

Filière Génie de l'Environnement & Géosciences (S3)

Module : Géomatique

- TP N°2 : - Délimitation d'un bassin versant**
- Extraction des cartes à partir de MNT
- La mise en page d'une carte (la pente)



Prof. Morad TAHER

Un **bassin versant** est une zone géographique délimitée naturellement, dans laquelle **toutes les eaux de pluie ou de ruissellement** s'écoulent vers un **même point de sortie**, généralement un cours d'eau, un lac ou un océan.

Un bassin versant est délimité par des **lignes de crête** (hauteurs de terrain), appelées **lignes de partage des eaux**, qui séparent deux bassins versants voisins. Toute l'eau qui tombe à l'intérieur de ce périmètre, que ce soit sous forme de pluie, de fonte des neiges ou d'autres précipitations, est drainée vers un même exutoire.

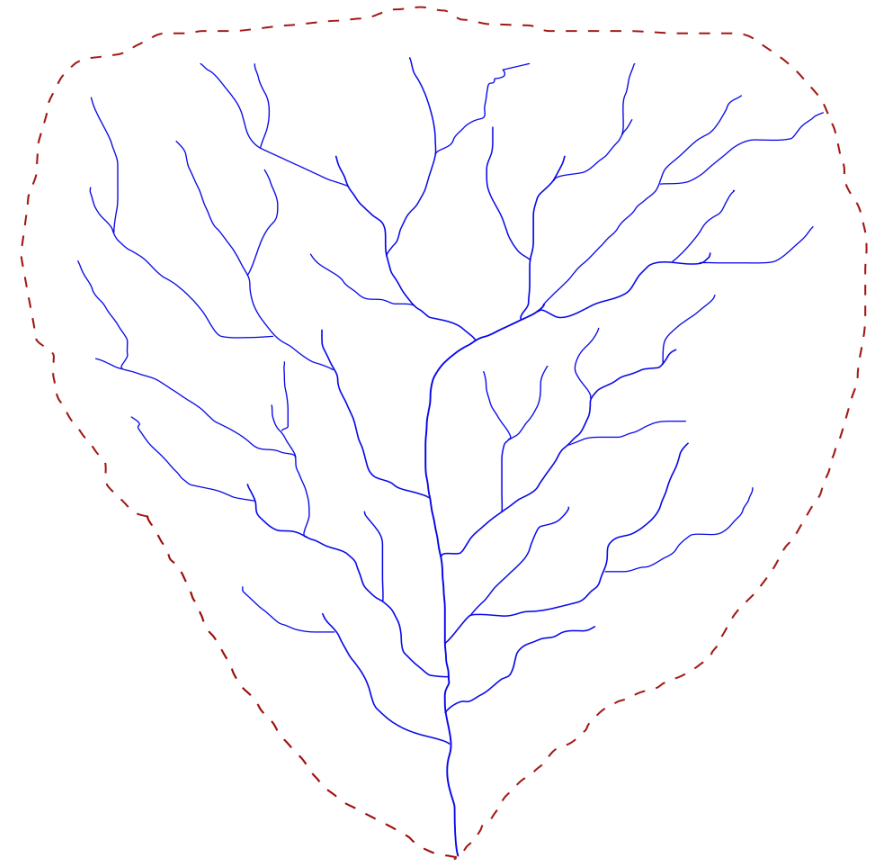
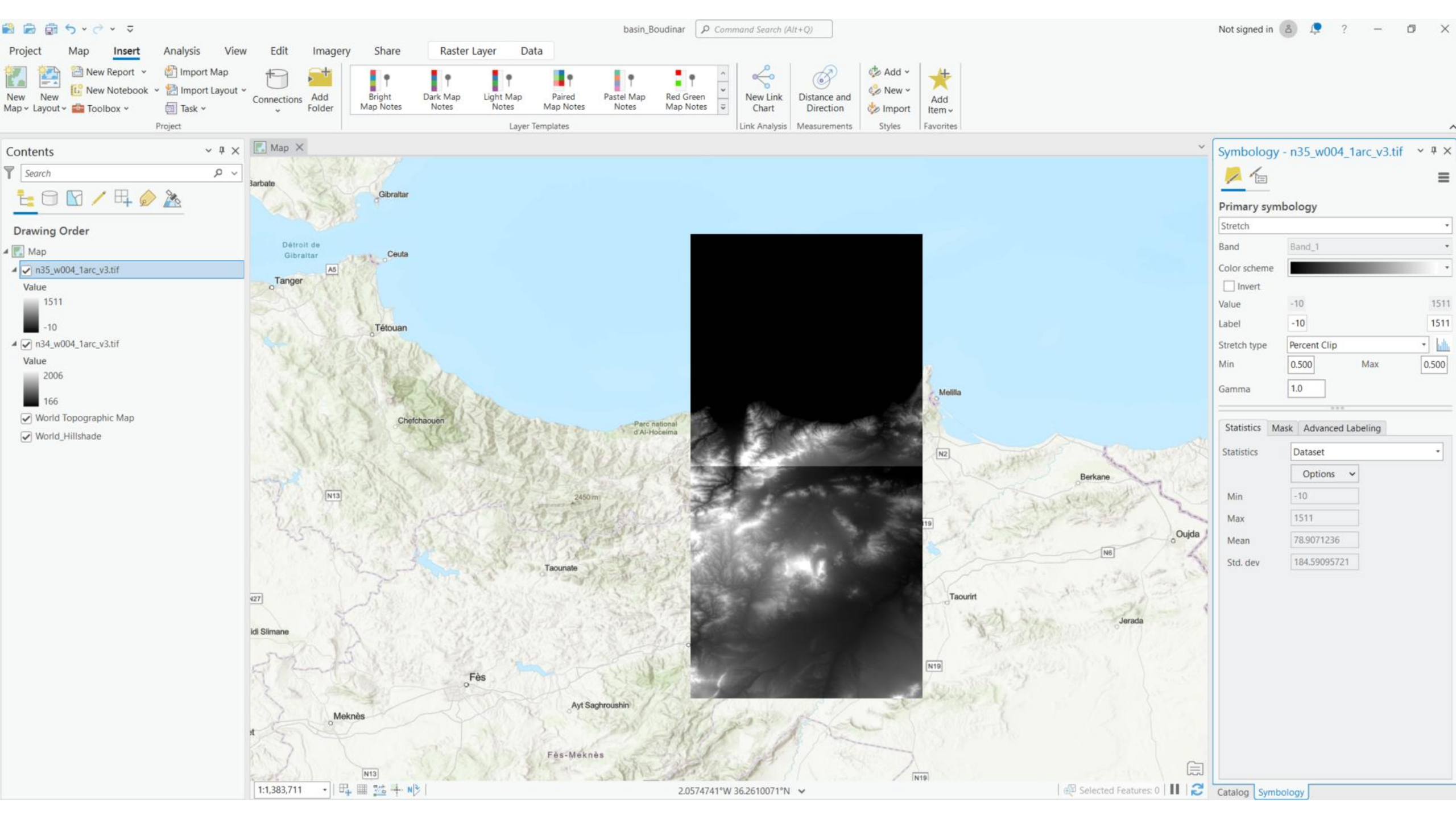
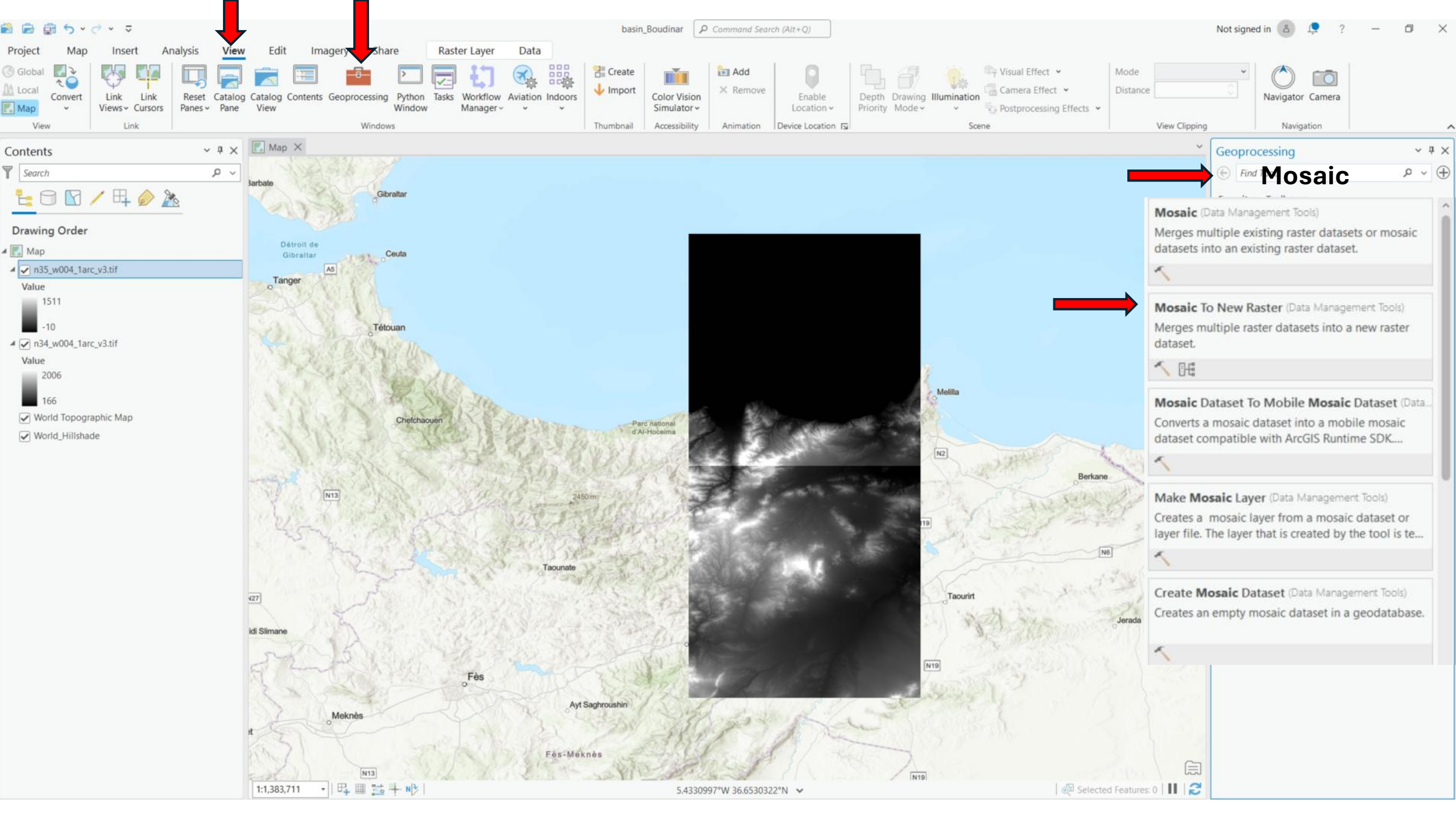


Schéma type d'un bassin versant



**La mosaïque de deux ou plusieurs images de MNT
(Modèle Numérique de Terrain)**



Mosaic

Geoprocessing

Mosaic To New Raster

Parameters Environments

* Input Rasters

* Output Location

Raster Dataset Name with Extension

Spatial Reference for Raster

Pixel Type

8 bit unsigned 16

Cellsize

* Number of Bands

1

Mosaic Operator

Last

Mosaic Colormap Mode

First

Run

Ajouter toutes les cartes à mosaïquer

Geoprocessing

Mosaic To New Raster

Parameters Environments

Processing Extent

Extent Default

Parallel Processing

Parallel Processing Factor

Geodatabase

Output CONFIG Keyword

Raster Storage

Pyramid

Build

Pyramid levels

Skip first

Resampling BILINEAR

Compression type DEFAULT

Raster Statistics

Calculate

X skip factor 1

Y skip factor 1

Statistics ignore value(s)

Compression Type LZ77

Tile Size

Width 128

Height 128

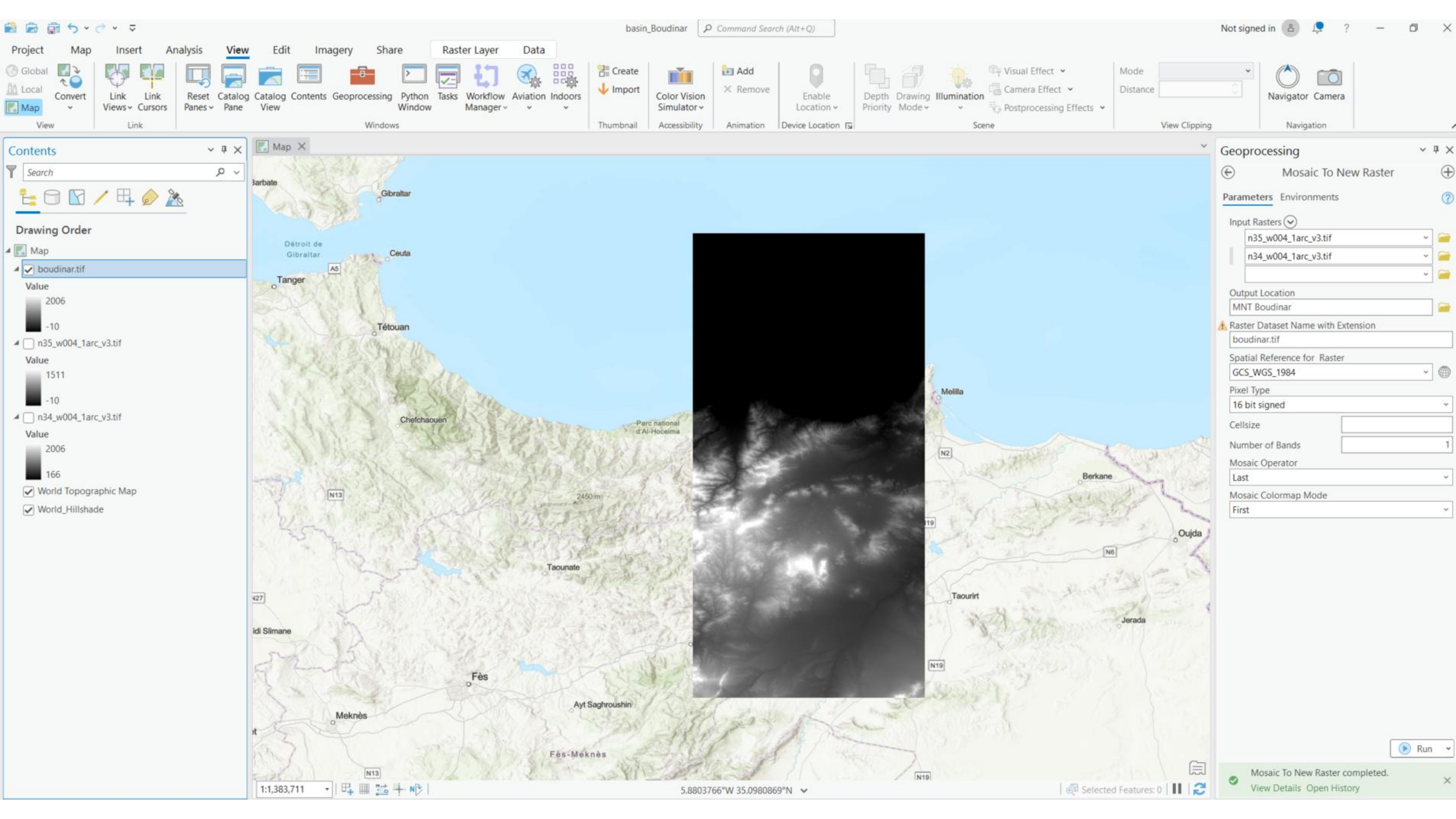
Resampling Method

Nearest Bilinear

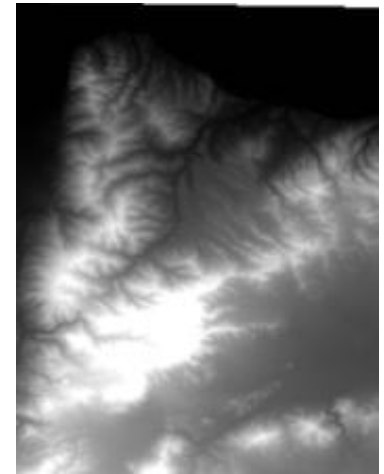
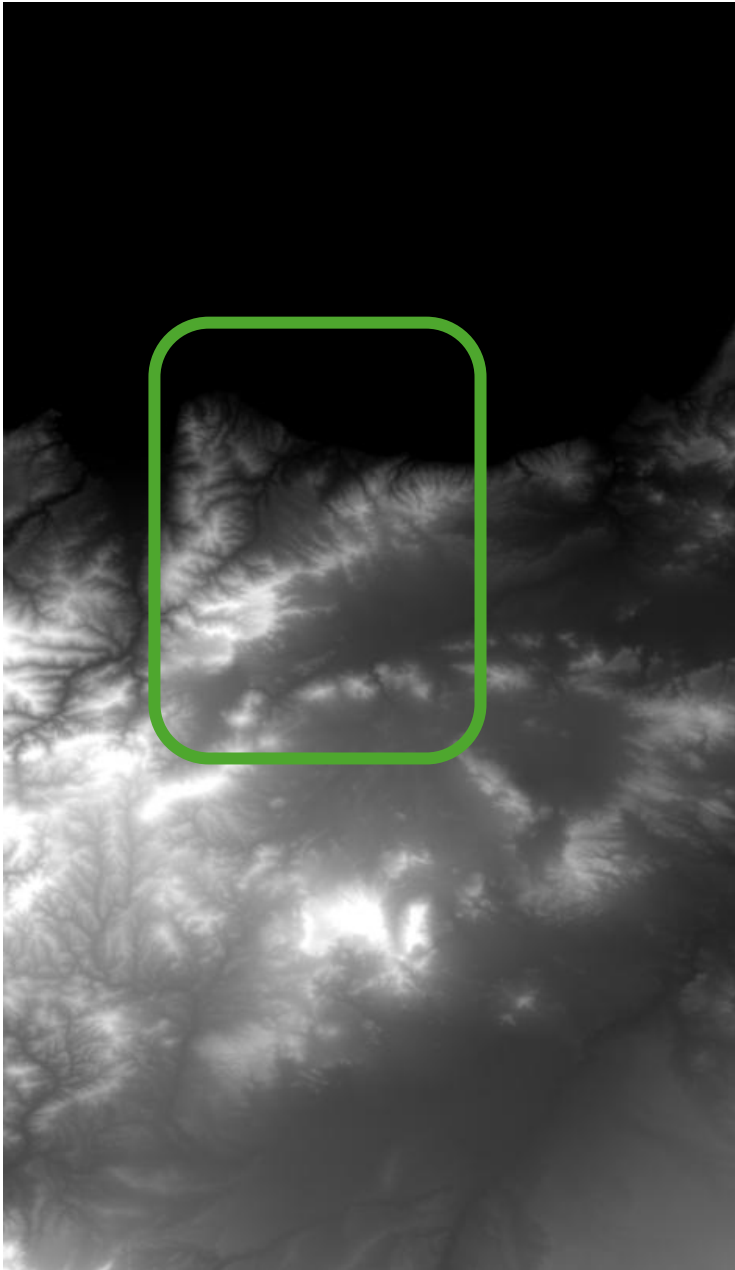
NoData

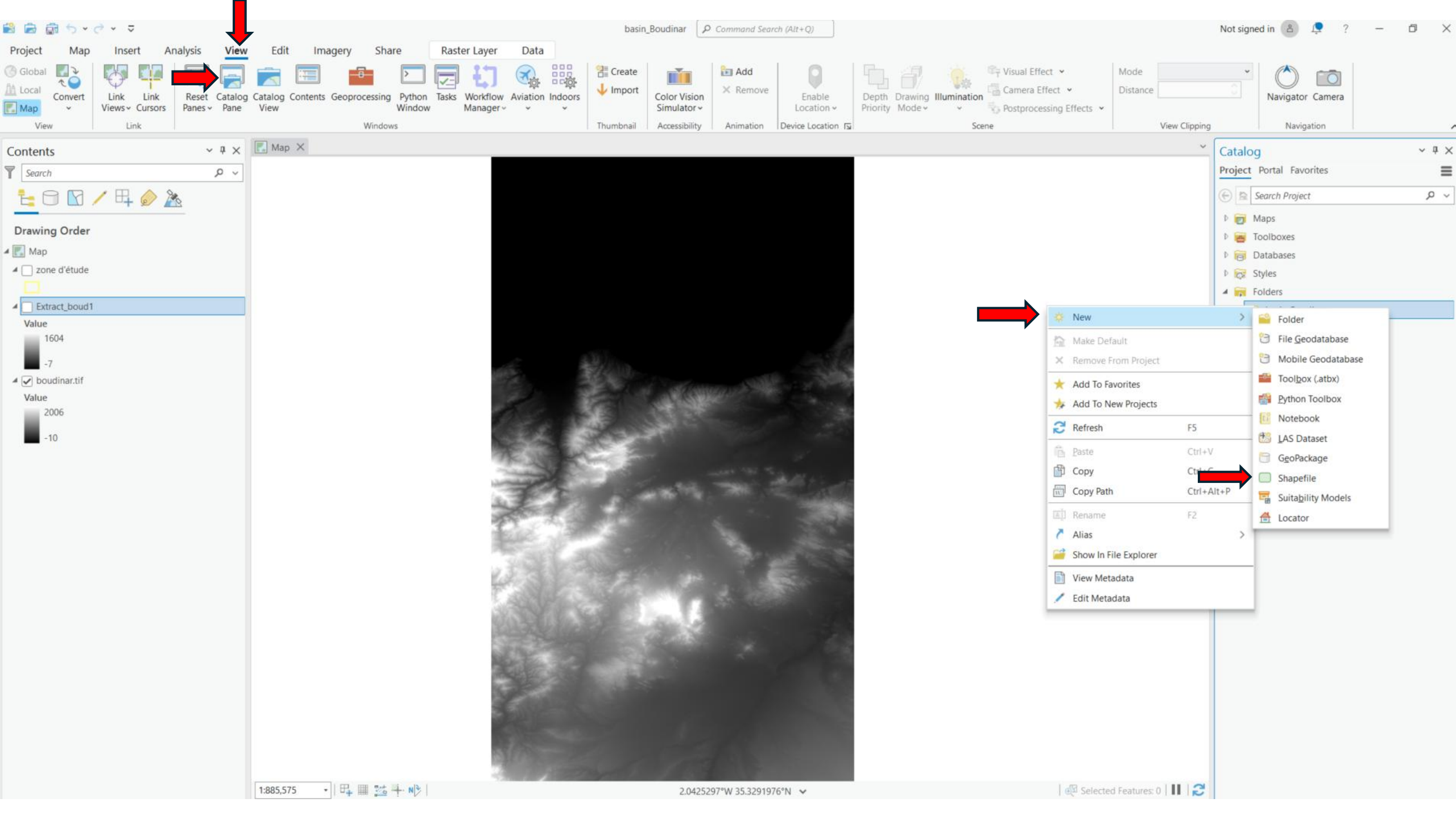
None

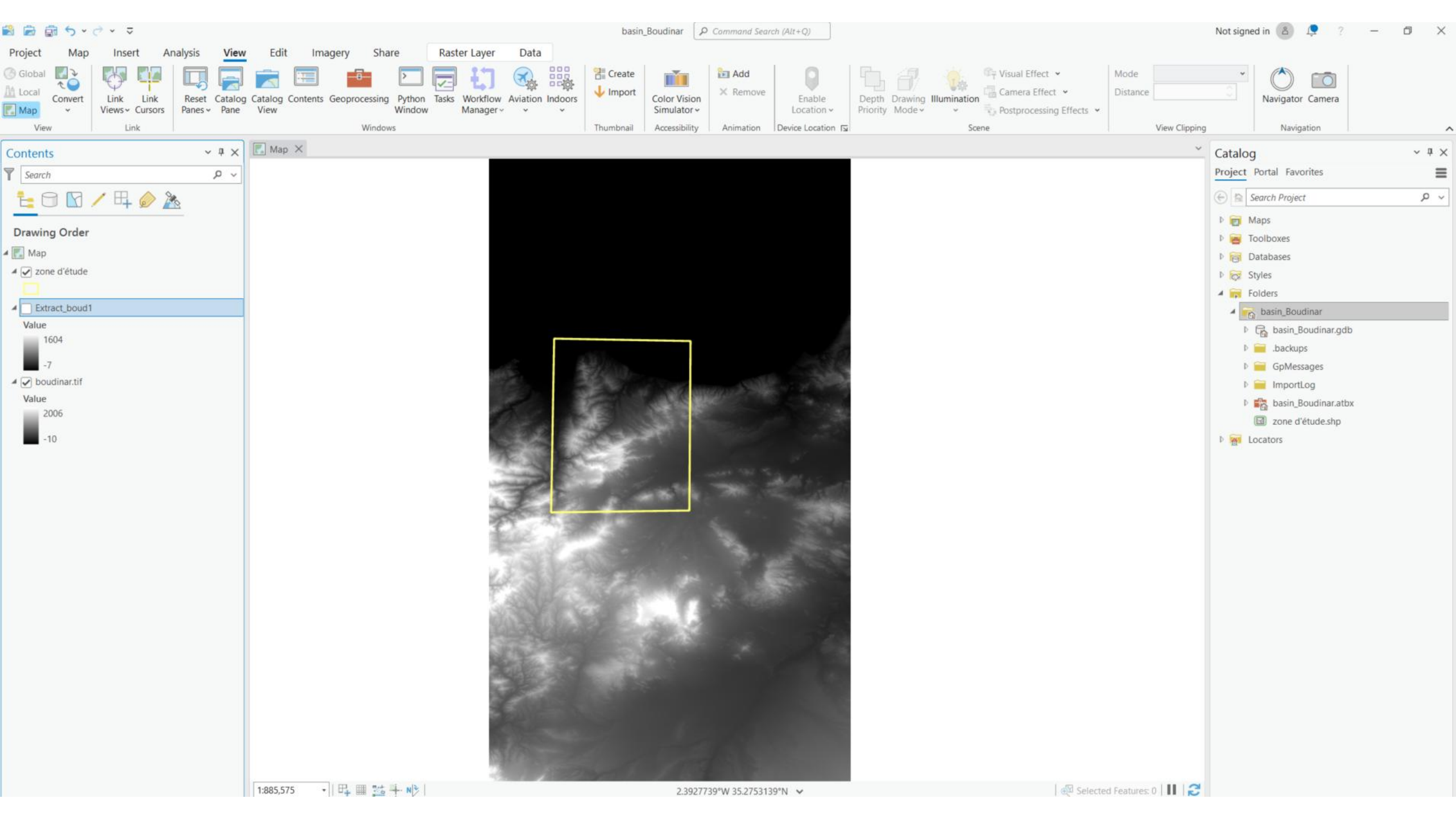
Run

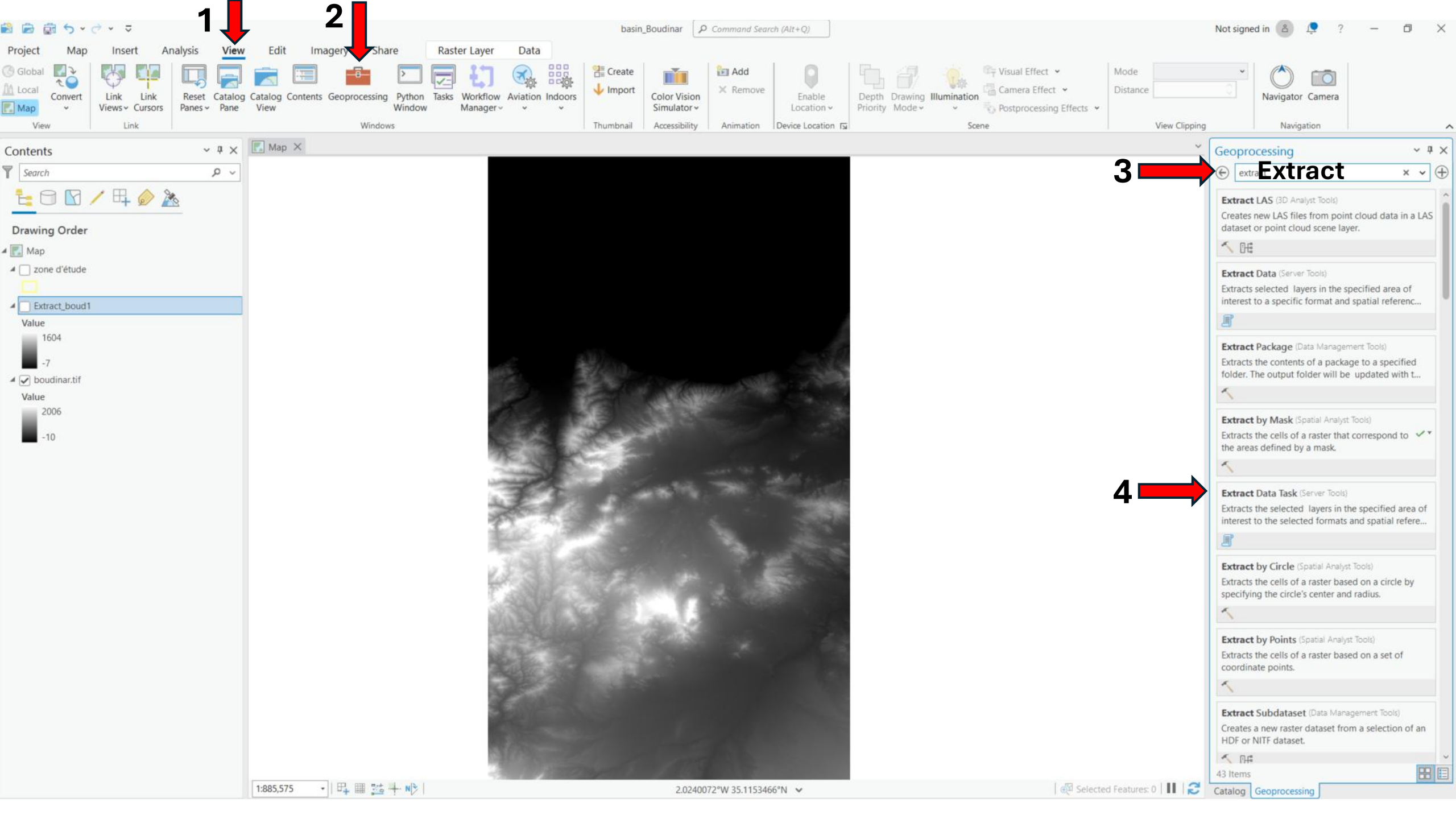


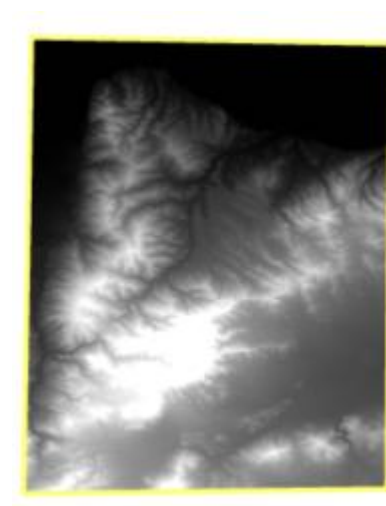
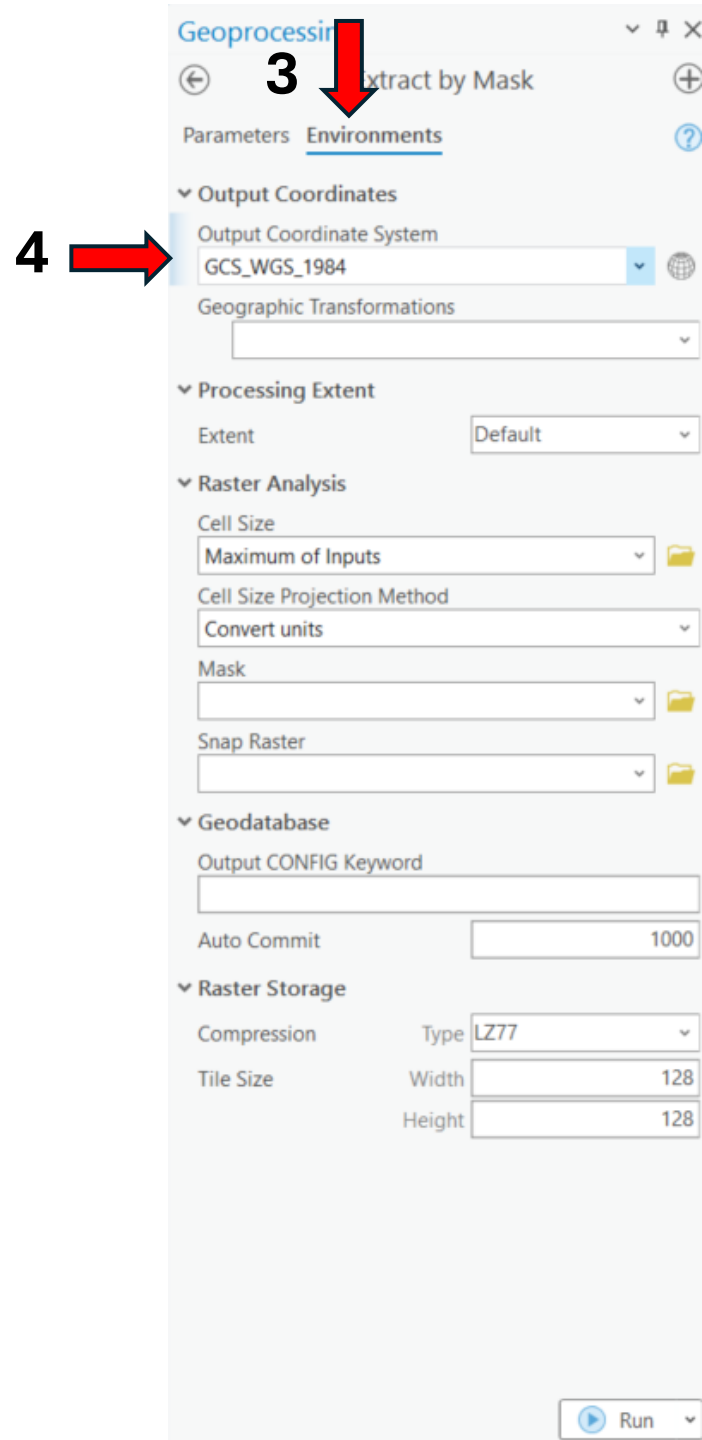
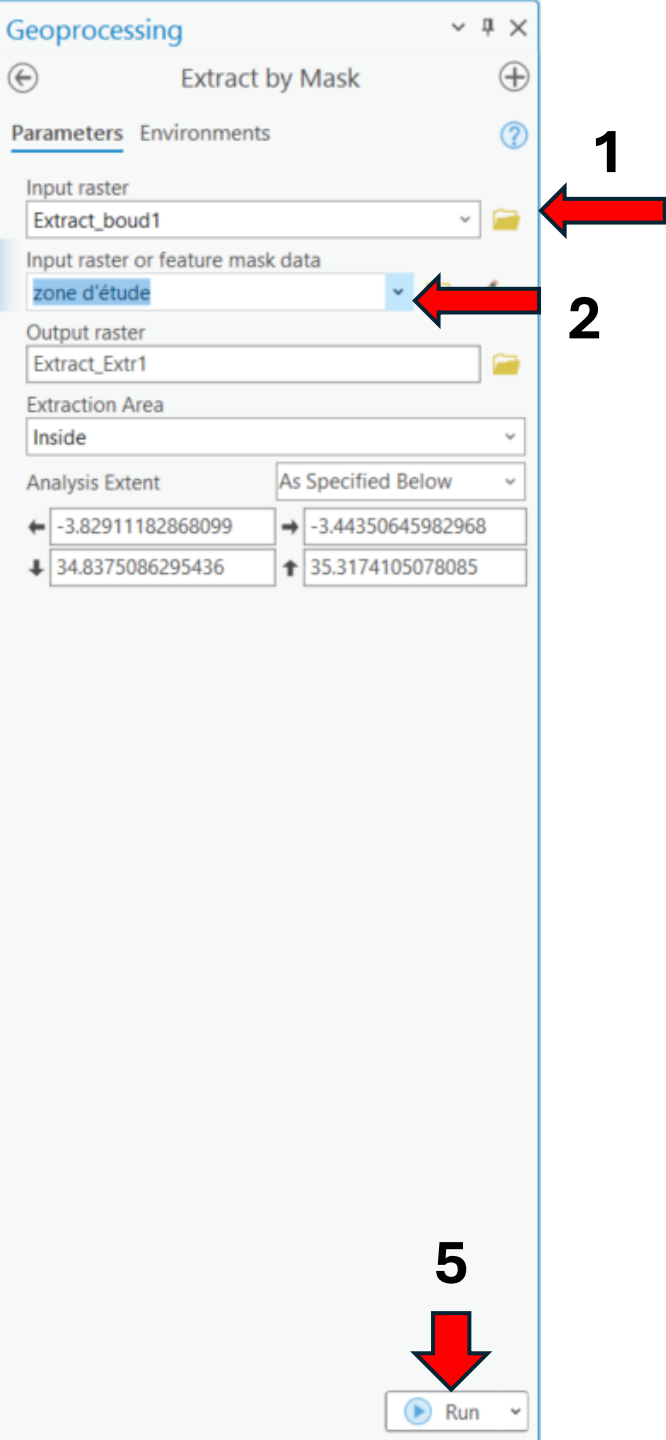
Extraction de la zone d'étude











1

View

2

Geoprocessing

3

Geoprocessing

4

Spatial Analyst Tools

5

Hydrology

6

Fill

Map

boudinar.tif

Value

2006

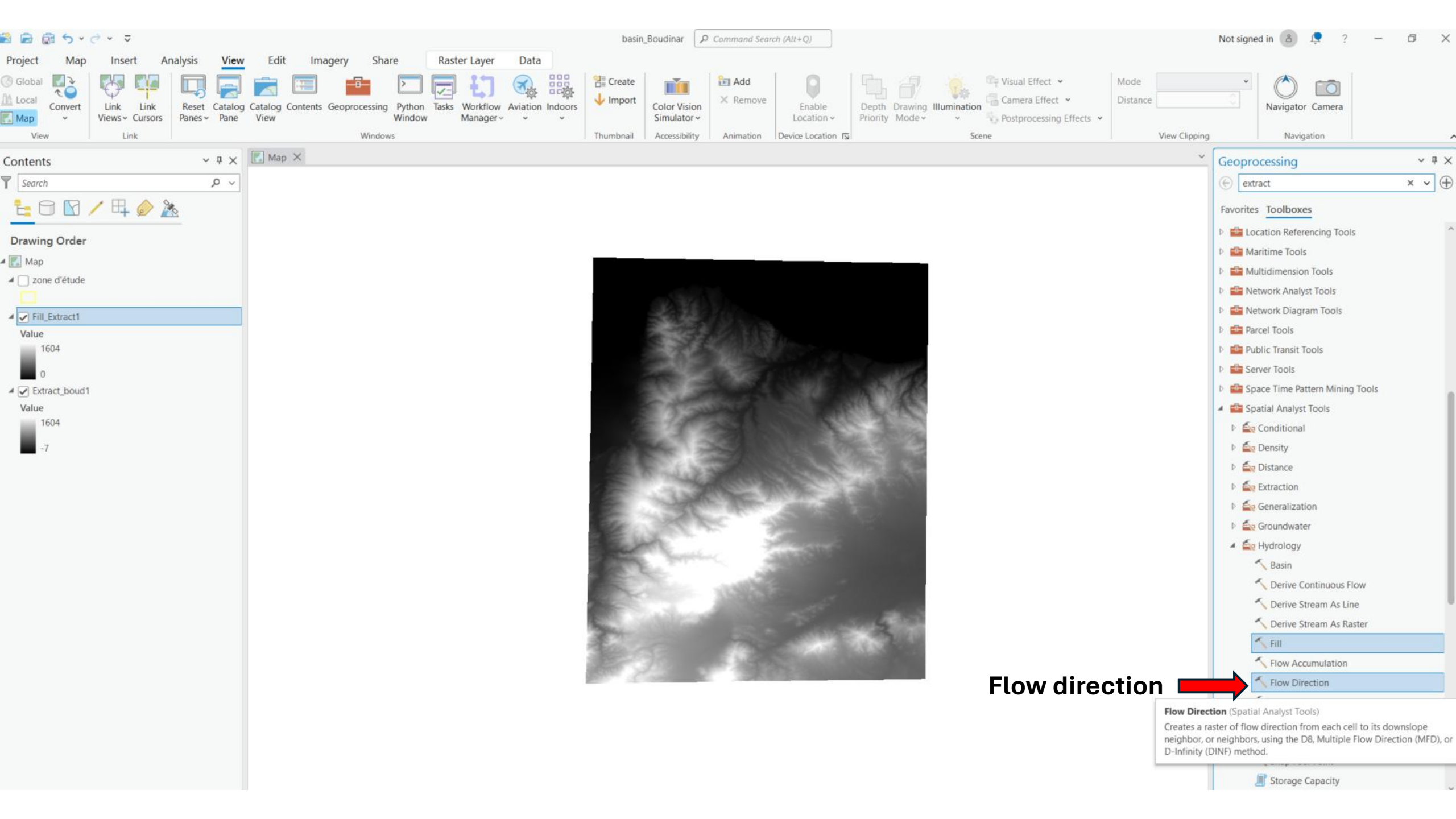
-10

Map

1:85,575

Fill = remplissage

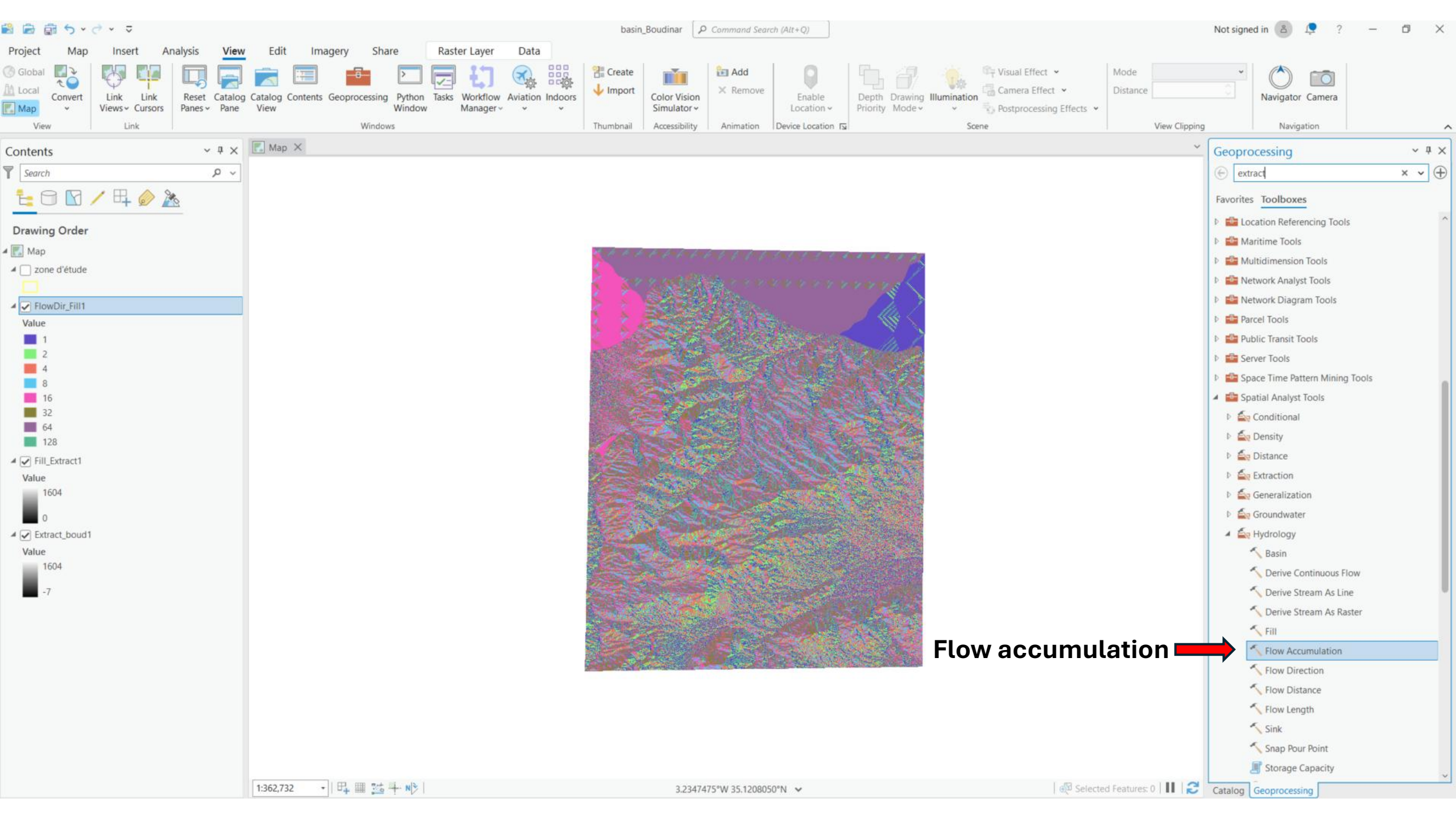
Remplit les puits dans un raster de surface pour supprimer les petites imperfections dans les données.



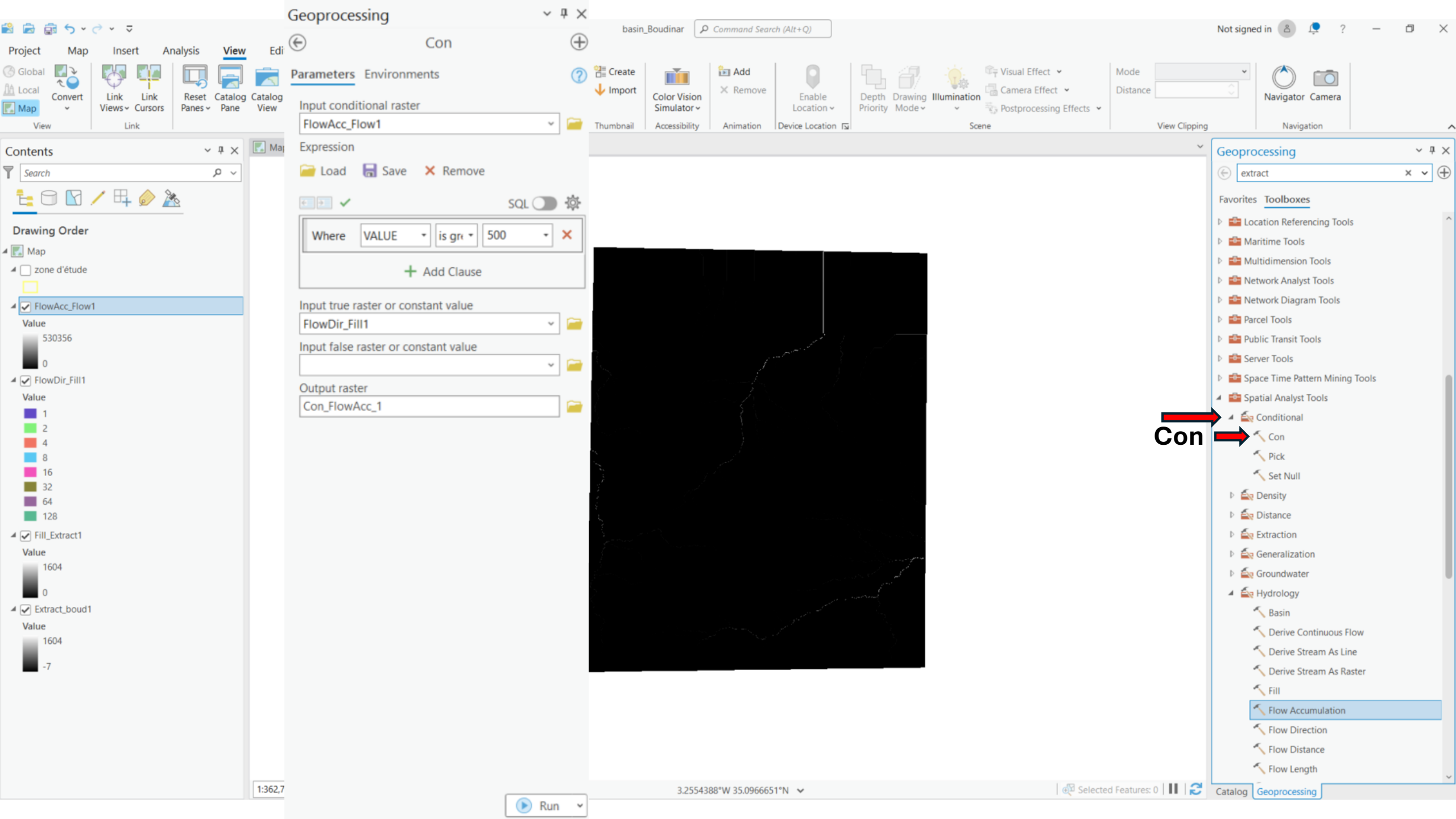
Flow direction

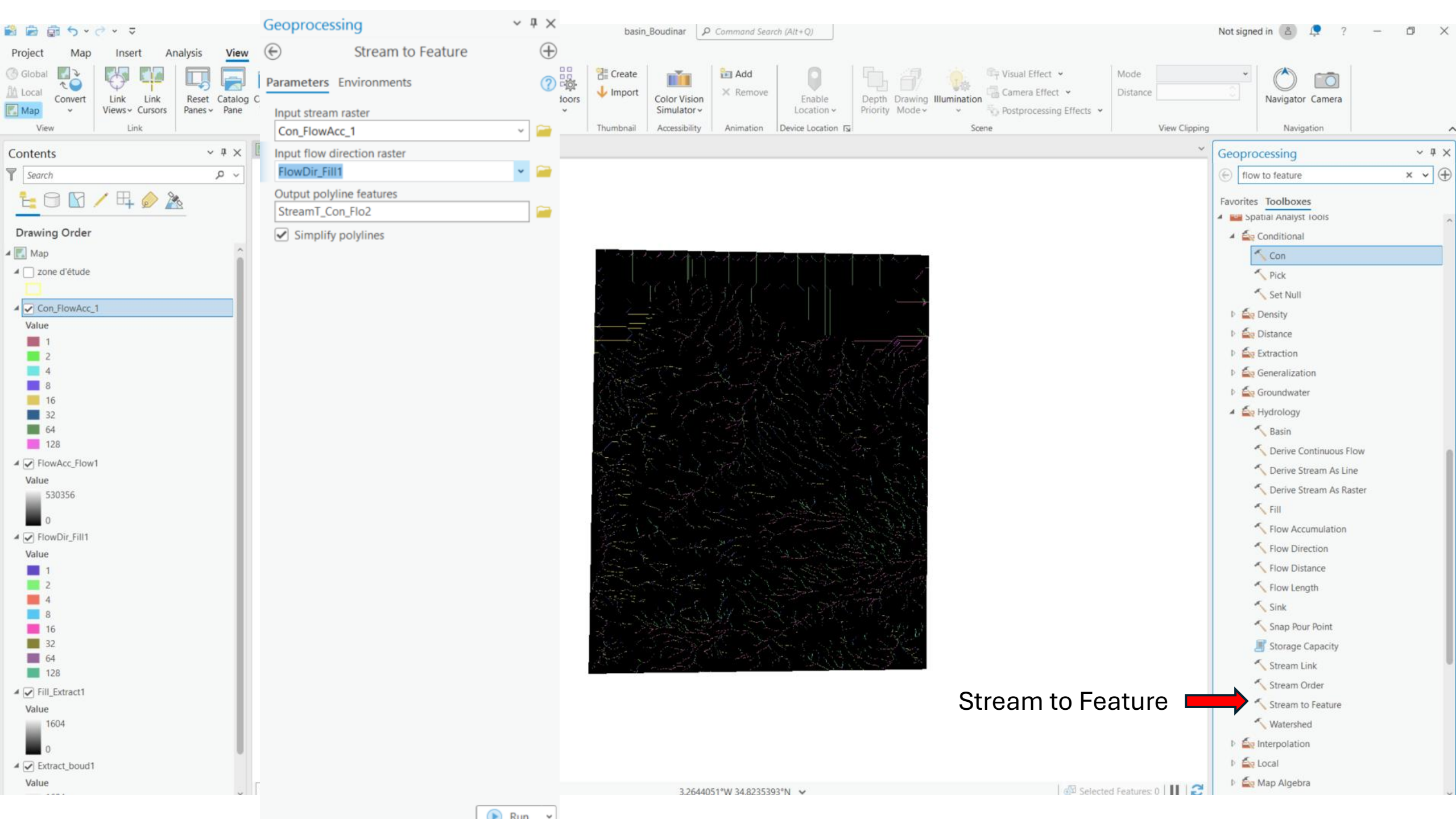


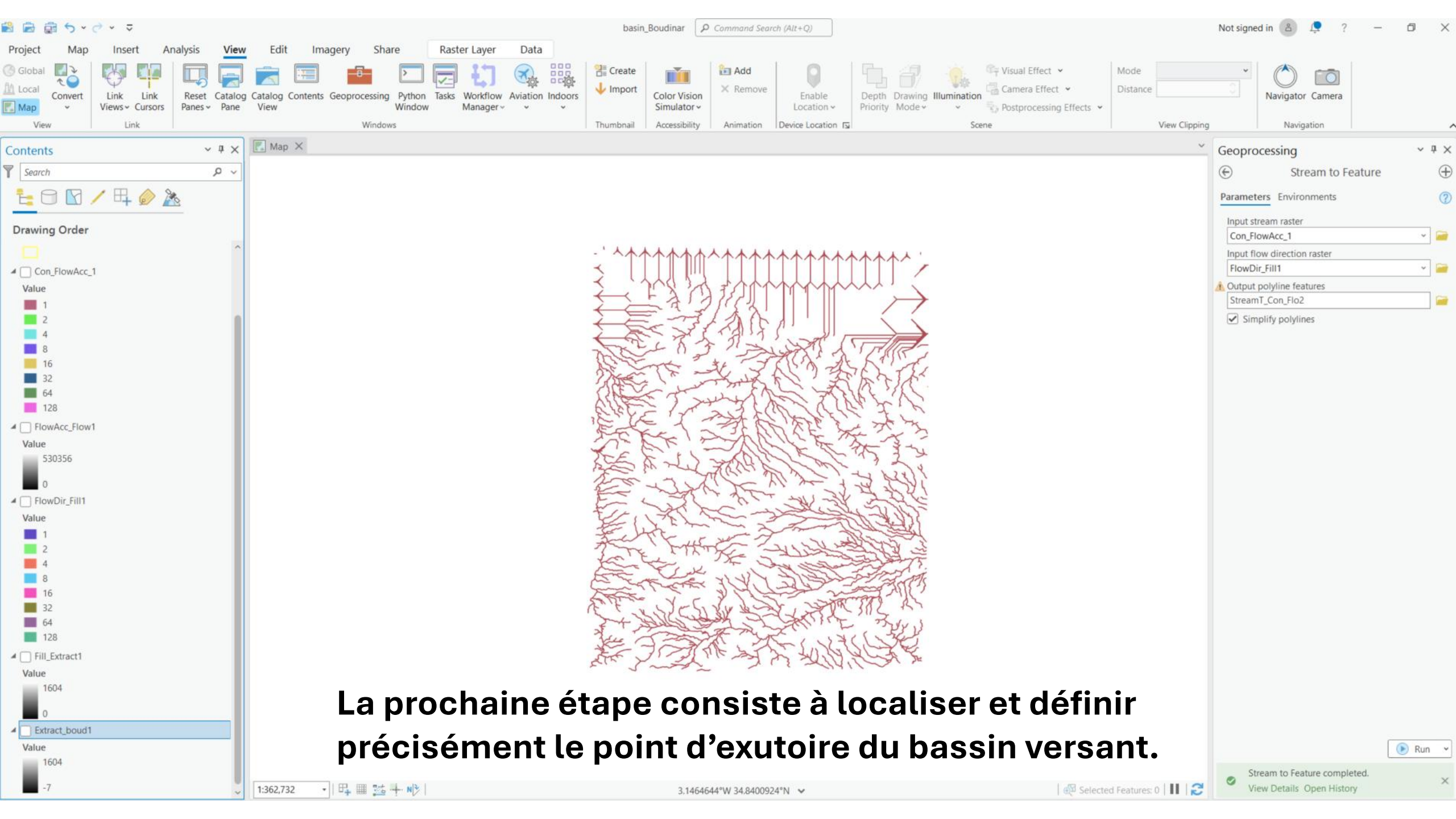
Flow Direction (Spatial Analyst Tools)
Creates a raster of flow direction from each cell to its downslope neighbor, or neighbors, using the D8, Multiple Flow Direction (MFD), or D-Infinity (DINF) method.



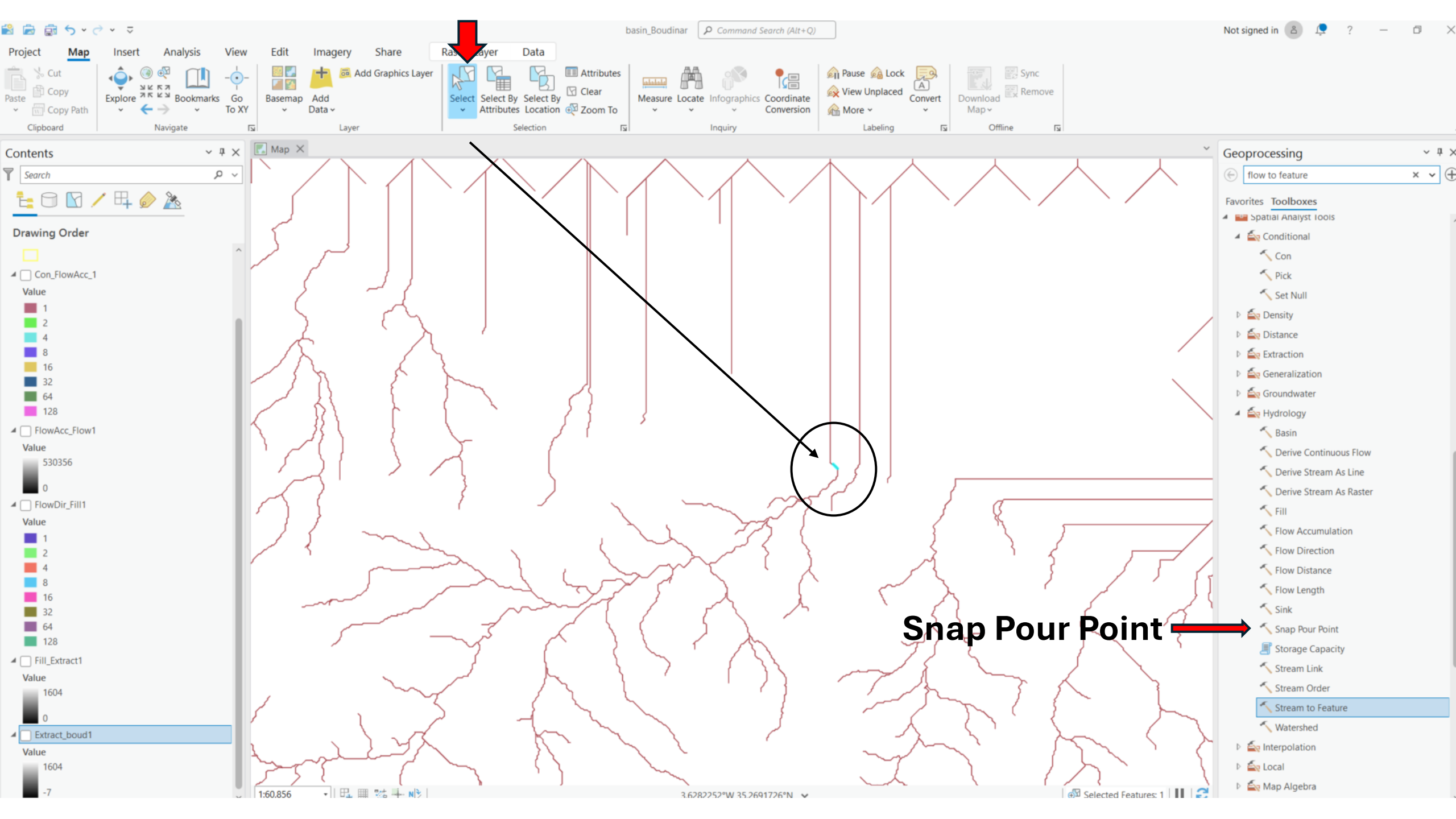
Flow accumulation







La prochaine étape consiste à localiser et définir précisément le point d'exutoire du bassin versant.



Geoprocessing

Snap Pour Point

Parameters Environments

Input raster or feature pour point data
StreamT_Con_Flo2

The input has a selection. Records to be processed: 1

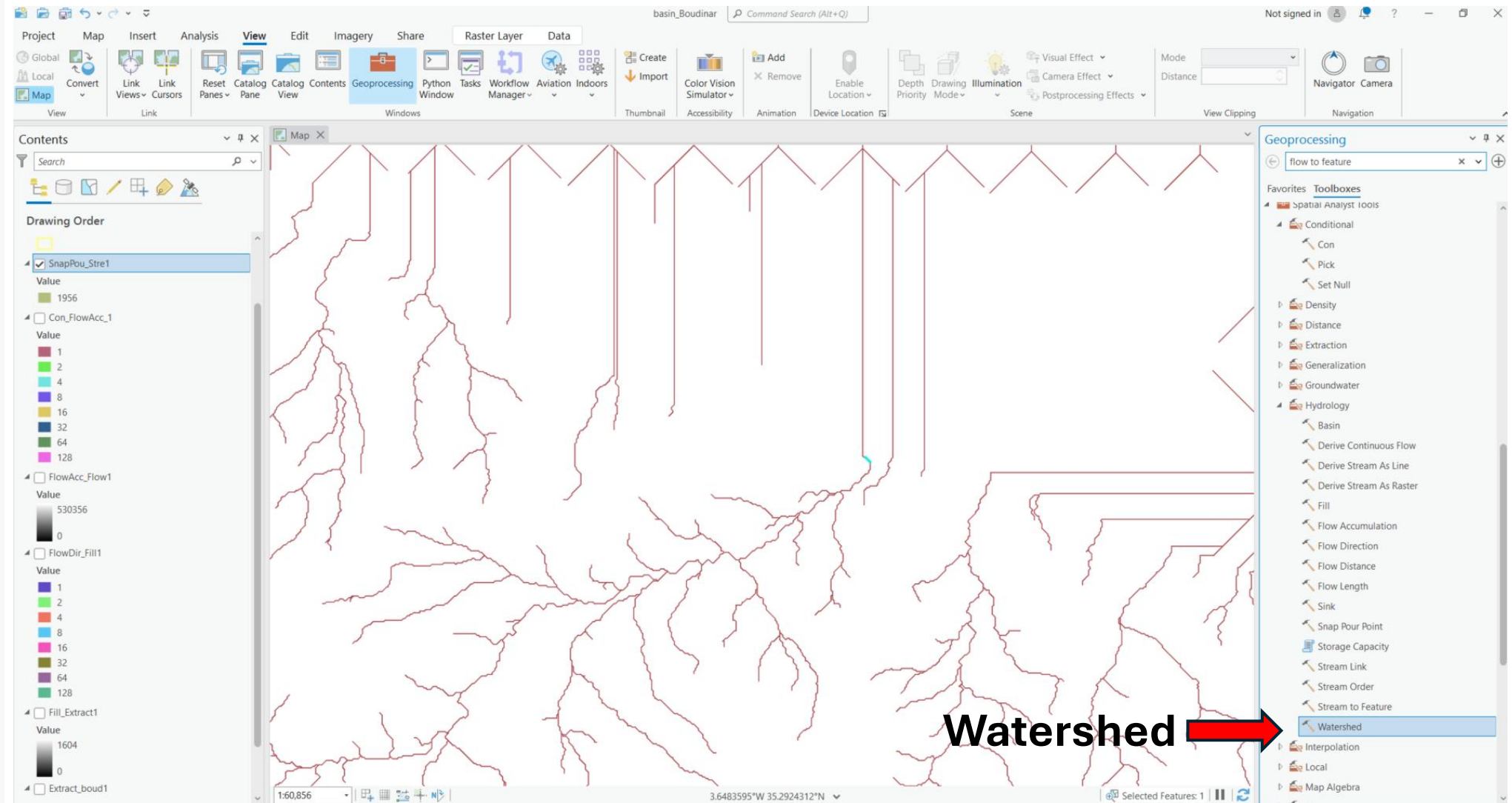
Pour point field
arcid

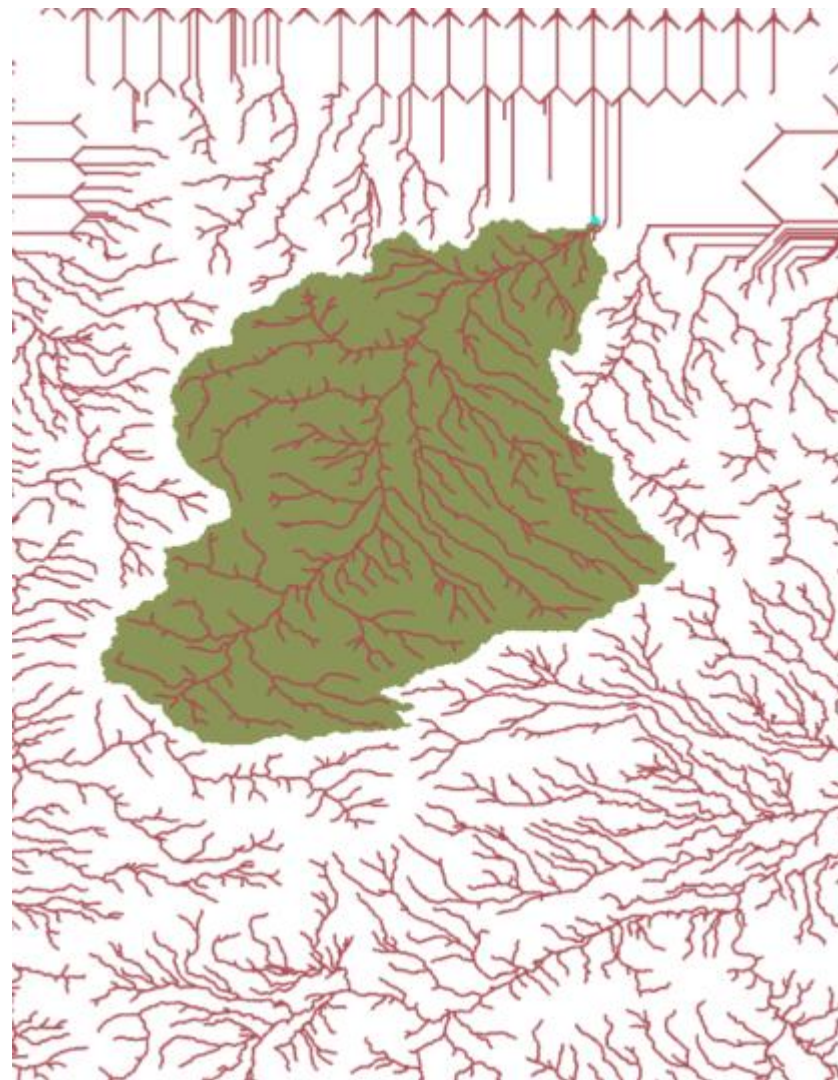
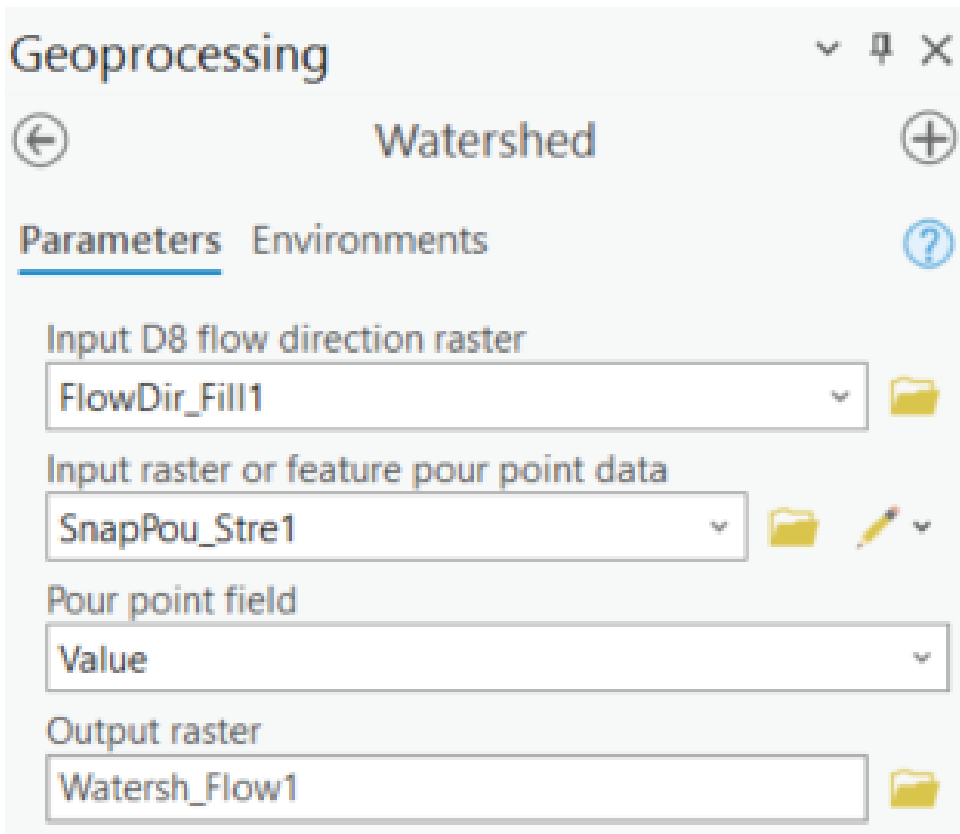
Input accumulation raster
FlowAcc_Flow1

Output raster
SnapPou_Stre1

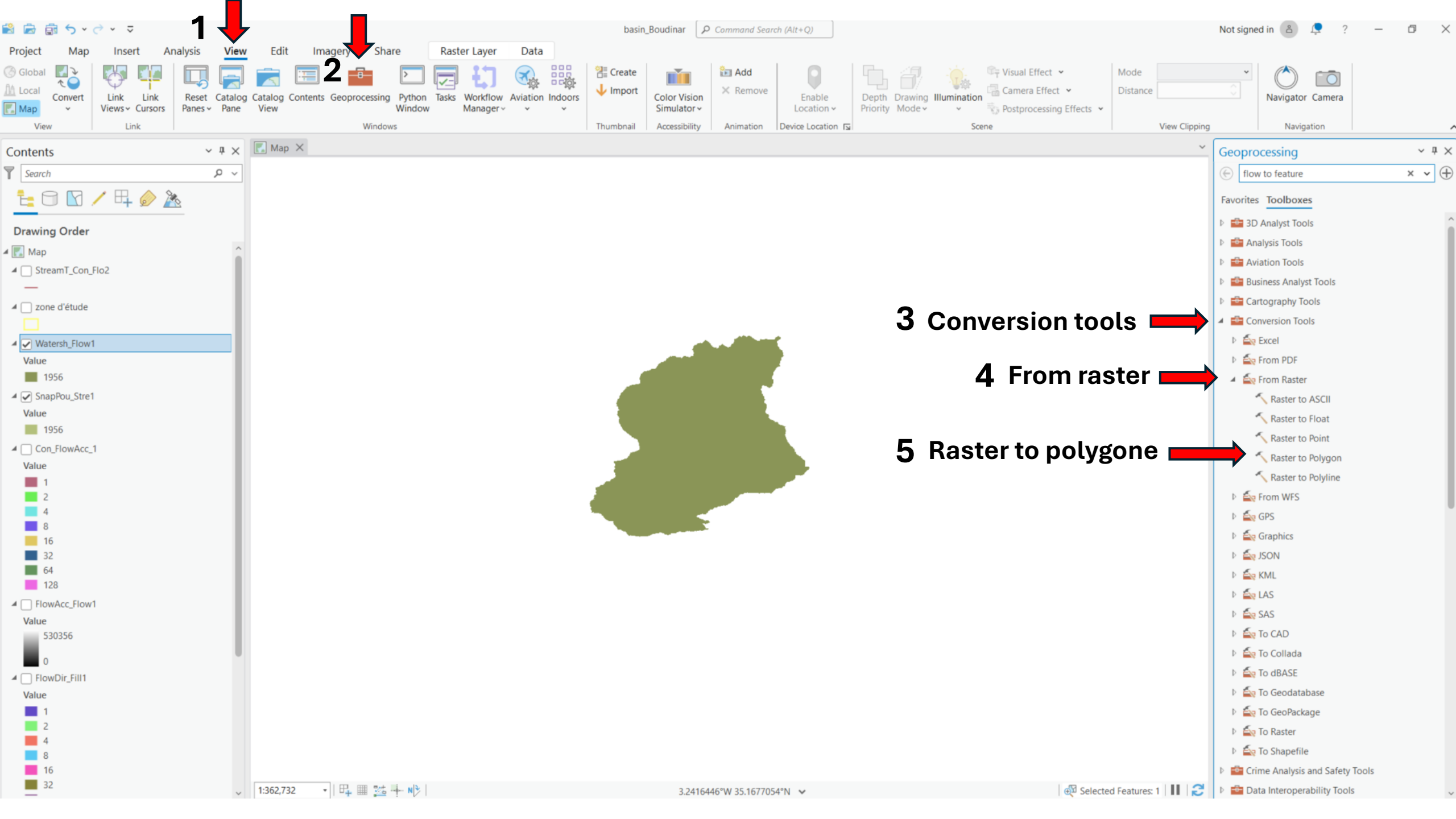
Snap distance
0

Run





La prochaine étape est de convertir le raster (bassin versant) en polygone



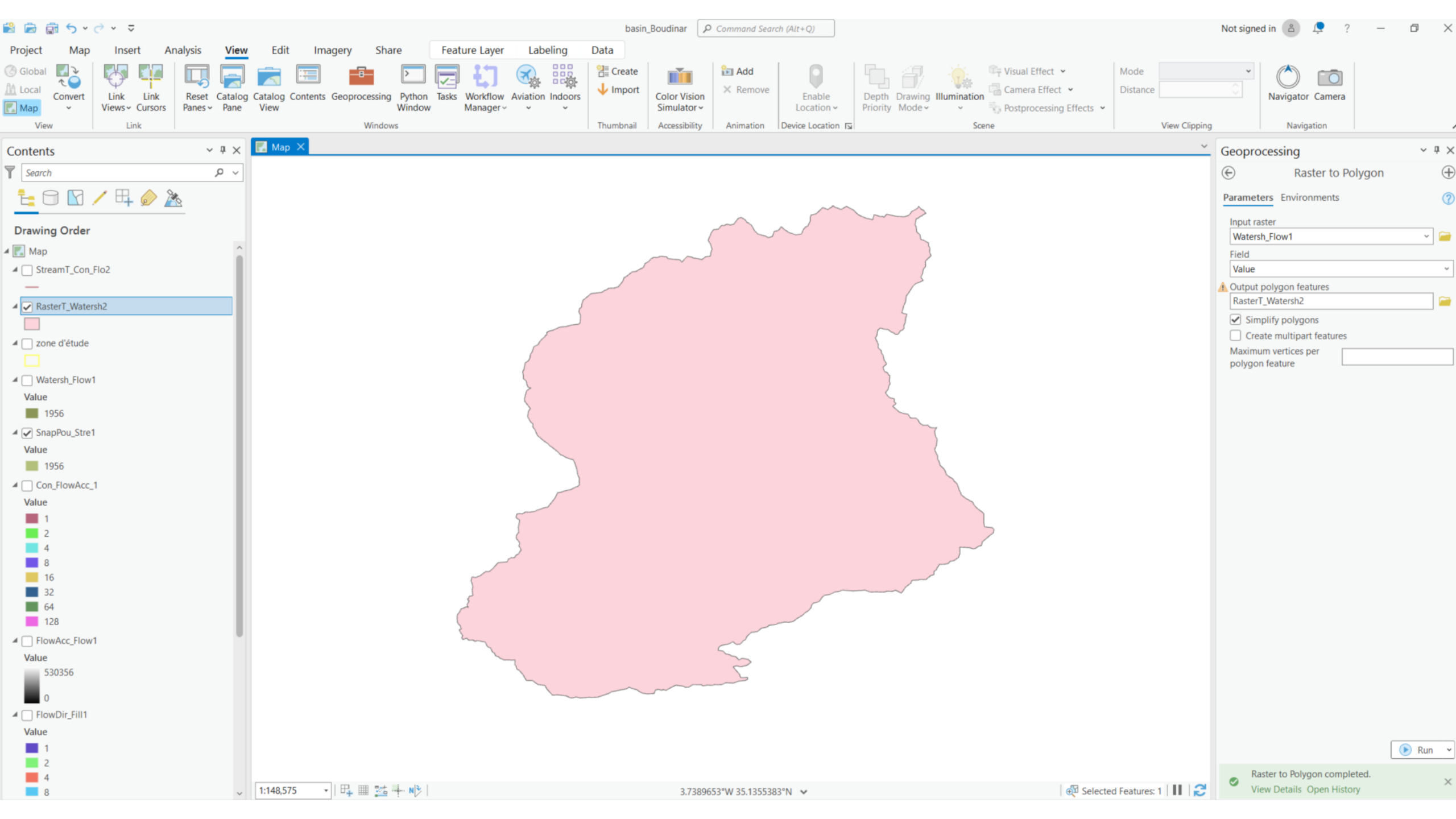
1

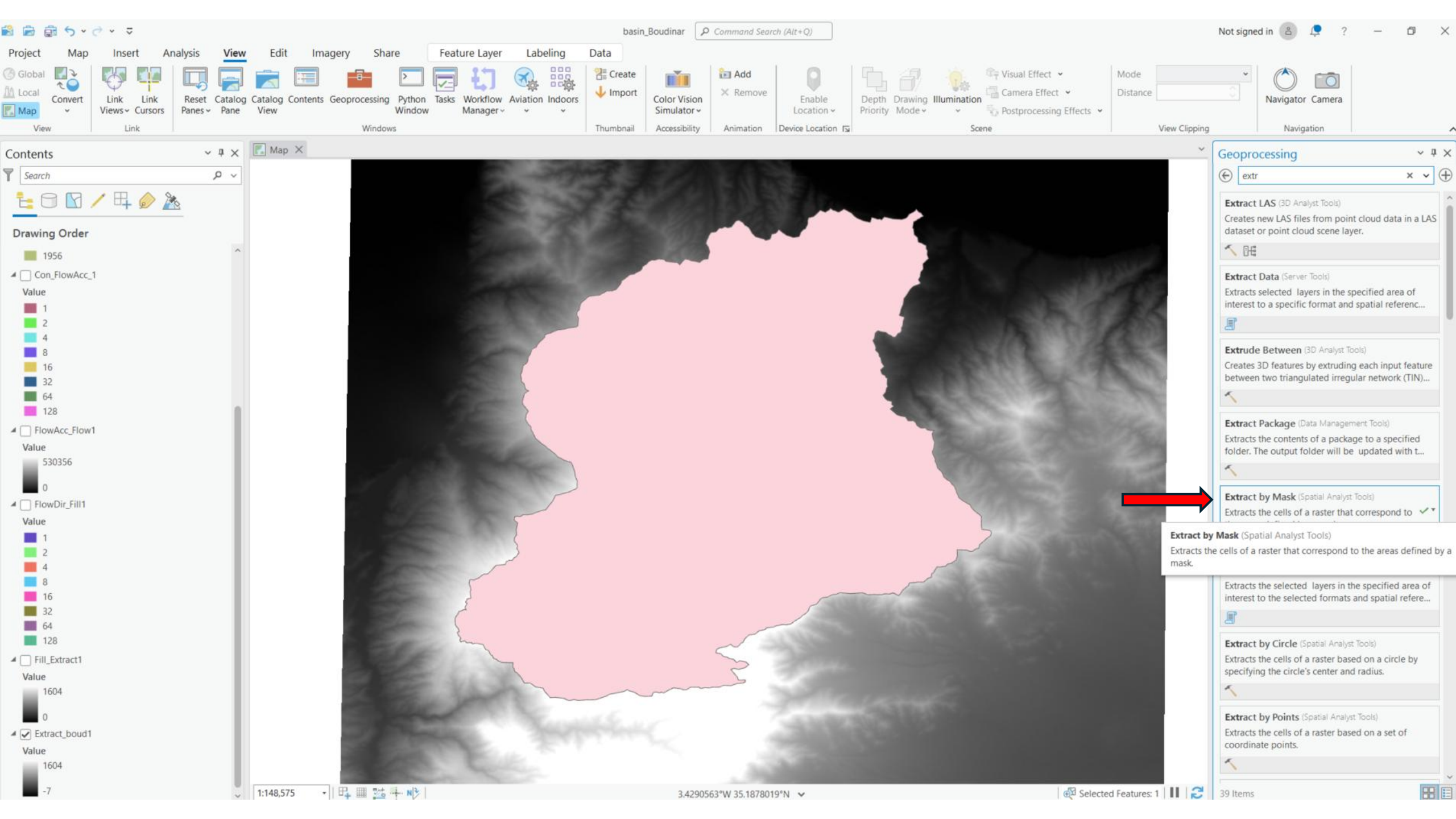
2

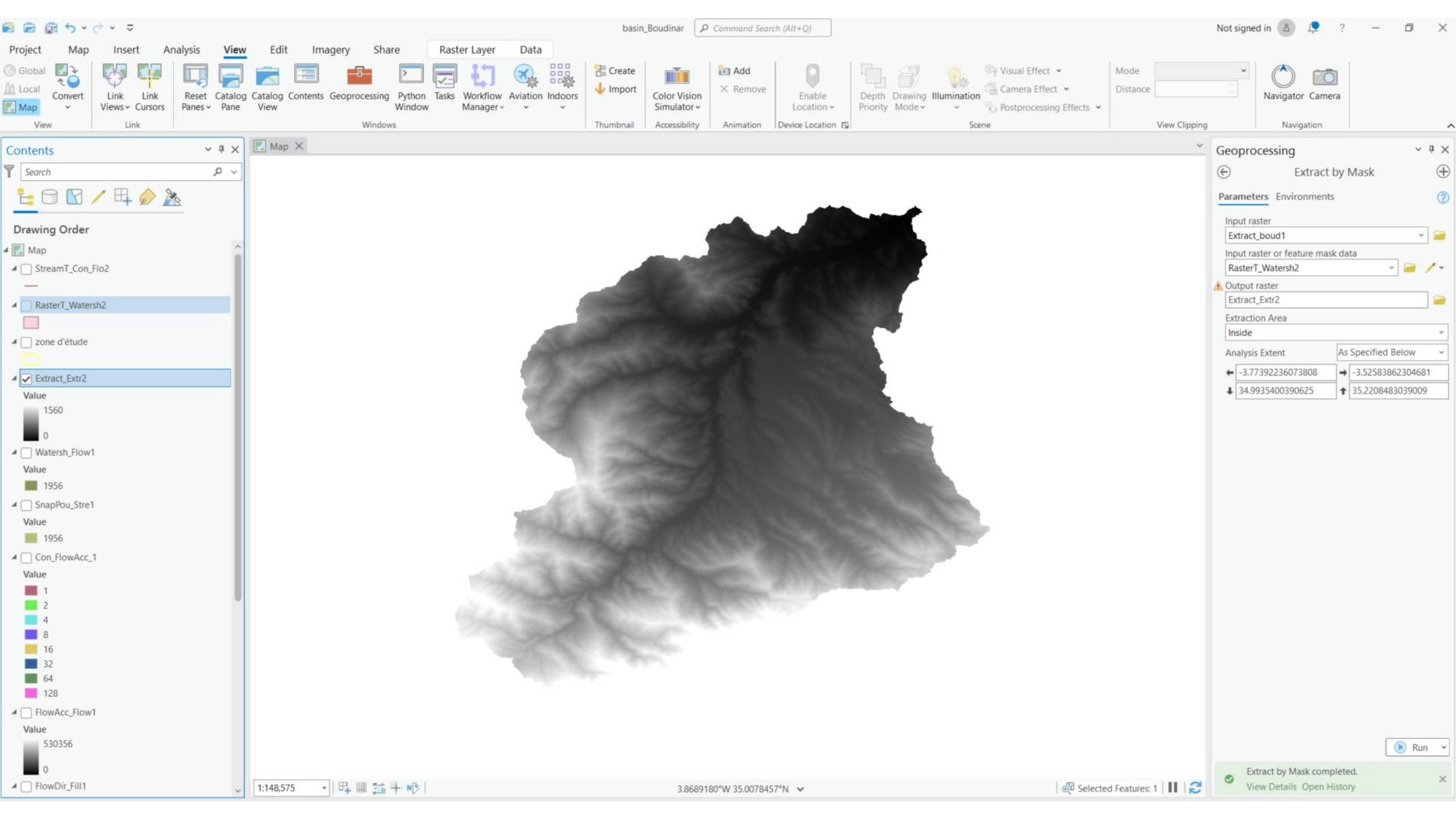
3 Conversion tools

4 From raster

5 Raster to polygone







Les cartes dérivées du MNT

Carte des altitudes

The image shows the QGIS interface with a grayscale elevation map of a basin. The 'View' menu is open, and the 'Symbology' option is highlighted. A red arrow labeled '1 Symbology' points to this option. Another red arrow labeled '2 Classify' points to the 'Symbology - Extract_Extr2' panel on the right. This panel shows the 'Primary symbology' settings, including 'Stretch' as the method, 'Band_1' as the band, and 'Standard Deviation' as the stretch type with 2 standard deviations. The 'Statistics' tab is also visible, showing the dataset's min, max, mean, and standard deviation.

1 Symbology

2 Classify

Symbology - Extract_Extr2

Primary symbology

Stretch

Band: Band_1

Color scheme: [gradient]

☐ Invert

Value: 0 1560

Label: 0 1560

Stretch type: Standard Deviation

Number of standard deviations: 2

Gamma: 1.0

Statistics Mask Advanced Labeling

Statistics: Dataset

Options

Min: 0

Max: 1560

Mean: 552.15349284

Std. dev: 314.79454908

Symbology - Extract_Extr2



Primary symbology

Classify

Field: Value

Normalization: <None>

Method: Manual Interval

Classes: 5

Color scheme:

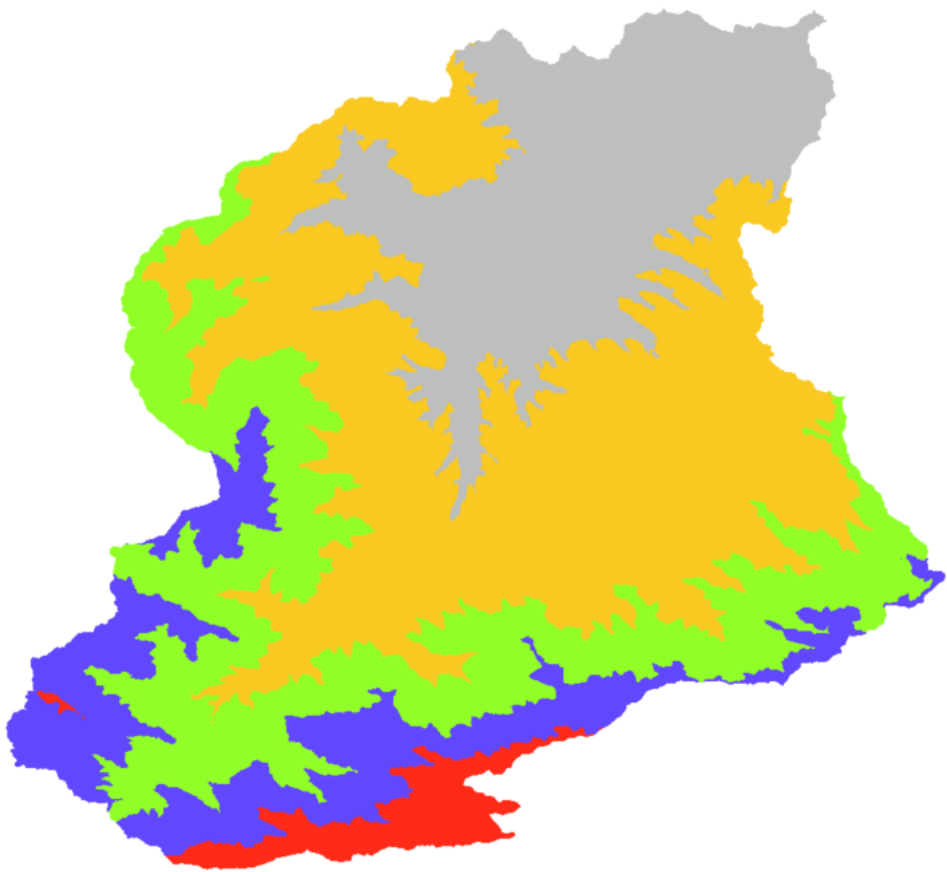
Classes Mask Histogram

More + 0.0 - 0.0

Color	Upper value	Label
	≤ 300.0	0.001 - 300
	≤ 600.0	300.001 - 600
	≤ 900.0	600.001 - 900
	≤ 1200.0	900.001 - 1,200
	≤ 1560.0	1,200.001 - 1,560

Contents

- Search
- Drawing Order
- Map
 - ☐ StreamT_Con_Flo2
 - ☐ RasterT_Watersh2
 - ☐ zone d'étude
 - ☒ Extract_Extr2
 - Value
 - 0.001 - 300
 - 300.001 - 600
 - 600.001 - 900
 - 900.001 - 1,200
 - 1,200.001 - 1,560
 - ☐ Watersh_Flow1
 - Value
 - 1956
 - ☐ SnapPou_Stre1
 - Value
 - 1956
 - ☐ Con_FlowAcc_1
 - Value
 - 1
 - 2
 - 4
 - 8
 - 16
 - 32
 - 64



Carte des pentes

The screenshot displays the ArcGIS Pro interface. The main map area shows a grayscale slope map of a terrain. On the left, the 'Contents' pane lists several layers: 'Map', 'StreamT_Con_Flo2', 'RasterT_Watersh2', 'zone d'étude', 'Extract_Extr2' (selected), 'Watersh_Flow1', 'SnapPou_Stre1', 'Con_FlowAcc_1', 'FlowAcc_Flow1', and 'FlowDir_Fill1'. The 'Extract_Extr2' layer is highlighted, and its 'Value' legend shows a grayscale ramp from 0 to 1560. On the right, the 'Geoprocessing' pane is open, showing a list of toolboxes. A red arrow points from the 'Spatial Analyst Tools' folder to the 'Surface' tool, which is also highlighted. Another red arrow points from the text 'Surface puis slope' to the 'Surface' tool. The bottom status bar shows the scale '1:148,575' and coordinates '3.4267963°W 35.1485336°N'.

Project Map Insert Analysis View Edit Imagery Share Raster Layer Data

Global Local Map Convert Link Views Cursors Reset Panes Catalog Pane Catalog Contents Geoprocessing Python Tasks Workflow Manager Aviation Indoors

Create Import Color Vision Simulator Add Remove Enable Location Depth Priority Drawing Mode Illumination Visual Effect Camera Effect Postprocessing Effects

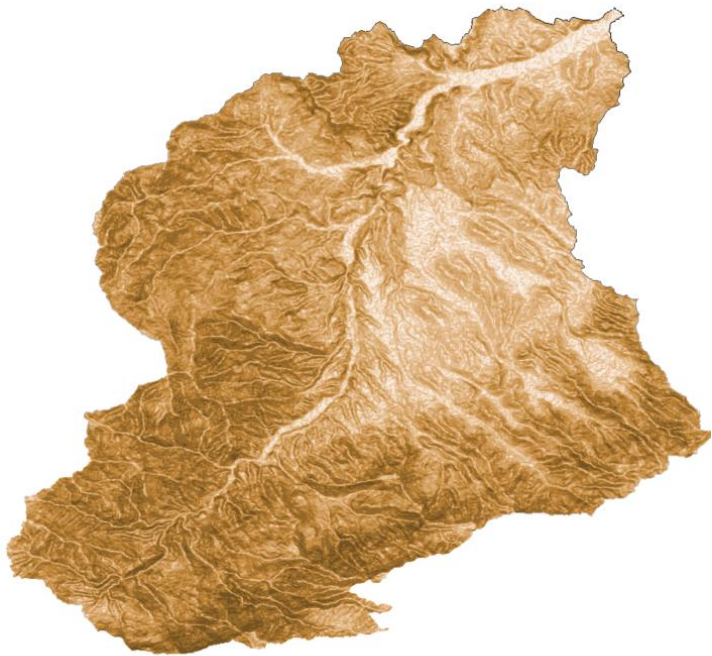
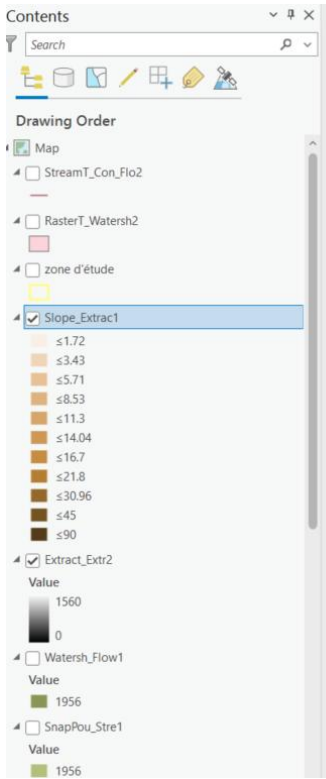
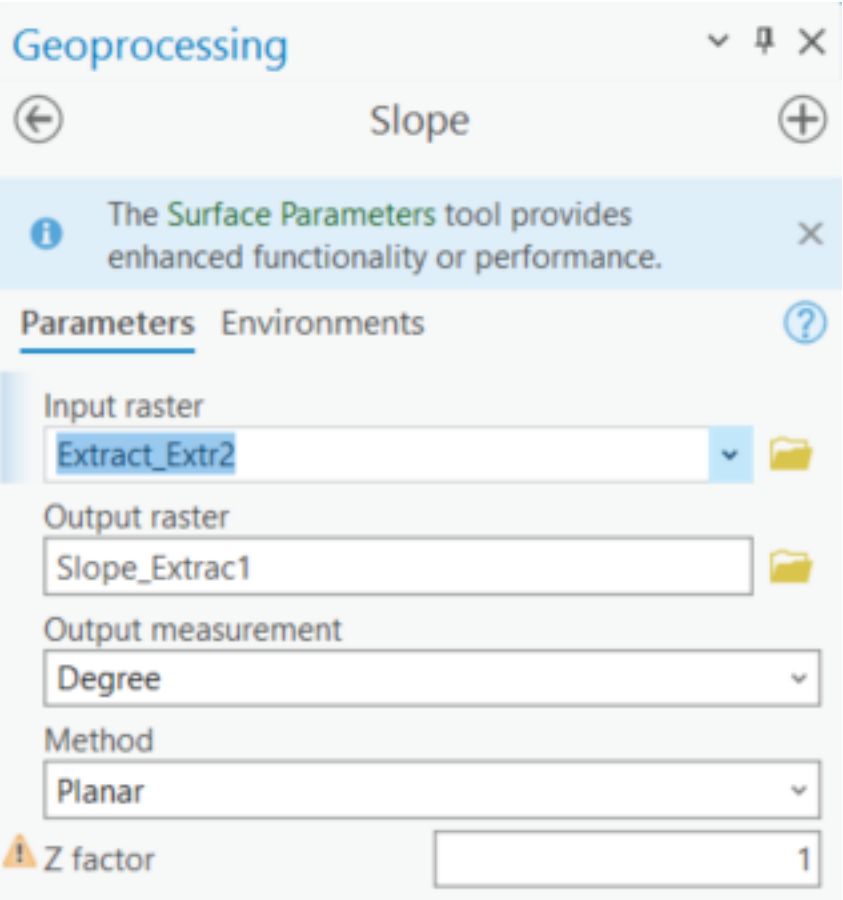
Mode Automatic Distance 0.05 m Navigator Camera

Contents Search Drawing Order Map StreamT_Con_Flo2 RasterT_Watersh2 zone d'étude Extract_Extr2 Value 1560 0 Watersh_Flow1 Value 1956 SnapPou_Stre1 Value 1956 Con_FlowAcc_1 Value 1 2 4 8 16 32 64 128 FlowAcc_Flow1 Value 530356 0 FlowDir_Fill1

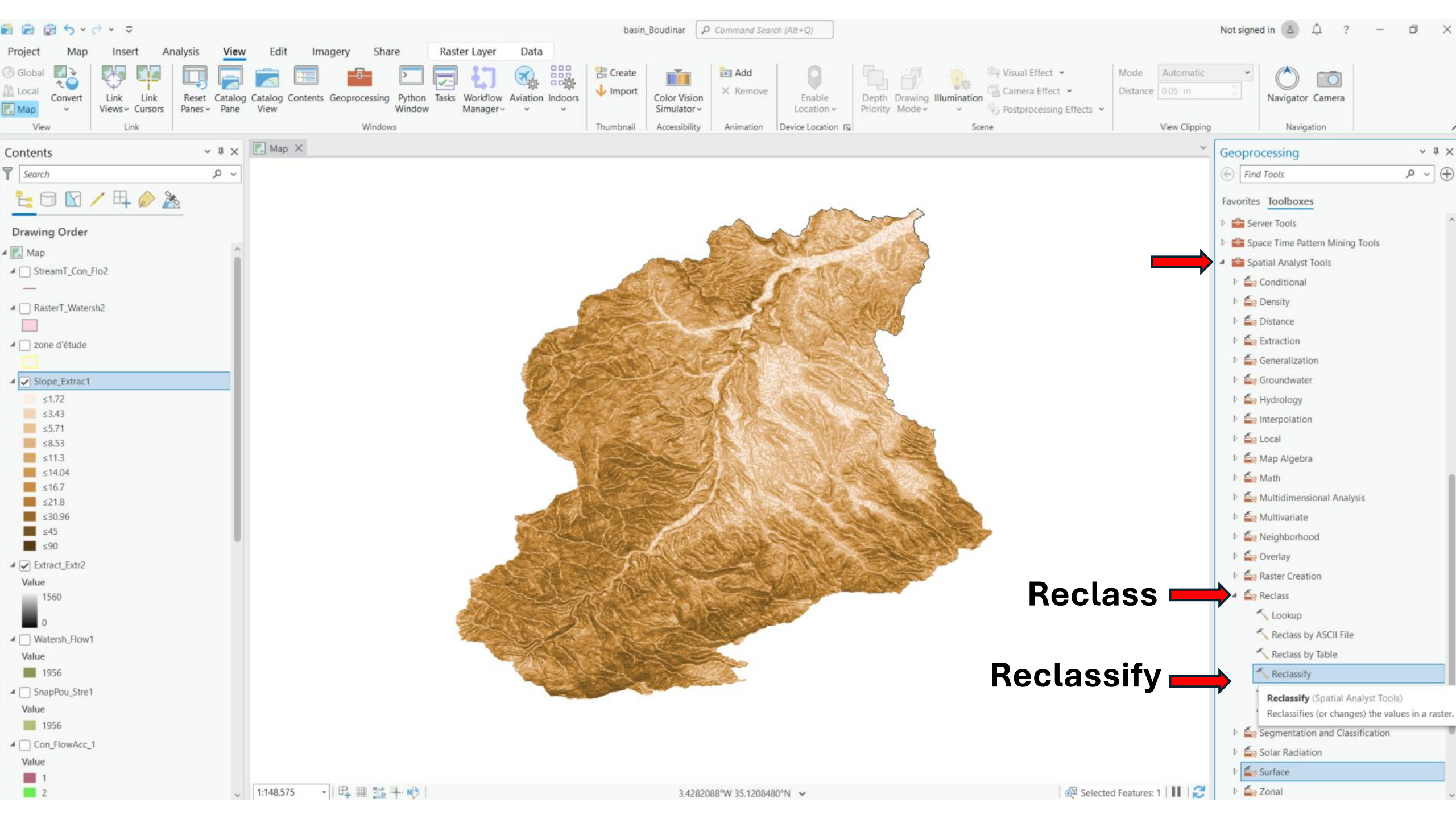
Geoprocessing Find Tools Favorites Toolboxes Space Time Pattern Mining Tools Spatial Analyst Tools Conditional Density Distance Extraction Generalization Groundwater Hydrology Interpolation Local Map Algebra Math Multidimensional Analysis Multivariate Neighborhood Overlay Raster Creation Reclass Segmentation and Classification Solar Radiation Surface Zonal Spatial Statistics Tools Territory Design Tools Topographic Production Tools Trace Network Tools Utility Network Tools Workflow Manager Tools

Surface puis slope

1:148,575 3.4267963°W 35.1485336°N Selected Features: 1

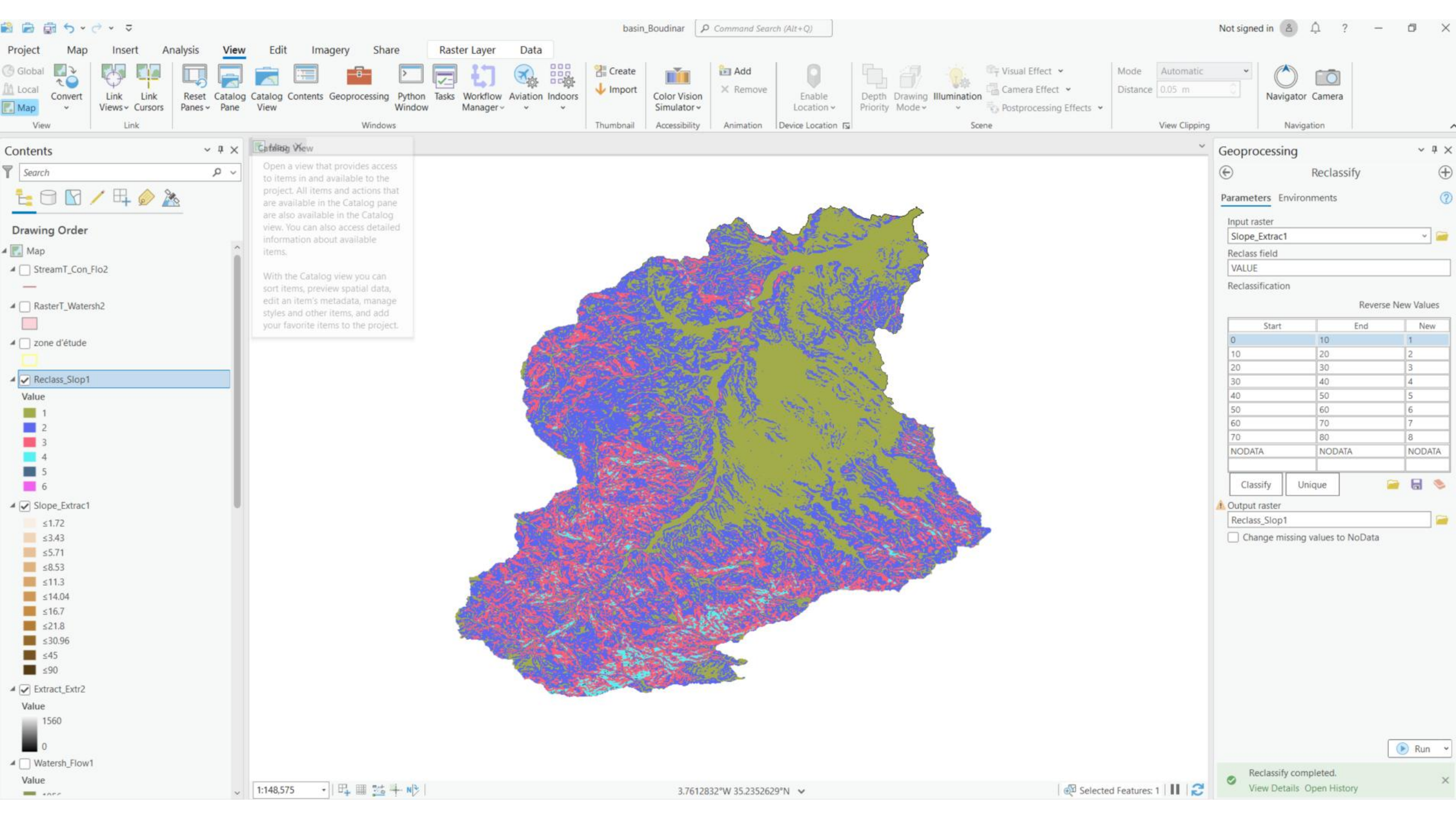


Puis cliquer sur Run (Exécuter)

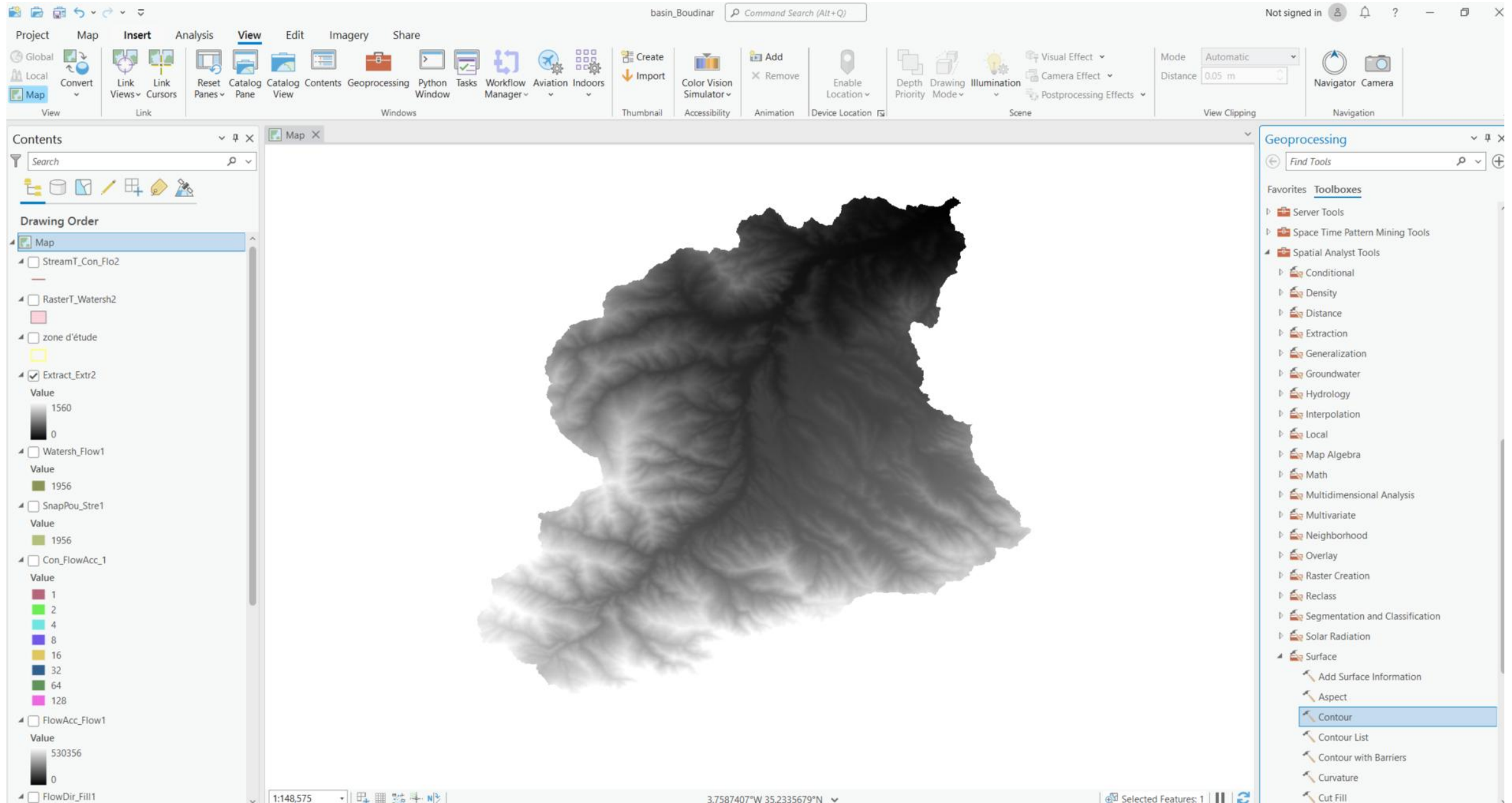


Reclass

Reclassify



Carte des contours



Geoprocessing

Contour

Parameters Environments

Input raster
Extract_Extr2

Output feature class
Contour_Extract2

Contour interval 100

Base contour 0

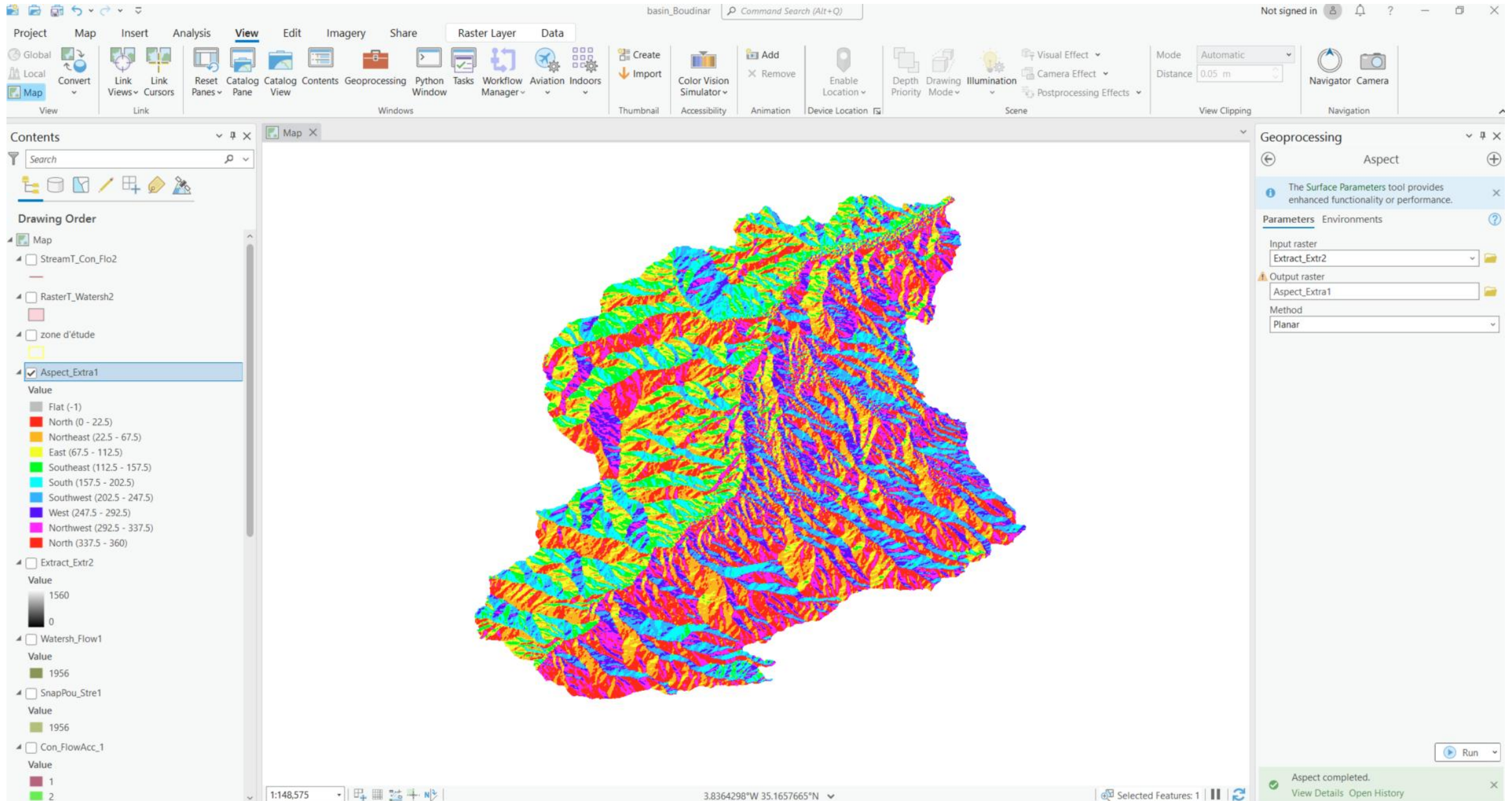
Z factor 1

Contour type
Contour

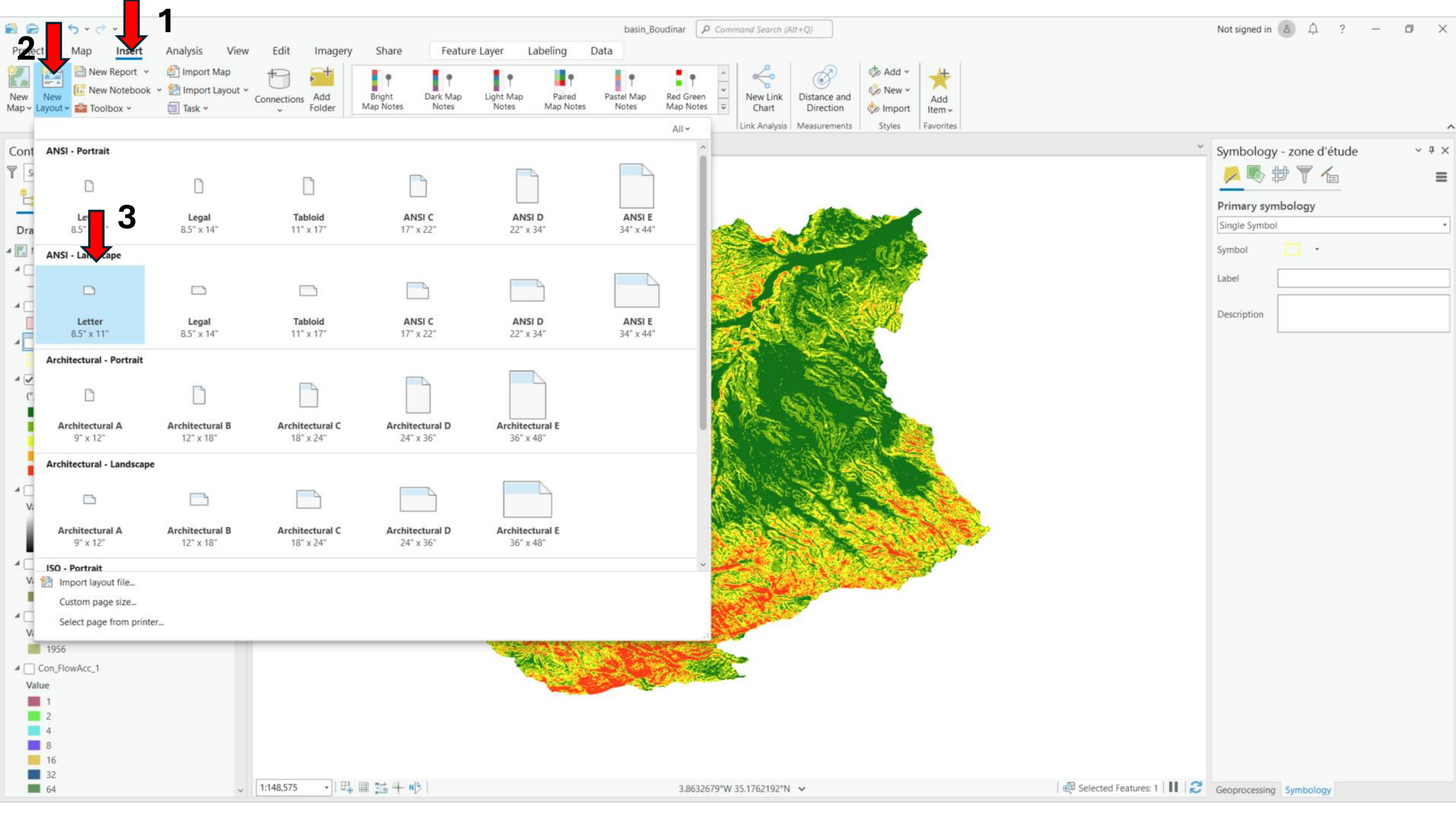
Maximum vertices per feature



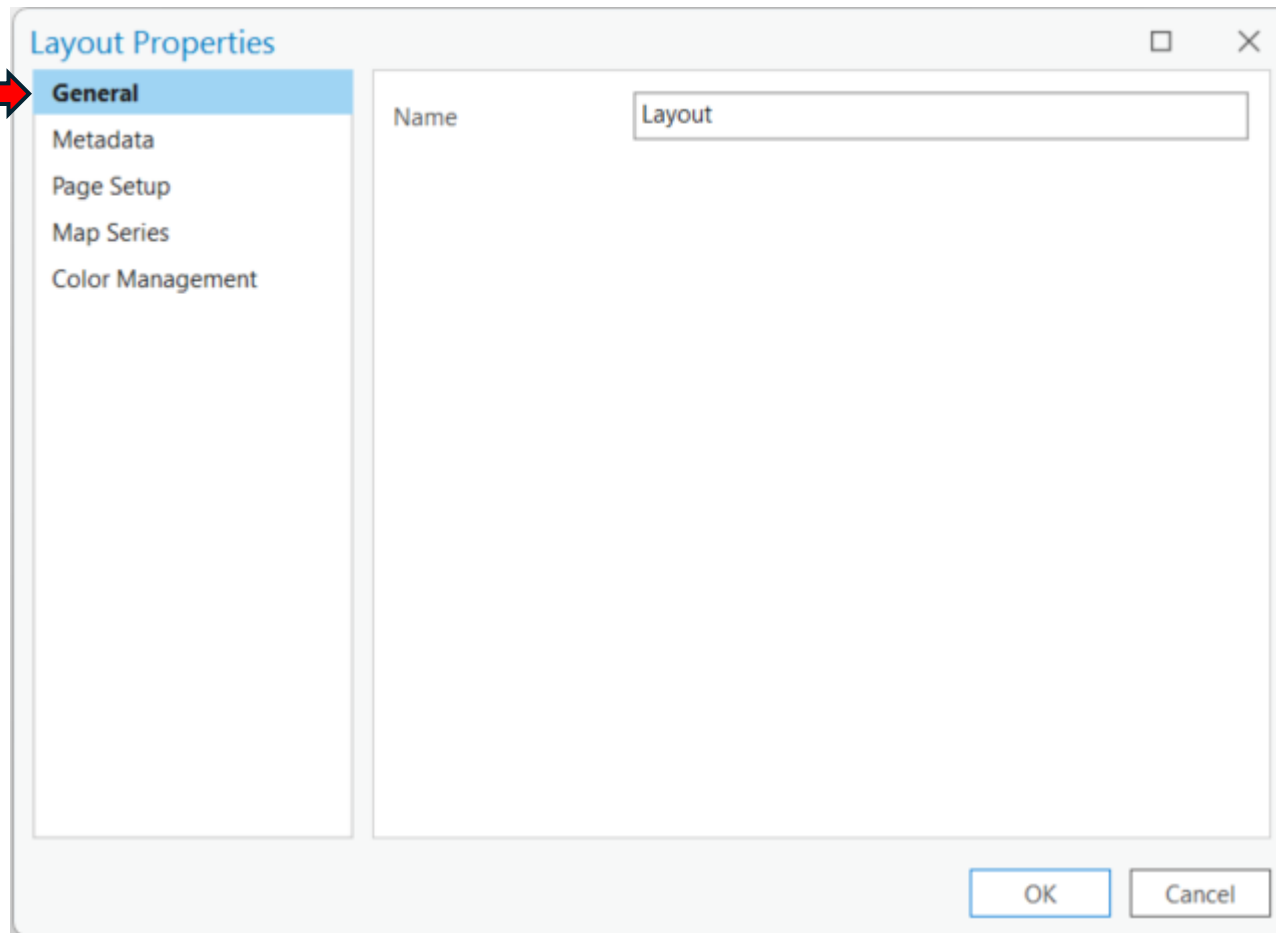
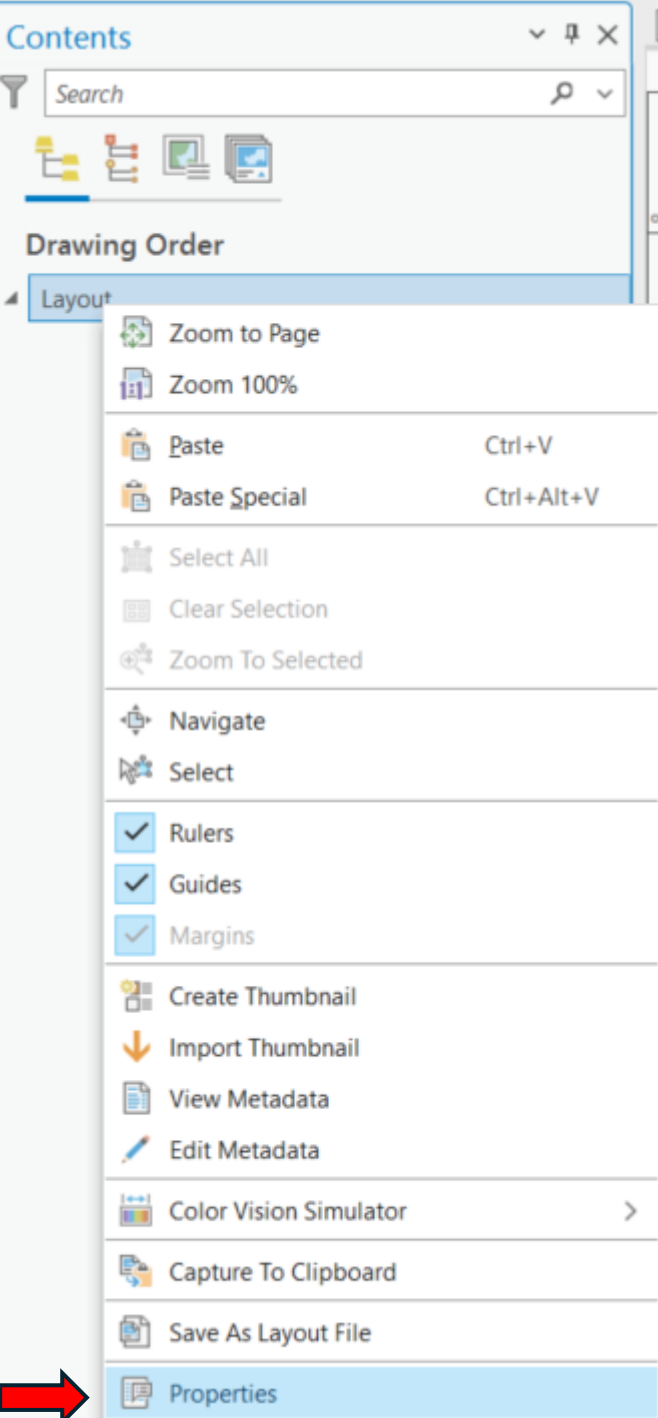
Carte d'exposition (Aspect)

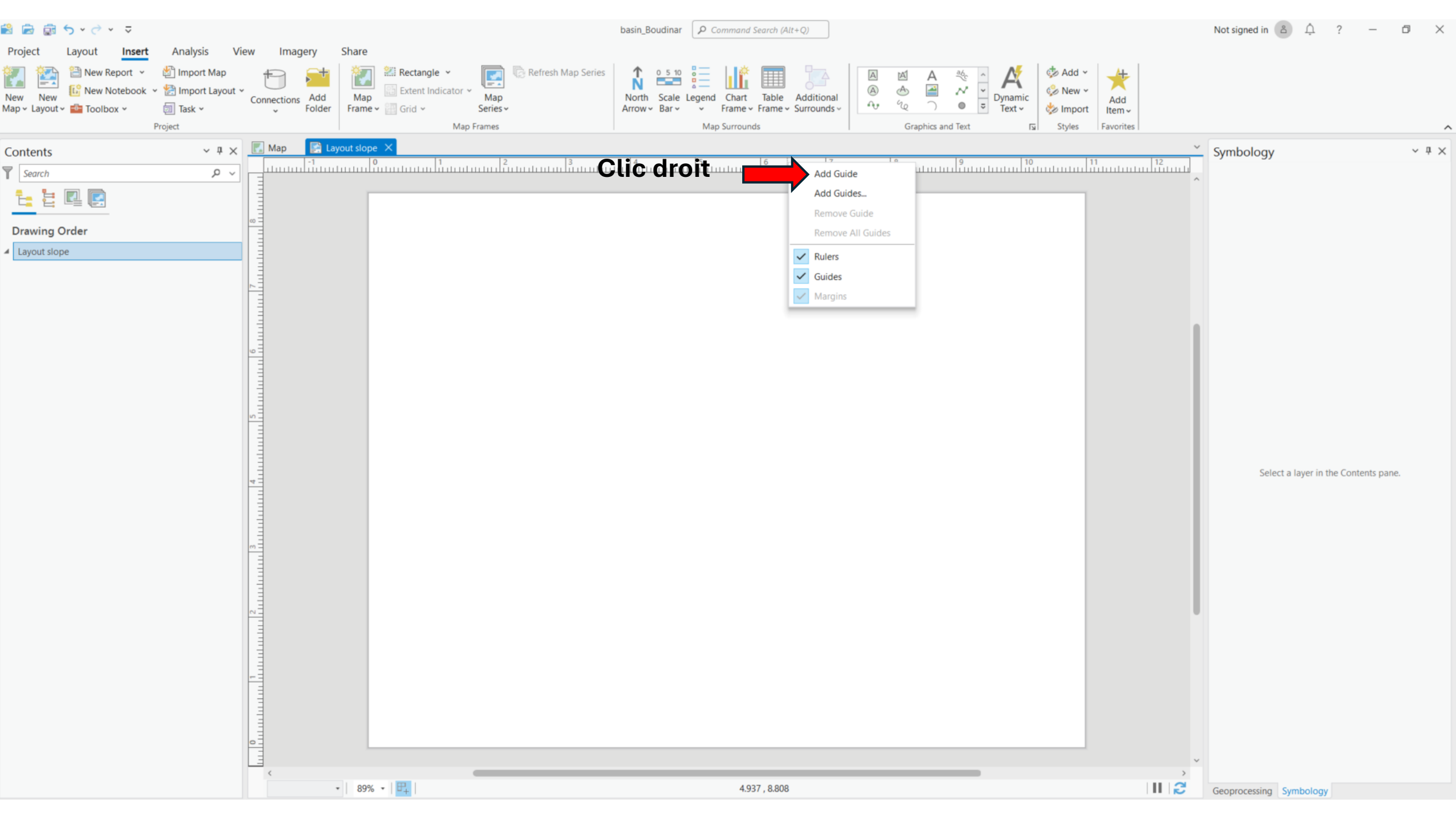


La mise en page d'une carte (la pente)

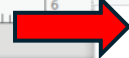


Changer le nom de Layout

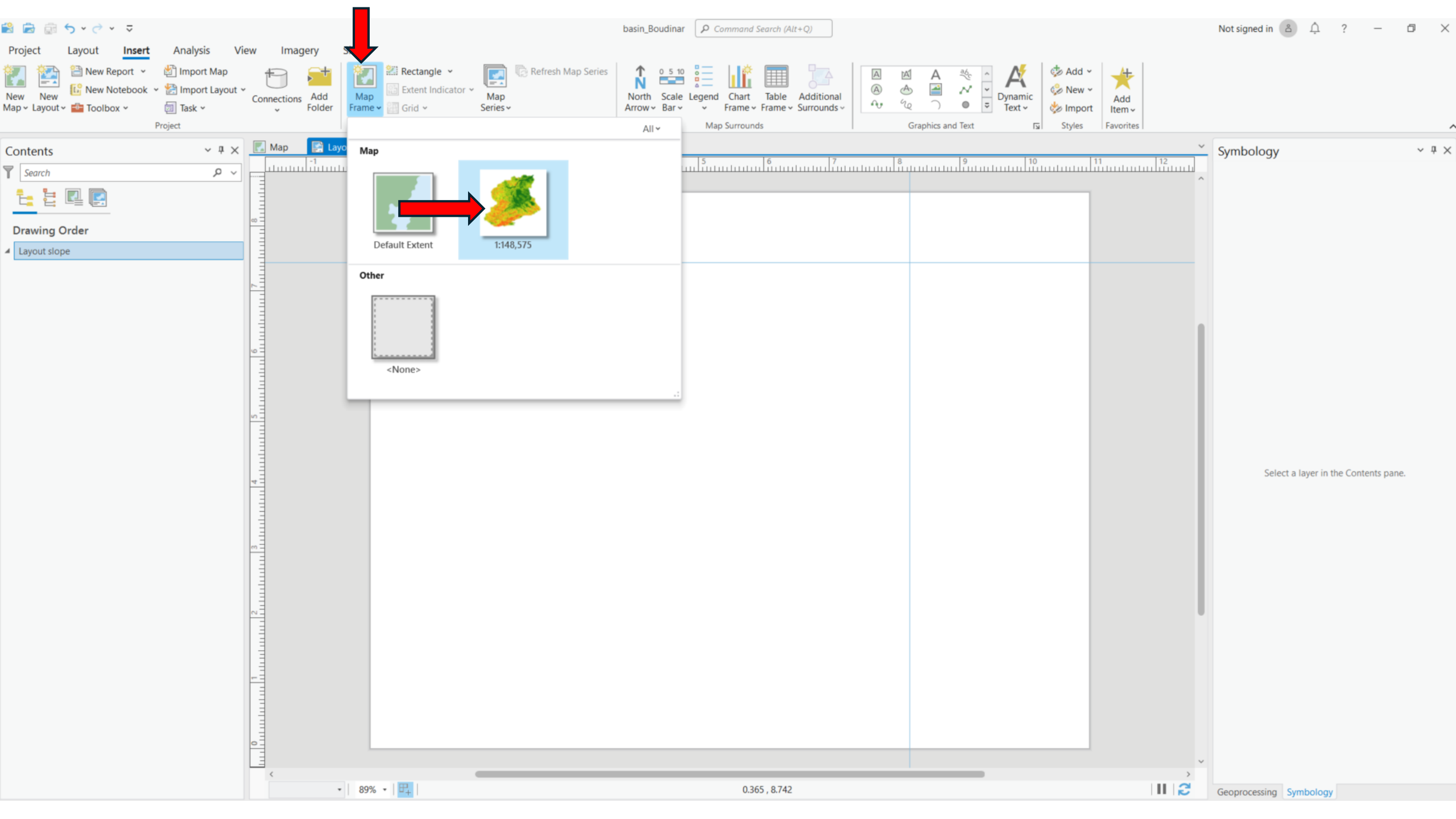




Clic droit



- Add Guide
- Add Guides...
- Remove Guide
- Remove All Guides
- ☒ Rulers
- ☒ Guides
- ☒ Margins



Project Layout **Insert** Analysis View Imagery Share Map Frame

New Map New Layout New Report New Notebook Import Map Import Layout Task

Connections Add Folder Map Frame Extent Indicator Map Series Refresh Map Series

North Arrow Scale Bar Legend Chart Frame Table Additional Surrounds

Graphics and Text Dynamic Text Add New Import Add Item

Contents

Search

Drawing Order

Layout slope

☒ Map Frame

☒ Map

☐ StreamT_Con_Flo2

☐ RasterT_Watersh2

☐ zone d'étude

☒ La pente (*)

0.001 - 7.014

7.015 - 13.151

13.152 - 19.069

19.07 - 25.863

25.864 - 55.891

☐ Extract_Extr2

Value

1560

0

☐ Watersh_Flow1

Value

1956

☐ SnapPou_Stre1

Value

1956

☐ Con_FlowAcc_1

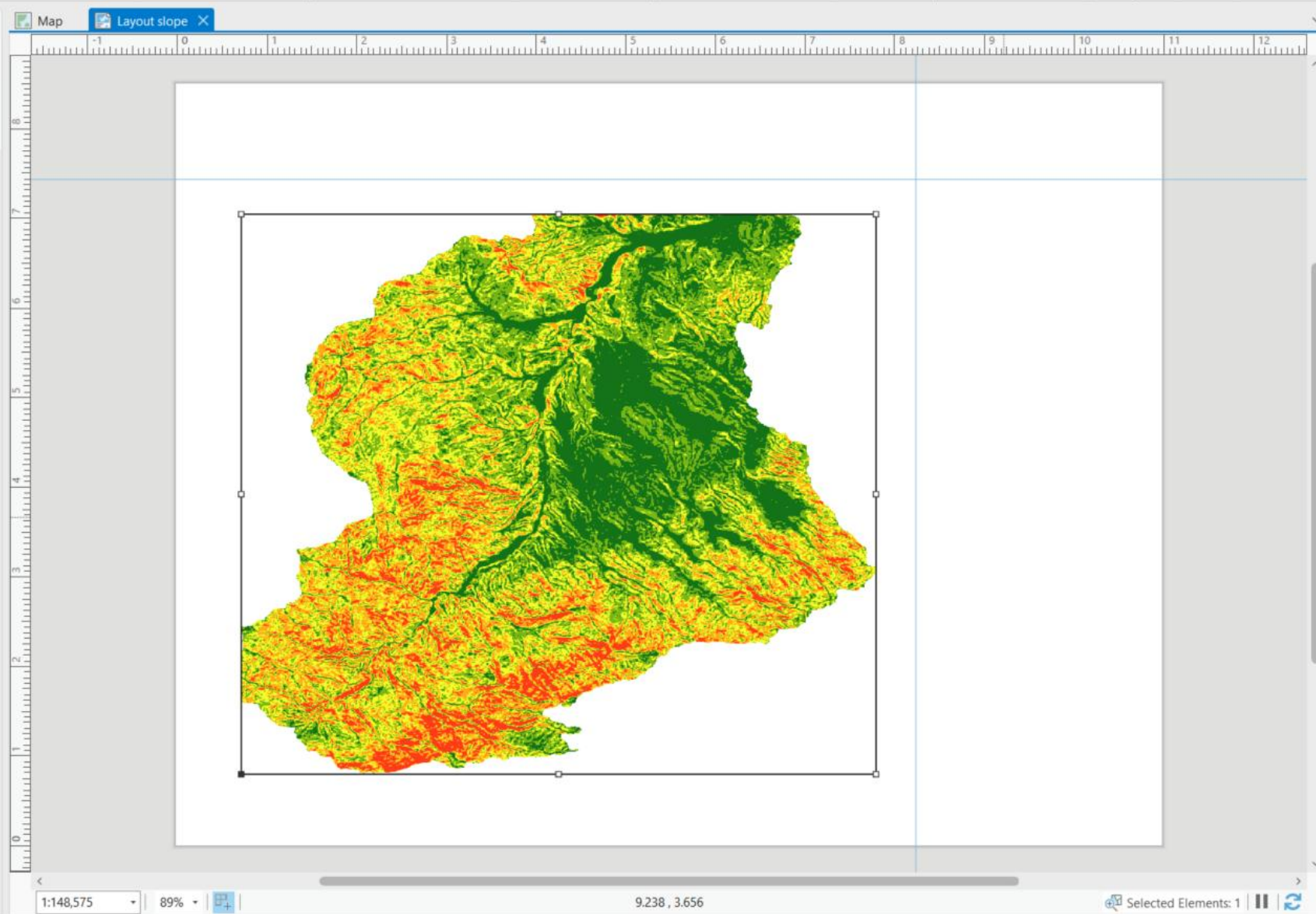
Value

1

2

4

8



Element

Map Frame

Map Frame

Options

General

Name Map Frame

☒ Visible

☐ Locked

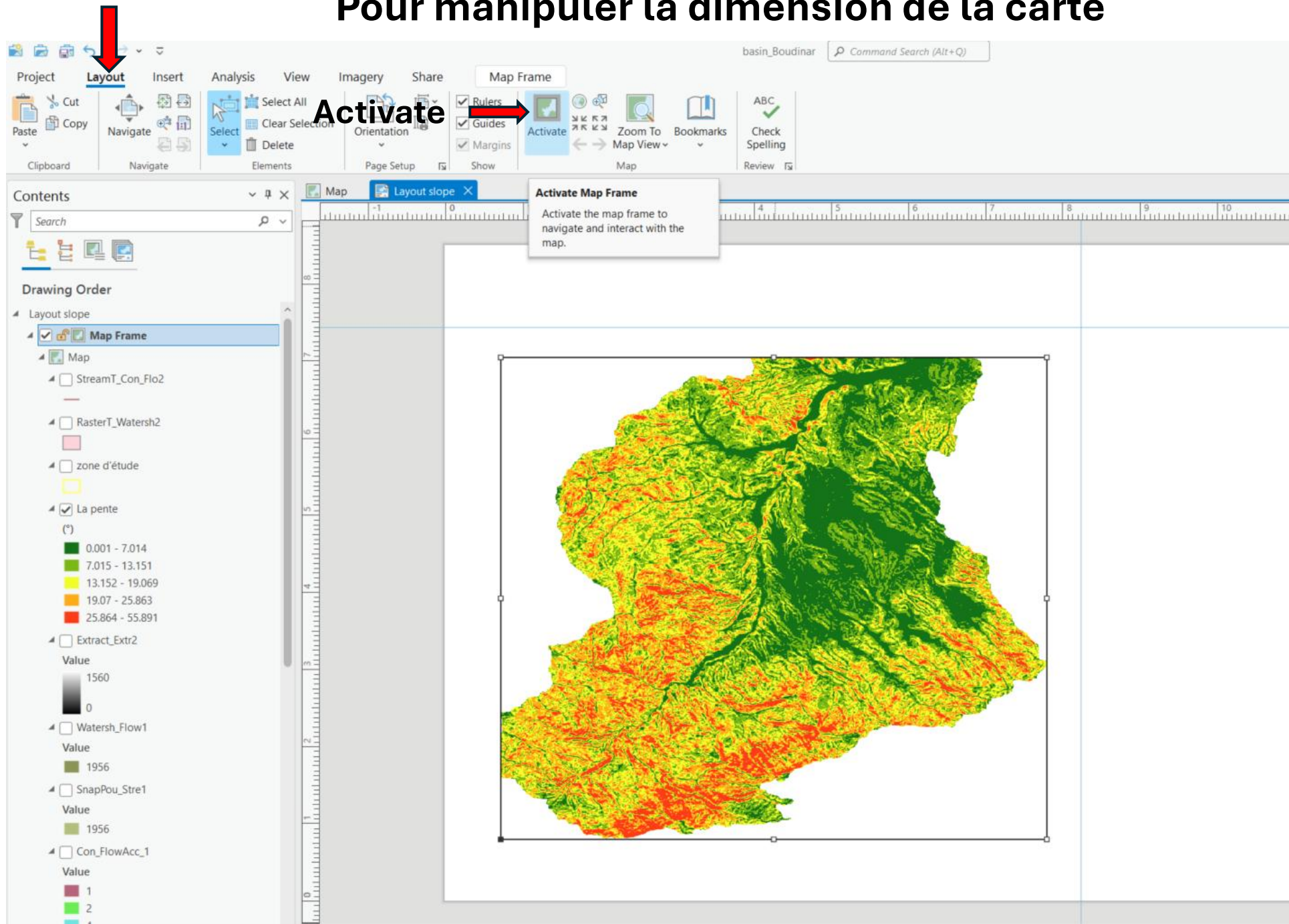
Map Frame

Map Map

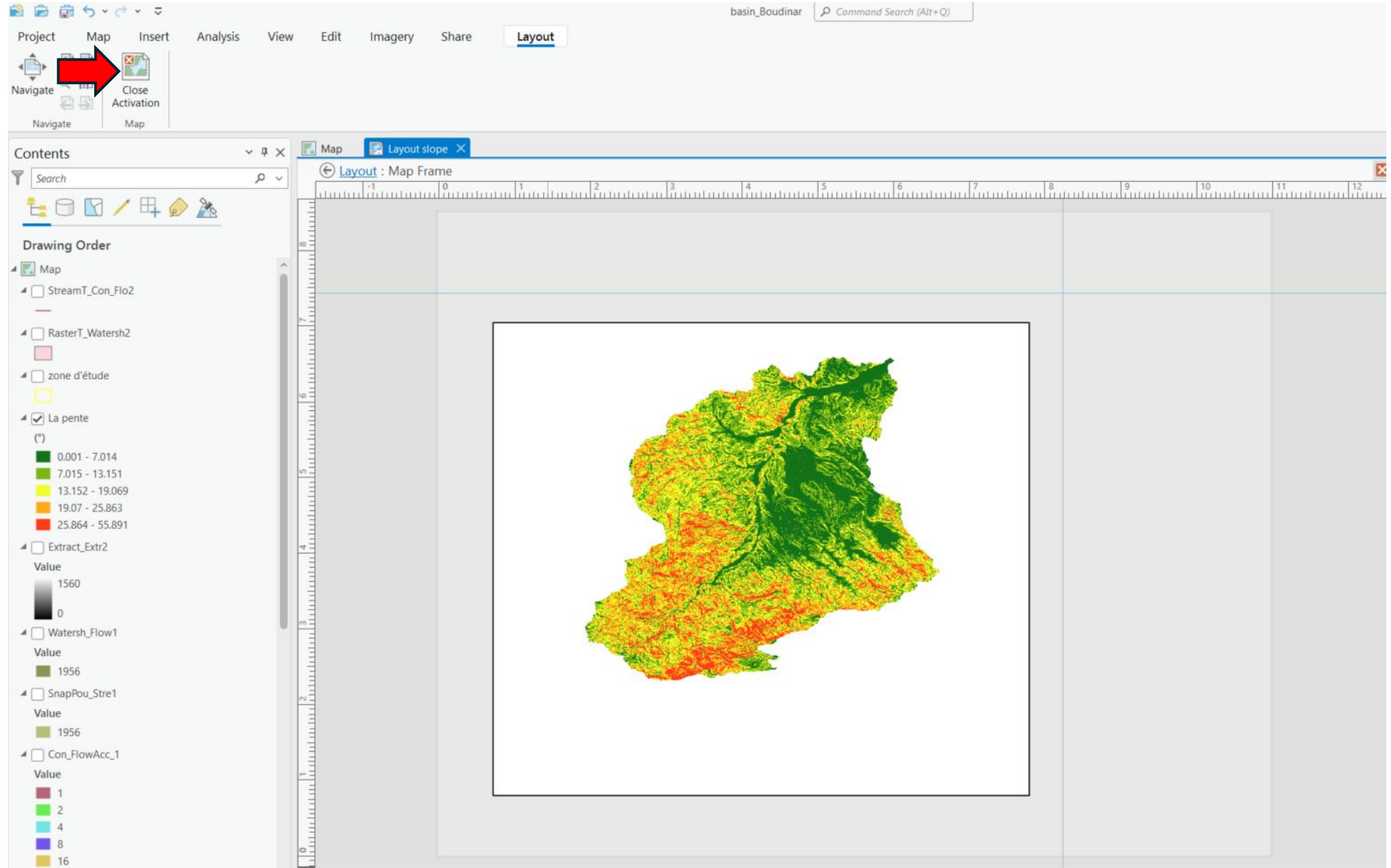
Accessibility

Geoprocessing Symbology Element

Pour manipuler la dimension de la carte



Cliquer sur fermer l'activation une fois la carte déplacée à la position souhaitée



Ajouter la légende

The screenshot displays the ArcGIS Pro software interface. The top ribbon includes tabs for Project, Layout, Insert, Analysis, View, Imagery, and Share. The 'Insert' tab is active, showing options like New Report, New Notebook, and various map frame tools. The 'Map Frame' sub-tab is selected, displaying tools for Rectangle, Extent Indicator, Map Series, and Grid. The 'Contents' pane on the left shows the 'Layout slope' map frame selected, with a list of layers including 'StreamT_Con_Flo2', 'RasterT_Watersh2', 'zone d'étude', 'La pente', and 'Extract_Extr2'. The 'La pente' layer is checked and shows a color-coded slope scale from 0.001 to 55.891 degrees. The main map area shows a topographic map with a color-coded slope overlay. A 'Legends' panel is open on the right, displaying a grid of legend styles. 'Legend 6' is highlighted, showing its properties: Style: ArcGIS 2D, Category: Legends, and Tags: title;vertical spac.

basin_Boudinar Command Search (Alt+Q)

Project Layout **Insert** Analysis View Imagery Share Map Frame

New Map New Layout New Report New Notebook Import Map Import Layout Task Connections Add Folder Map Frame Extent Indicator Map Series Refresh Map Series

Contents Search

Drawing Order

Layout slope

Map Frame

Map

StreamT_Con_Flo2

RasterT_Watersh2

zone d'étude

La pente

0.001 - 7.014

7.015 - 13.151

13.152 - 19.069

19.07 - 25.863

25.864 - 55.891

Extract_Extr2

Value

1560

0

Watersh_Flow1

Legends

Legend 1 Legend 2 Legend 3

Legend 4 Legend 5 Legend 6

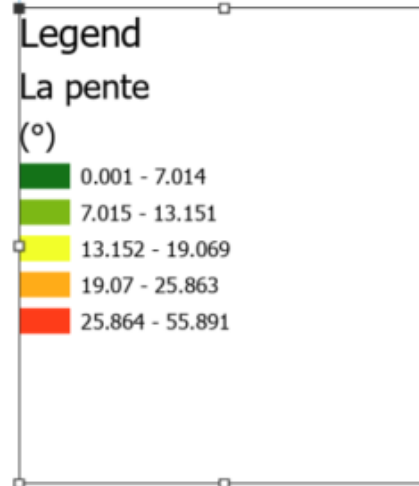
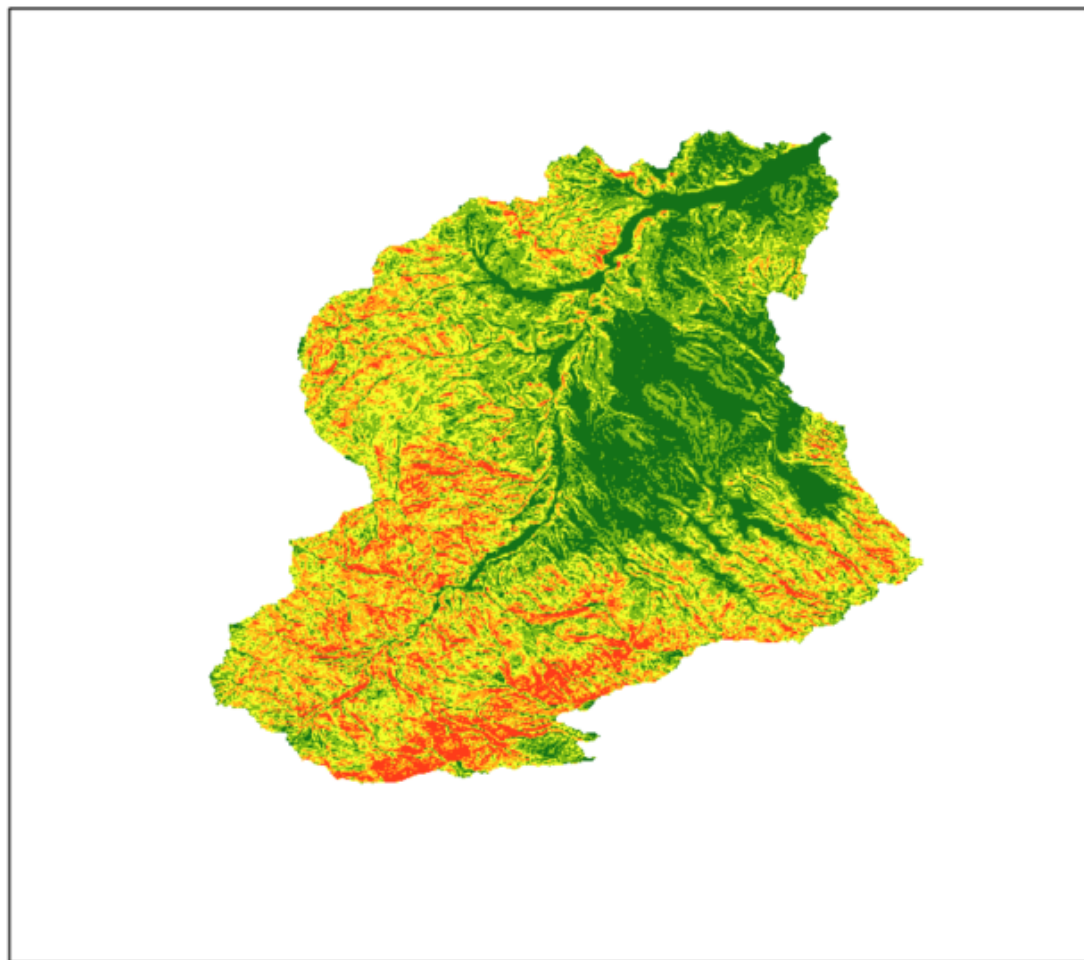
More...

Legend 6

Style: ArcGIS 2D

Category: Legends

Tags: title;vertical spac



Legend

Legend Text Symbol

Options

General

Name Legend

☒ Visible

☐ Locked

Legend

Map frame Map Frame

Title ☒ Show Legend

Legend Items

Show properties...

☒ Sync fonts when adding items

Synchronize with map

☒ Layer visibility

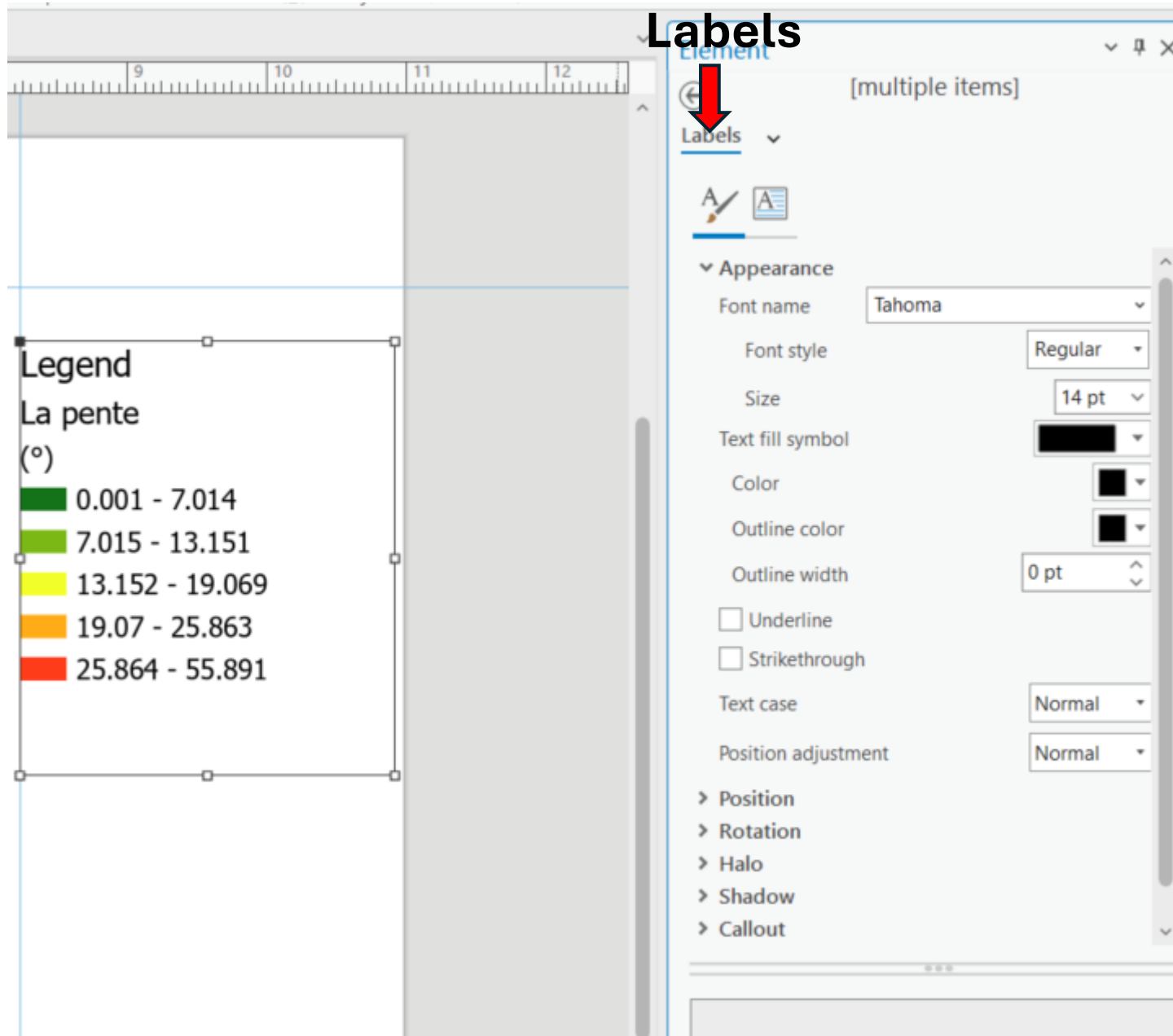
☐ Layer order

☒ New layer

☒ Reference scale

Pour changer la taille des chiffres

Labels



The image shows a software interface with a legend and a 'Labels' panel. The legend is titled 'Legend' and 'La pente (°)' and lists five ranges of values with corresponding color swatches:

- 0.001 - 7.014
- 7.015 - 13.151
- 13.152 - 19.069
- 19.07 - 25.863
- 25.864 - 55.891

The 'Labels' panel on the right shows the following settings:

- Font name: Tahoma
- Font style: Regular
- Size: 14 pt
- Text fill symbol: [Black square]
- Color: [Black]
- Outline color: [Black]
- Outline width: 0 pt
- Underline: ☐
- Strikethrough: ☐
- Text case: Normal
- Position adjustment: Normal

Below the 'Labels' panel, there are expandable sections for Position, Rotation, Halo, Shadow, and Callout.

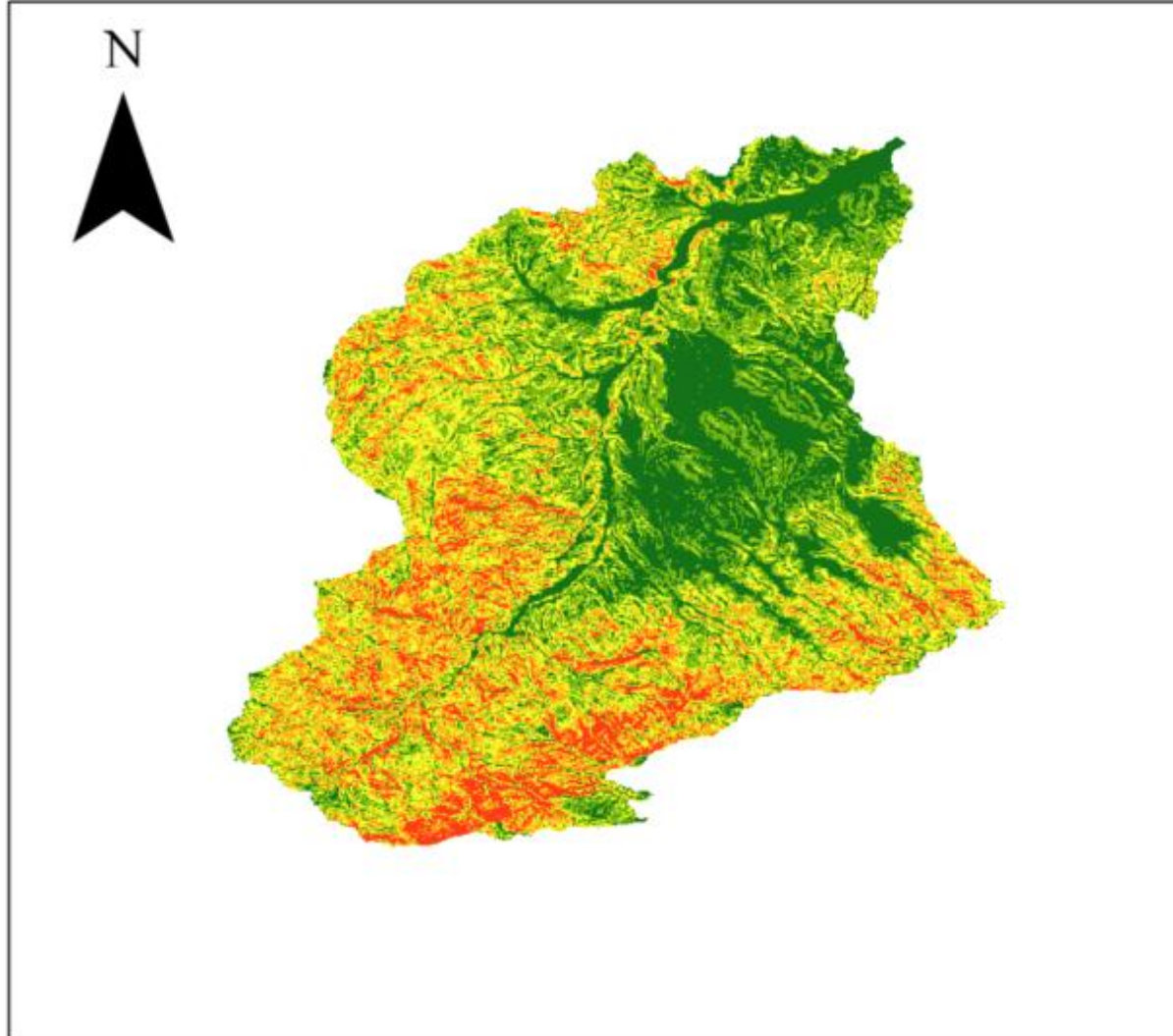
Ajouter le Nord géographique

The screenshot displays the ArcGIS Pro software interface. The top ribbon includes tabs for Project, Layout, Insert, Analysis, View, Imagery, and Share. The 'Insert' tab is active, showing options like New Report, Import Map, and Map Series. A 'North Arrow' tool is highlighted in the ribbon. On the left, the 'Contents' pane shows a 'Drawing Order' list for a 'Layout slope' map. The map area shows a topographic map with a slope legend. A 'North Arrows' menu is open, displaying various north arrow styles. The legend on the right is titled 'La pente (°)' and shows five color-coded categories for slope values.

North Arrows

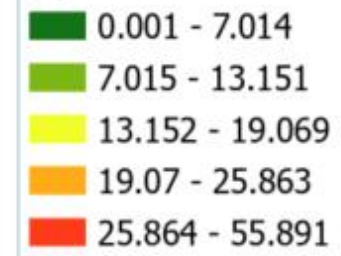
La pente (°)

- 0.001 - 7.014
- 7.015 - 13.151
- 13.152 - 19.069
- 19.07 - 25.863
- 25.864 - 55.891

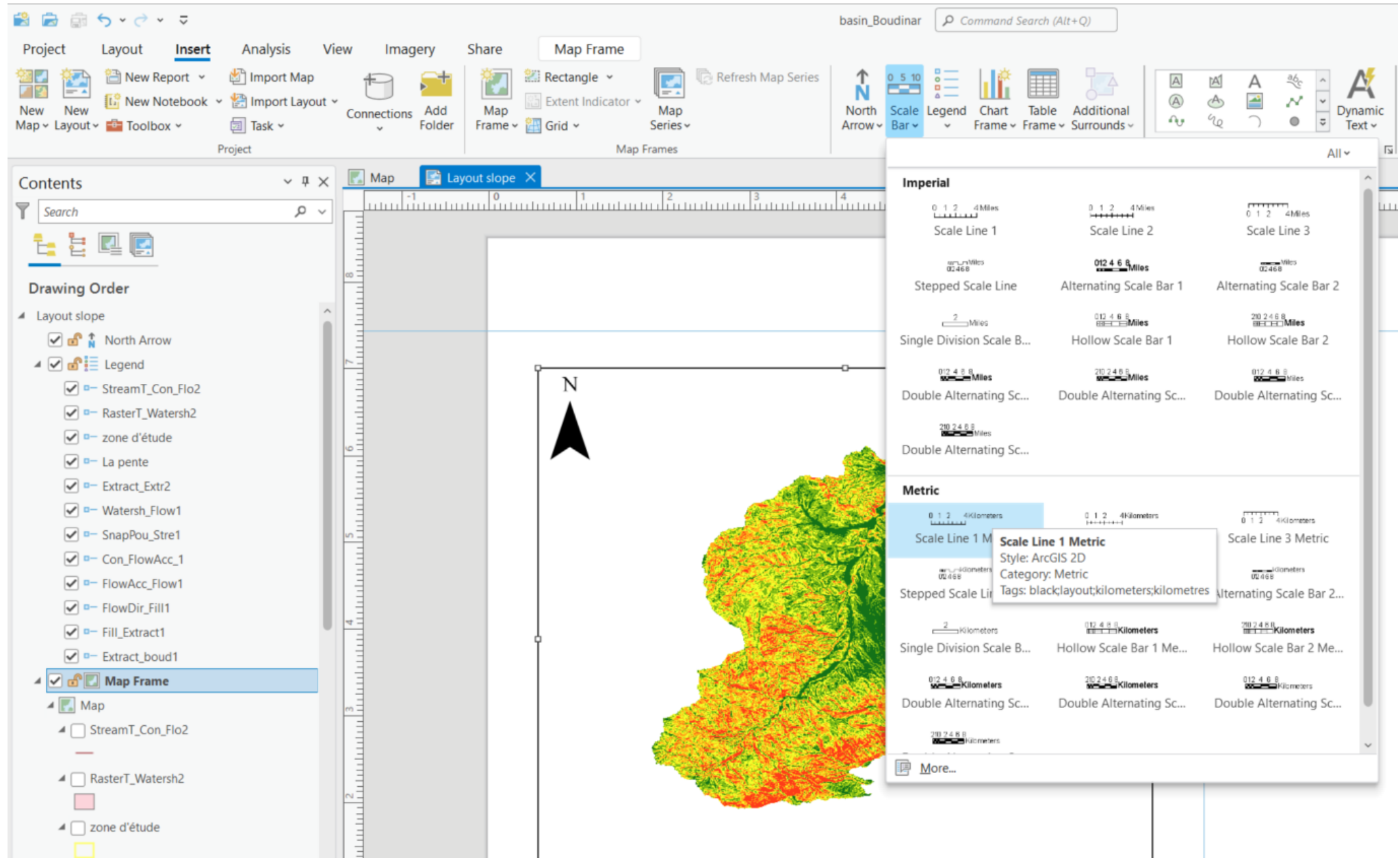


La pente

(°)



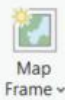
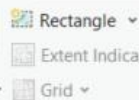
Ajouter l'échelle



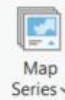
Share

Scale Bar

Design

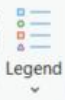
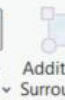
Map
Frame ▾

Extent Indicator ▾

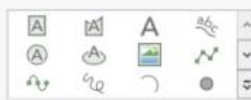
Map
Series ▾

Refresh Map Series

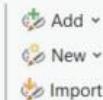
Map Frames

North
Arrow ▾Scale
Bar ▾Legend
▾Chart
Frame ▾Table
Frame ▾Additional
Surrounds ▾

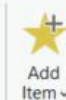
Map Surrounds



Graphics and Text

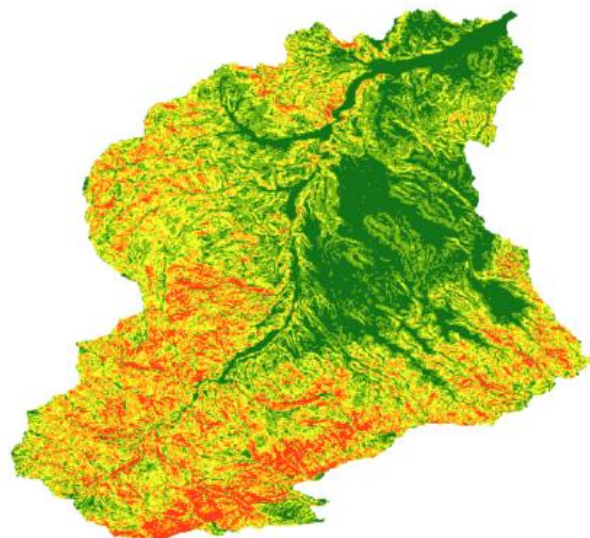
Dynamic
Text ▾Add ▾
New ▾
Import

Styles

Add
Item ▾

Favorites

out slope X



La pente
(°)

0.001 - 7.014
7.015 - 13.151
13.152 - 19.069
19.07 - 25.863
25.864 - 55.891

Element

Scale Bar

Scale Bar ▾ Text Symbol



Options

General

Name Scale Bar

☒ Visible☐ Locked

Scale Bar

Map frame Map Frame ▾

☐ Compute at center

Map Units

Map Units Kilometers ▾

Label Text km

Label Position After labels ▾

Offset

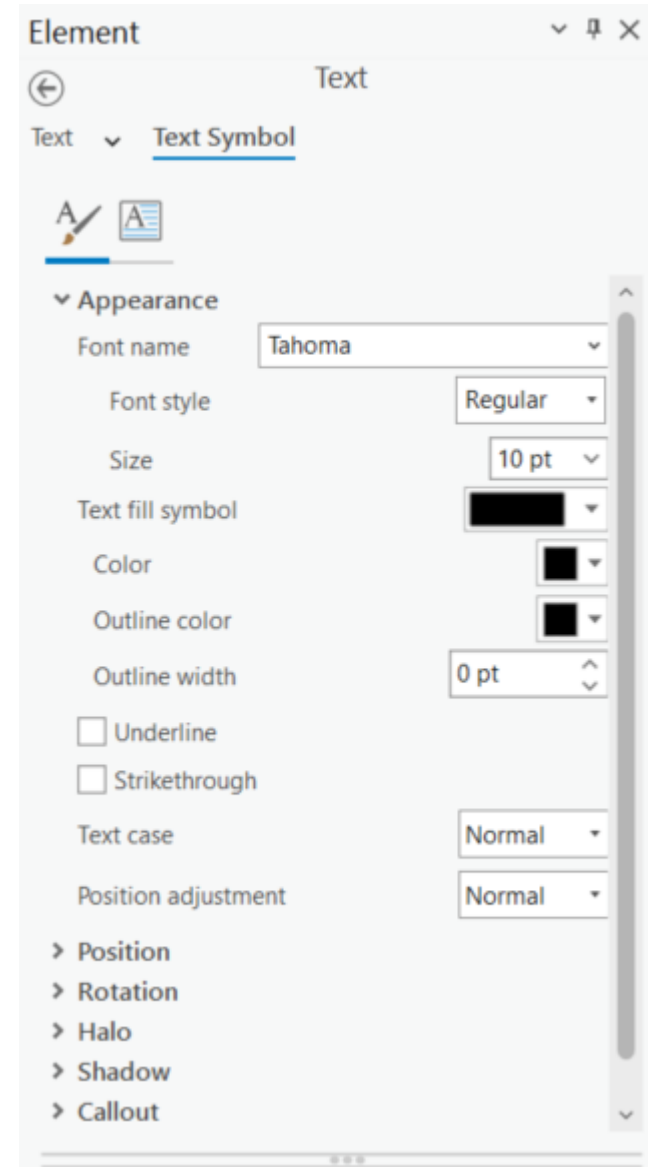
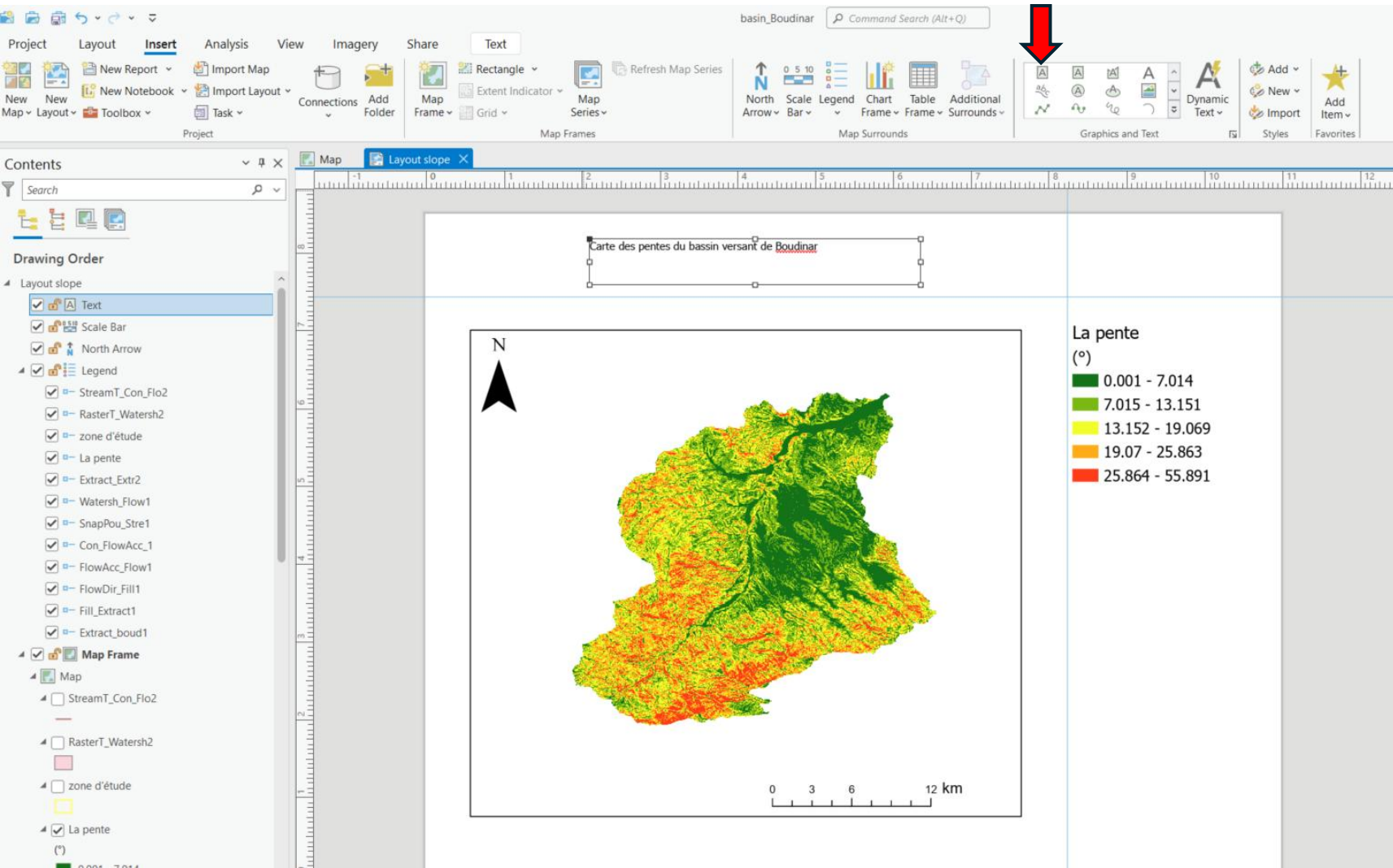
5 pt

Symbol

Aa

Ajouter le titre de la carte

Le titre : Carte des pentes du bassin versant de Boudinar



Ajouter les droits (credits) de l'auteur

basin_Boudinar Command Search (Alt+Q) Not signed in

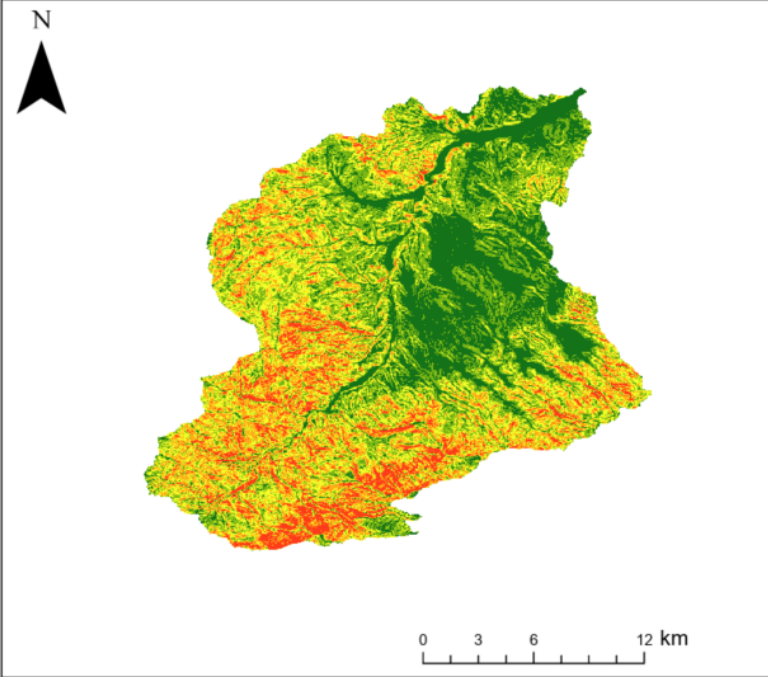
Map Series Refresh Map Series

North Arrow Scale 0 5 10 Legend Chart Frame Table Additional Surrounds

Graphics and Text

Map Frames

Carte des pentes du bassin versant de Boudinar



0 3 6 12 km

Map Frame

Camera	Credits	Description
Camera X: 3°39'21"W	Credits Show the map frame credits.	

Map Units	Reference Scale	Relative Scale
Map Units Degree	Reference Scale 1:0	Relative Scale 1 inch equals 4 miles

Name of Map	Relative Scale Metric	Rotation	Scale
Name of Map Map	Relative Scale Metric 1 centimeter equals 2 kilometers	Rotation 0	Scale 1:232,148

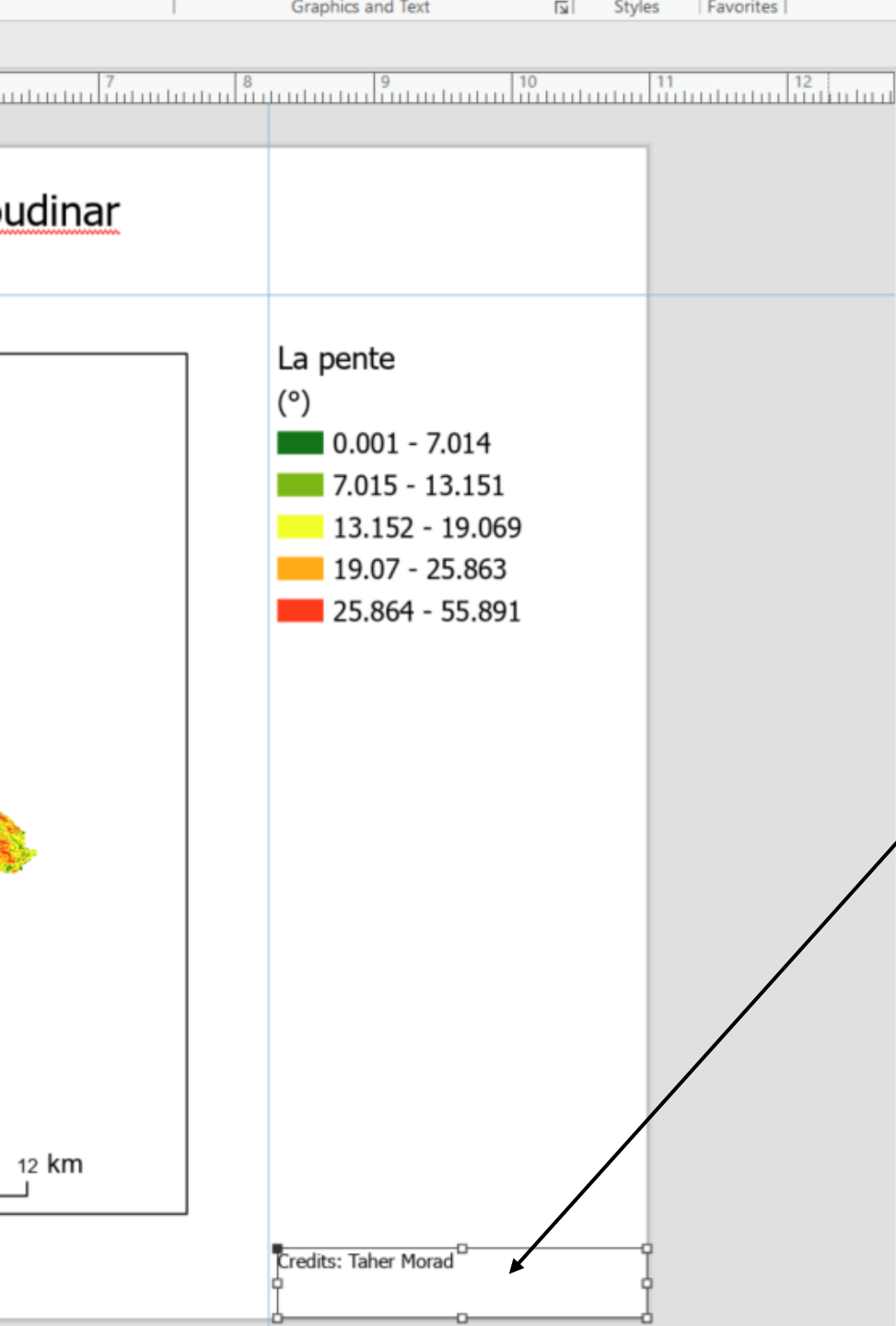
Spatial Reference
Spatial Reference
Name: GCS WGS 1984

Map Frame - Time

Start Time	End Time	Current Time
------------	----------	--------------

Map Frame - Coordinates

Upper Left	Upper Middle	Upper Right
Upper Left 3°50'36"W 35°15'45"N	Upper Middle 3°39'21"W 35°15'45"N	Upper Right 3°28'6"W 35°15'45"N



Element

Text 1

Text ▾ Text Symbol

Options

- General
- Text

Help with dynamic text

Credits: credits Taher Morad

Paragraph

Columns: 1

Column Gap: 0.0694 in

Margin: 0 in

Element

Text 1

Text ▾ Text Symbol

Appearance

Font name: Tahoma

Font style: Regular

Size: 10 pt

Text fill symbol: [Black]

Color: [Black]

Outline color: [Black]

Outline width: 0 pt

☐ Underline

☐ Strikethrough

Text case: Normal

Position adjustment: Normal

Position

Rotation

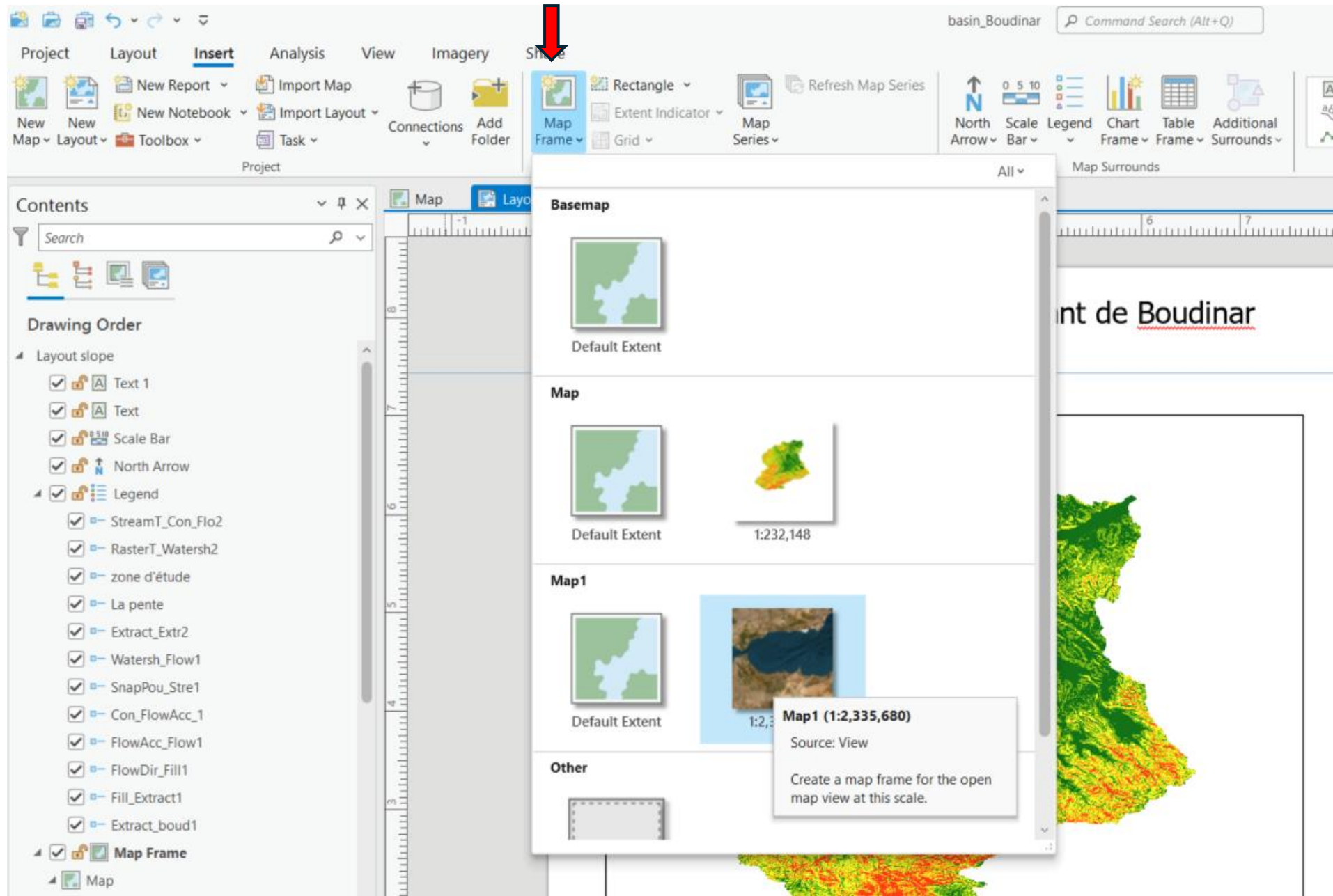
Halo

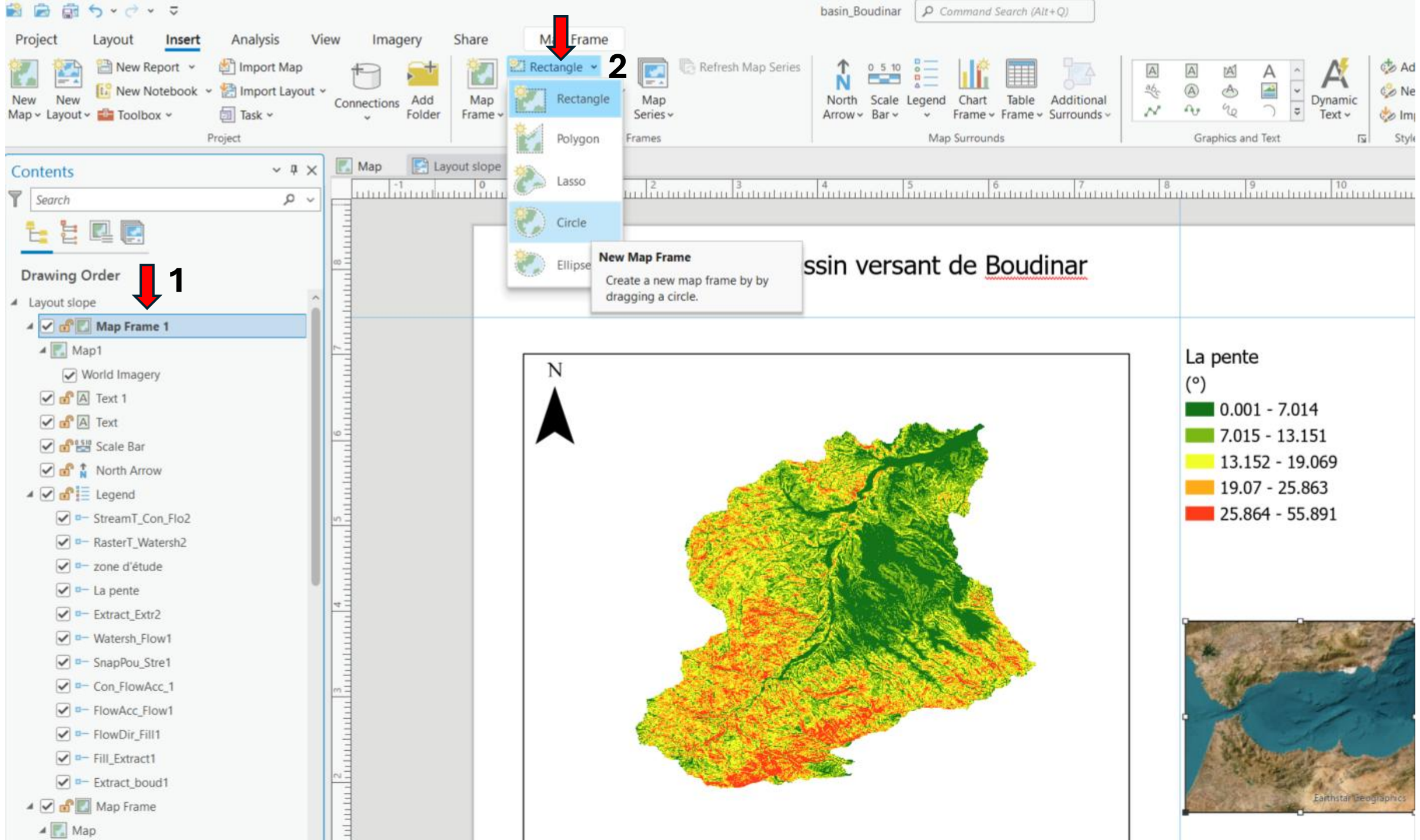
Shadow

Callout

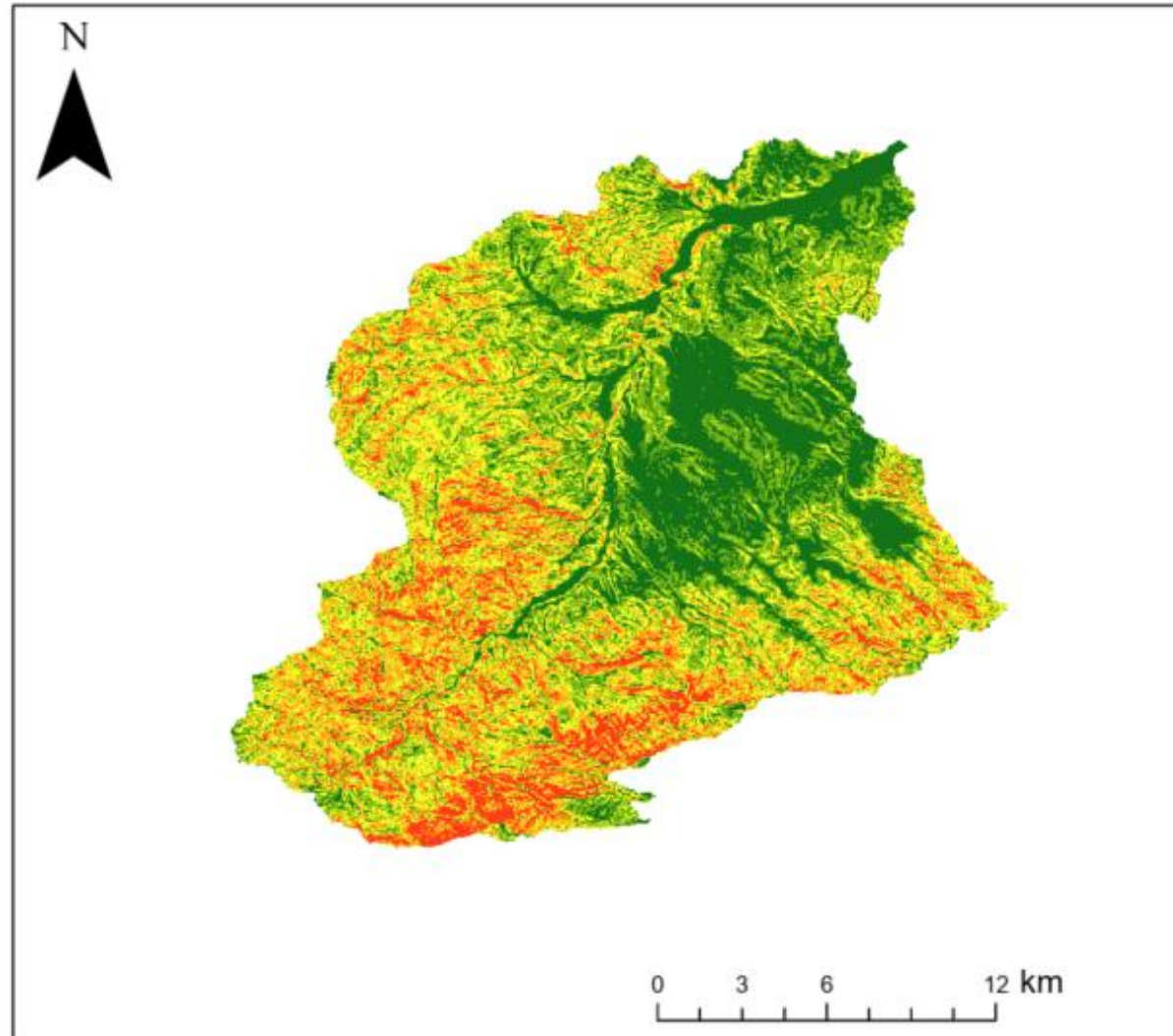
Output

Ajouter la localisation de la carte

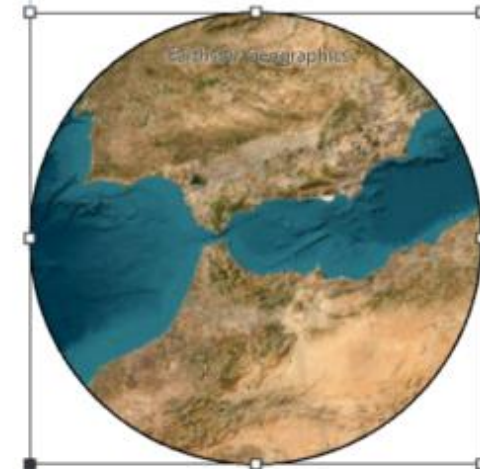
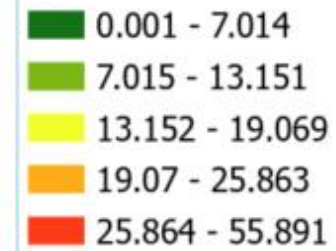




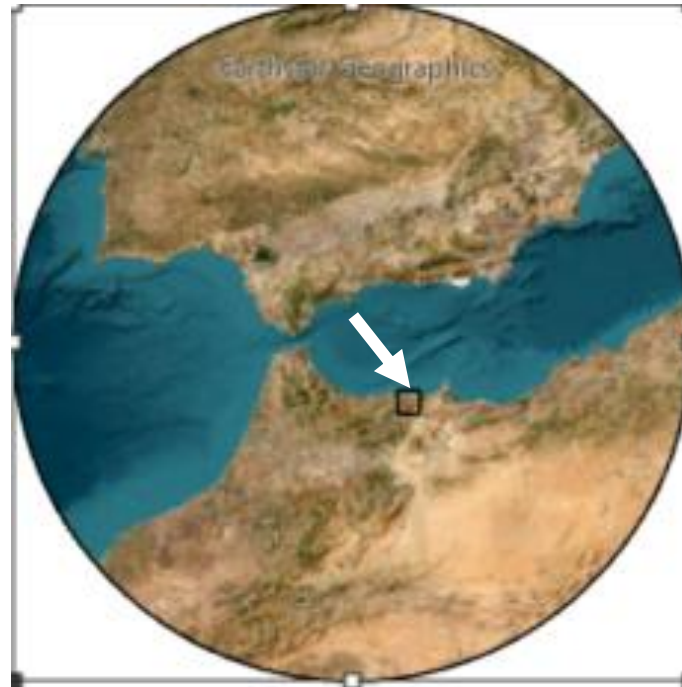
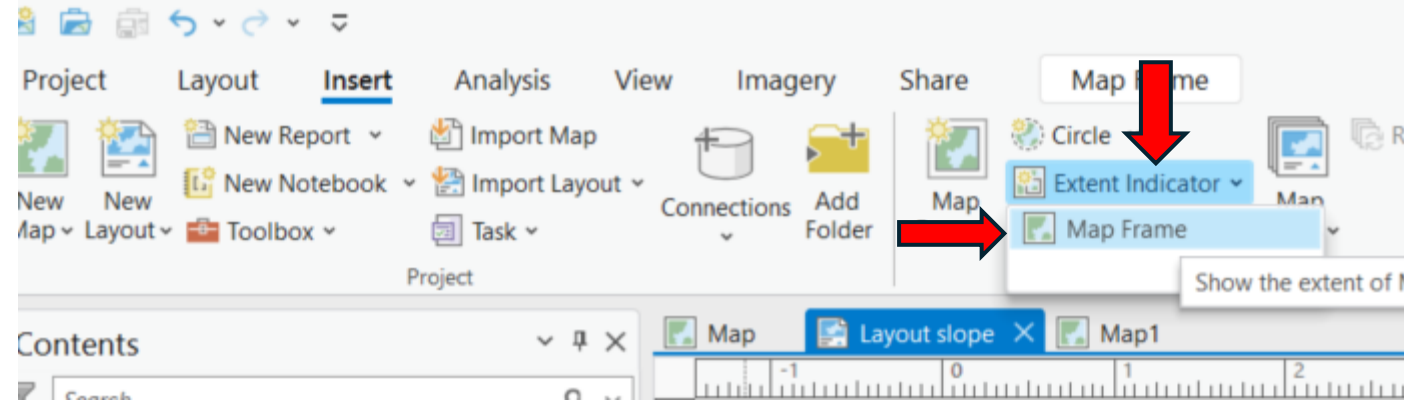
Carte des pentes du bassin versant de Boudinar

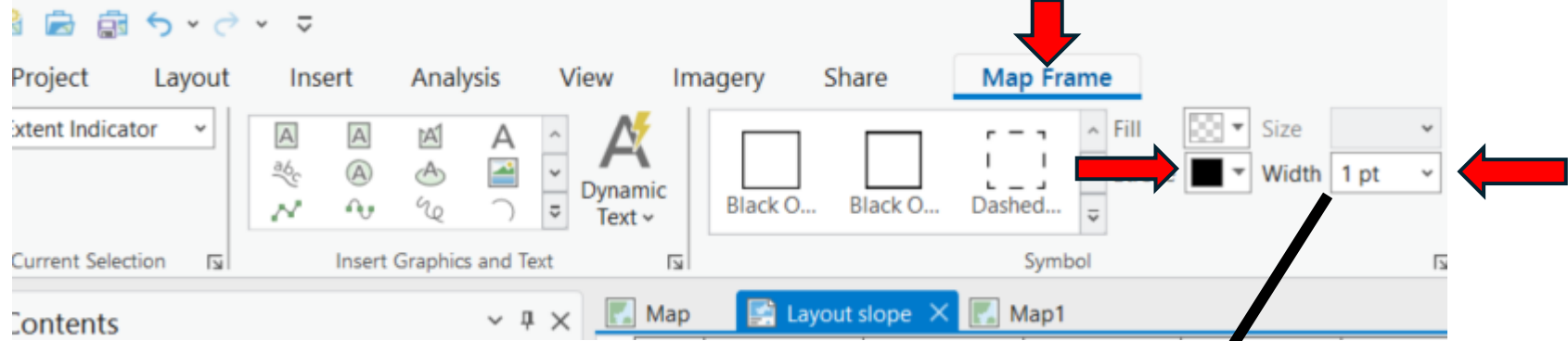


La pente
(°)



Credits: Taher Morad





Exporter la carte

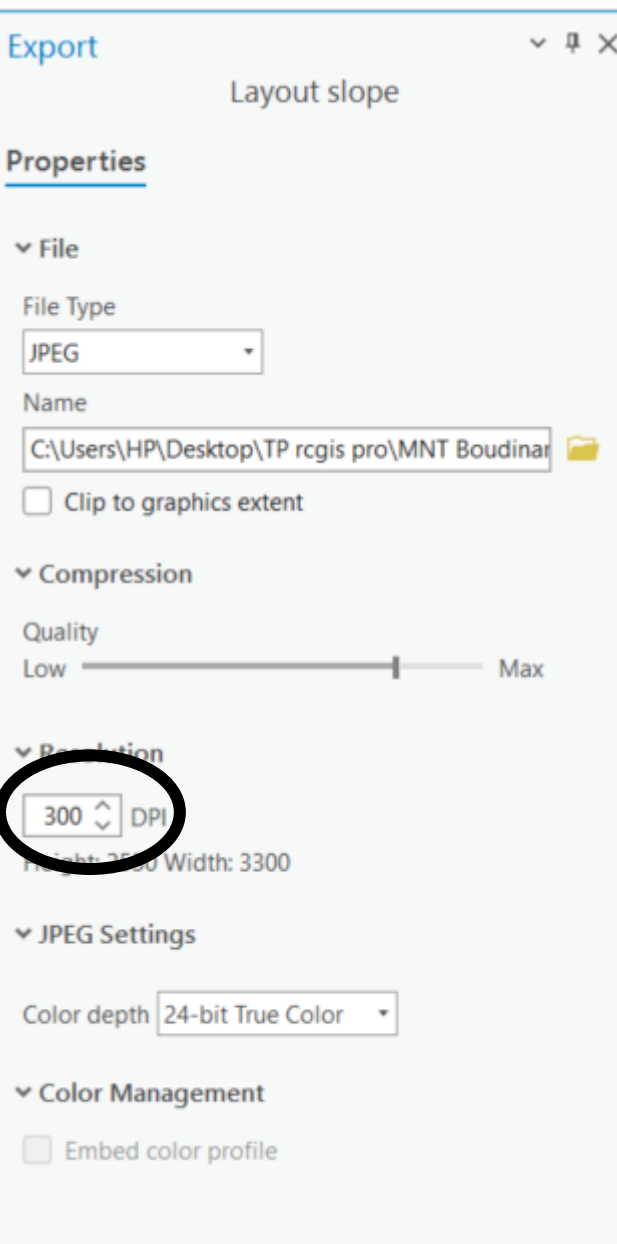
The screenshot shows the QGIS interface with the 'Share' menu open. The 'Export Layout' option is selected, which has opened the 'Export Presets' dialog. In this dialog, the 'Web JPEG' preset is highlighted with a red arrow. The background map shows a topographic map of a region, with a legend on the right indicating slope values in degrees. The legend is titled 'La pente (°)' and lists five ranges with corresponding color swatches: 0.001 - 7.014 (dark green), 7.015 - 13.151 (light green), 13.152 - 19.069 (yellow), 19.07 - 25.863 (orange), and 25.864 - 55.891 (red). A north arrow is visible on the left side of the map. The 'Contents' panel on the left shows the project structure, including 'Map Frame 2' and 'Map1'.

Export Presets

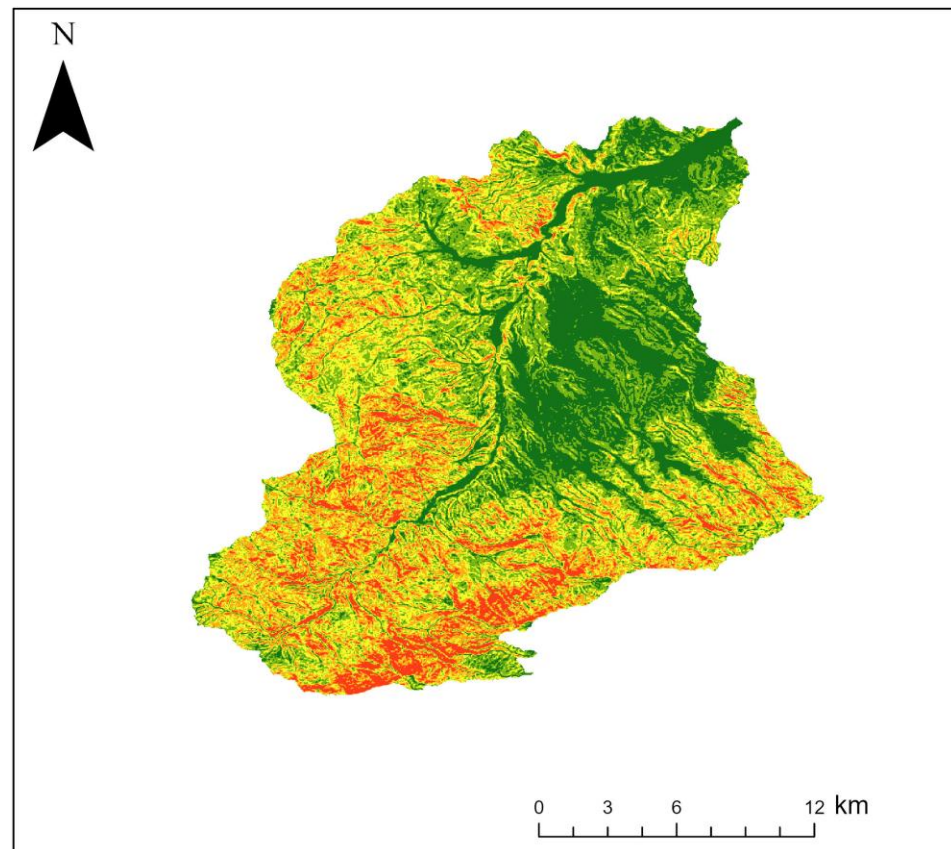
- Default AIX
- Flattened PDF
- GeoReferenced PDF
- GeoTIFF
- Vector PDF
- Web JPEG**

La pente (°)

- 0.001 - 7.014
- 7.015 - 13.151
- 13.152 - 19.069
- 19.07 - 25.863
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Carte des pentes du bassin versant de Boudinar



La pente
(°)

- 0.001 - 7.014
- 7.015 - 13.151
- 13.152 - 19.069
- 19.07 - 25.863
- 25.864 - 55.891



Credits: Taher Morad