
Lab9 地圖學與GIS

定量主題地圖：
點子圖、流動地圖、面量地圖、多變量地圖

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本週實習內容

- **Thematic map**

- ① 點子圖 (dot density map)
- ② 流動地圖 (flow map)
- ③ 面量圖 (choropleth map)
- ④ 整合應用
 - 雙變量面量圖 (bi-variate choropleth map)
 - 面量圖 + 比例符號

- **GIS processing**

- 產生幾何中心點 (polygon centroid)
- Spatial join

- **Review:**

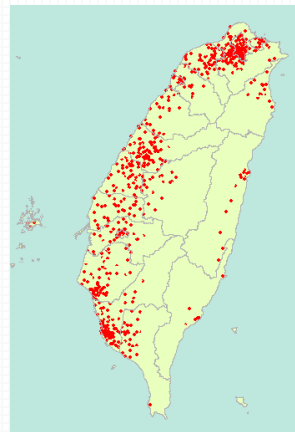
- ✓ *Field calculator*
- ✓ *Calculate geometry*
- ✓ *Dissolve*
- ✓ *Join*
- ✓ *Data selection*

Data

- 點子圖
 - *tw_n_population.shp* (鄉鎮市區)
 - *tw_n_county.shp* (縣市)
- 流動地圖
 - **OD data:** *crude_oil.csv*
 - *region_level.csv*
 - *country.shp*
- 面量圖
 - *crime_103.shp*
 - *crime_104.shp*
 - *TPE_town.shp*

點子圖

105年老年人口分布圖

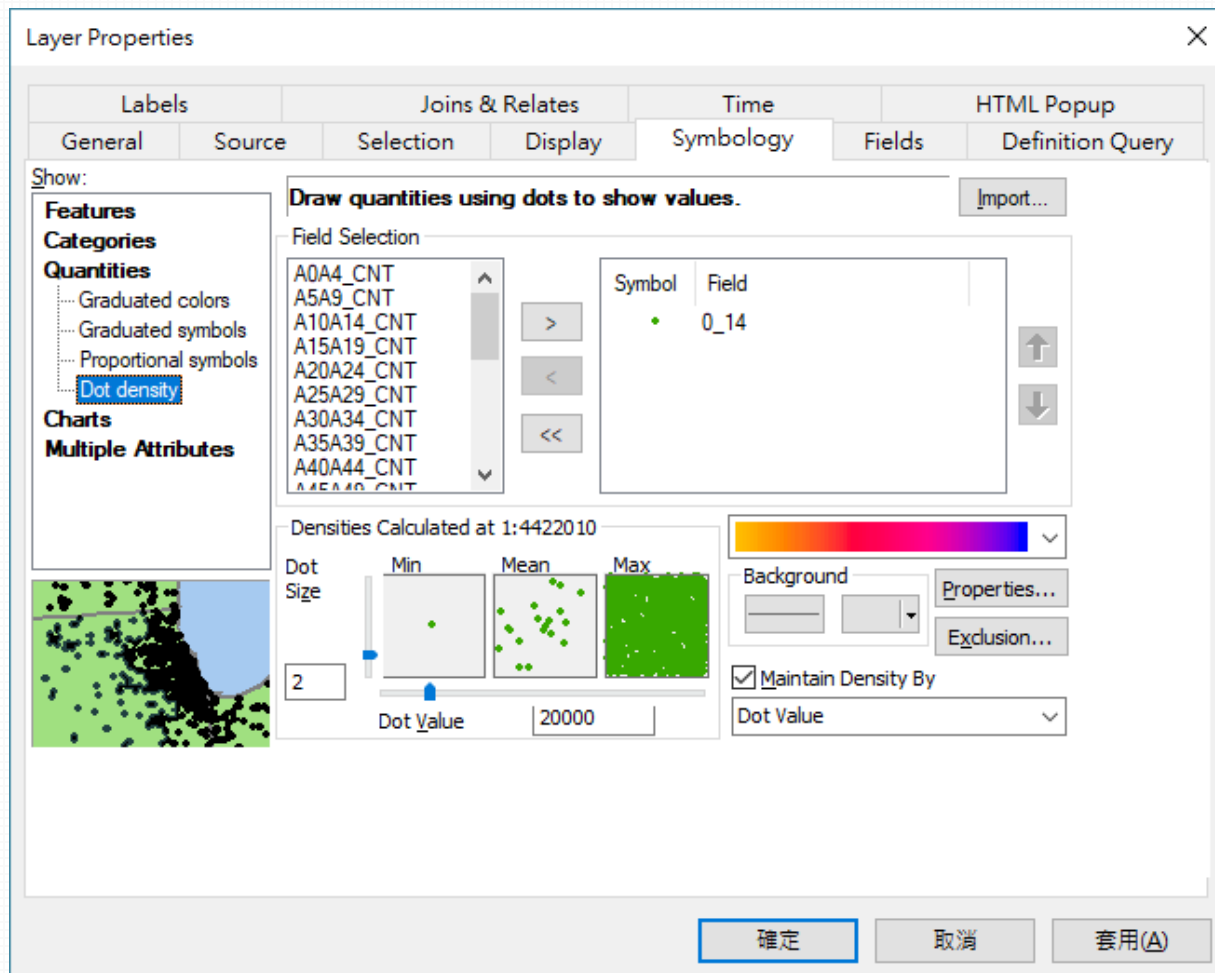


- 觀察資料 (open attribute table)
 - 資料單位：鄉鎮市區
- 資料處理 (field calculator)
 - 老年人口數

• Quantities → Dot density

□ 留意的：

- 多少人為一點、點的大小
- 呈現上一層級的行政邊界



流動地圖

2015全球石油交易流動地圖

① 流動資料

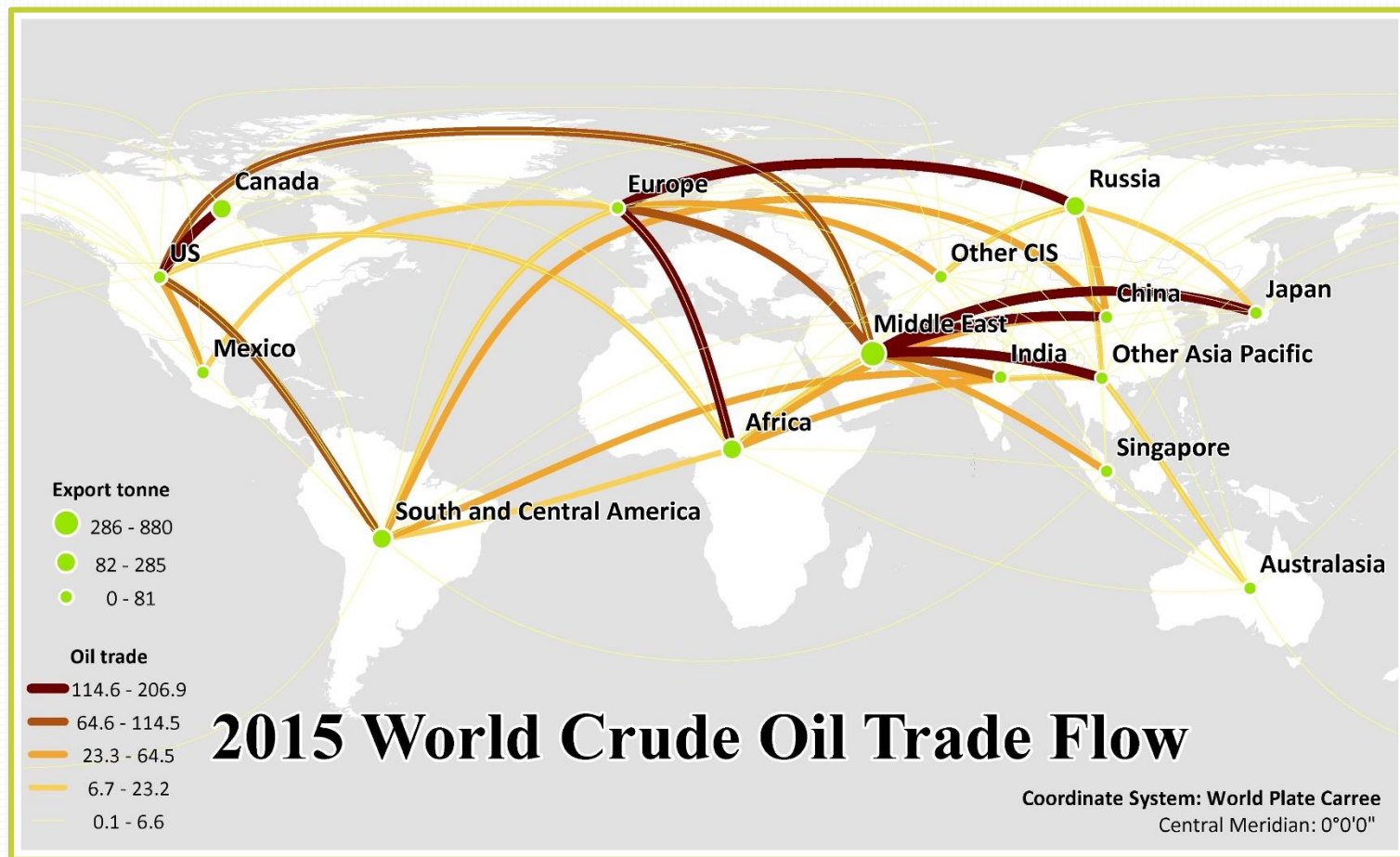
- OD data: **pair data**

② 工具：XY to Line

③ 資料處理：

- 建立點
- 計算XY坐標
- Join資料

↑ 符合工具的input data所需的內容與格式



流動資料

OD table

↓ 起點

↓ 終點

↓ 屬性資料

	A	B	C
1	orig	des	crude.oil
2	US	US	0
3	Canada	US	157.8
4	Mexico	US	34.3
5	South and Central America	US	79.7
6	Europe	US	1.3
7	Russia	US	1.4
8	Other CIS	US	0.7
9	Middle East	US	74.1
10	Africa	US	14
11	Australasia	US	0.5
12	China	US	0
13	India	US	0.1
14	Japan	US	0
15	Singapore	US	0

← 一筆資料

Another type: OD matrix

	US	Canada	Mexico	South and Central America	Europe	Russia	Other CIS	Middle East	Africa
US	0.0	21.0	0.00	0.40	1.80	0.00	0.00	0.20	0.30
Canada	157.8	0.0	0.05	0.05	1.40	0.00	0.00	0.00	0.00
Mexico	34.3	0.0	0.00	0.40	13.70	0.00	0.00	0.00	0.00
South and Central America	79.7	0.6	0.00	0.00	14.60	0.05	0.00	0.00	0.00
Europe	1.3	0.8	0.00	1.20	0.00	0.05	0.05	0.05	0.40
Russia	1.4	0.0	0.00	0.90	158.50	0.00	23.20	0.20	0.90
Other CIS	0.7	0.6	0.00	0.00	56.00	2.90	0.00	6.60	0.70
Middle East	74.1	4.1	0.00	4.90	108.30	0.05	0.00	0.00	12.90
Africa	14.0	5.5	0.00	11.90	133.75	0.00	0.00	0.30	0.00

Data Management Tools → Features → XY to Line

OD data ←

起點坐標 ←

終點坐標 ←

XY To Line

Input Table

Output Feature Class

Start X Field

Start Y Field

End X Field

End Y Field

Line Type (optional)
GEODESIC

ID (optional)

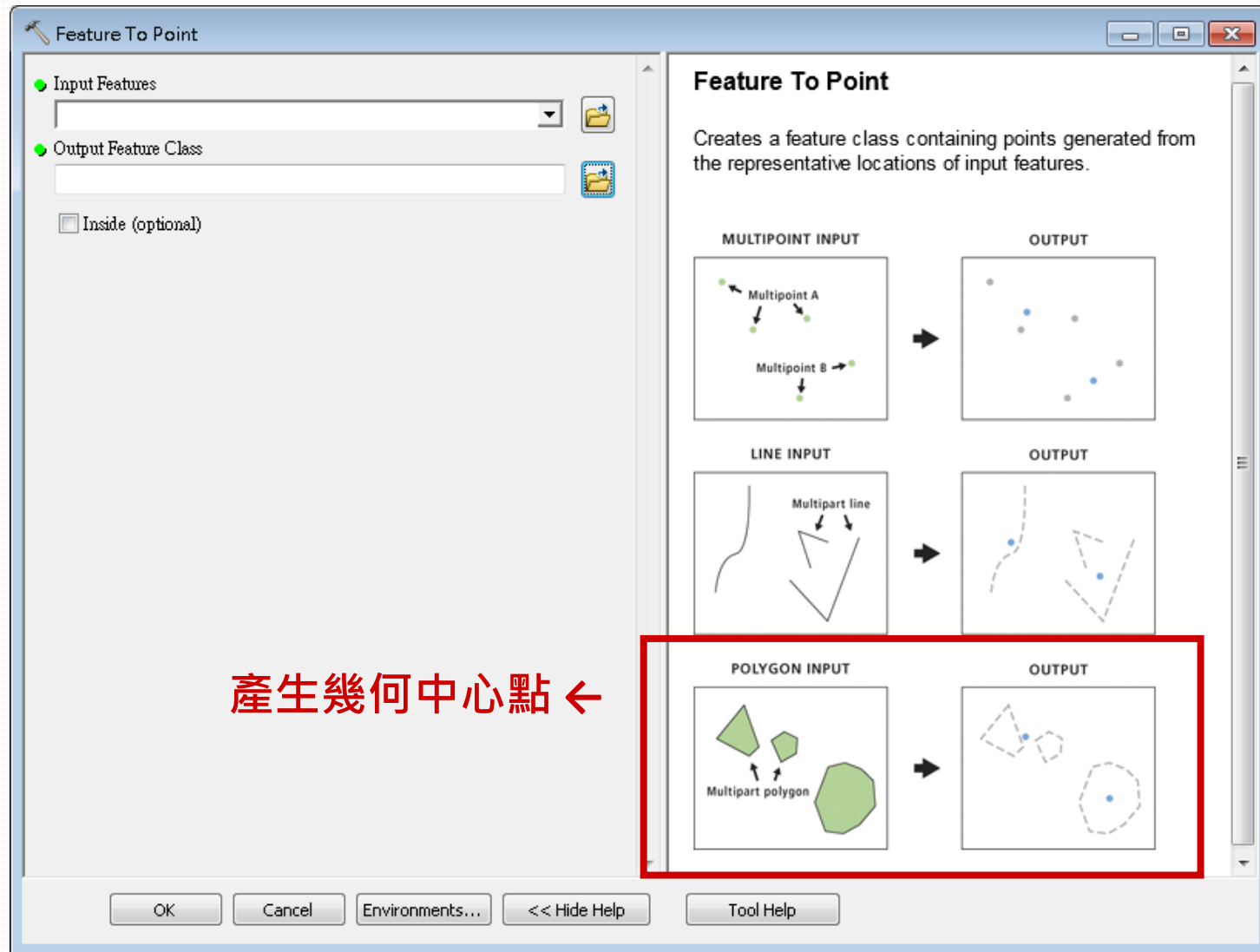
Spatial Reference (optional)
GCS_WGS_1984

OK Cancel Environments... << Hide Help Tool Help

XY To Line

Creates a new feature class containing geodetic line features constructed based on the values in a start x-coordinate field, start y-coordinate field, end x-coordinate field, and end y-coordinate field of a table.

Data Management Tools → Features → Feature to point

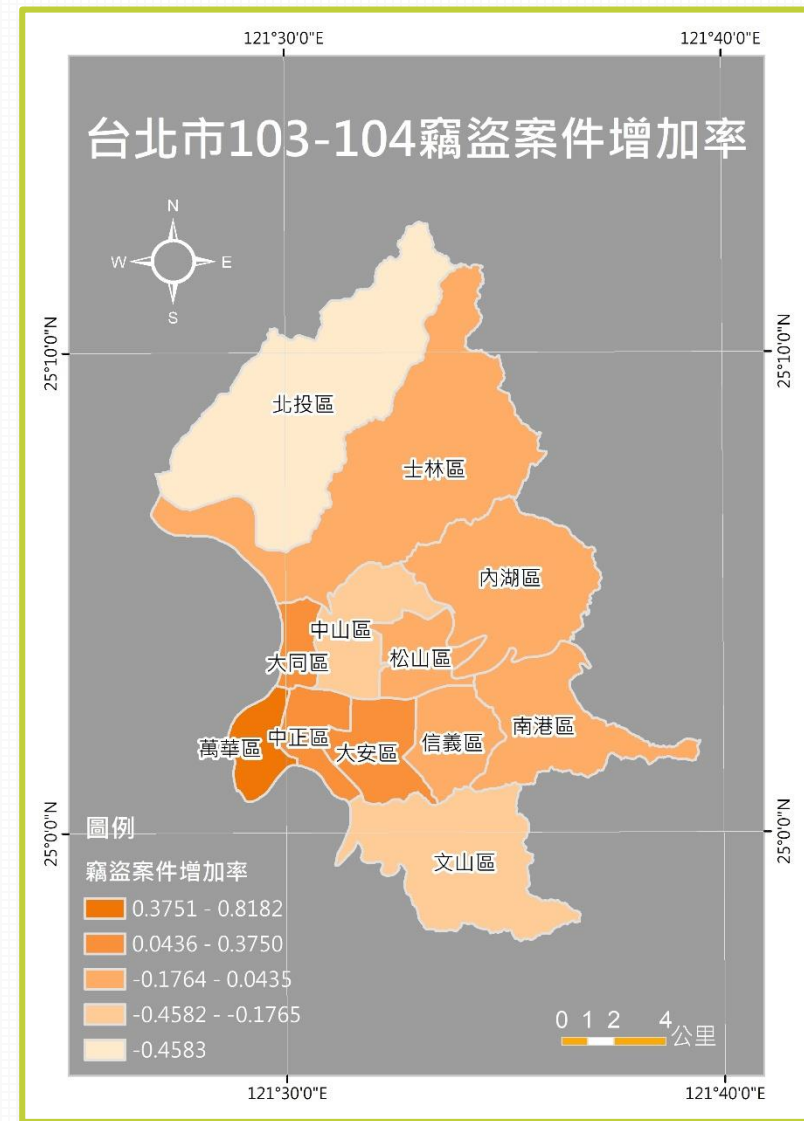
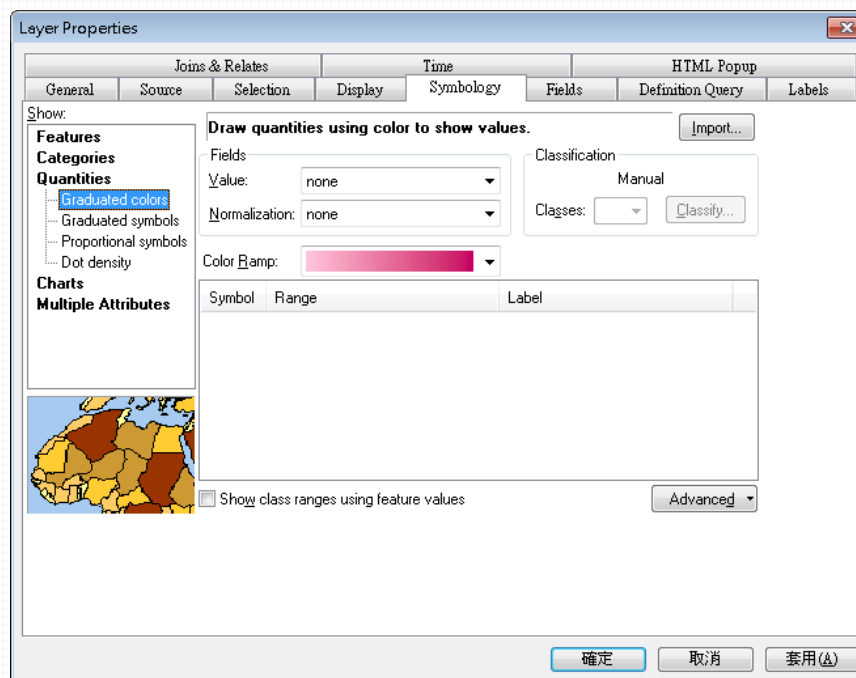


面量圖

台北市103 – 104年住宅竊盜增加率地圖

- 觀察資料
 - 竊盜案件：點資料
 - 行政區：面資料 ← 面量圖
- 資料處理：
 - 點加總至面 ← Spatial join
 - 計算「竊盜增加率」

- Quantities
→ Graduated colors



Spatial Join

Join Data

Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.

What do you want to join to this layer?

Join data from another layer based on spatial location

1. Choose the layer to join to this layer, or load spatial data from disk:

crime_103

2. You are joining: Points to Polygons

Select a join feature class above. You will be given different options based on geometry types of the source feature class and the join feature class.

☒ Each polygon will be given a summary of the numeric attributes of the points that fall inside it, and a count field showing how many points fall inside it.

How do you want the attributes to be summarized?

☐ Average ☐ Minimum ☐ Standard Deviation

☐ Sum ☐ Maximum ☐ Variance

☐ Each polygon will be given all the attributes of the point that is closest to its boundary, and a distance field showing how close the point is (in the units of the target layer).

Note: A point falling inside a polygon is treated as being closest to the polygon, (i.e. a distance of 0).

3. The result of the join will be saved into a new layer.

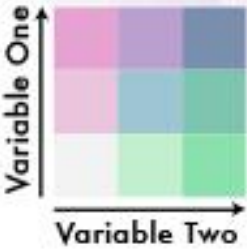
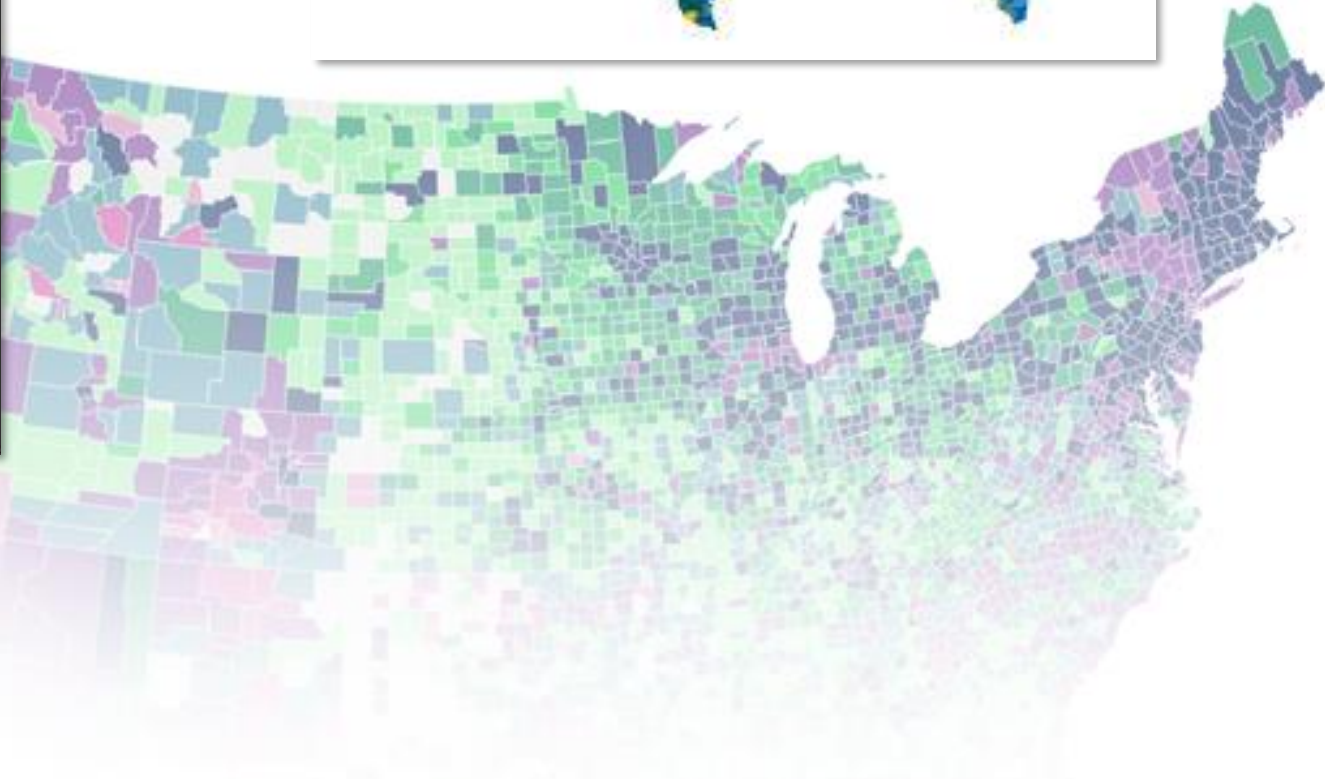
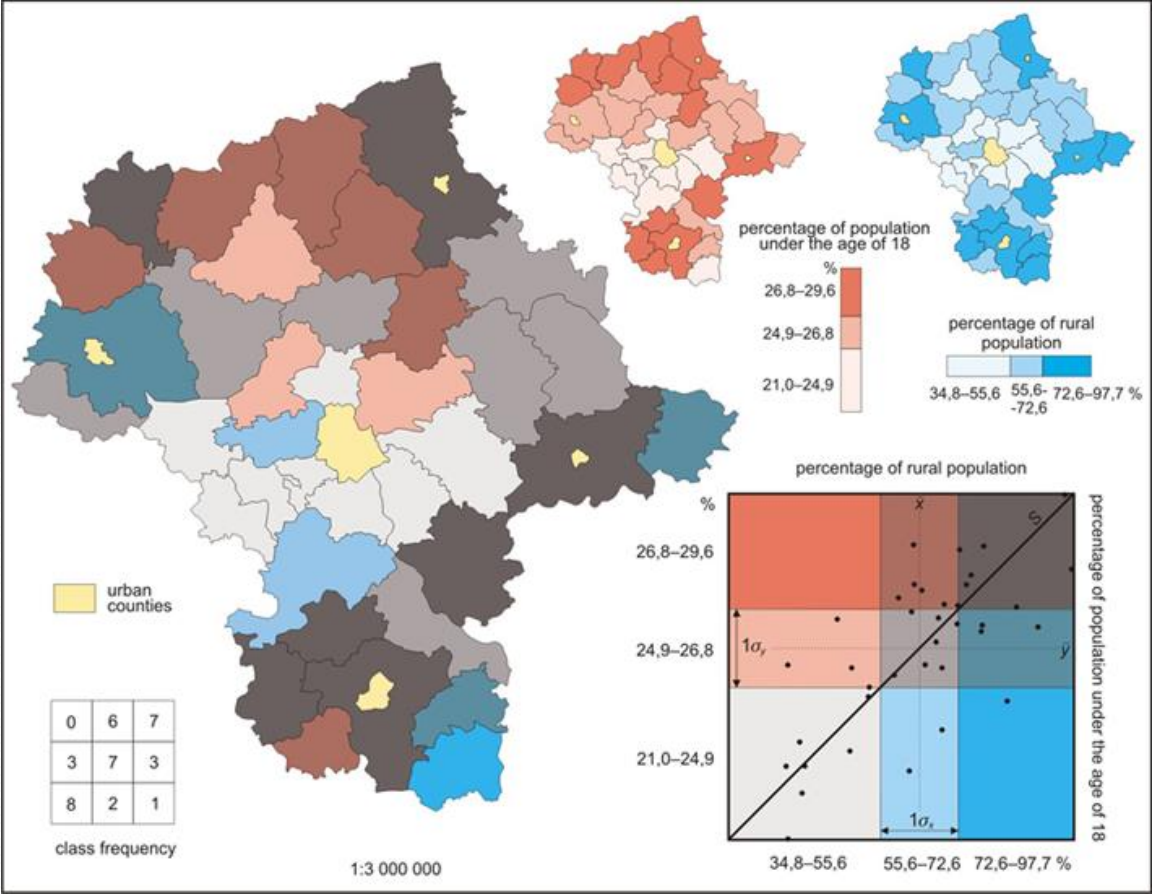
Specify output shapefile or feature class for this new layer:

H:\r05228031\crime_choropleth\Join_Output.shp

[About joining data](#) OK Cancel

Output: shapefile ←

Bi-variate choropleth examples



雙變量面量圖 + 比例符號

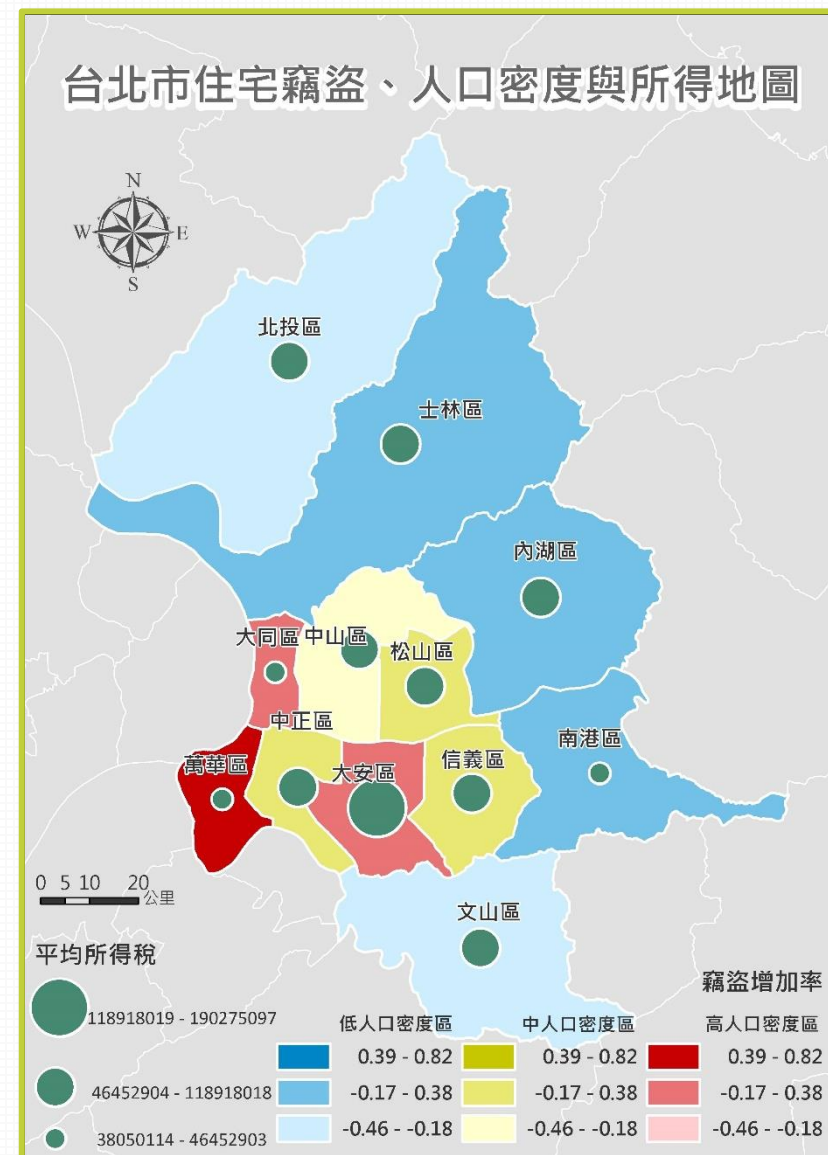
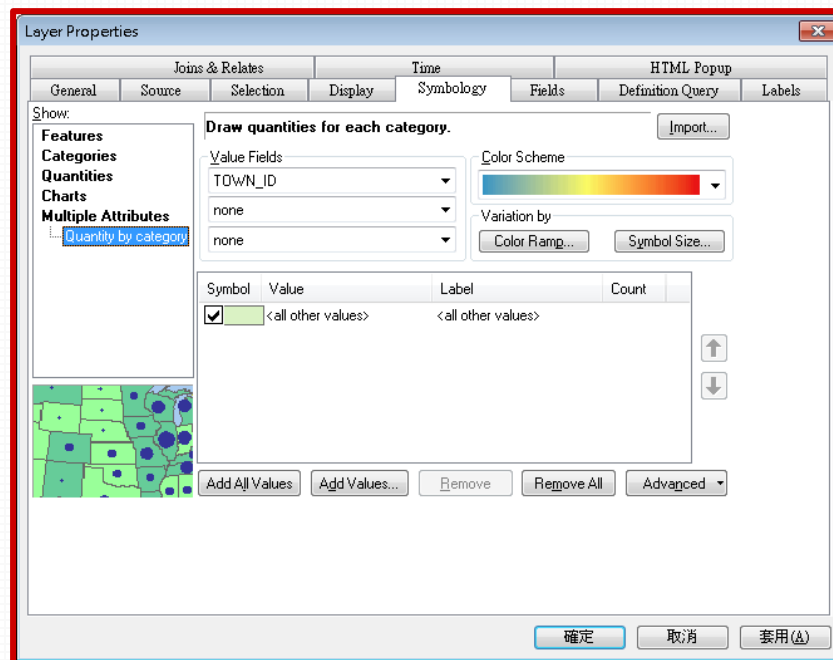
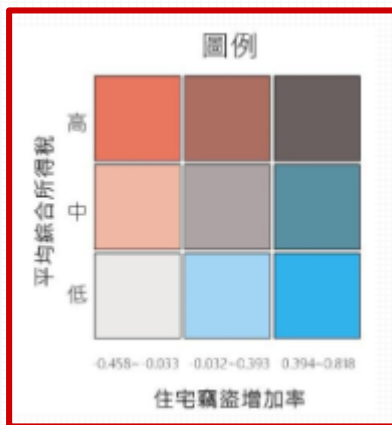
台北市103 – 104年住宅竊盜增加率 & 人口密度 & 平均所得地圖

- 變數

- 住宅竊盜增加率 ← derived values
- 人口密度 ← derived values
- 平均所得稅 ← total values; ratio

- 表現方式:

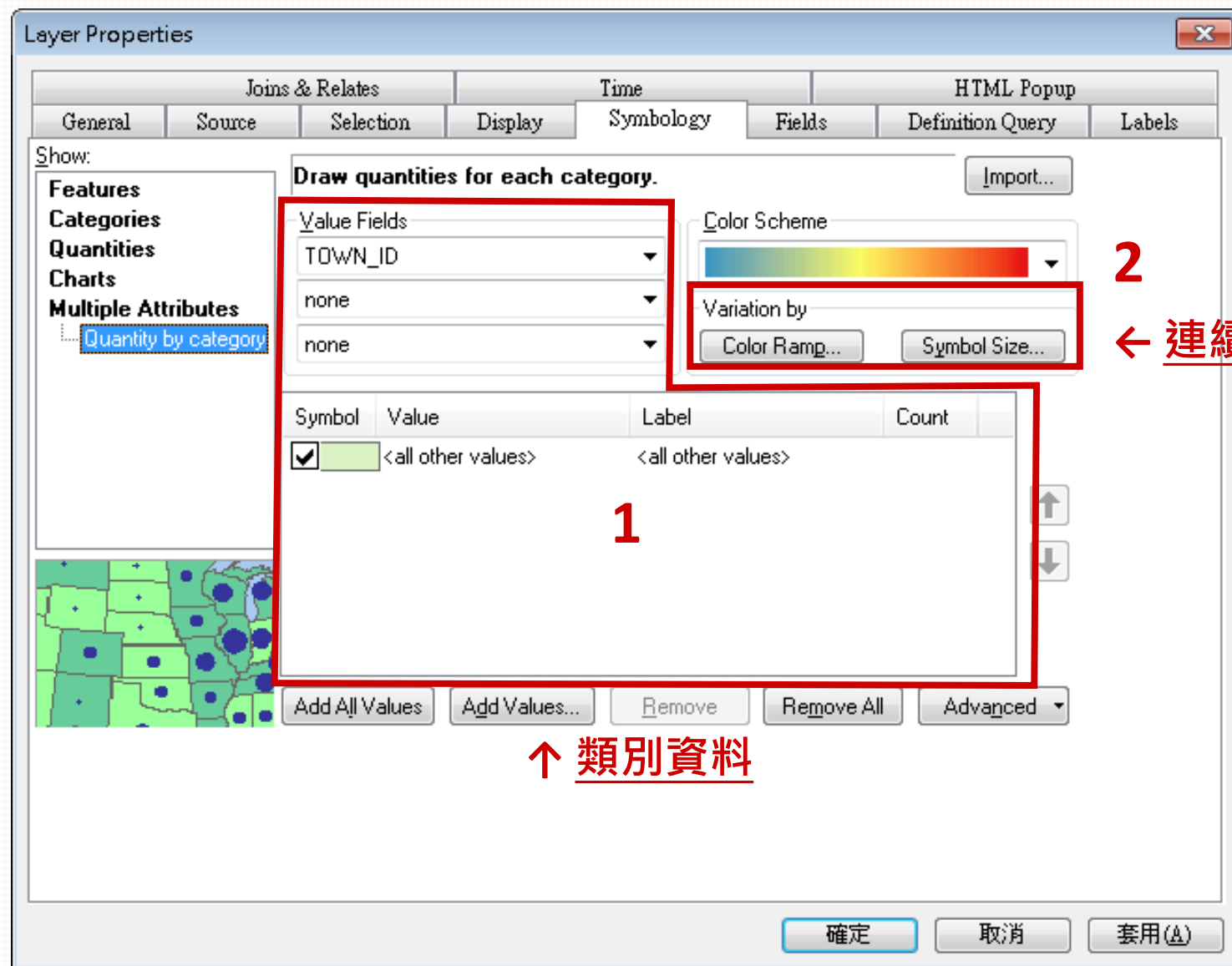
- Multiple attributes
- Bi-variate 3×3 label



① Multiple attributes

1 + 2

- 1類別在2屬性上的變異



2

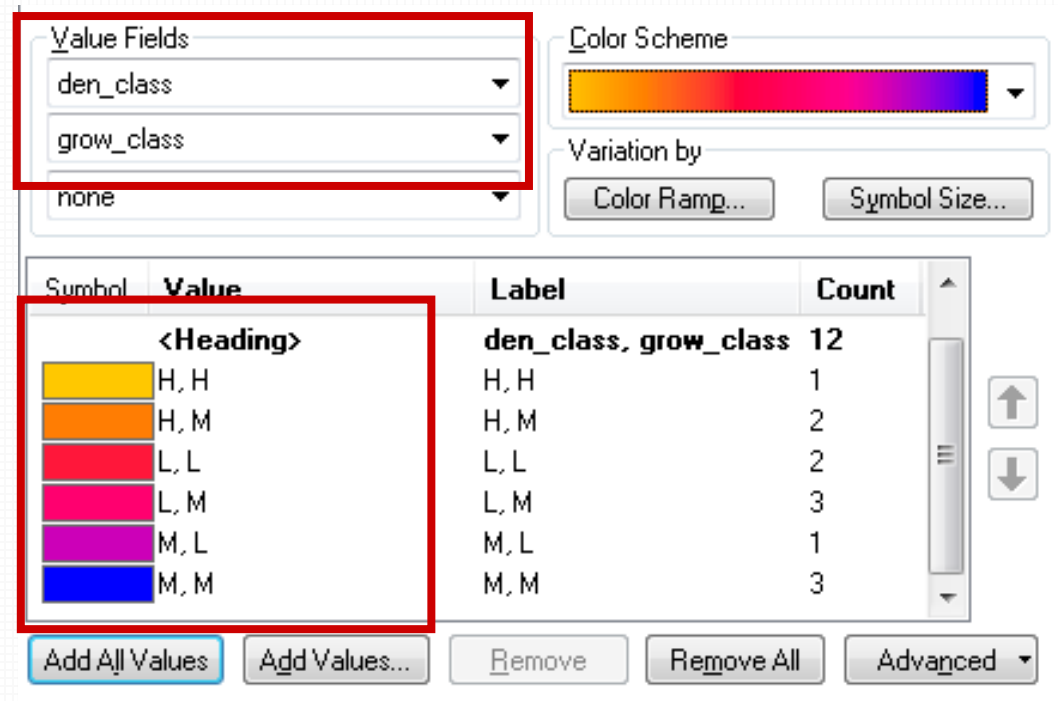
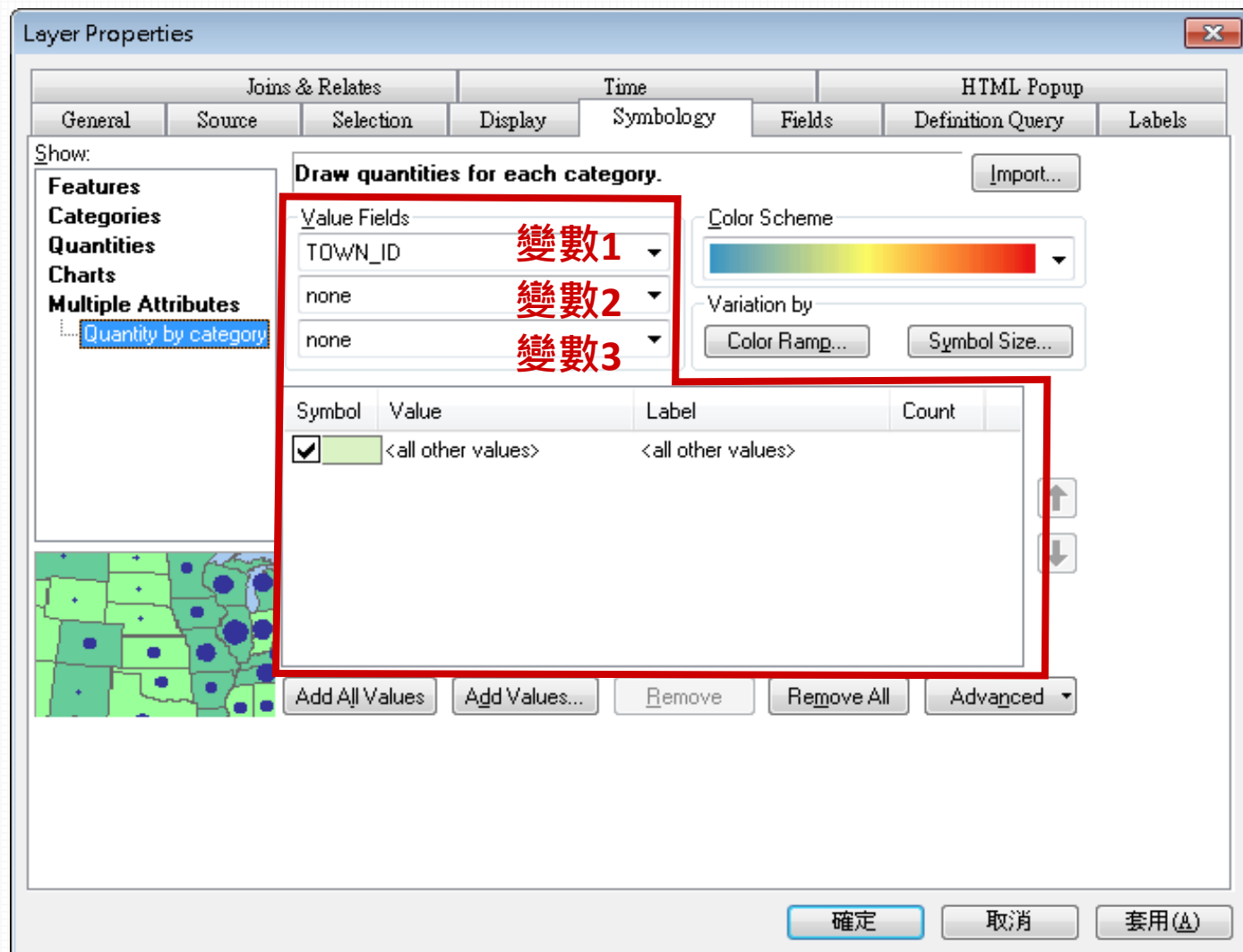
← 連續資料

1

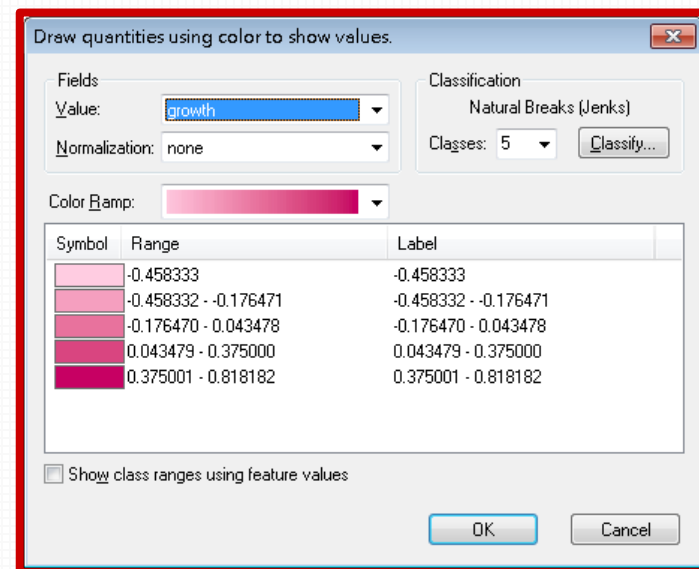
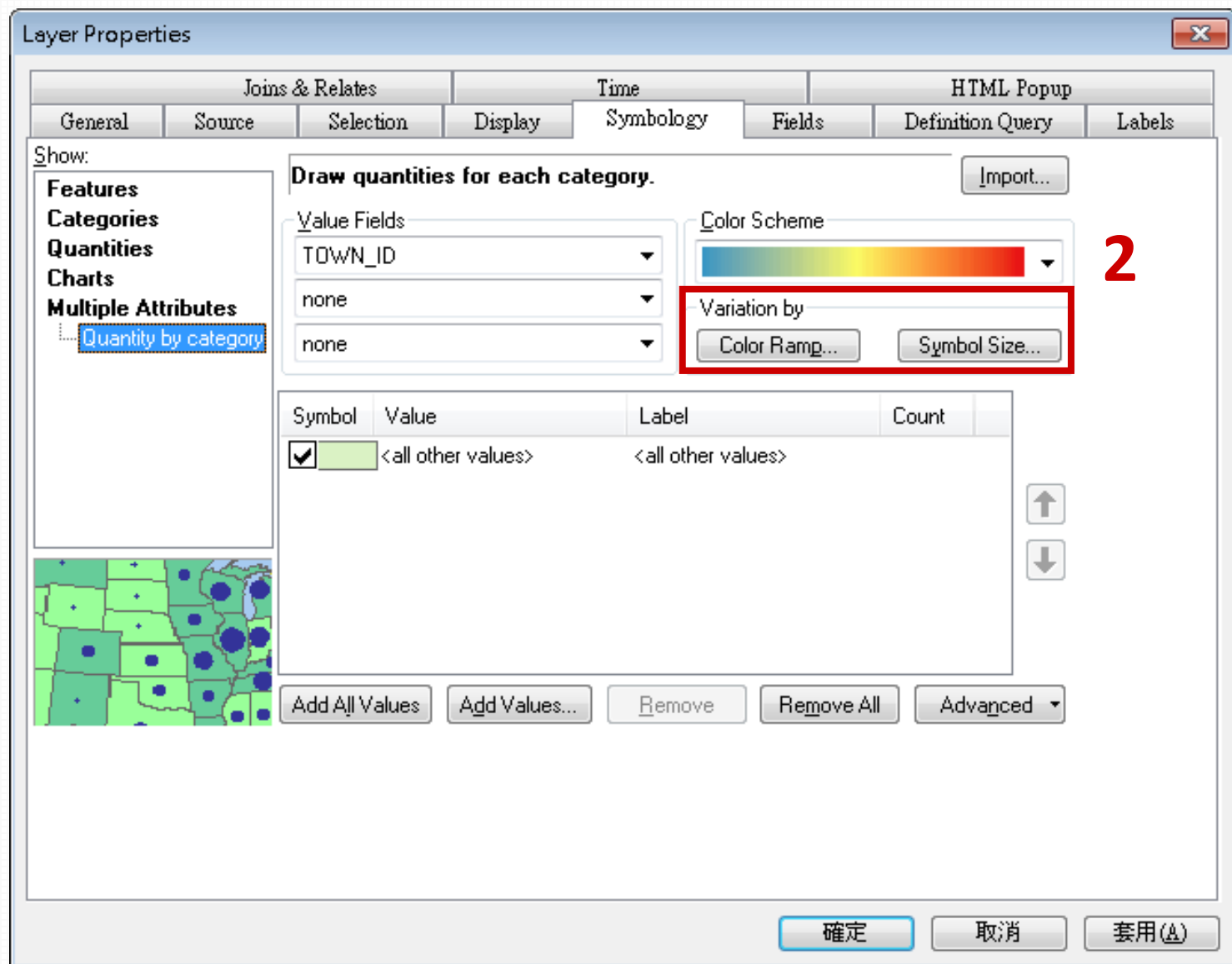
↑ 類別資料

① Multiple attributes - 1

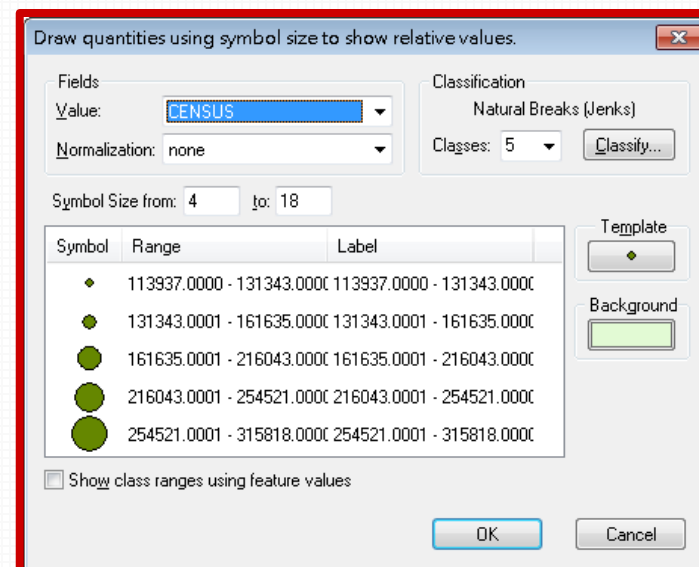
1



① Multiple attributes - 2



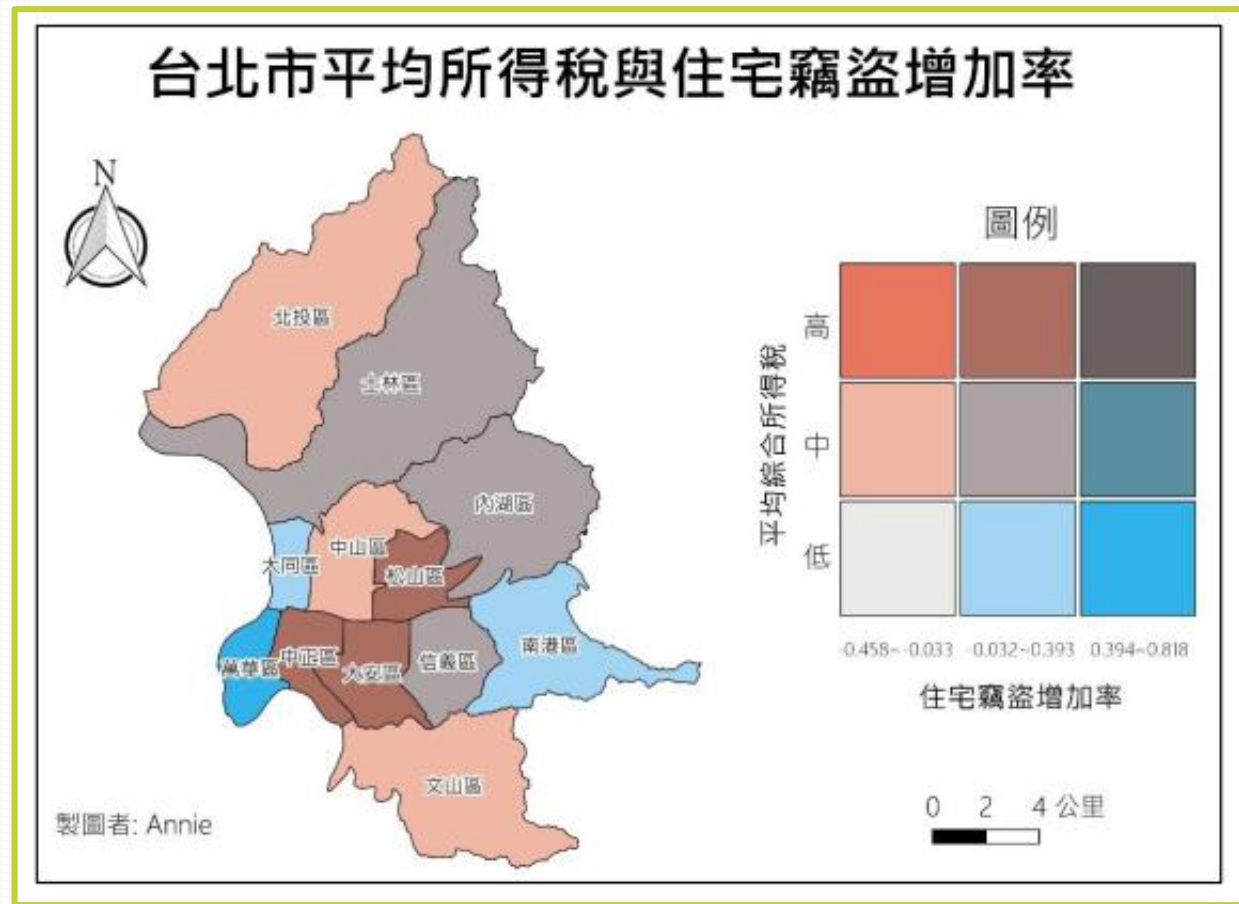
Way1:
graduated
color



Way2:
graduated
symbols

② Bi-variate 3×3 label

- 3×3 label → 9類
- Field calculator: if – else 條件式分成9類
- 針對9個類別分別指定顏色



If – else in field calculator

```
Dim density
If [den_class] = "L" And [grow_class] = "L" Then
density = "1"

elseif [den_class] = "L" And [grow_class] = "M" Then
density = "2"

elseif [den_class] = "L" And [grow_class] = "H" Then
density = "3"

elseif [den_class] = "M" And [grow_class] = "L" Then
density = "4"

elseif [den_class] = "M" And [grow_class] = "M" Then
density = "5"

elseif [den_class] = "M" And [grow_class] = "H" Then
density = "6"

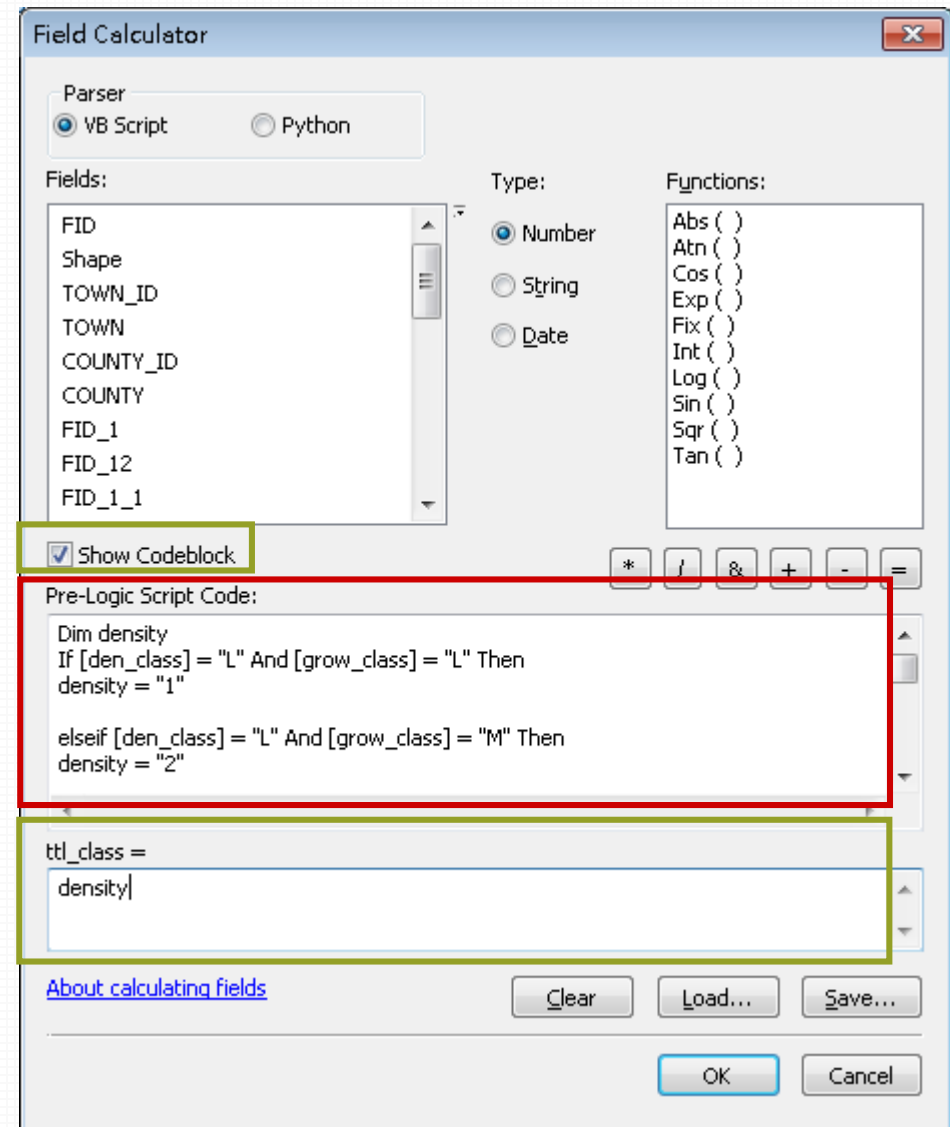
elseif [den_class] = "H" And [grow_class] = "L" Then
density = "7"

elseif [den_class] = "H" And [grow_class] = "M" Then
density = "8"

else
density = "9"
end if
```

定義函數

if-else



Hint：台北市103－104年住宅竊盜增加率 & 人口密度 & 平均所得地圖

- Step1: 決定各變數應以何種方式繪製、呈現
- Step2: 整理繪圖所需的資料樣態
 - 連續 / 離散資料？
- 善用圖層疊加繪製地圖

This lab...

- Thematic map：點子圖、流動地圖、面量地圖、**多變量地圖**
- **GIS processing**
 - Feature to point (產生幾何中心點)
 - Spatial Join
 - *Field calculator*
 - *Calculate geometry*
 - *Dissolve*
 - *Join*
 - *Data selection*

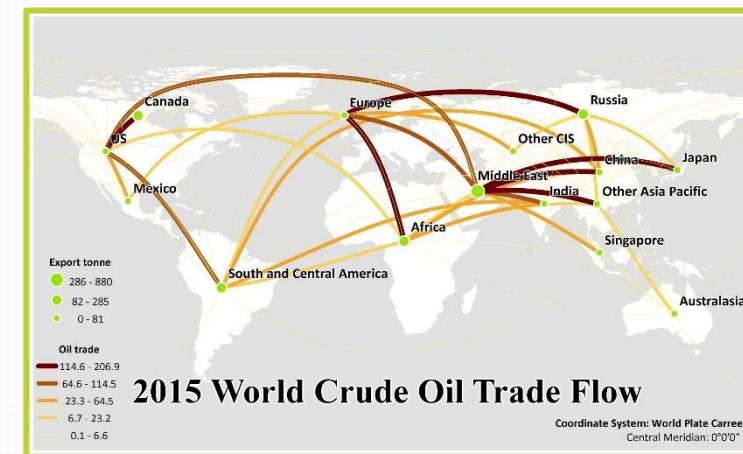
本週作業

1. 105年全國人口分布點子圖

2. 全球石油交易流動地圖

□ 查核點：

- ✓ 呈現石油出口量大小
- ✓ 呈現流動量大小
- ✓ 選擇任一種世界地圖的投影方法，並以文字註解



3. 台北市103 – 104年住宅竊盜增加率 & 人口密度 & 平均所得地圖

□ 查核點：

- ✓ 以1張地圖呈現3個變量
- ✓ 文字說明地圖中看到的現象

- 繳交檔案：3張地圖(.jpg) 壓縮上傳至ceiba作業區
- 繳交期限：5/25 (五) 中午12點

