Editing

Editing vector gds (shapefile format)

- Attributes
  - data update
  - creating and modifying tables
- Creating a new gds
- Spatial data
  - data update
  - adding new data
- Topology and topological data editing

Data editing

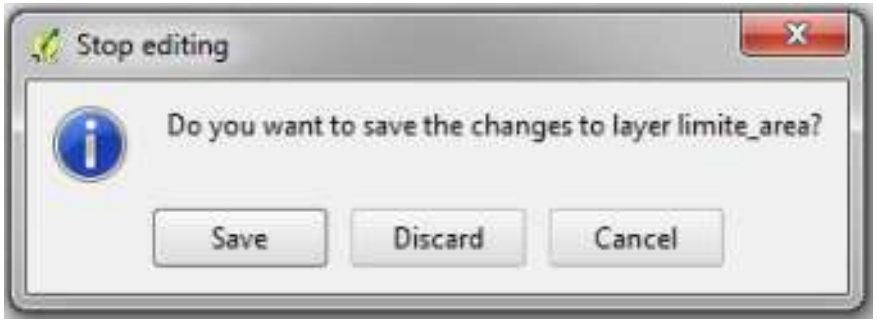
- Scope: vector gds in shapefile format
- Data editing includes:
  - in an existing gds
    - attribute values update
    - table structure modification (removing or adding attributes)
    - coordinates modification
    - new features creation requires
      - adding coordinates to locate each geographic feature on the Earth surface
      - recording the attribute values that uniquely describe each geographic feature
    - removing features
  - in a new gds
    - to create a new shapefile (geometric type point, line or polygon)
    - …

Data editing – general (1)

- Data editing always requires to enter in **editing mode**
  - by default the layers in a QGIS project are in read-only mode
  - to enter in editing mode use  Toggle Editing; you can find it:
    - in the context menu of the layer
    - in the Layer Properties → Fields window
    - in the layer Attribute table window
    - in the Digitizing toolbar
- The  Save Layer Edits button saves all updates made after the last save order (this operation cannot be undone!)

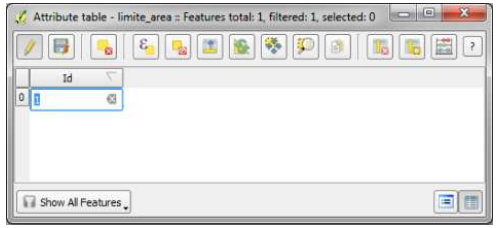
Data editing – general (2)

- To exit editing mode, use again  Toggle Editing and choose between to save or to discard data changes

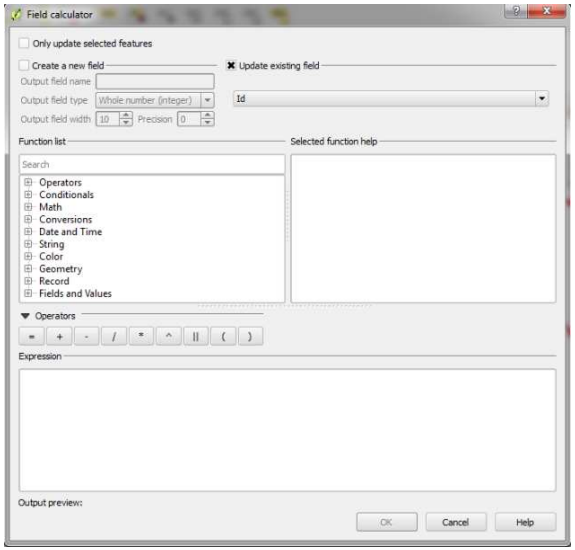


Attribute values update

- In the editing mode it is always possible to update the attribute values
  - either writing directly in the cells of the Attribute table window



  - or using the Field Calculator



  - always respecting the attribute data type (integer, real, text or data)

Table structure modification (1)

- In the Layer Properties → Fields windows it is possible to remove an attribute
  - using the  Delete Column button
- In the Layer Properties → Fields windows it is possible to create a new attribute
  - using the  New Column button
  - in type Decimal number (real)
    - Width = maximum number of numerical digits
    - Precision = maximum number of numerical digits in the fraction part of the number
    - Width - Precision = maximum number of numerical digits in the integer part of the number

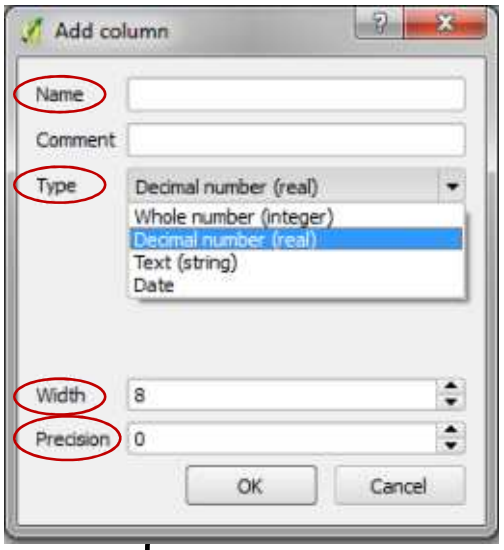
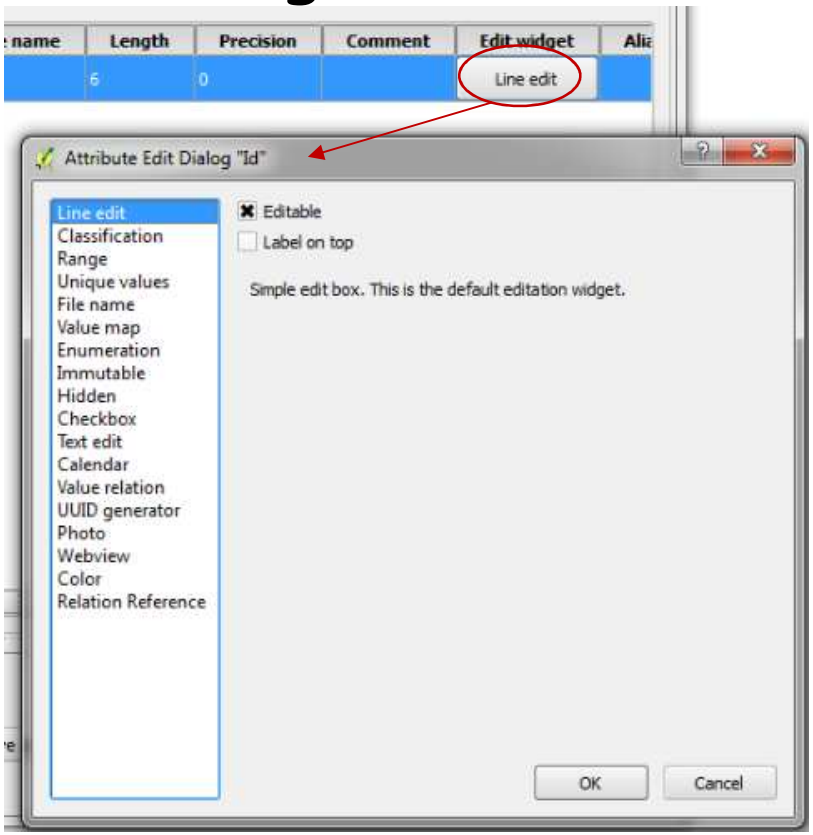


Table structure modification (2)

- In the Layer Properties → Fields windows, for each attribute it is also possible to define the values or the range of values that are allowed



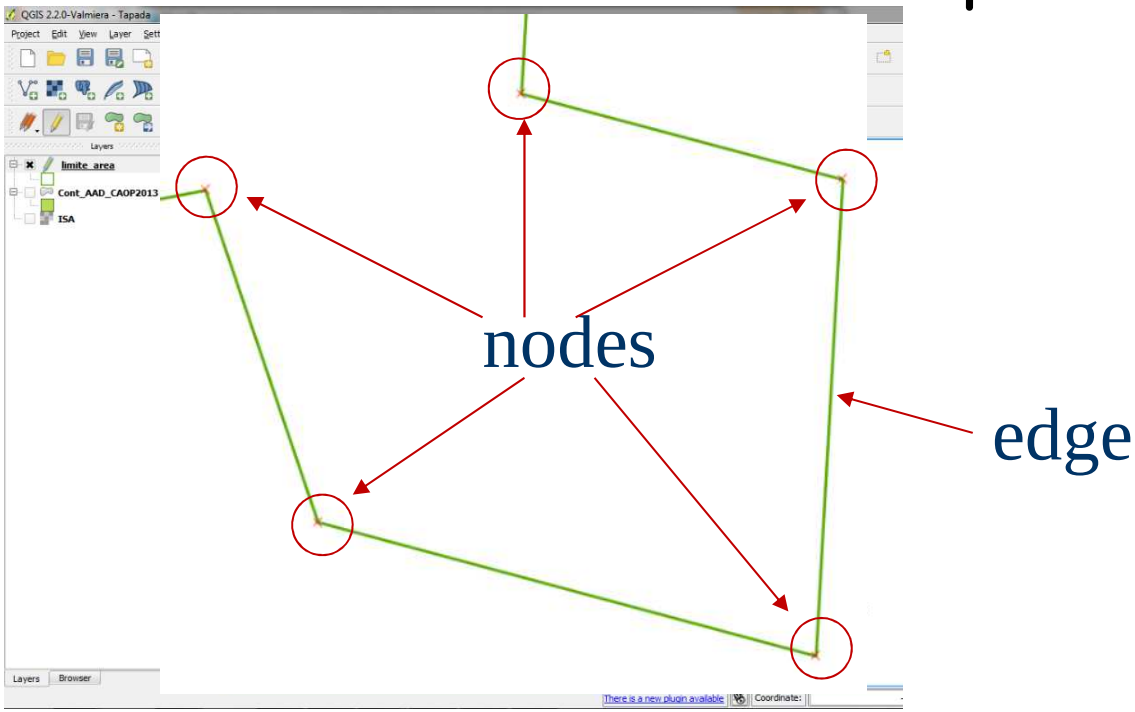
Coordinates editing (1)

- Toolbars
  - Digitizing

  - Advanced Digitizing

Coordinates editing (2)

- One point is composed by one node
- One line is composed by 2 nodes, at least
- One polygon is composed by 3 nodes, at least, and the first and last nodes overlap

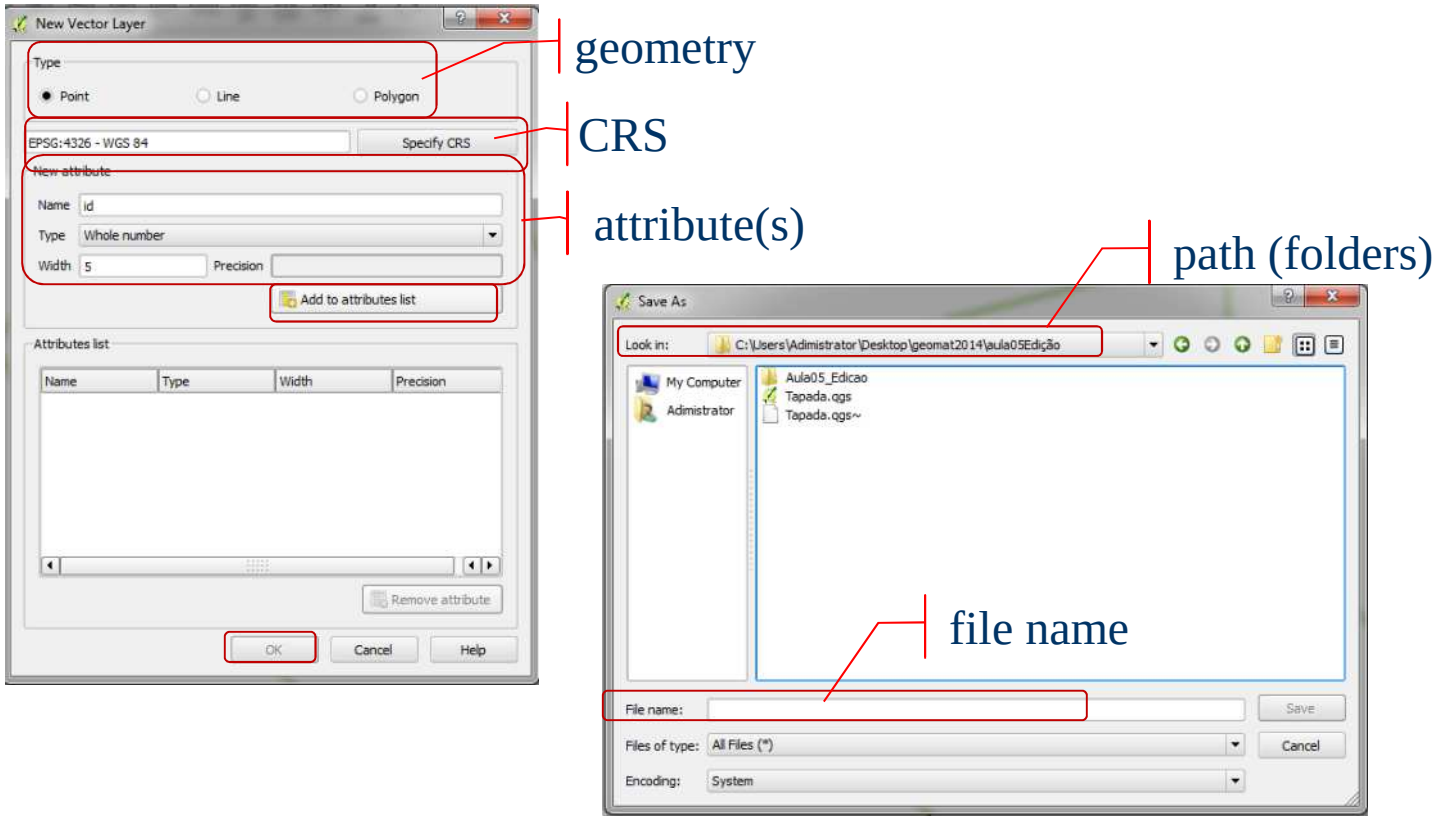


Coordinates editing (3)

- The  Node Tool button of the Digitizing toolbar turns on the **node editing mode**, in order
  - to move one node
  - to remove one node
  - to add one node
  - it is also possible to select several nodes and to move or to remove them all at once
  - it is possible to select
    - one single node
    - two nodes of one edge
    - any set of nodes (using the Ctrl Key)
    - drawing one rectangle enclosing several nodes

Creating a new gds (shapefile format)

- **Menu** Layer → New → New Shapefile Layer



Snapping and snapping tolerance (1)

- **Snapping tolerance** is the distance QGIS uses to search for the closest vertex and/or segment you are trying to connect when you set a new vertex or move an existing vertex
  - if you aren't within the snapping tolerance, QGIS will leave the vertex where you release the mouse button, instead of snapping it to an existing vertex and/or segment
  - the snapping tolerance setting affects all tools which work with tolerance
  - the snapping tolerance is set either in pixels or in map units (the project/layer CRS unit)

Snapping and snapping tolerance (2)

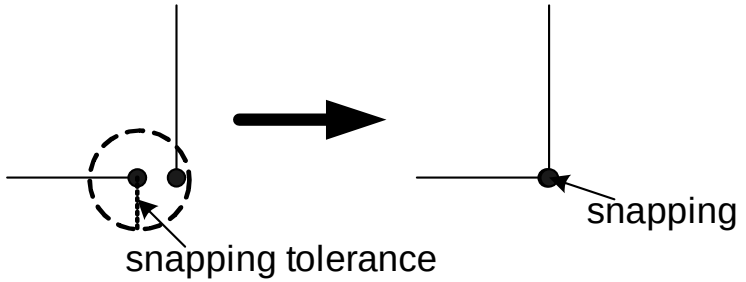
- The snapping tolerance may be defined
  - as the default value for all project layers using Settings menu → Options → Digitizing (Snapping area)
  - for an individual layer using Settings menu → Snapping Options (this layer setting overrides the project default value)
- Snapping will never occur to a layer which is not checked in the snapping options dialog, regardless of the global snapping tolerance

Search radius

- **Search radius** is the distance QGIS uses to search for the closest vertex you are trying to move when you click on the map
  - if you aren't within the search radius, QGIS won't find and select any vertex for editing and it will pop up an annoying warning to that effect
  - it is used by almost all editing functions
  - if the *search radius* value is 0, many editing functions will not work (node editing, for instance)
  - the *search radius* value is set in Settings menu → Options → Digitizing (Snapping area)

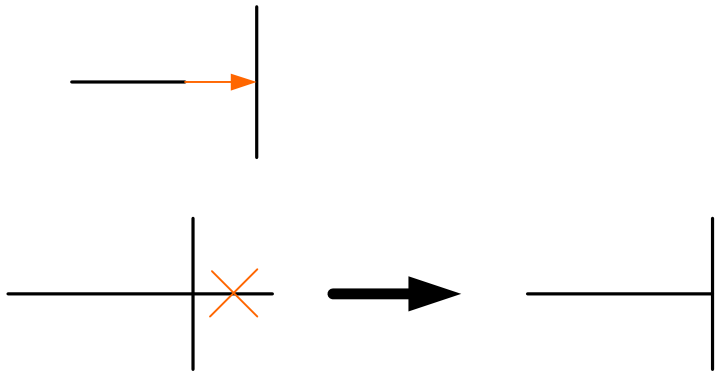
Editing tools - *snapping*

- To avoid connection errors / to share node / to overlap edges and nodes:
  - **snapping** – when snapping is turned on, the pointer will jump, or snap to, edges, vertices, and other geometric elements when the pointer is near them and within a certain tolerance
  - **snapping tolerance** – the snapping tolerance is the distance within which the pointer snaps to another locatione



Common errors (lines)

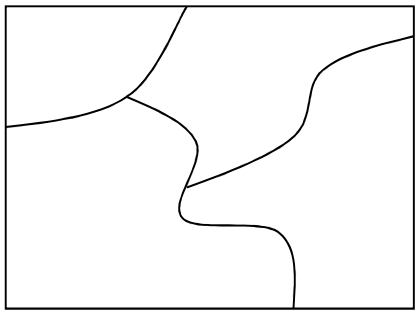
- Connection errors:
  - **omission**
  - **commission**



  - lines intersection without one node (within an arc-node topology)

Topology in GIS

- In GIS, a topology is a set of rules and behaviours concerning how points, lines and polygons may share a geographic space.
- Examples:
  - Polygons share boundaries (polygon topology: countries, parcels, ...).



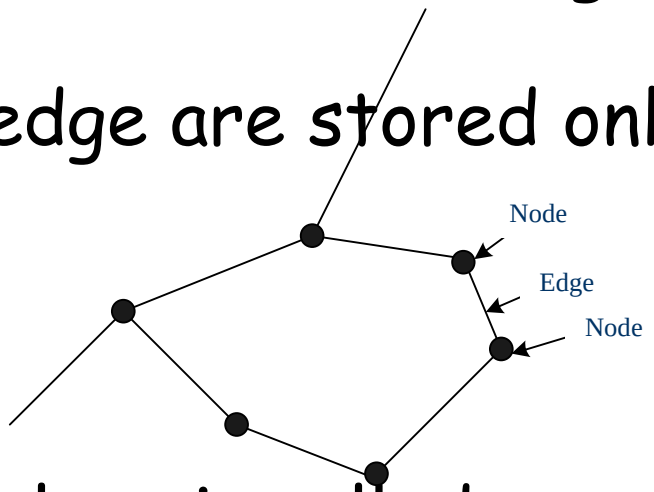
  - Lines share end-points (roads, streams, communication facilities, ...).

Topology advantages

- Topology is fundamentally used to ensure data integrity
  - spatial relationships integrity, as well
- Topology is also used for analyzing spatial relationships in many situations, such as
  - dissolving the boundaries between adjacent polygons with the same attribute values
  - traversing a network/graph, finding the shortest path between two points.

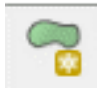
Graph – basic concepts

- A topological data model represents features (points, lines or polygons) over an underlying graph defined by nodes and edges.
  - each edge is defined by two nodes
  - the intersection of 2 or more edges is always one node
  - every node and edge are stored only once



- Data without a topology is called spaghetti data.

Creating new geographic features

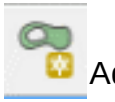
- Depending on the layer geometric type where the new feature is going to be stored, use
  -  Add Feature to add a node (an ordered pair of real numbers, the point coordinates)
  -  Add Feature to add a sequence of ordered pairs (nodes) that define a line
  -  Add Feature to add a sequence of ordered pairs (nodes) that define a polygon ("forcing" the 1st and last nodes to overlap)

  and to record the attribute values describing the new feature (if the default mode is on).

Creating/Editing multipart *features*

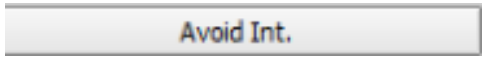
- To add one part of a multipart feature, first select the feature to update and use  Add Part to create the new feature part (point, line or polygon)
  - obviously, it is not necessary to record attribute values
  - obviously, if the feature length/perimeter/area *features* were already computed, it is necessary to update them
- To remove one part of a multipart feature use  Delete Part and click **over** one of this part nodes
  - obviously, if the feature length/perimeter/area *features* were already computed, it is necessary to update them

Creating complex *features: ring*

- A ring polygon is a polygon that contains in its interior other polygon(s) (empty or not empty)
  - it has a discontinuous border – one exterior and the other interior
  - a ring polygon with an empty polygon in its interior is also called a *donut*
- To create a ring with a "hole", after the exterior border creation use  Add Ring to create the interior border
- To create a ring containing other polygon(s), after the exterior border creation, use  Fill Ring to create the exterior border of the new polygon (which is, simultaneously, the interior border of the first polygon) and to record the attribute values of the new polygon.

Editing a coverage

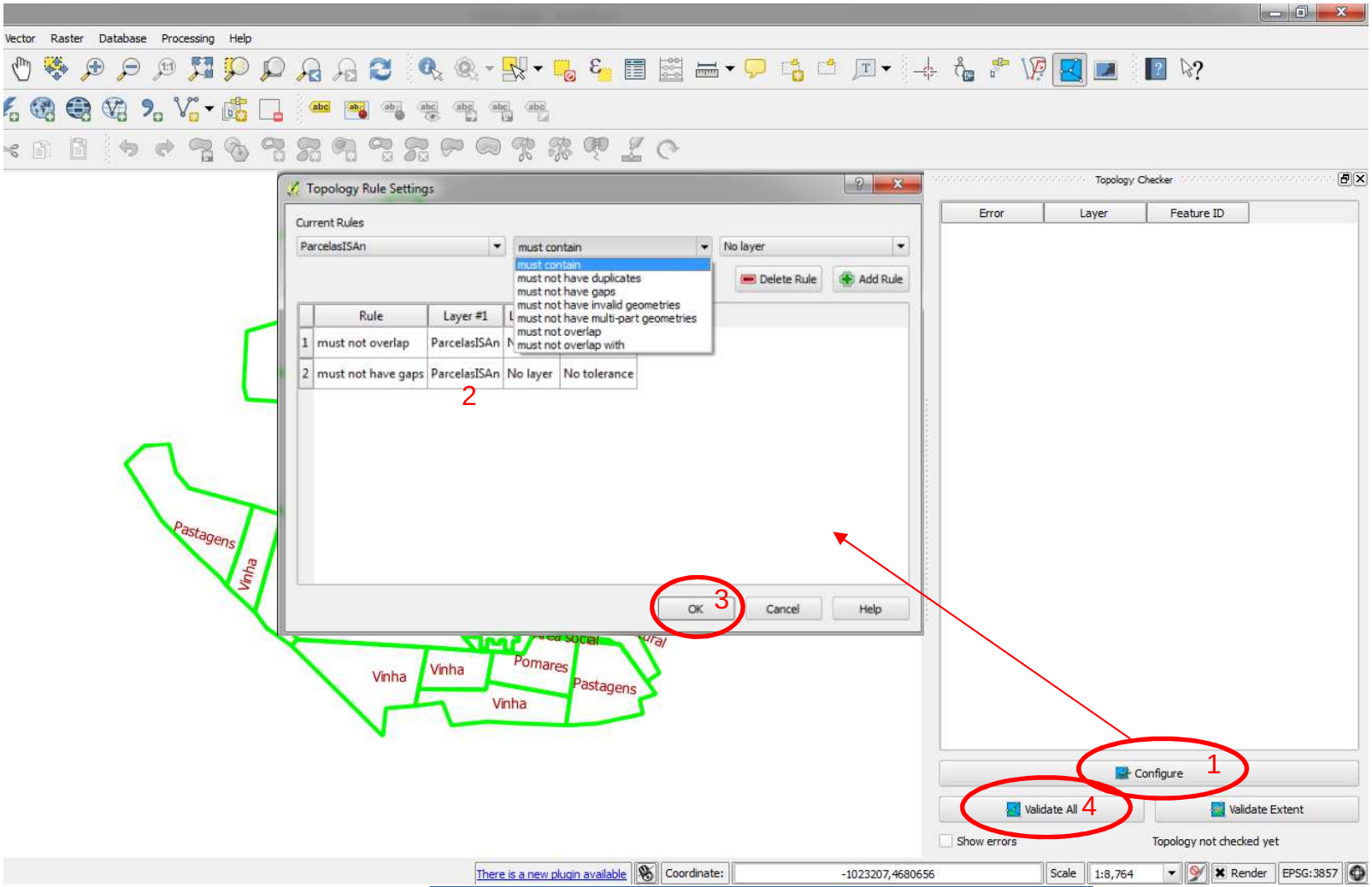
- A **coverage** is a set of polygons whose intersection is empty and whose union is the universe (the study area in the GIS context)
  - in a coverage, every shared edge of adjacent polygons is recorded **only once**
  - in a coverage, there is not "holes" and polygons never overlap (there are not ***sliver polygons***)
  - in a coverage, editing one node of a shared edge of two adjacent polygons, necessarily updates the geometry of these two features (by other words, their locations on the Earth surface)
- **Menu** Settings → Snapping Options helps on coverage editing
  - 

enables the creation and maintenance of shared edges of adjacent polygons
  - 

avoids polygons overlapping

Topological errors checking

- menu Vector → Topology checker



Split and *merge functions*

- It is possible to divide one feature (line or polygon) in two distinct adjacent *features* using  Split Features
  - the attribute values of the new features remain identical to those of the divided feature
  - the result of editing the shared edge nodes always depends on the option Enable topological editing (of menu Settings → Snapping Options) setting
- Use  Merge Selected Features to merge two *features* into **one**
  - basic feature if they are adjacent features
  - multipart feature, otherwise
    - in both cases it is also necessary to record the attribute values of the new feature

Other functions

- Reshape Features
- Move Feature(s)
- Rotate Feature(s)
- Delete Selected
- Merge Attributes of Selected Features
- Copy / Cut + Paste *features* between two layers
  - of identic geometric types
  - only the attribute values of attributes with identic names and data types
- Current edits (menu ...)
  - useful when it is necessary to edit two or more layers simultaneously (but to avoid whenever that is possible)
- ...