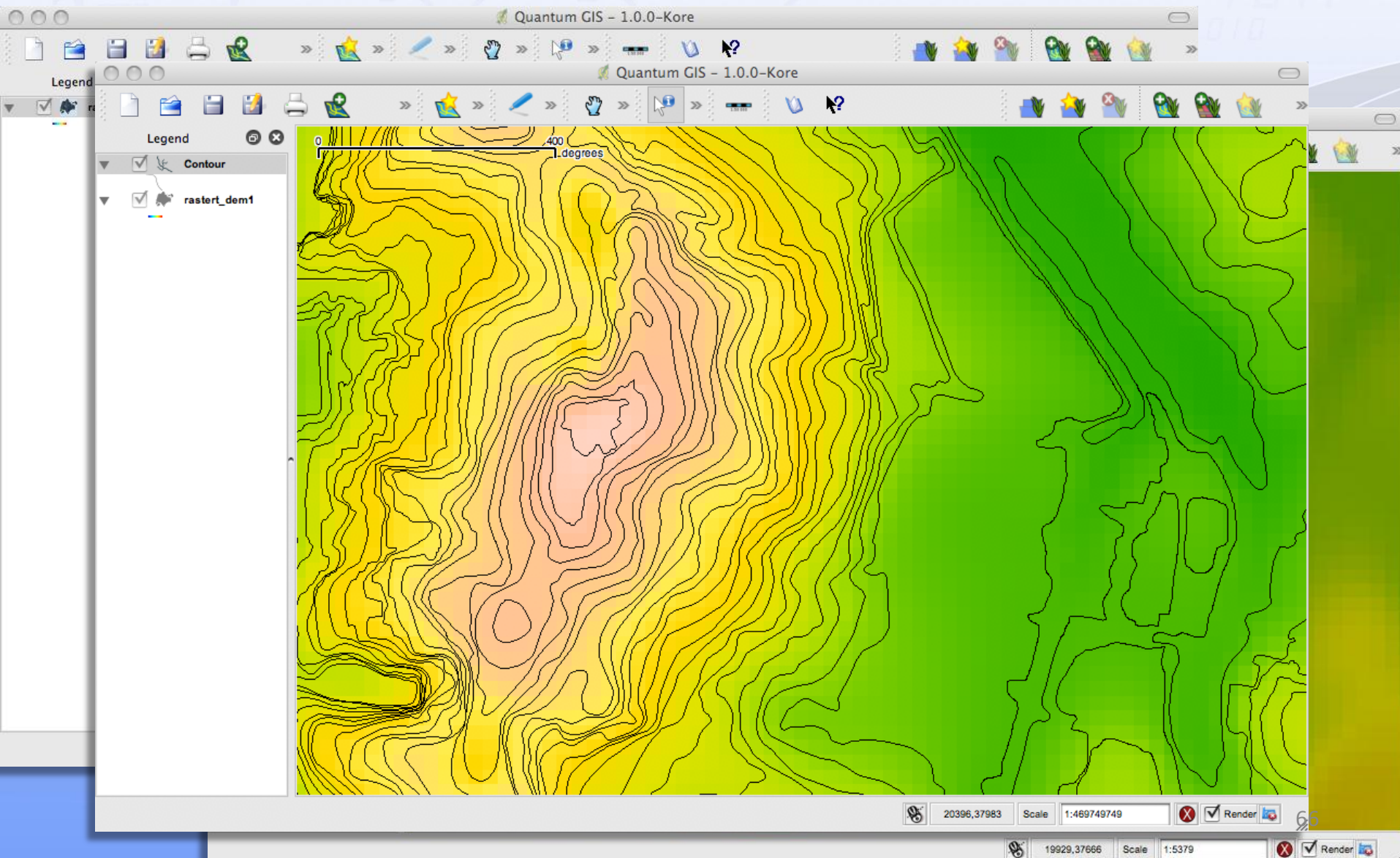
- point
- line
- polygon

Vector Data Model

Vector Data Model

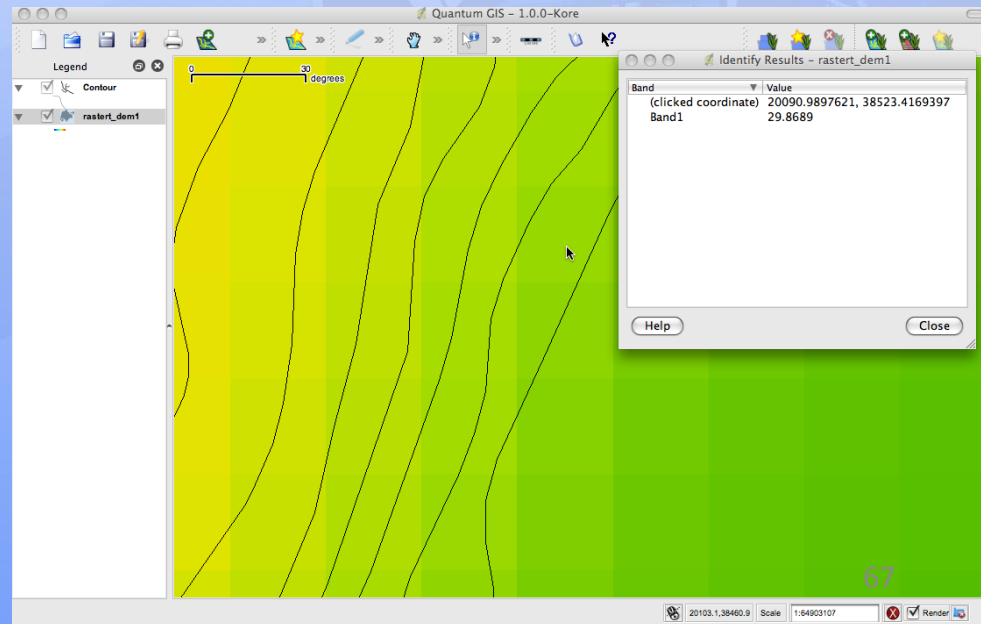


Raster Data Model



Raster Data Model

- raster, grid, surface, image
- rows, columns and cells
- each cell contains a value
- size of cell: resolution

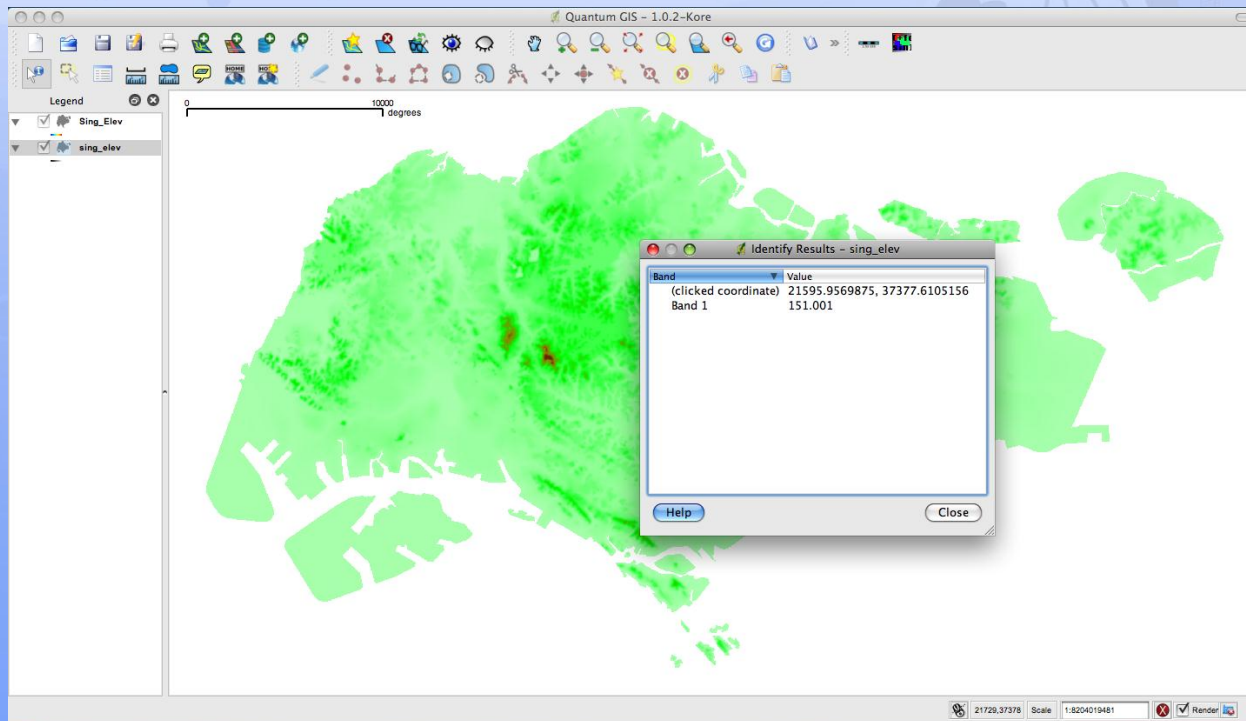


Other Data Models

- Object Oriented Data Model
- TIN (Triangulated Irregular Network) → elevation; higher efficiency than raster
- Regions Data Model → eliminate some of the limitations of polygons; regions may overlap, one region can consist of multiple polygons
- 3D data models (one x,y-coordinate has multiple z values)

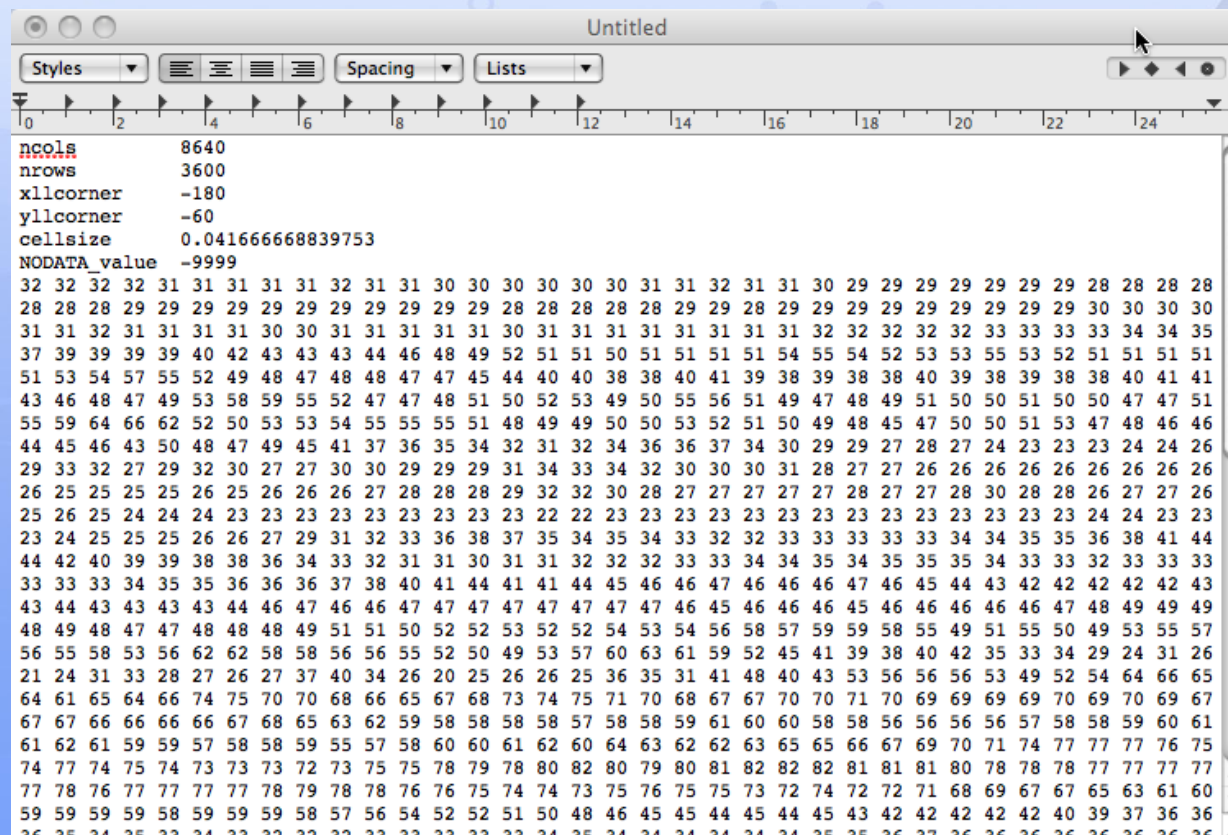
Raster Data

- Raster data:
 - Spatial data: location of cell in grid
 - Attribute data: cell value



Raster Data Storage

- Simplest form: text file
- Contains limited spatial information



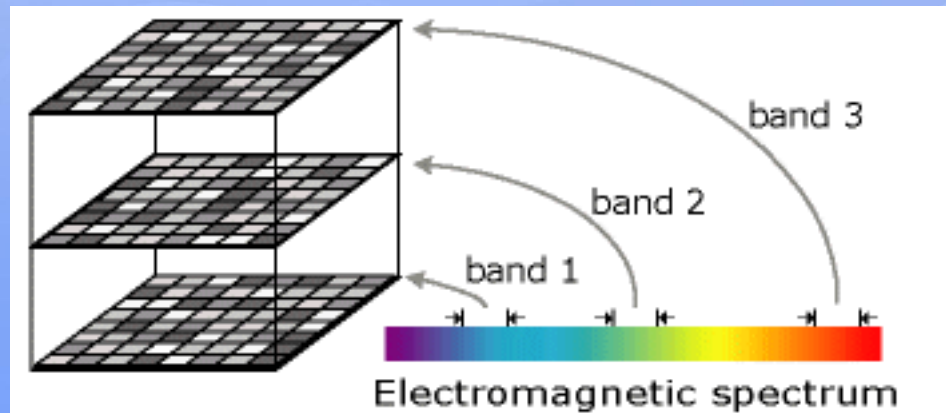
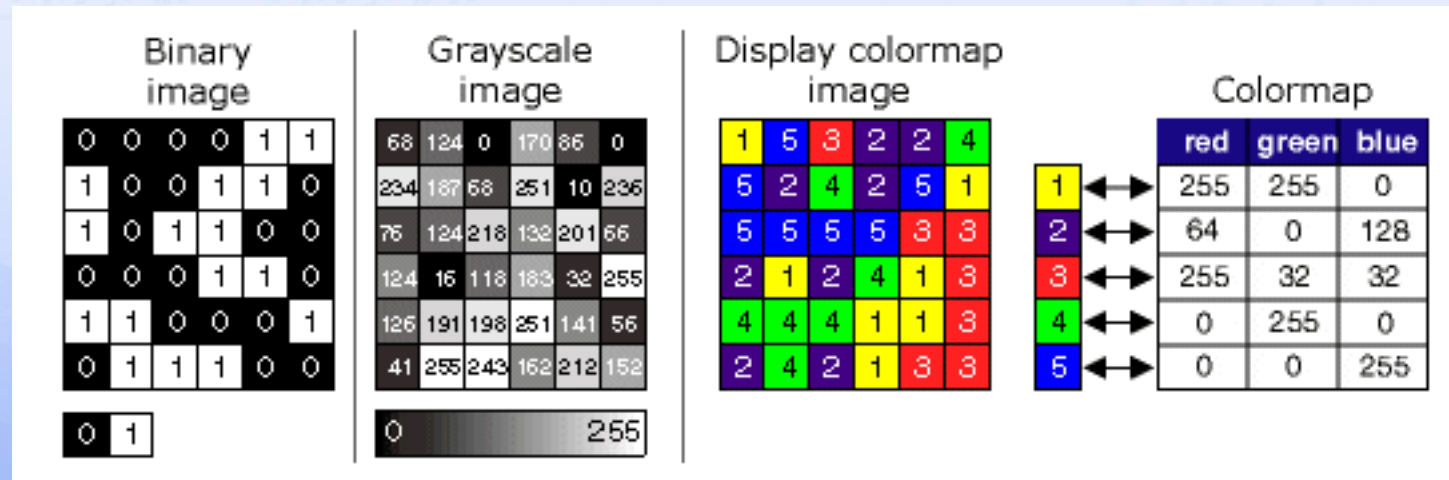
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Raster Data Storage

- Many formats (images, better storage efficiency, more location data, better computational efficiency, etc.)
- Images can be accompanied by a projection file or projection information
- Images can contain more than one band per cell: multiple band data

Raster Data - Display

Single band data



Multiple band data