January 15-16, 2018

「Using QGIS：人口地圖繪製」工作坊

主辦單位：國立台灣大學人口與性別研究中心
國立台灣大學地理環境資源學系

教學網址：http://wenlab.geog.ntu.edu.tw/qgis_carto/

授課教師：溫在弘 Professor, NTU Geography

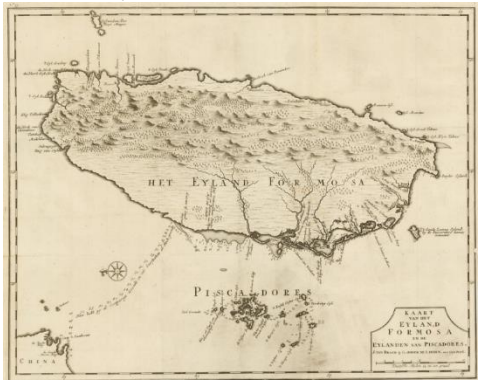
實習助教：陳威全 Ph.D. Candidate, NTU Geography

郭飛鷹 Ph.D. Student, NTU Geography

國立台灣大學 地理環境資源學系
地理計算科學 研究室
Laboratory for Geospatial Computational Science
NTU Geography

課程內容概述

1727年 荷蘭人繪製的 台灣地圖

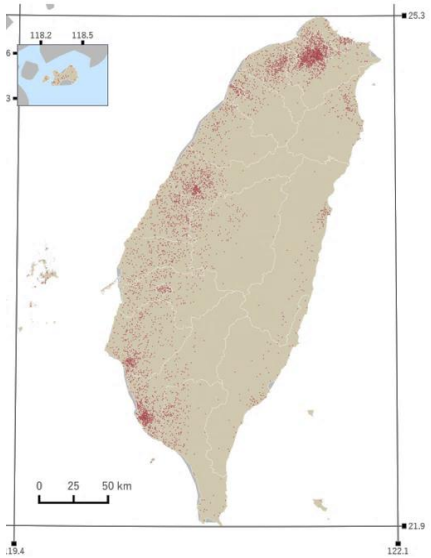


1/15：

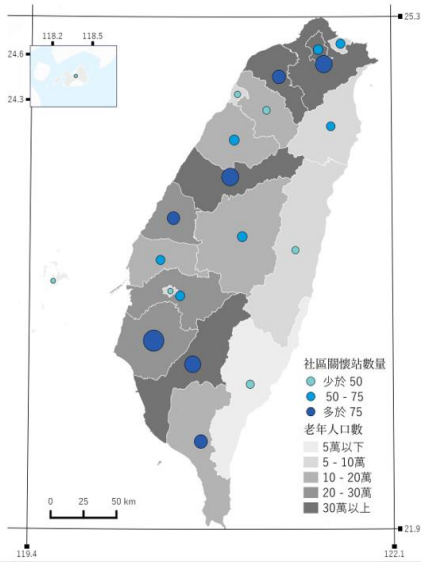
- 上午 (10:00am-12:00pm, 2 hours)
- 1. QGIS 基本環境介紹
- 2. 地圖的基本原則與要素。(投影與座標系統、比例尺設定與圖例設計)
- 3. 地圖實作：第一次繪製的台灣地圖 (北方一定在地圖的上方嗎?)

- 下午 (1:00pm-4:00pm, 3 hours)
- 1. 描述人口地理分布的基本原則
- 2. 地圖實作：
- (a) 點子圖 Dot Map
- (b) 面量圖 Shaded Map
- (c) 泡泡圖 Bubble Map

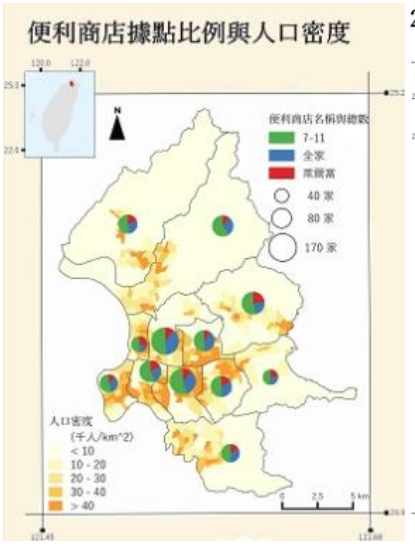
2015 老年人口分布

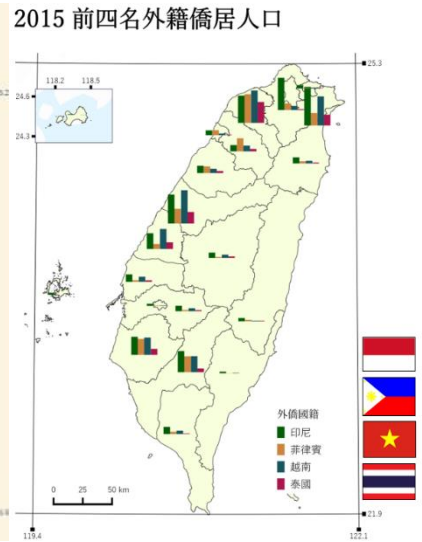


2015 老年人口與社區關懷站數量



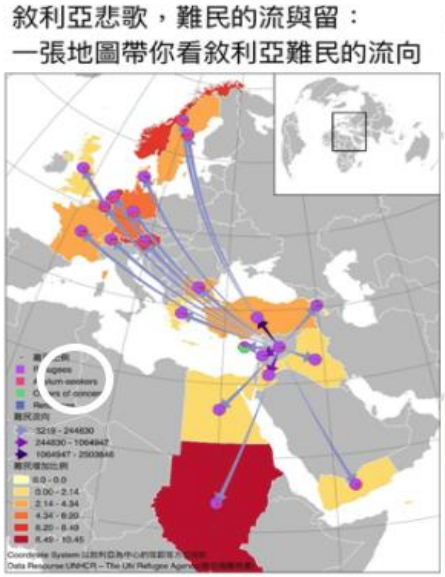
課程內容概述

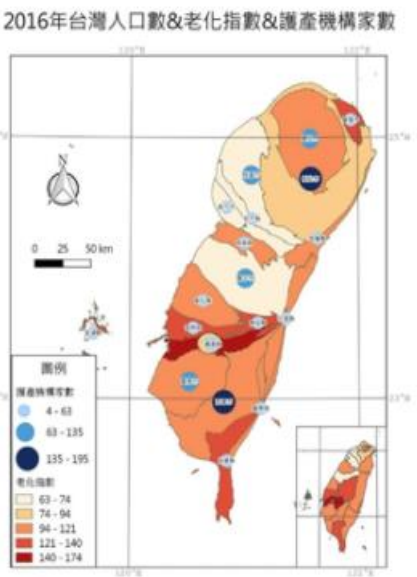




1/16：

- 上午 (10:00am-12:00pm, 2 hours)
- 1. 人口統計地圖呈現原則
- 2. 地圖實作：圓餅地圖 (Pie Chart Map)
  長條地圖 (Bar Chart Map)





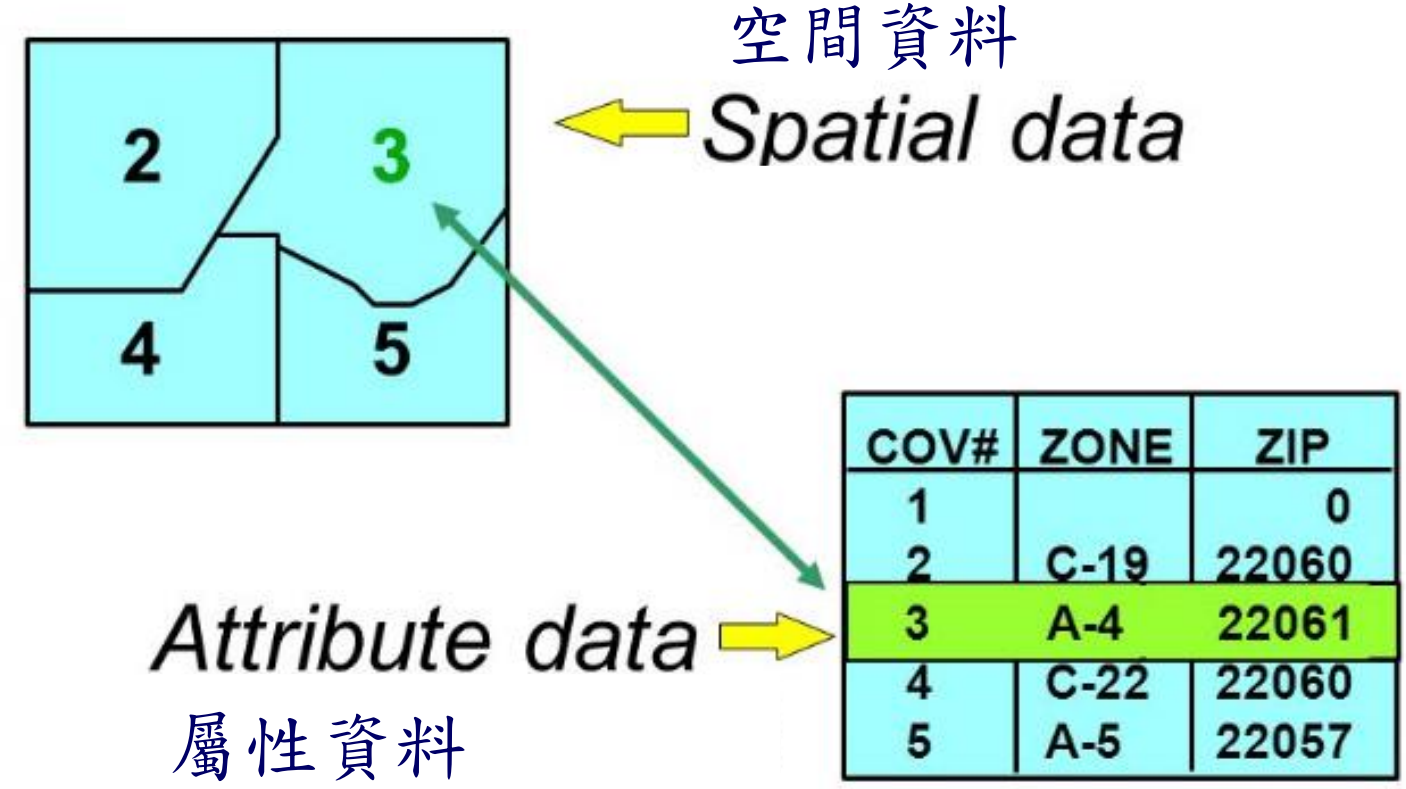
- 下午 (1:00pm-4:00pm, 3 hours)
- 1. 如何描述人口遷徙的空間分布
- 2. 地圖實作：流動地圖 Flow Map
- 3. 非傳統的地圖呈現：
  面積變形圖 Cartogram

課程提供的資料

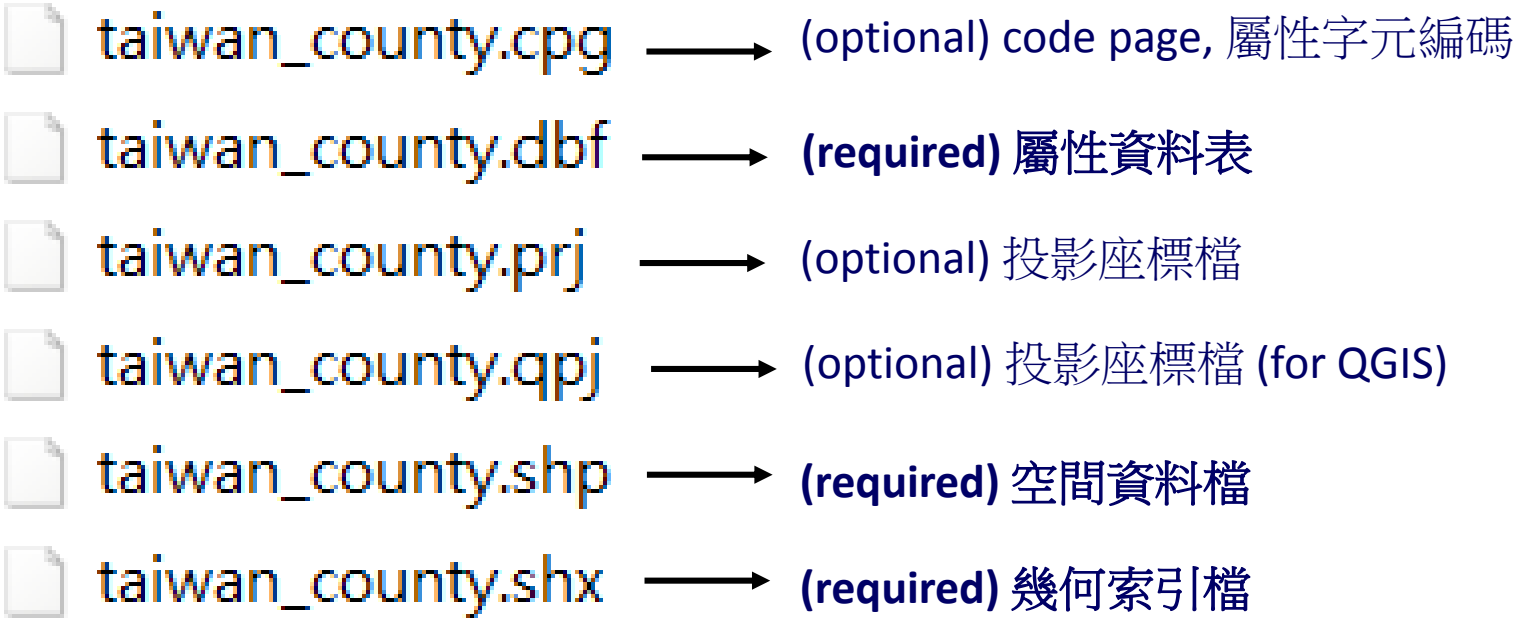
- twn_population.shp　　台灣鄉鎮人口統計
- taiwan_county.shp　　台灣縣市邊界
- nursing_institute.shp　　台灣縣市產護機構統計
- foreign_marriage.csv　　台灣縣市外籍配偶統計
- CrudeFlow2015.xlsx　　國際原油交易
- country.shp　　世界國家邊界

台灣人口相關的圖資來源：
國土資訊系統 社會經濟資料服務平台 https://segis.moi.gov.tw/

GIS 圖資檔案的概念



GIS 圖資檔案 (ESRI Shapefile 格式)



https://zh.wikipedia.org/wiki/Shapefile

人口資料來源

社會經濟資料服務平台

https://segis.moi.gov.tw/

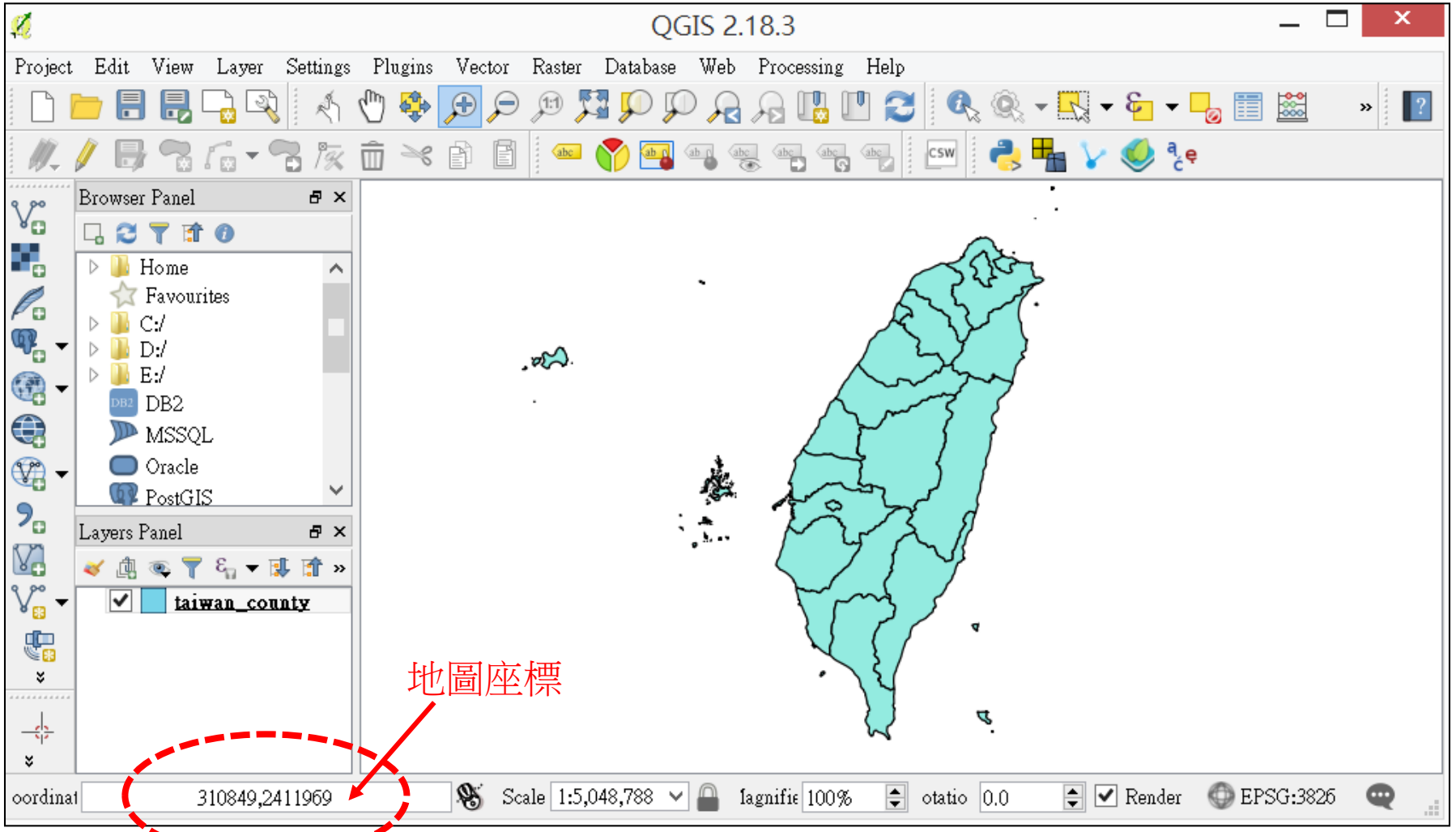
人口資料來源

內政資料開放平台

http://data.moi.gov.tw/moiod/default/Index.aspx

QGIS

taiwan_county.shp 台灣縣市邊界



台灣的座標系統 TWD97-TM2

Taiwan Datum (TWD) 台灣的大地基準

Datum: Taiwan Datum 1997

Geodetic Datum used in Taiwan

Taiwan Datum 1997 is a geodetic datum first defined in 1997 and is suitable for use in Taiwan, Republic of China - onshore and offshore - Taiwan Island, Penghu (Pescadores) Islands.. **Taiwan Datum 1997** references the GRS 1980 ellipsoid and the Greenwich prime meridian. Taiwan Datum 1997 origin is ITRF94 at epoch 1997.0 Taiwan Datum 1997 is a geodetic datum for Geodetic survey, GIS, topographic mapping, engineering survey. It was defined by information from National Land Surveying and Mapping Center (NLSC), http://www.nlsc.gov.tw Adopted in 1998.

Datum Details	
DATUM NAME:	Taiwan Datum 1997
CODE:	1026
AREA OF USE:	Taiwan
SCOPE:	Geodetic survey, GIS, topographic mapping, engineering survey.
TYPE:	geodetic
REALIZATION EPOCH:	1997
ORIGIN:	ITRF94 at epoch 1997.0
ELLIPSOID:	GRS 1980
PRIME MERIDIAN:	Greenwich
APPLICABLE CRS-S:	The following CRS are based on this dat [TWD97] [TWD97] [TWD97]

本初子午線

國際地球參考框架（ International Terrestrial Reference Frame，簡稱為 ITRF）。
ITRF 為利用全球測站網之觀測資料成果推算所得之地心坐標系統。

http://georepository.com/datum_1026/Taiwan-Datum-1997.html

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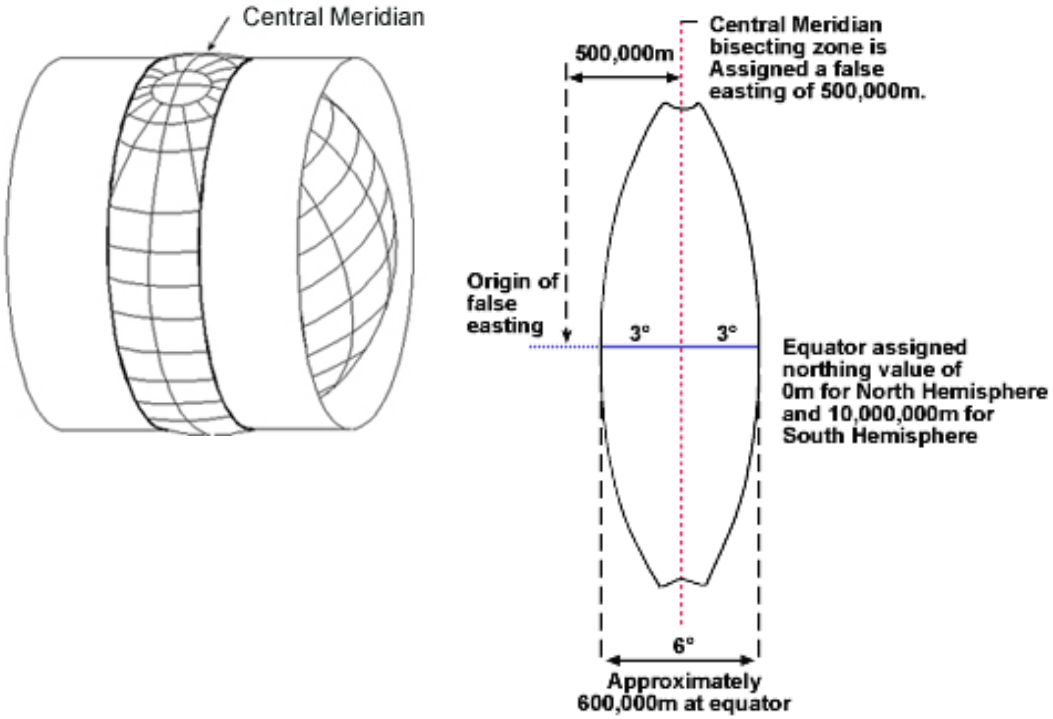
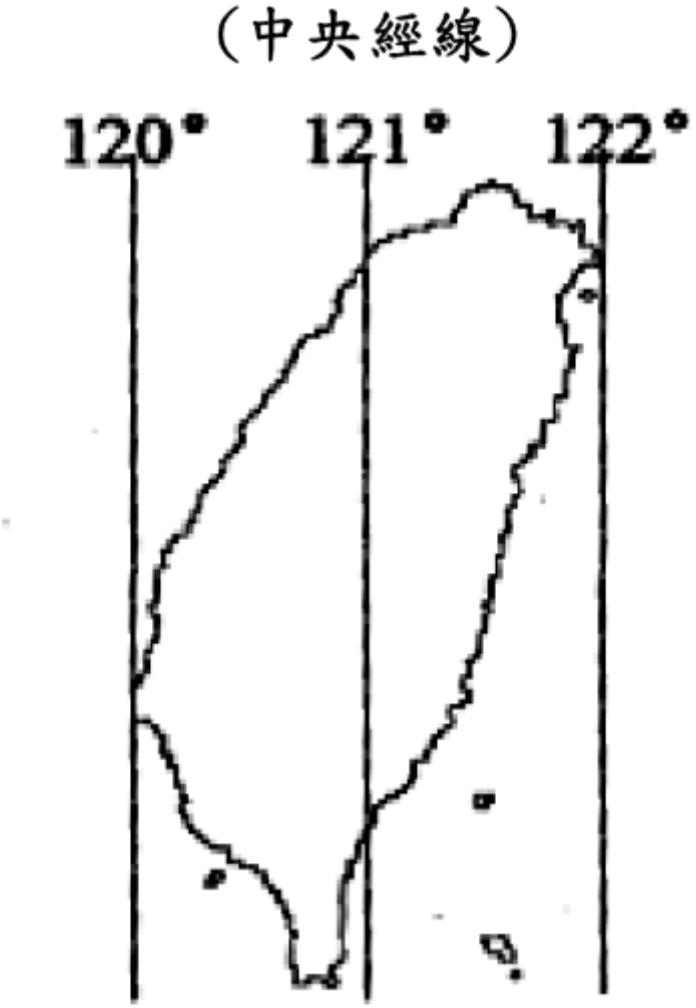
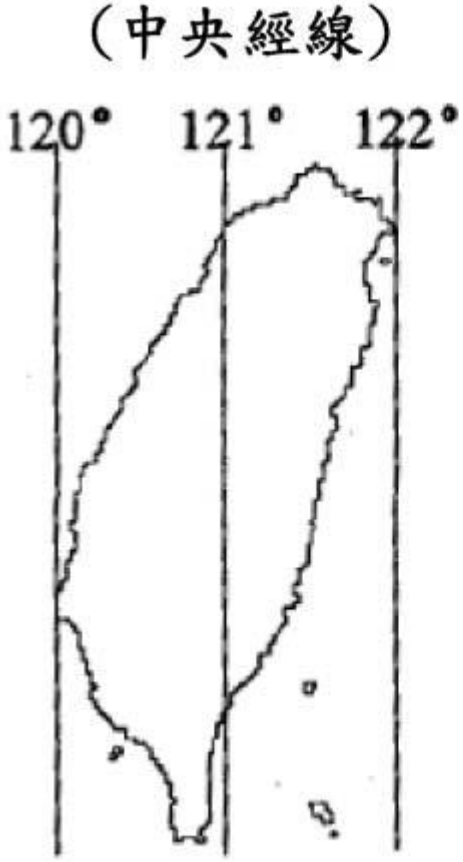
台灣的二度分帶座標 TM2

The **Secant** case of the
Transverse Mercator (TM)





台灣的二度分帶座標 TM2



台灣的二度分帶座標 TM2：投影參數

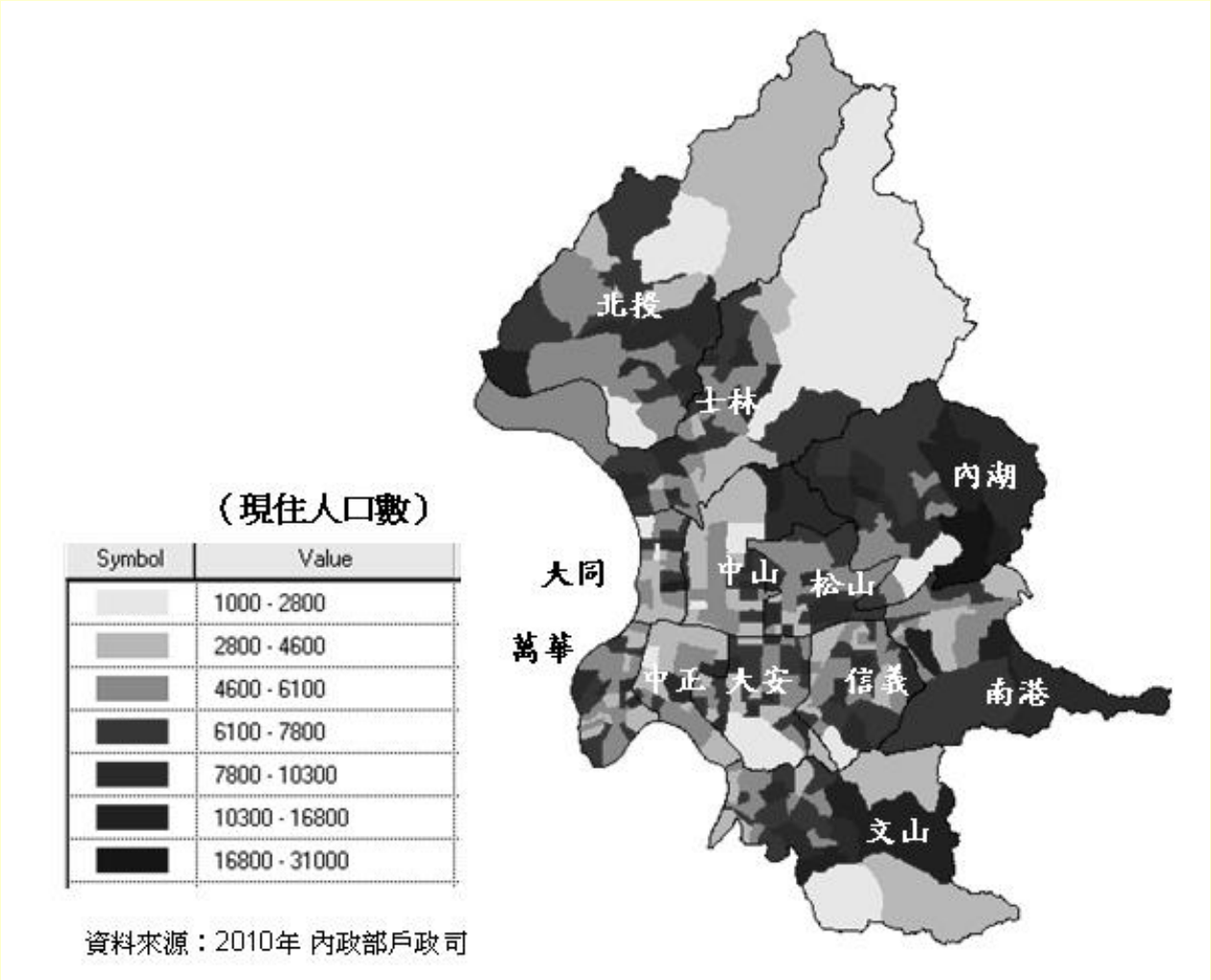
- Latitude origin: 0 degree
- Central meridian
  - 121 degrees E (台灣本島, 東引)
  - 119 degrees E (澎湖, 金門, 馬祖)
- Scale factor: 0.9999
- False easting: 250,000 meters
- False northing: 0 meter

地圖實作(預期成果)：台灣縣市圖

2/15 下午課程
Mapping: where is the most?

台北市人口

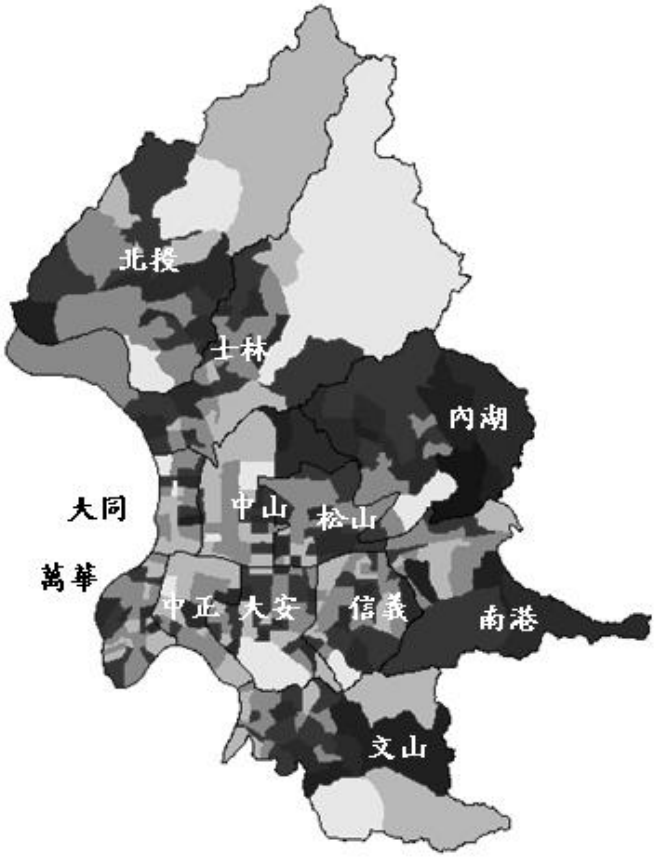
哪裡最多？

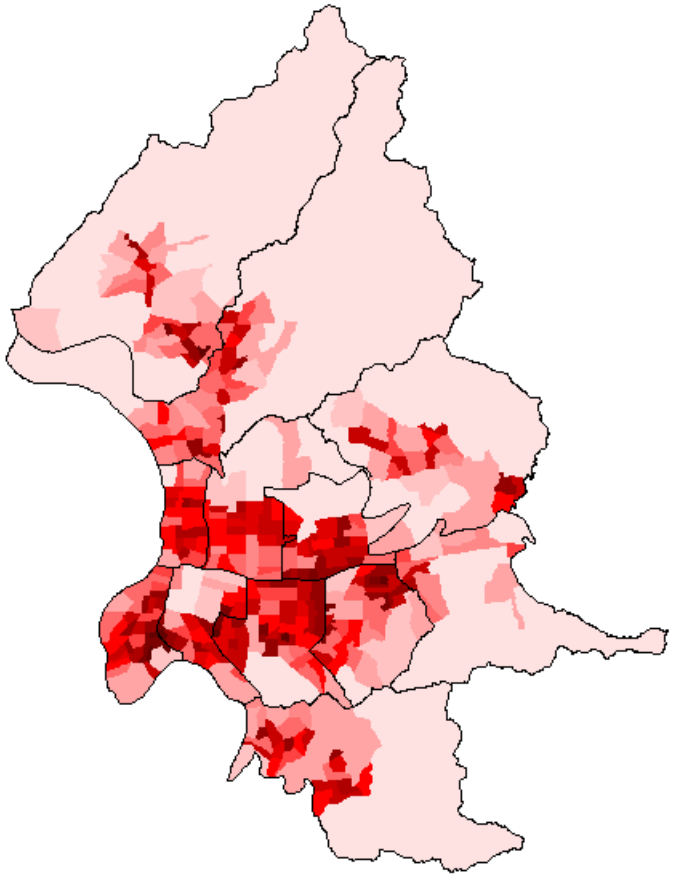


人口地圖：台北市的人口哪裡最多？

（現住人口數）

Symbol	Value
	1000 - 2800
	2800 - 4600
	4600 - 6100
	6100 - 7800
	7800 - 10300
	10300 - 16800
	16800 - 31000

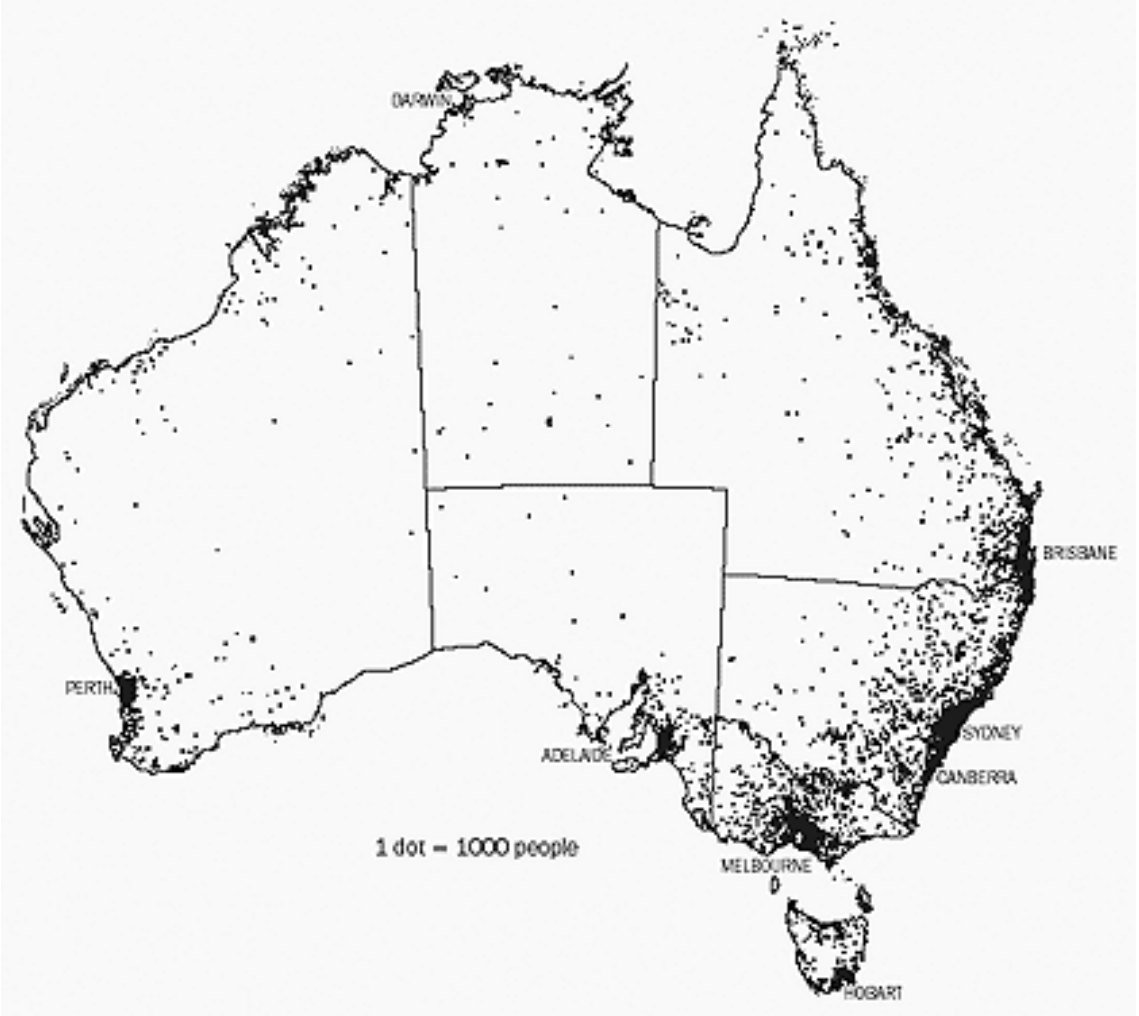




資料來源：2010年 內政部戶政司

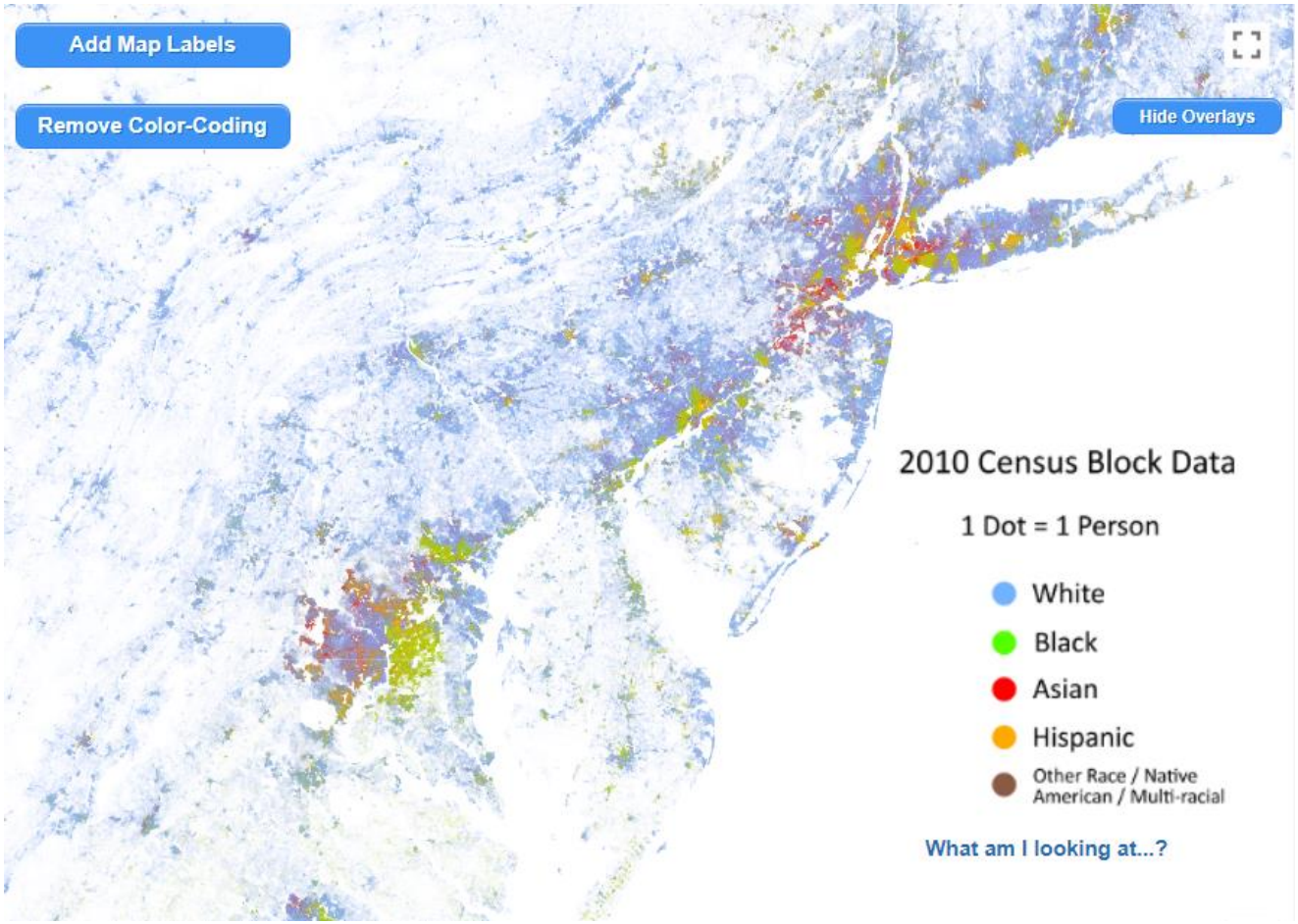
人口地圖常見的表現方式 1

點子圖 Dot Map



The Racial Dot Map: One Dot Per Person for the U.S.

The map displays 308,745,538 dots, one for each person residing in the United States at the location they were counted during the 2010 Census.



https://demographics.virginia.edu/DotMap/

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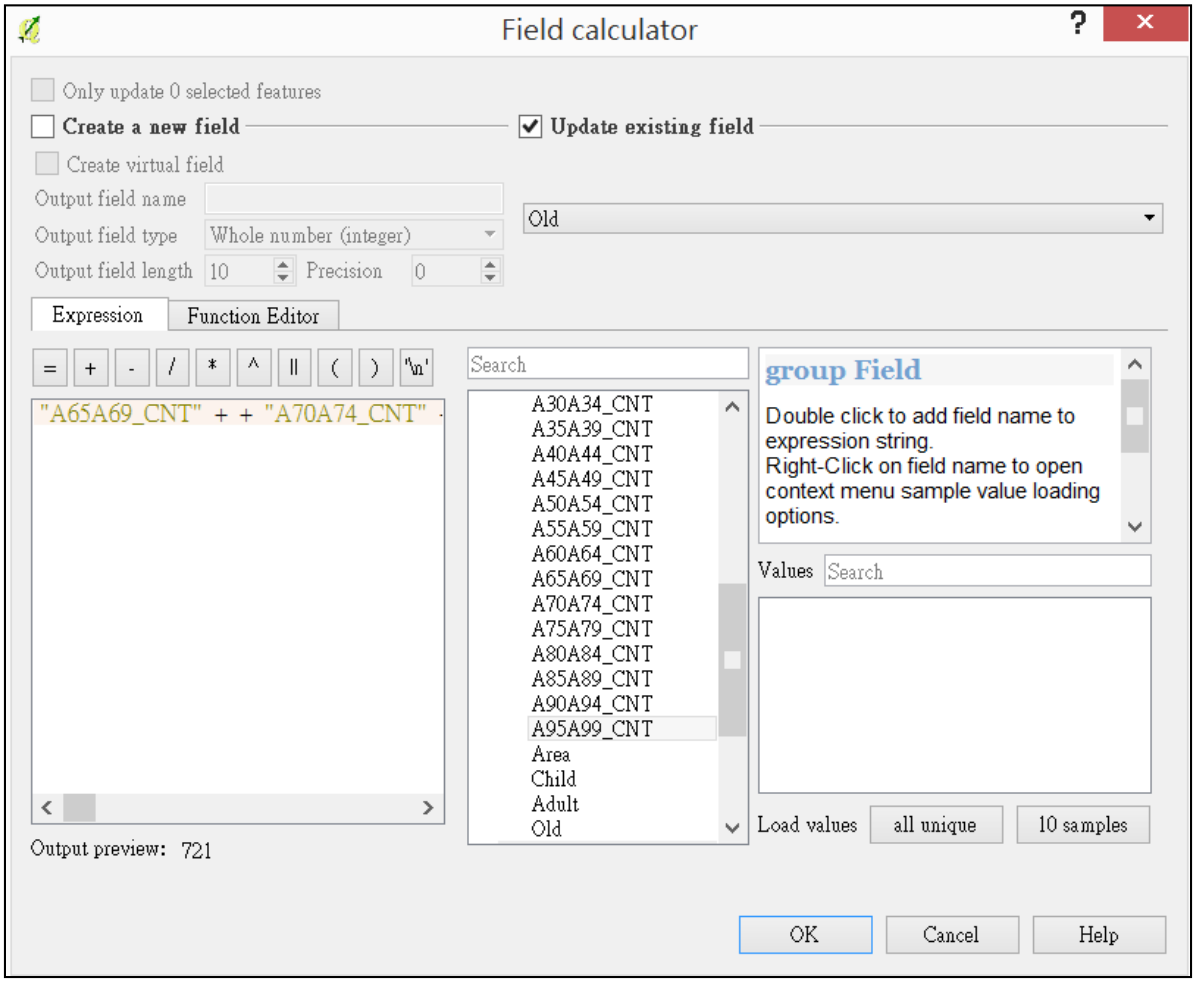
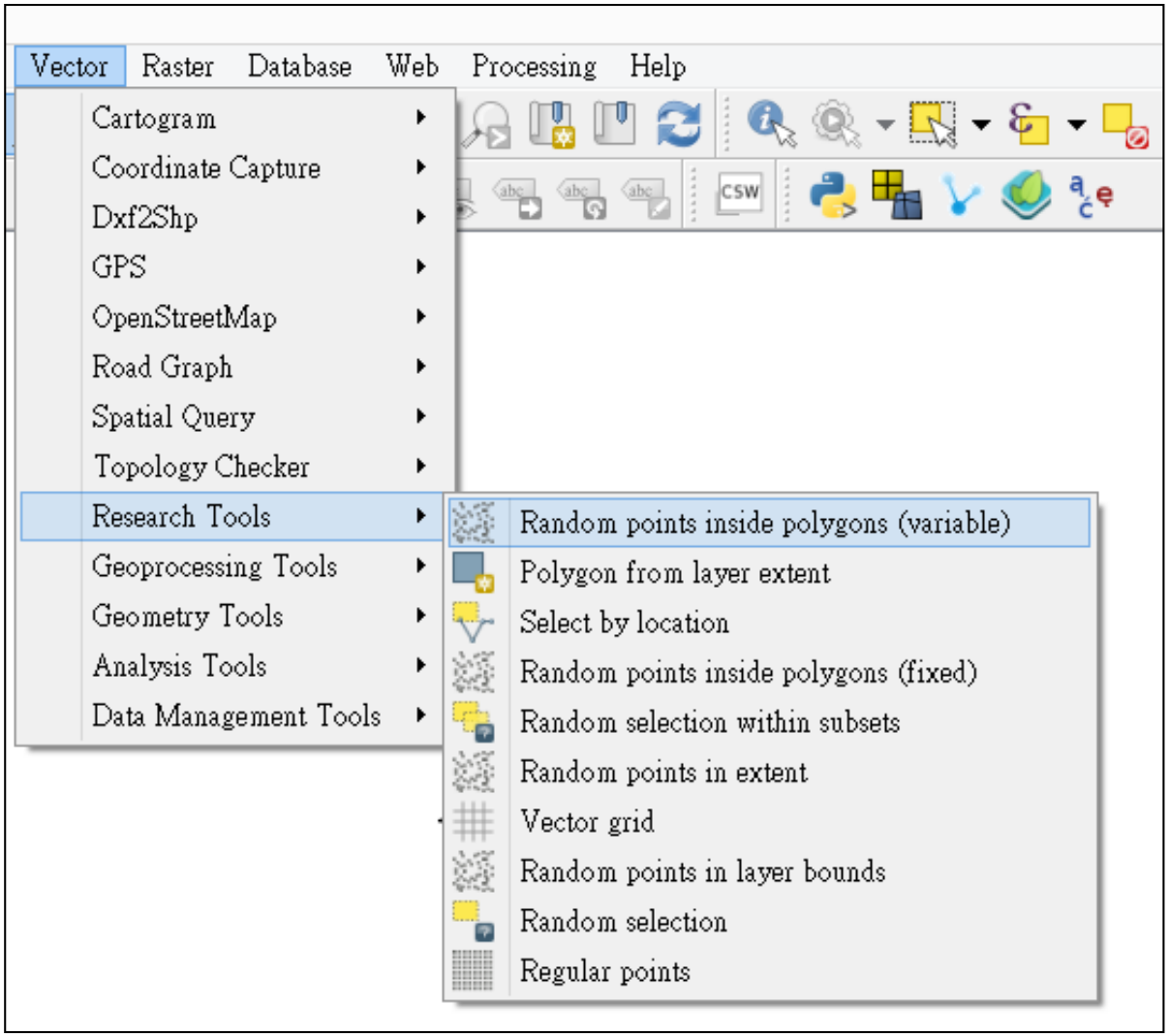
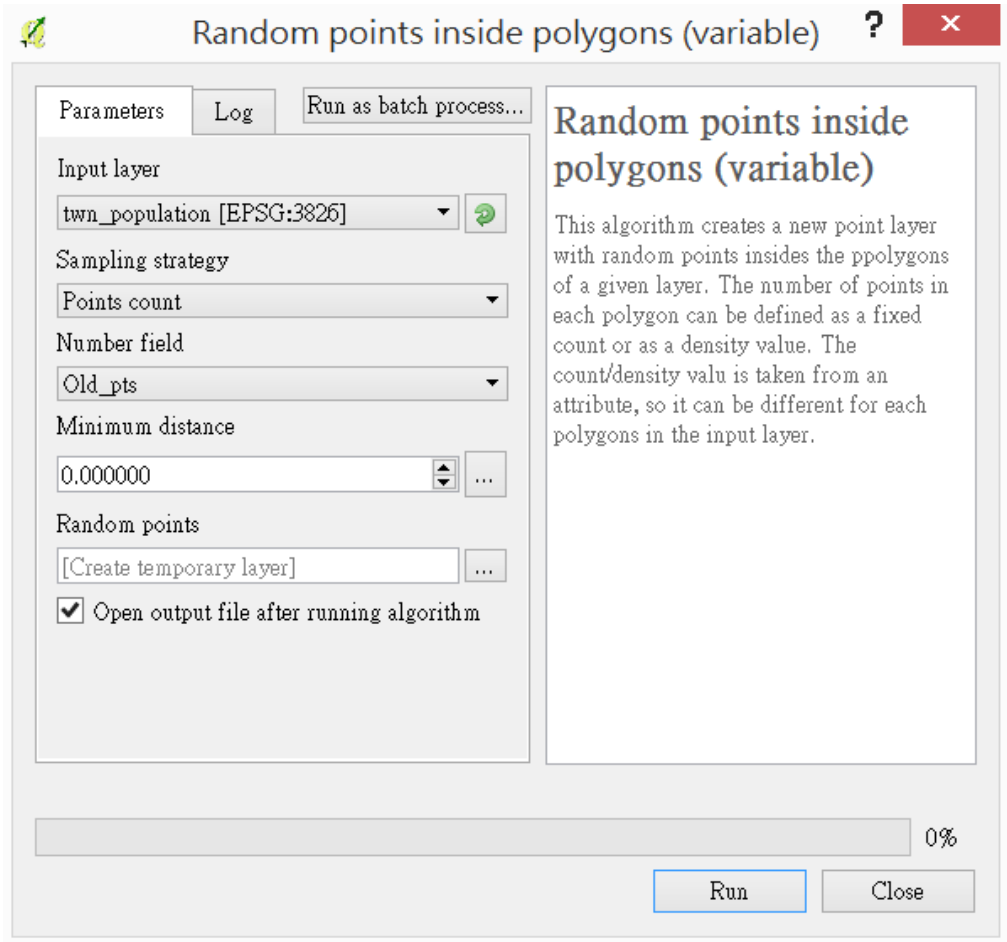
計算老年人口數 (age > 65)



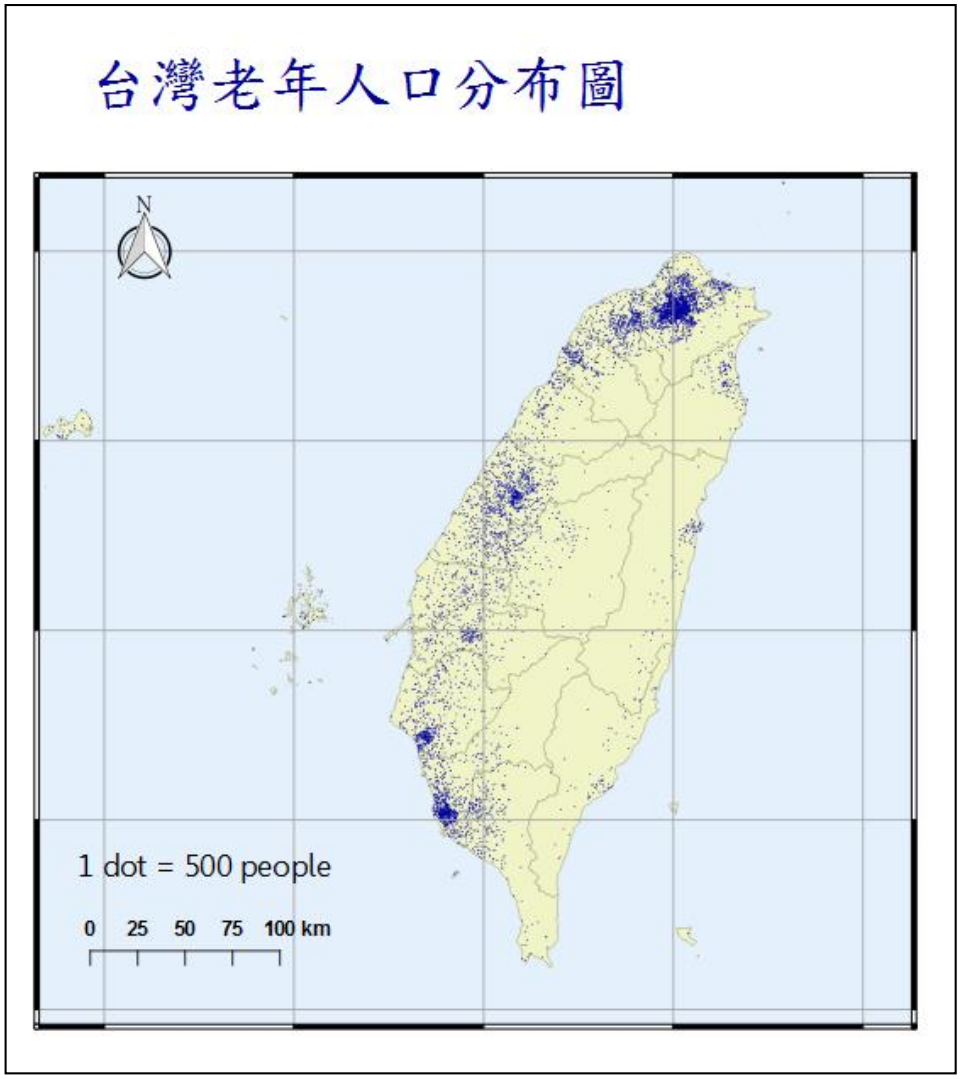
產生隨機點

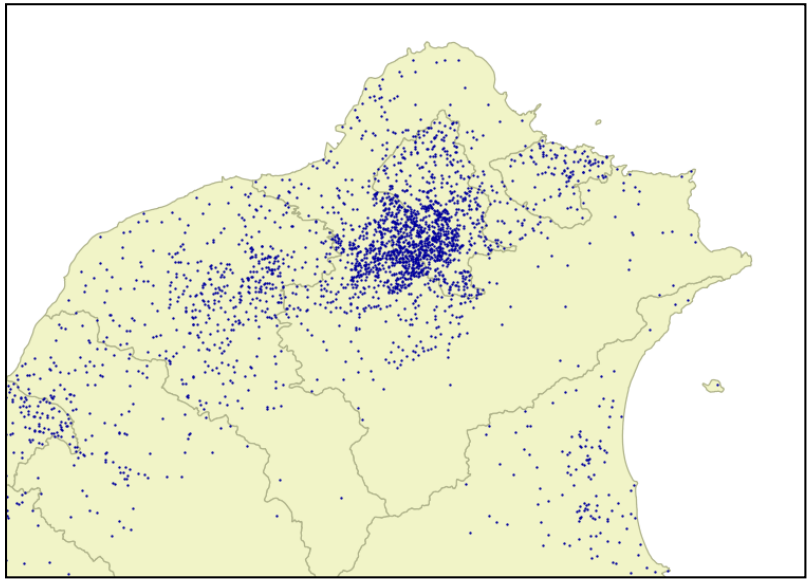

Vector
Raster
Database
Web
Processing
Help
Cartogram
Coordinate Capture
Dxf2Shp
GPS
OpenStreetMap
Road Graph
Spatial Query
Topology Checker
Research Tools
Geoprocessing Tools
Geometry Tools
Analysis Tools
Data Management Tools
Random points inside polygons (variable)
Polygon from layer extent
Select by location
Random points inside polygons (fixed)
Random selection within subsets
Random points in extent
Vector grid
Random points in layer bounds
Random selection
Regular points

產生隨機點：設定屬性欄位



地圖實作(預期成果)：台灣老年人口分布圖(點子圖)

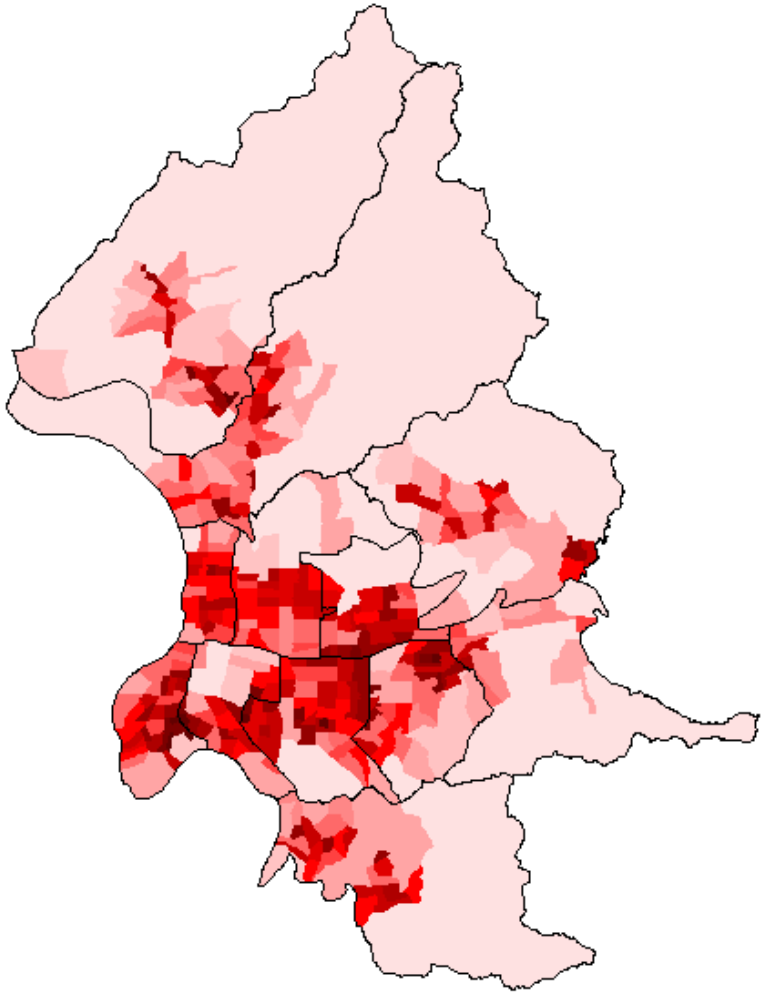




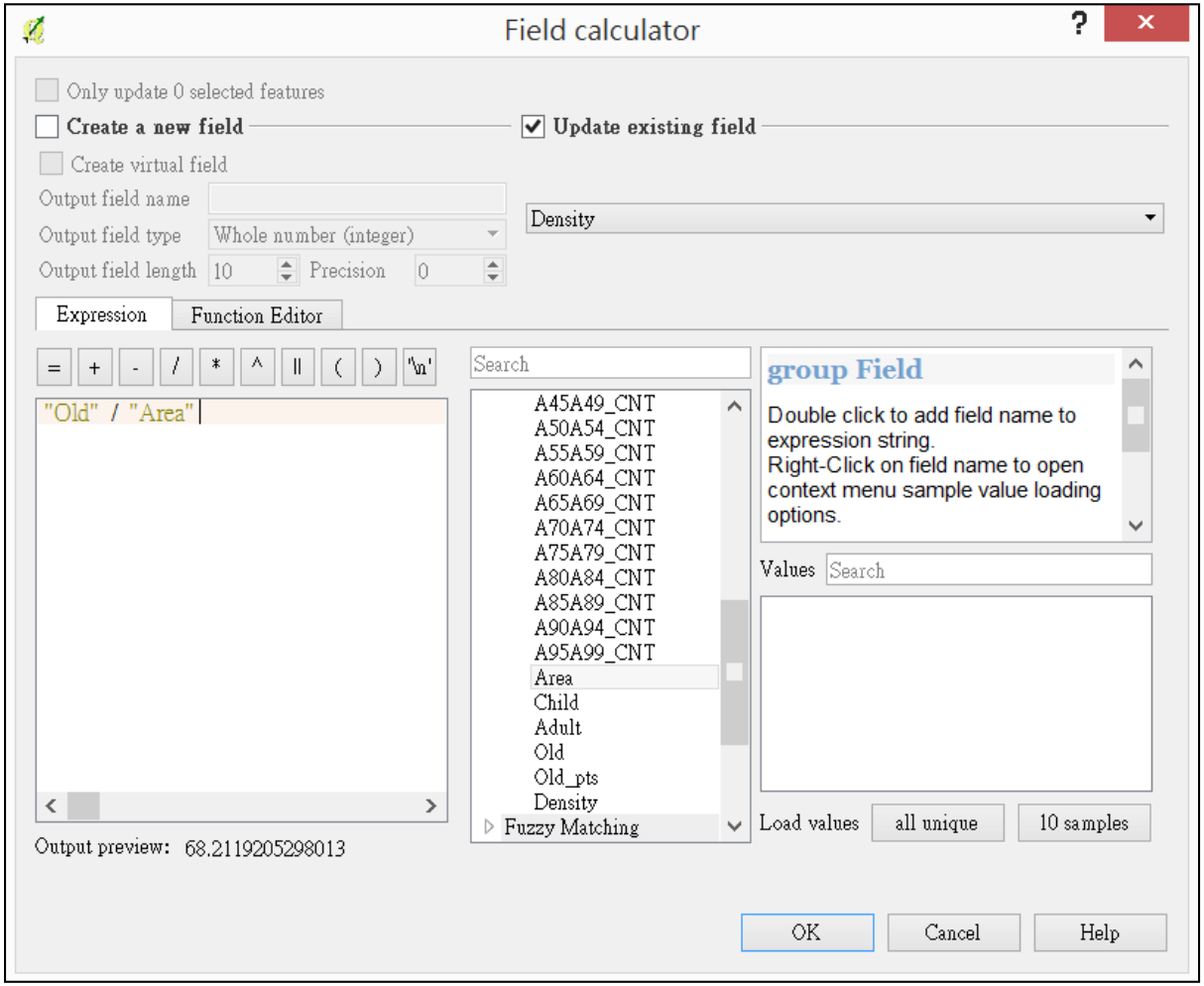
(北部地區局部放大圖)

人口地圖常見的表現方式 2

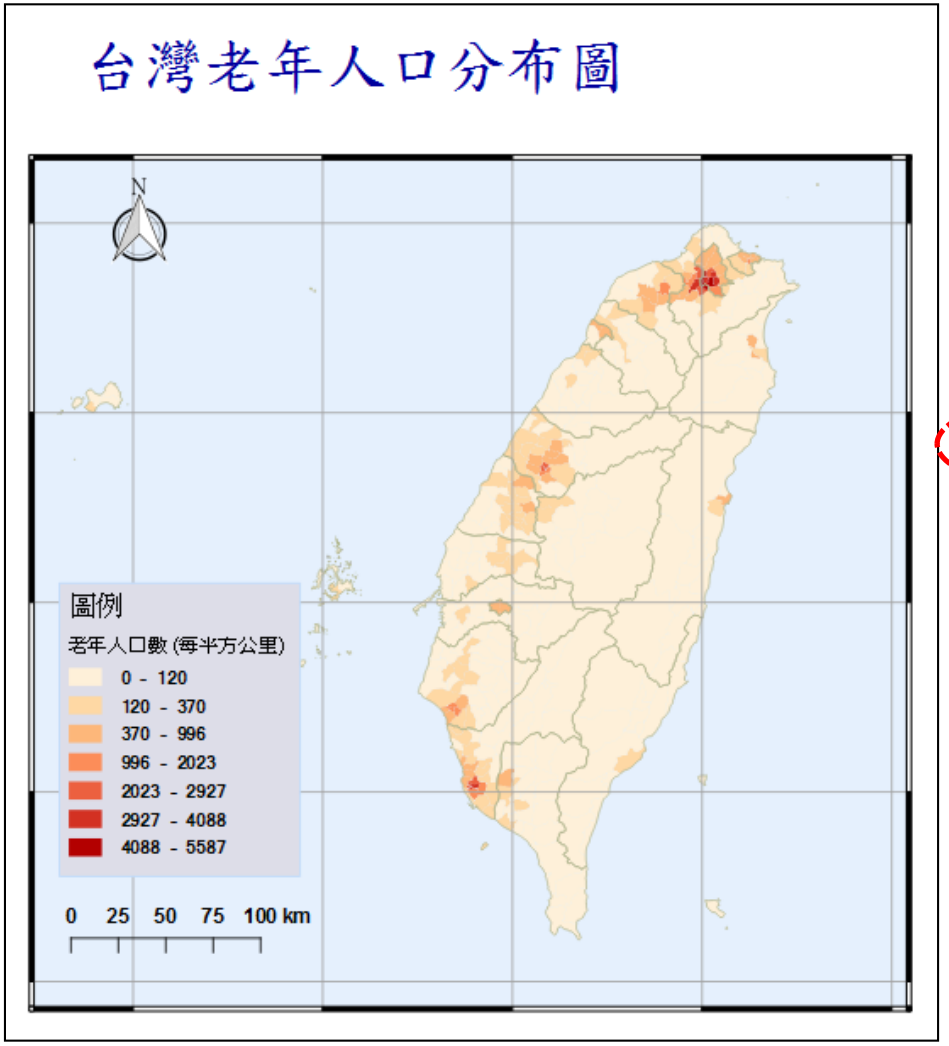
面量圖 Shaped Map

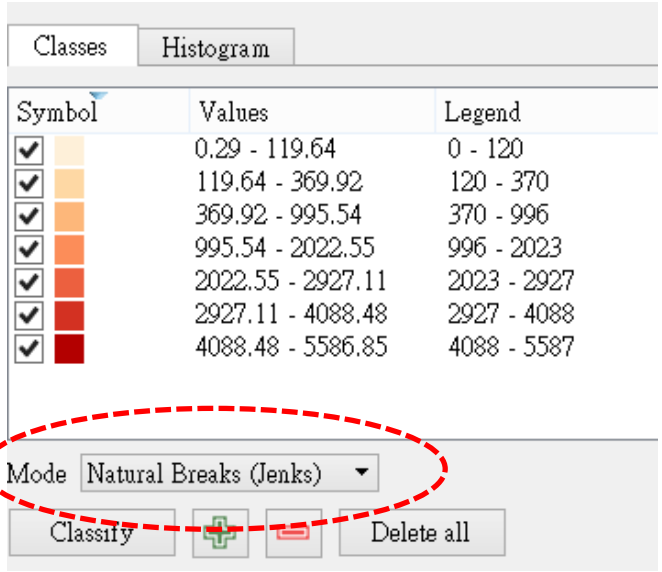


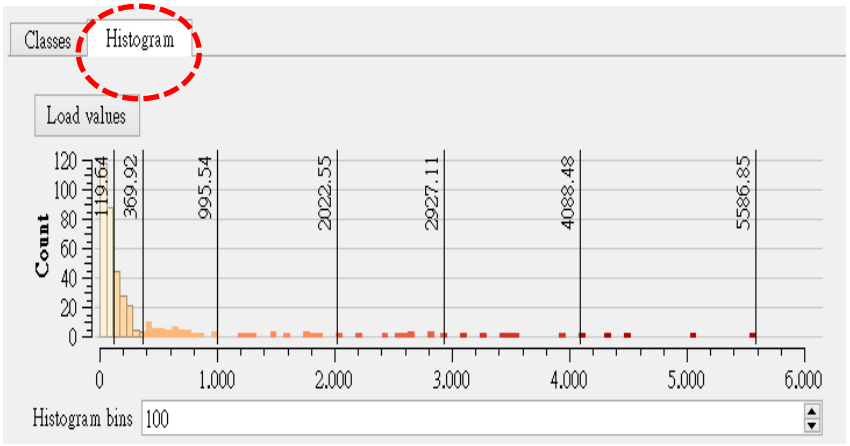
計算老年人口密度



地圖實作(預期成果)：台灣老年人口分布圖(面量圖)

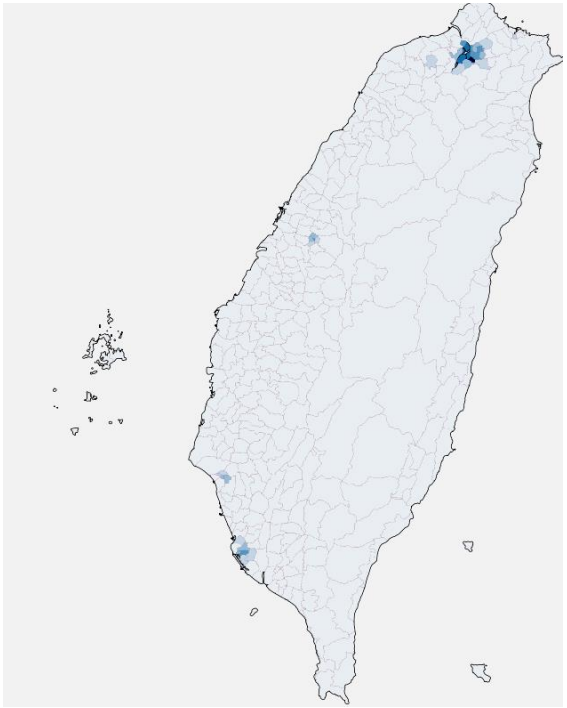




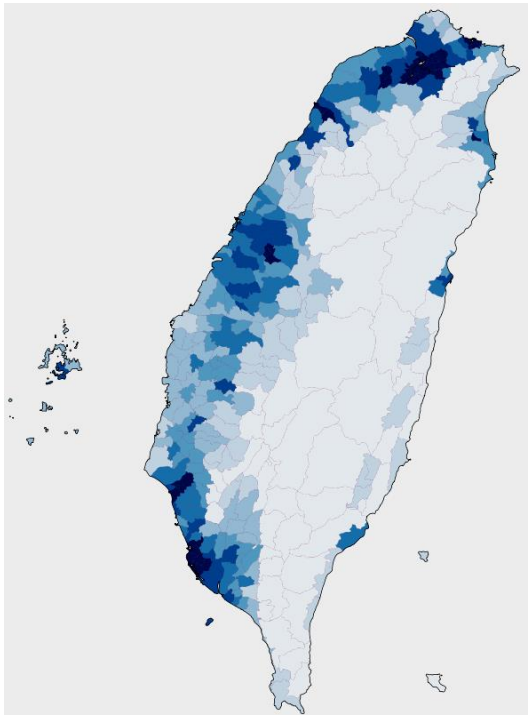


The devil is in the details 台灣人口分布圖

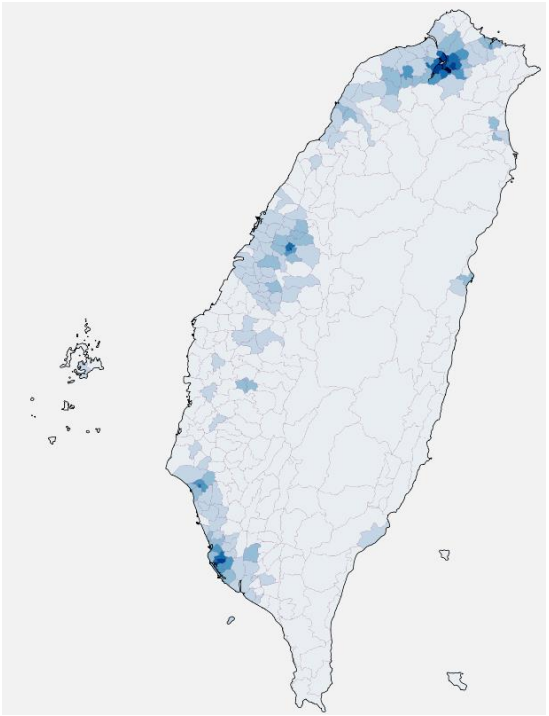
Equal Interval



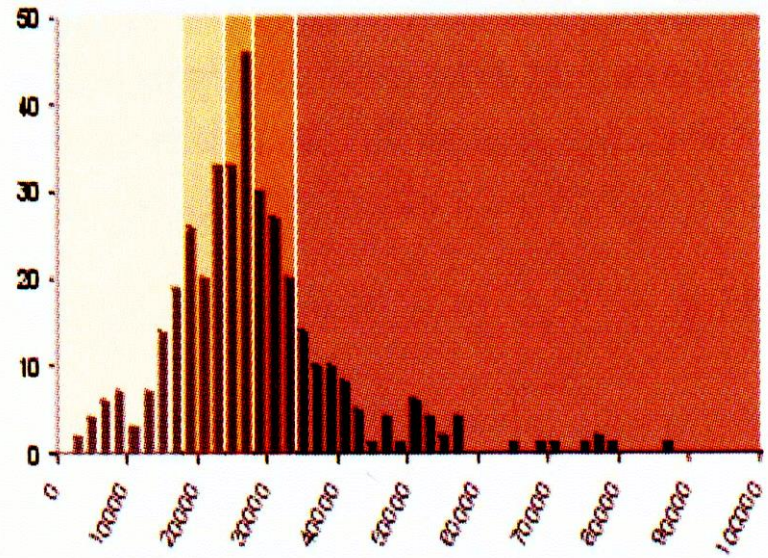
Quantile

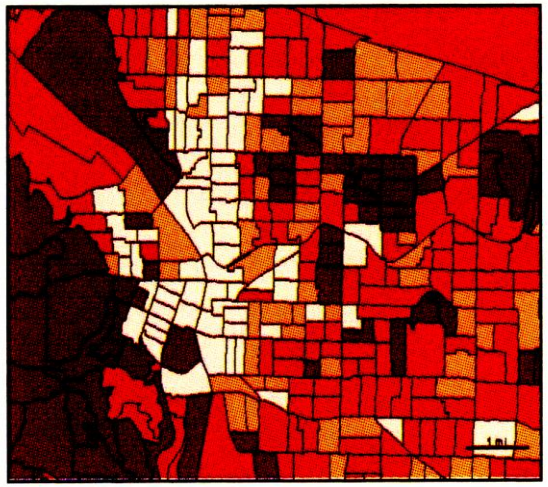


Natural Breaks

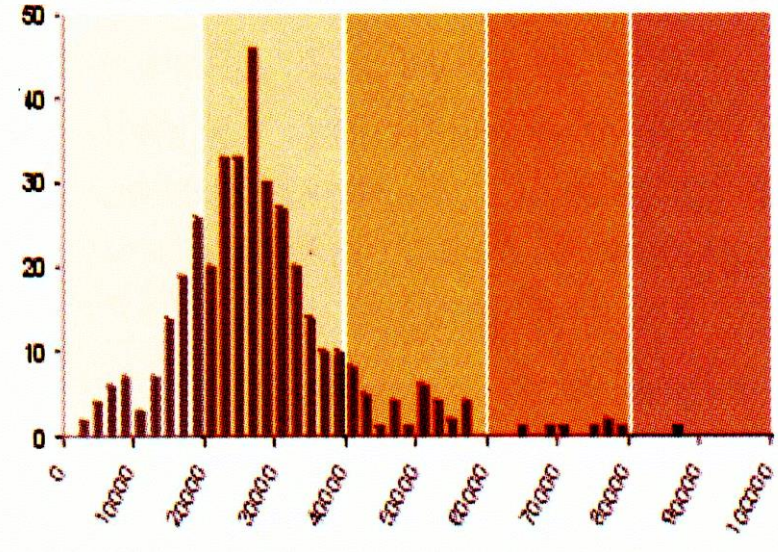


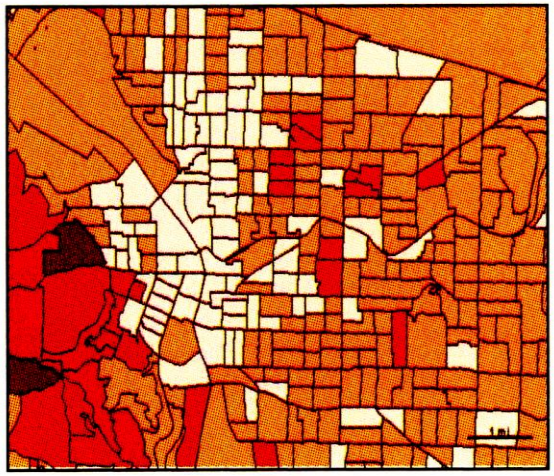
Classification Schemes





0 - 17056
17059 - 22500
22543 - 26387
26429 - 32083
32306 - 100000





0 - 20000
20001 - 40000
40001 - 60000
60001 - 80000
80001 - 100000

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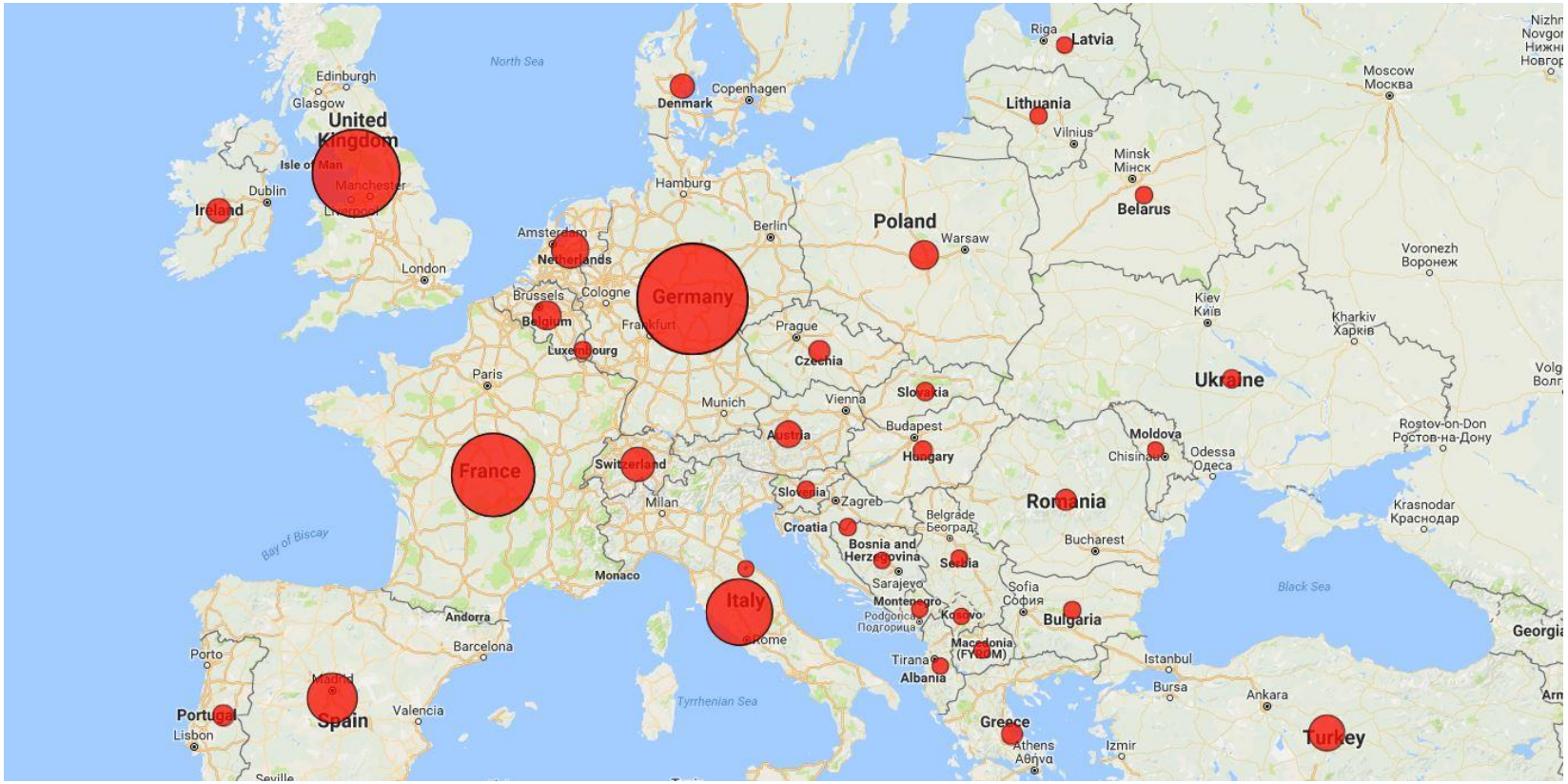
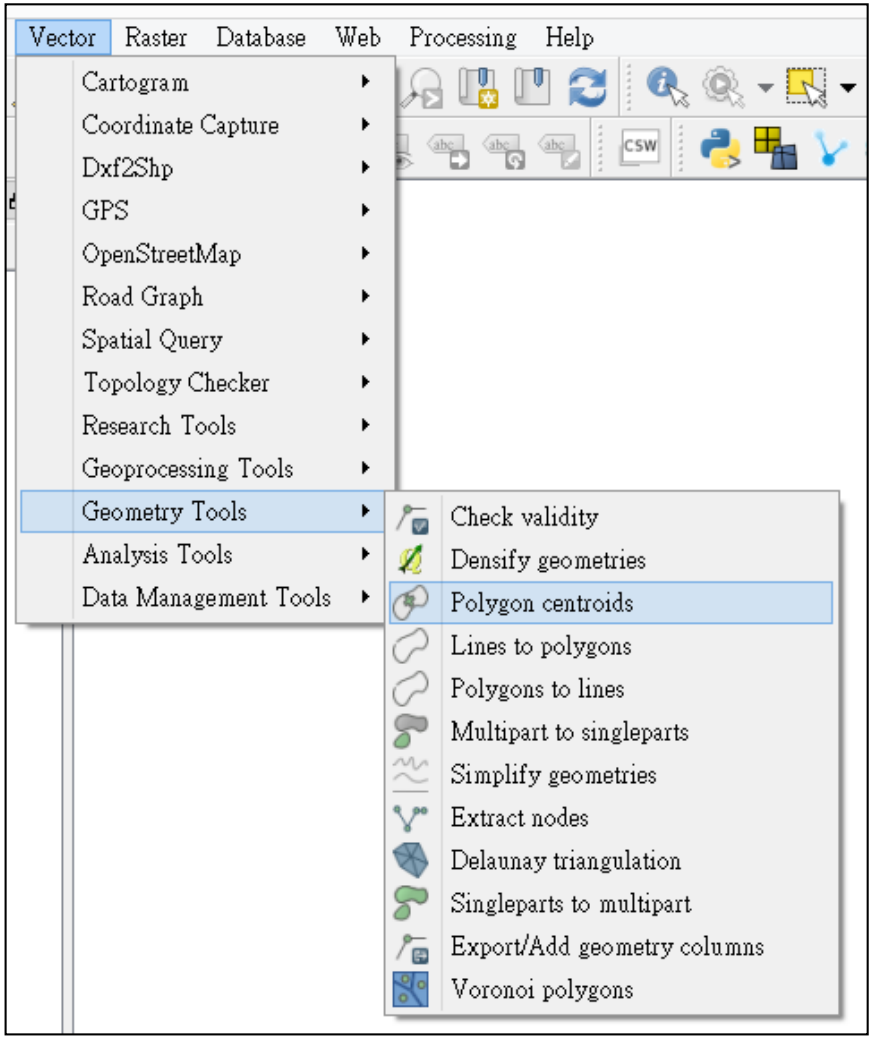
人口地圖常見的表現方式 3

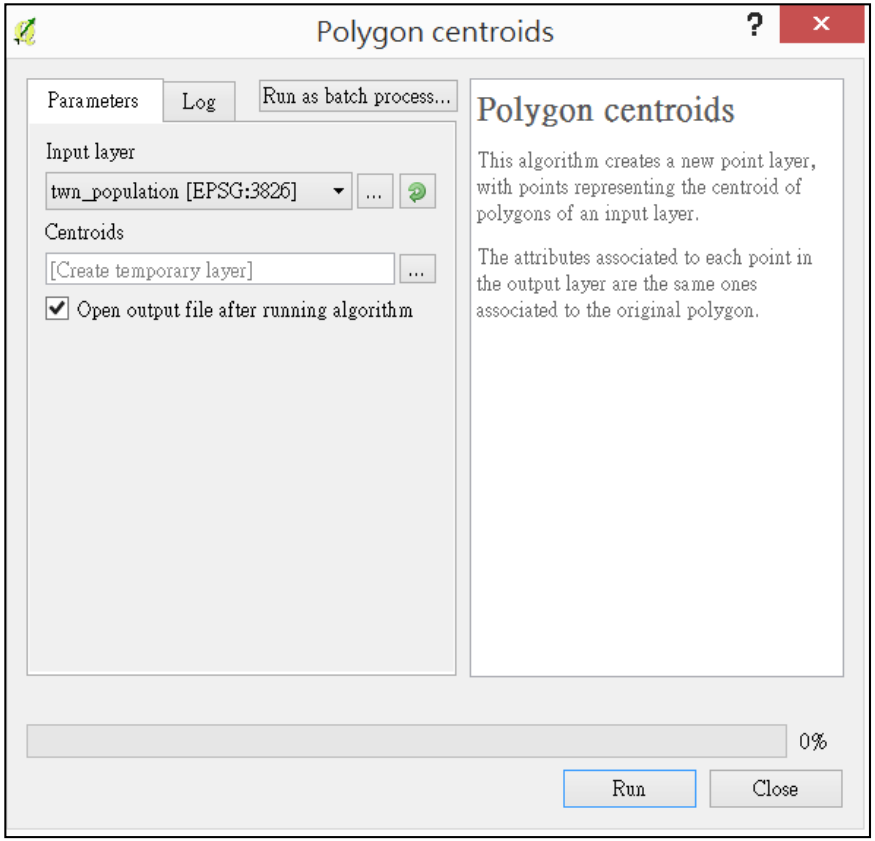
Bubble Map



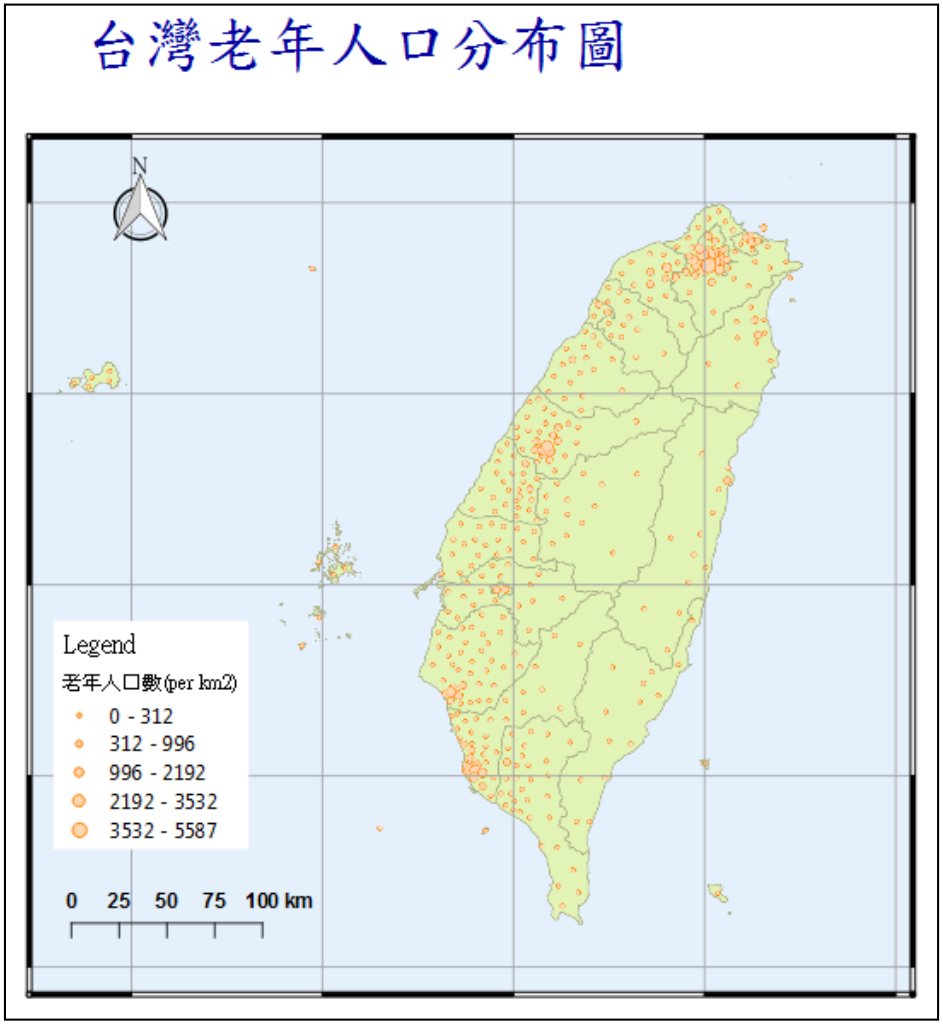
https://www.espatial.com/articles/create-a-bubble-map

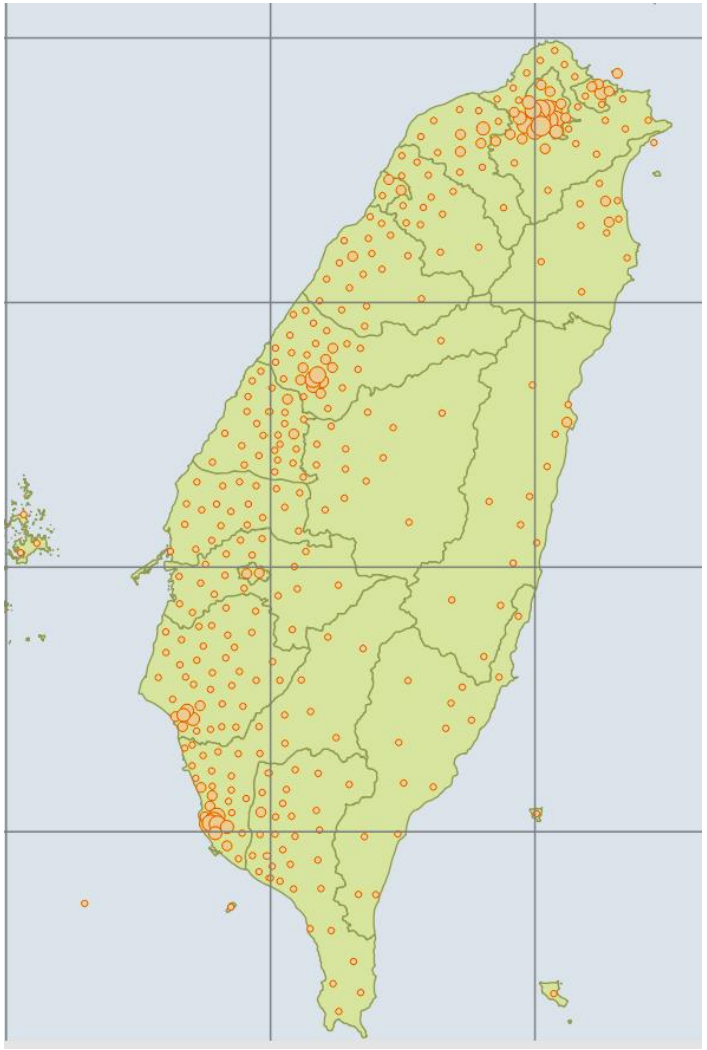
建立行政區的幾何中心點 centroid





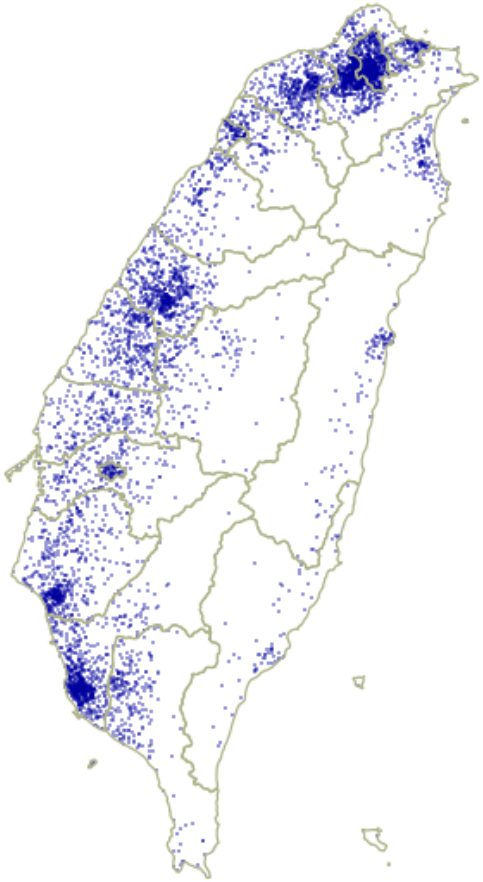
地圖實作 (預期成果)：台灣老年人口分布 (泡泡圖)



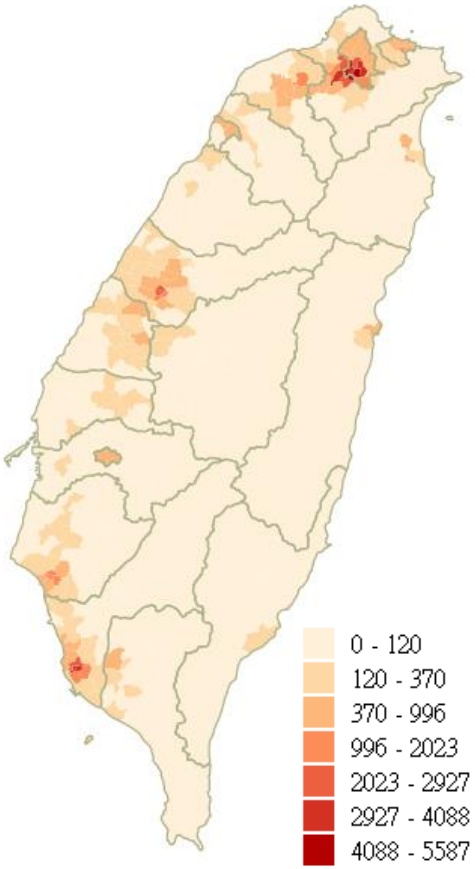


Comparisons: 人口地圖常見的表現方式

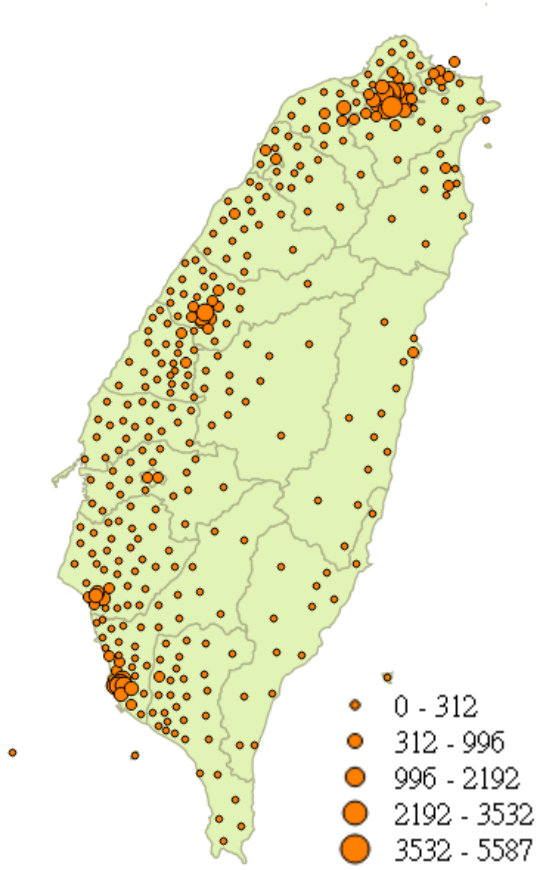
Dot map



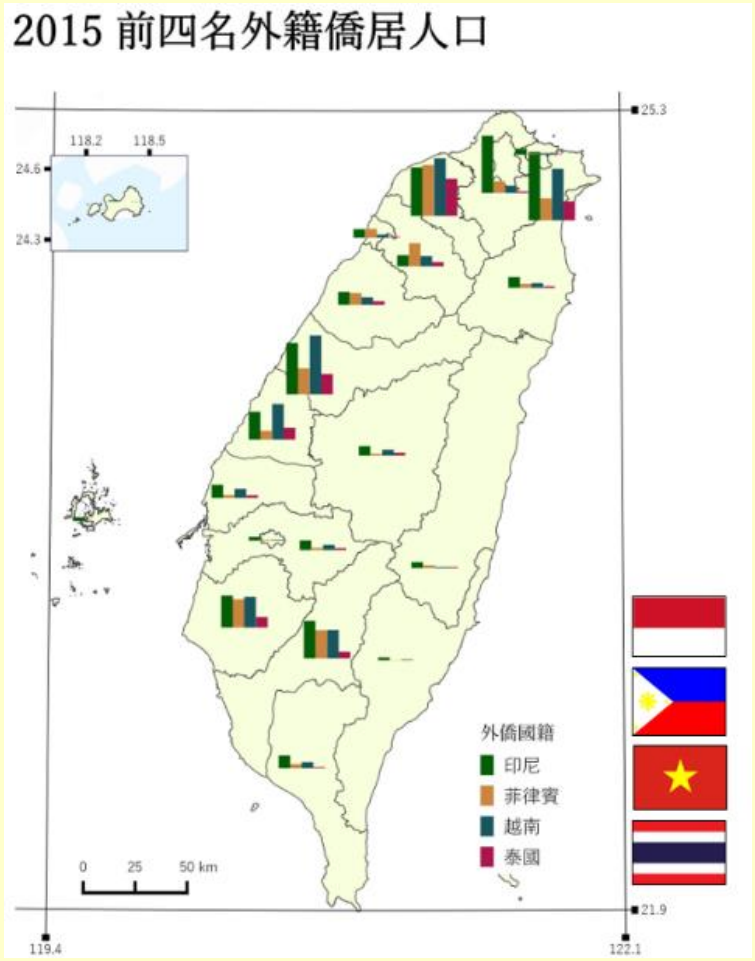
Shaped map

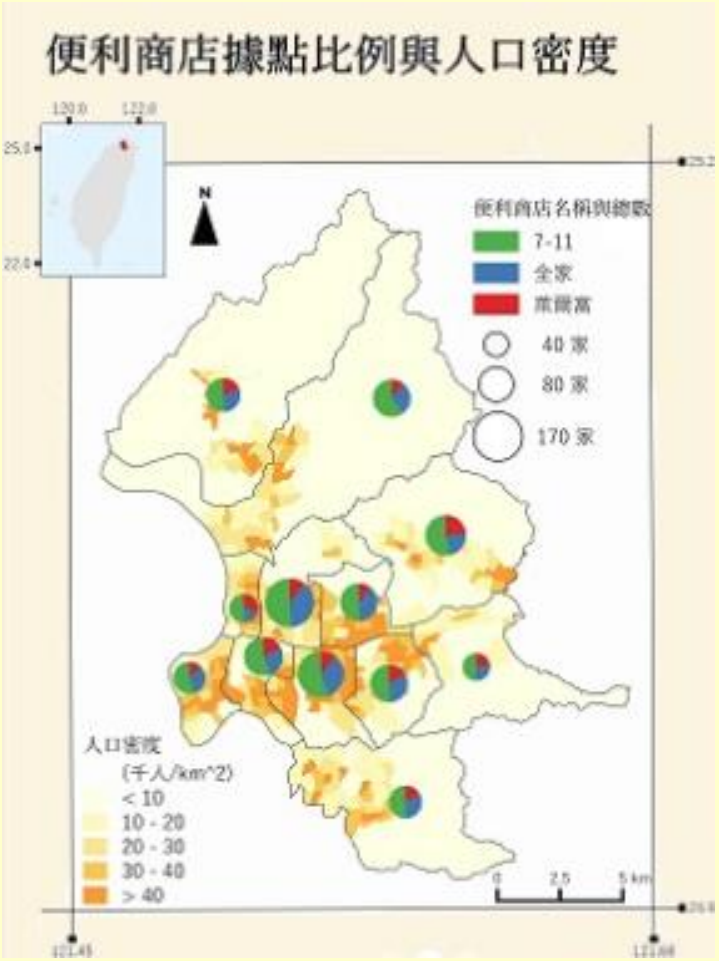


Bubble map



1/16 上午課程
統計地圖：長條圖與圓餅圖

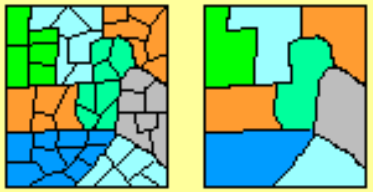




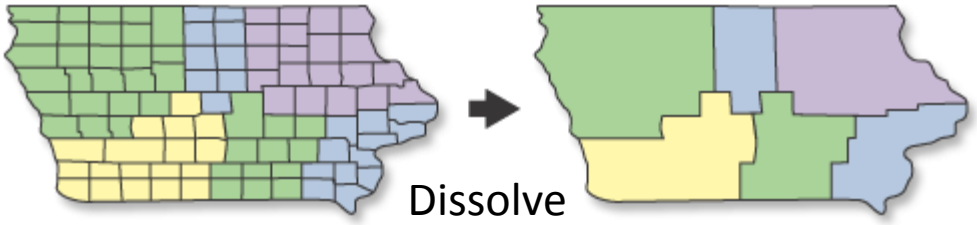
建立縣市單位的統計圖資

About Dissolve

This operation aggregates features that have the same value for an attribute that you specify.



情境 1

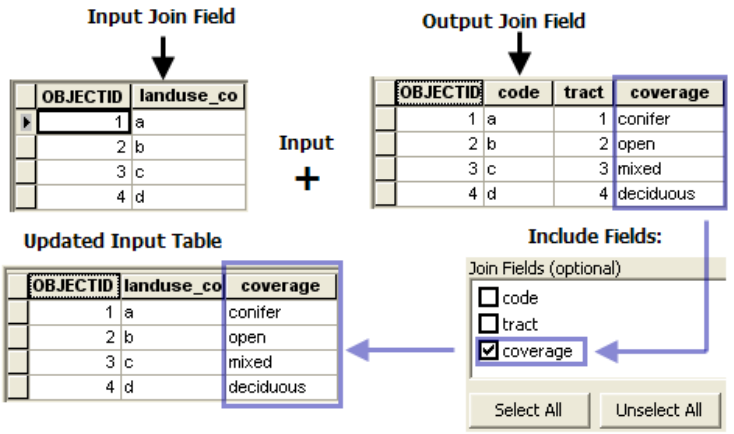


鄉鎮統計圖資　　縣市統計圖資

縣市統計的圖資

情境 2

縣市統計表格　　縣市統計圖資



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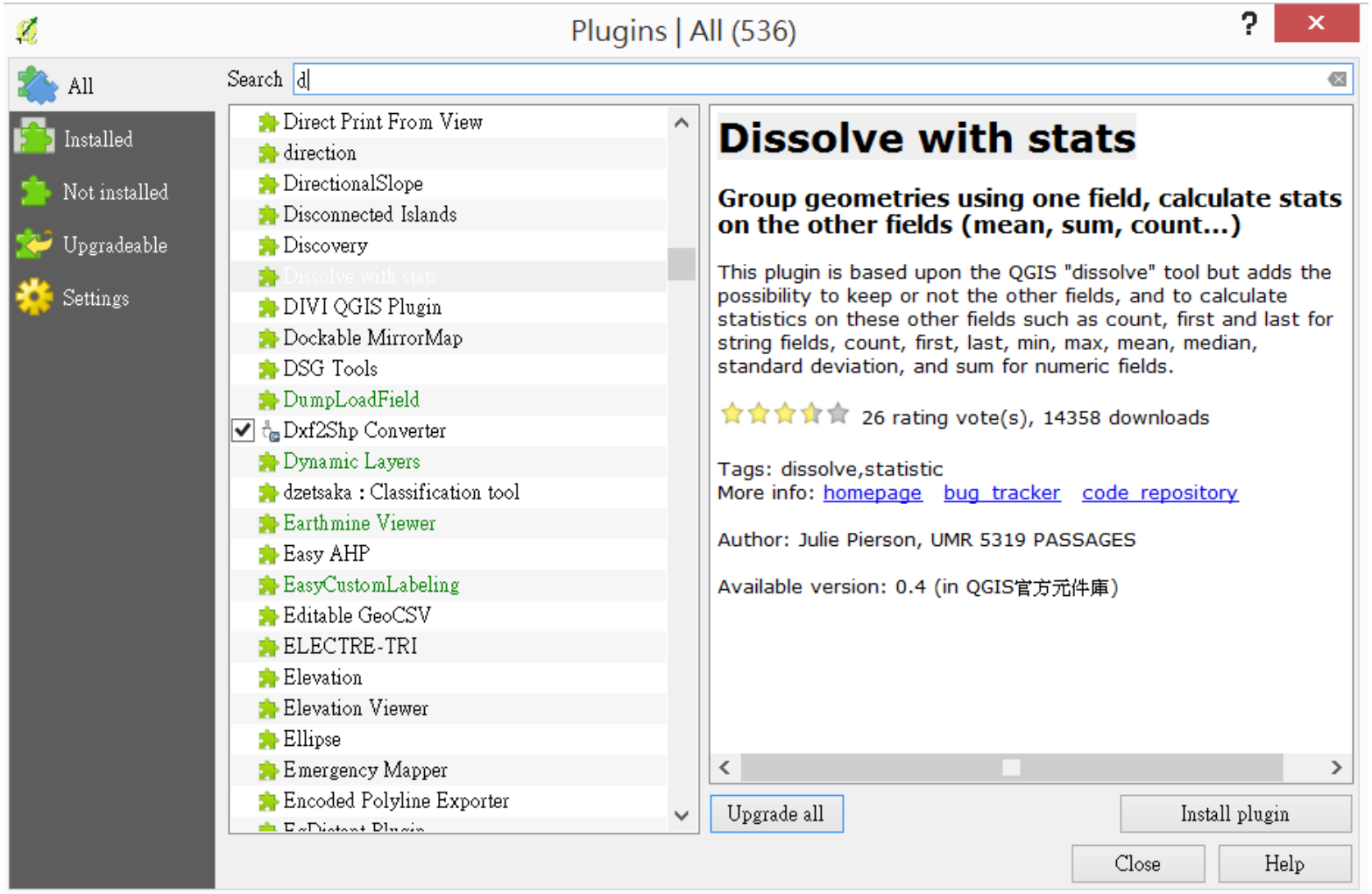
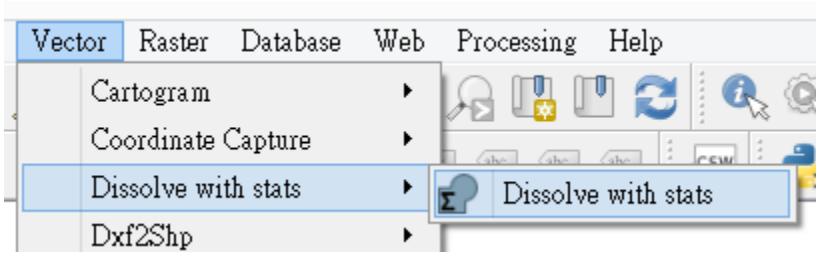
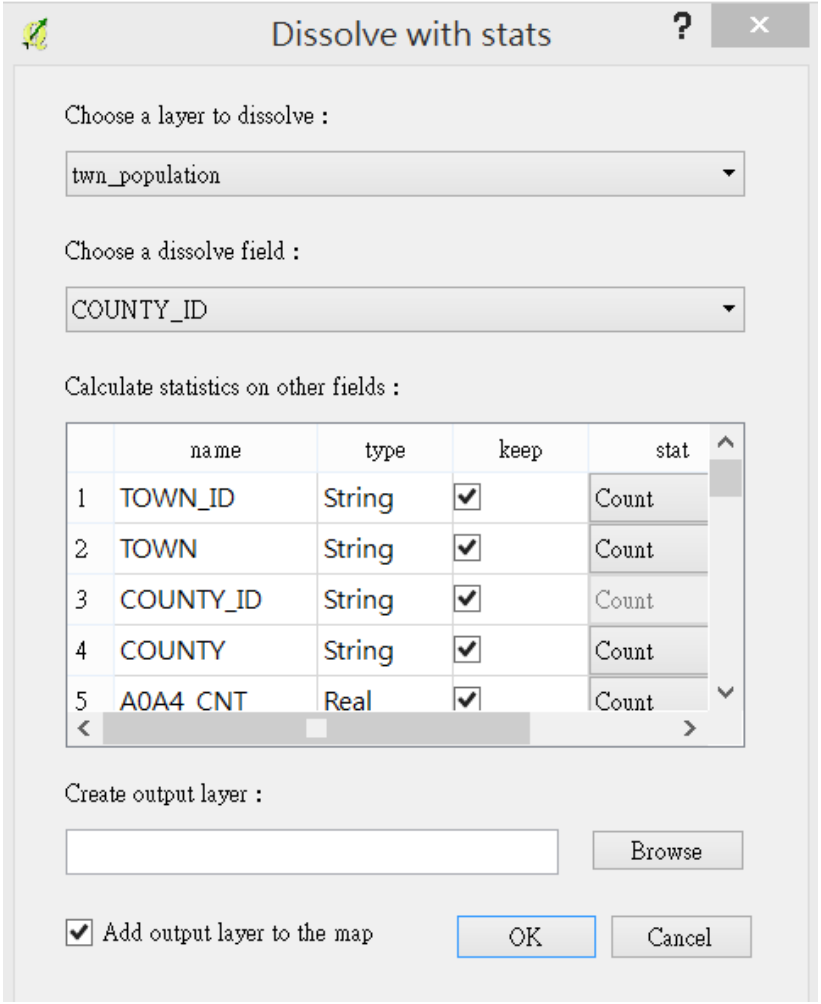
地理計算科學 研究室
Laboratory for Geospatial Computational Science
NTU Geography

安裝QGIS套件： Dissolve with stats



Using Dissolve with stats



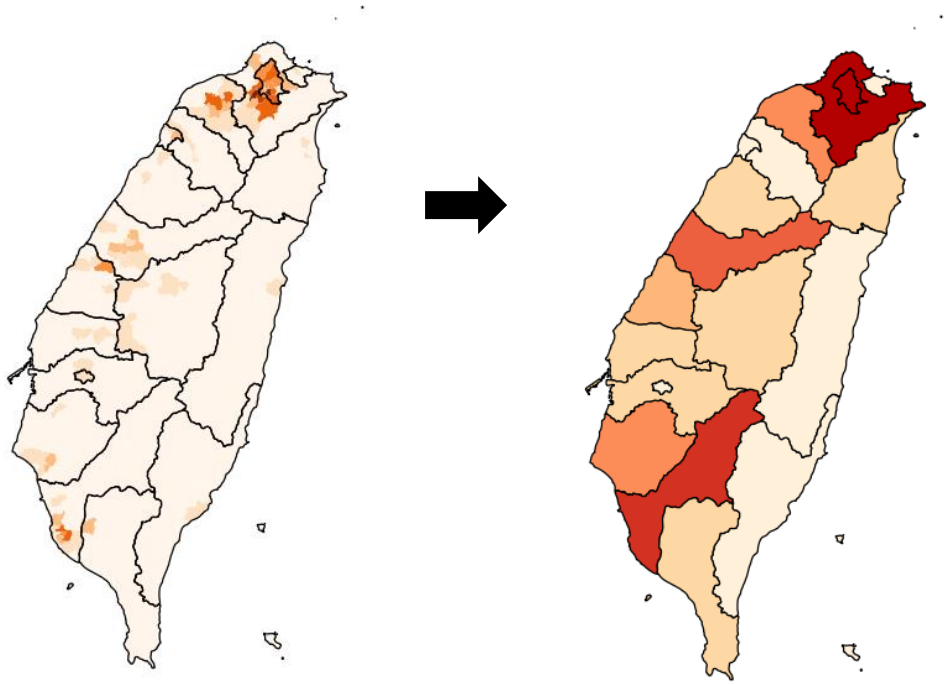


Dissolve

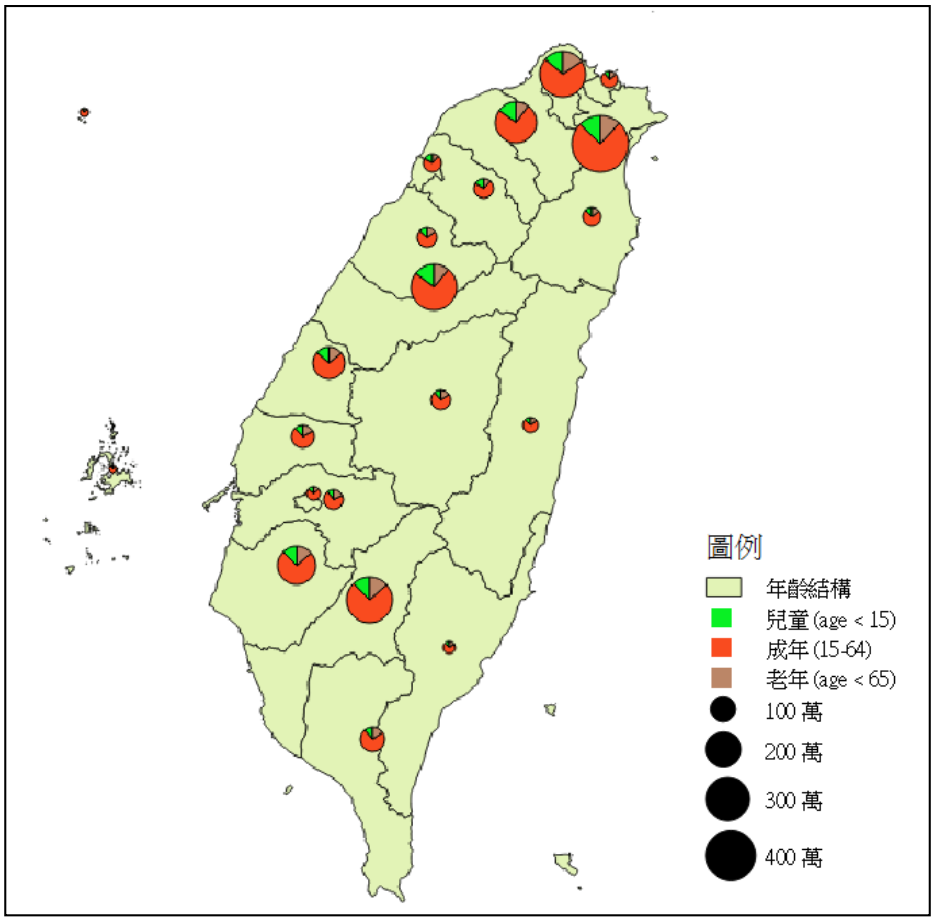
情境 1

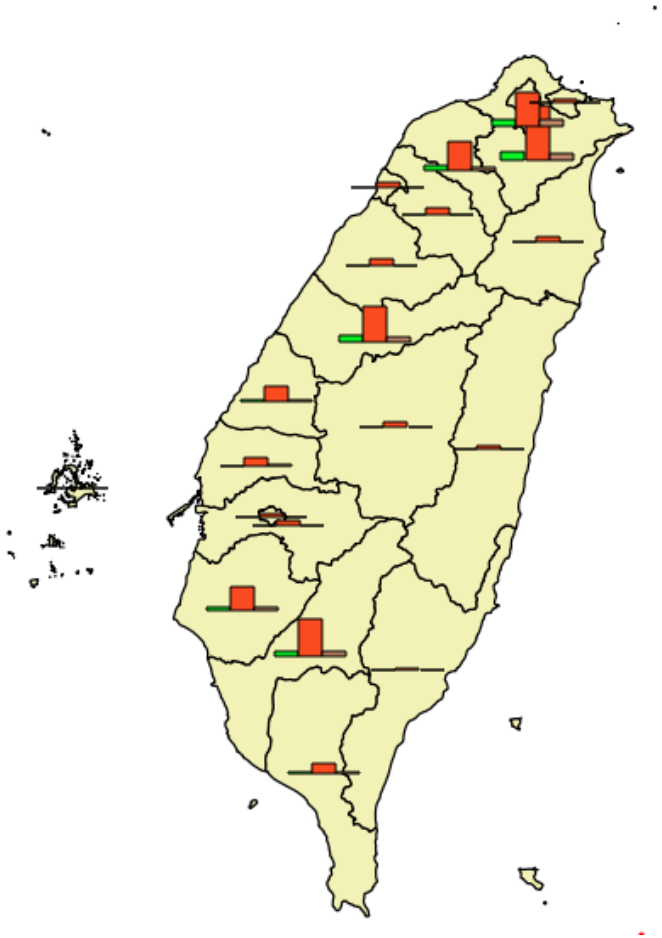
鄉鎮統計圖資　　縣市統計圖資

	COUNTY_ID	COUNTY	Area	Child	Adult	Old
1	67000	臺南市	2258.81	236571	1389761	259500
2	09020	金門縣	185.00	13674	105671	15723
3	66000	臺中市	2239.79	409212	2056123	301663
4	63000	臺北市	269.85	375128	1901446	418420
5	10009	雲林縣	1399.58	84610	491499	118693
6	10010	嘉義縣	1952.76	52919	370167	92176
7	09007	連江縣	29.73	1594	9714	1286
8	10016	澎湖縣	135.24	11486	76198	15569
9	10007	彰化縣	1244.54	175423	928761	182860



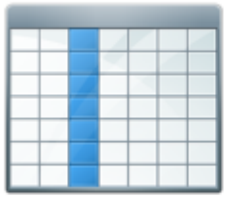
地圖實作 (預期成果)：統計地圖--長條圖與圓餅圖 (dissolve)



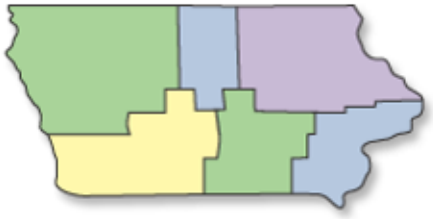


Data Join

情境 2



Join



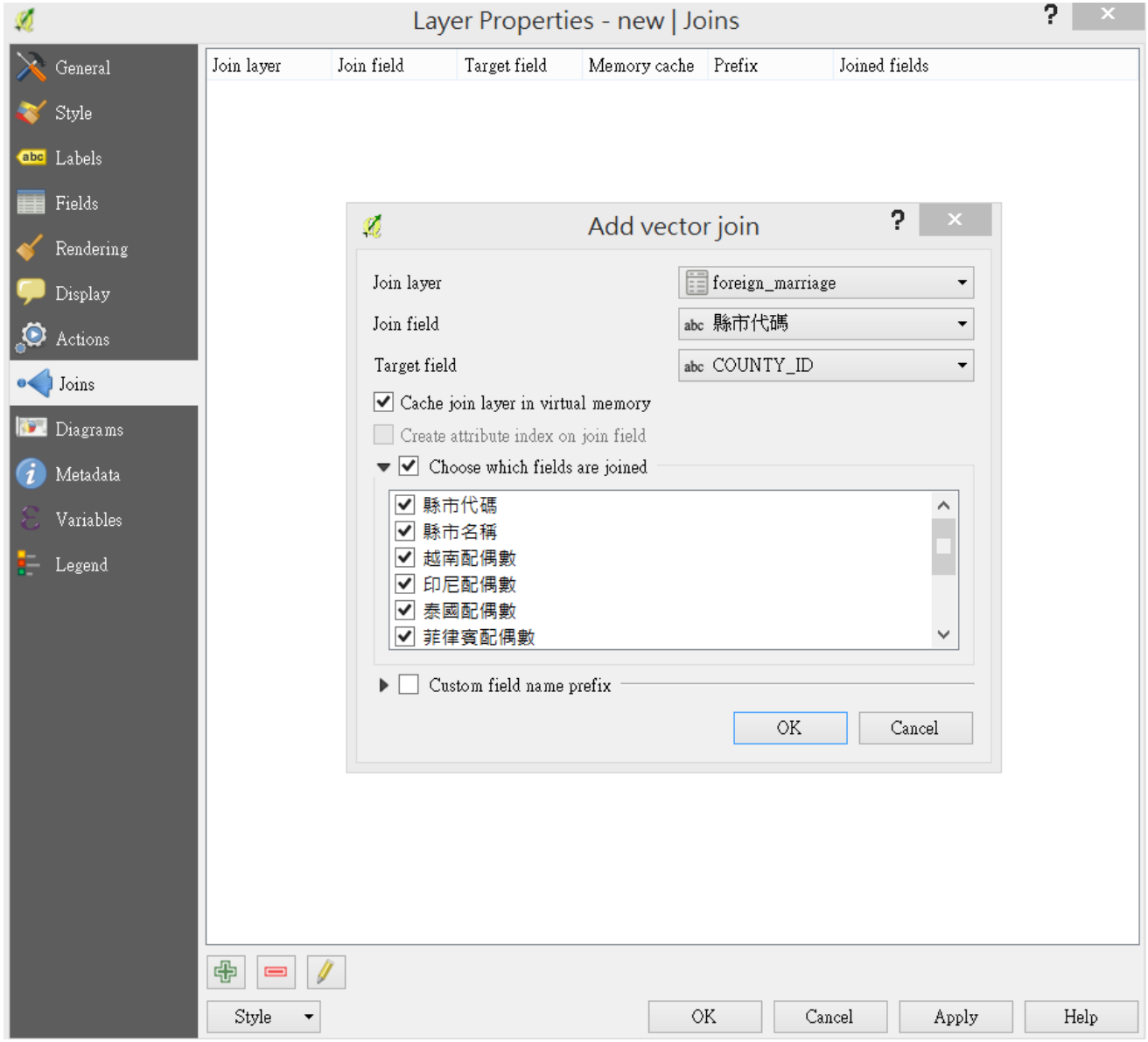
縣市統計表格

縣市統計圖資

	A	B	C	D	E	F	G	H	I
1	縣市代碼	縣市名稱	越南配偶數	印尼配偶數	泰國配偶數	菲律賓配偶數	柬埔寨配偶數	日本配偶數	韓國配偶數
2	65000	新北市	16728	3578	1617	1448	433	920	396
3	63000	臺北市	5177	1093	481	599	186	1546	412
4	68000	桃園市	9697	4625	2268	1585	299	347	116
5	66000	臺中市	9980	2242	832	791	742	477	138
6	67000	臺南市	7537	1064	500	405	328	230	68
7	64000	高雄市	11174	2065	629	867	440	450	135
8	10002	宜蘭縣	2179	449	118	88	131	40	9
9	10004	新竹縣	2267	2410	313	524	52	86	36
10	10005	苗栗縣	2884	1868	255	249	70	28	12
11	10007	彰化縣	6599	1723	484	380	407	64	19
12	10008	南投縣	3166	903	172	114	226	24	5
13	10009	雲林縣	4119	1803	214	155	261	38	12
14	10010	嘉義縣	3613	1170	139	121	167	13	4
15	10013	屏東縣	4687	1709	202	786	238	50	11
16	10014	臺東縣	956	259	29	87	42	29	4
17	10015	花蓮縣	1068	526	66	66	63	49	14
18	10016	澎湖縣	552	318	0	8	42	5	2
19	10017	基隆市	1673	282	104	92	67	51	28
20	10018	新竹市	1300	664	156	241	23	145	62
21	10020	嘉義市	877	195	45	59	63	24	10
22	9020	金門縣	170	113	6	4	3	3	1
23	9007	連江縣	43	5	3	1	3	0	0

foreign_marriage.csv

台灣縣市外籍配偶統計



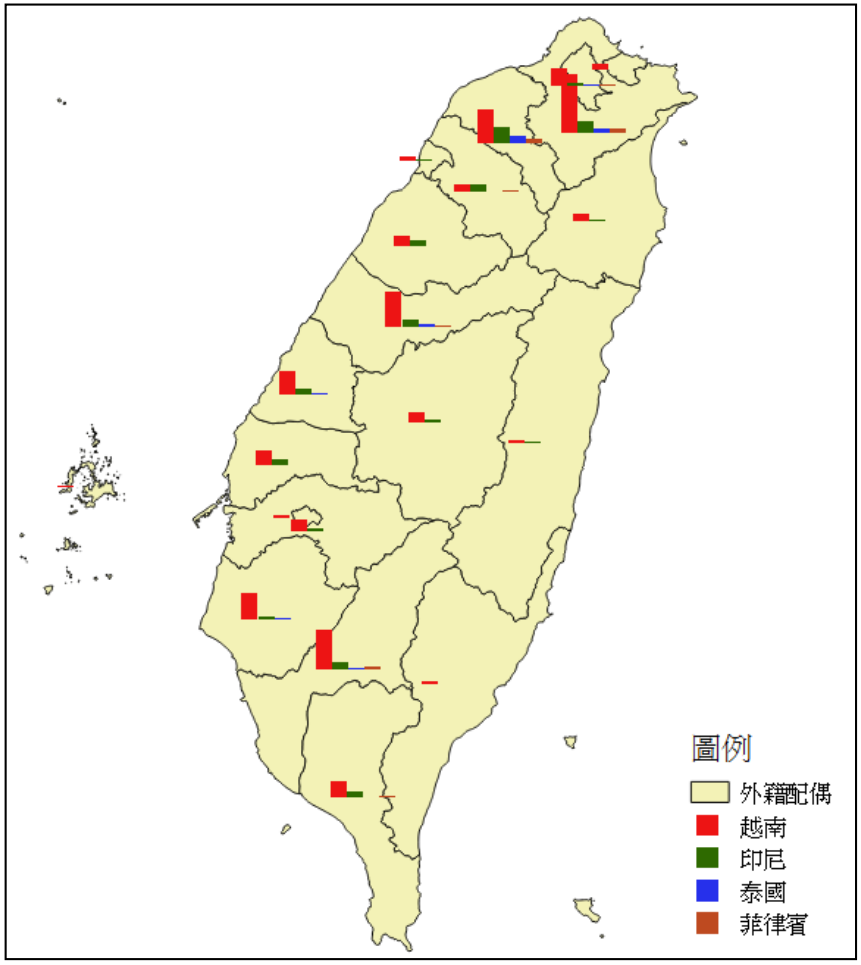
縣市統計的圖資

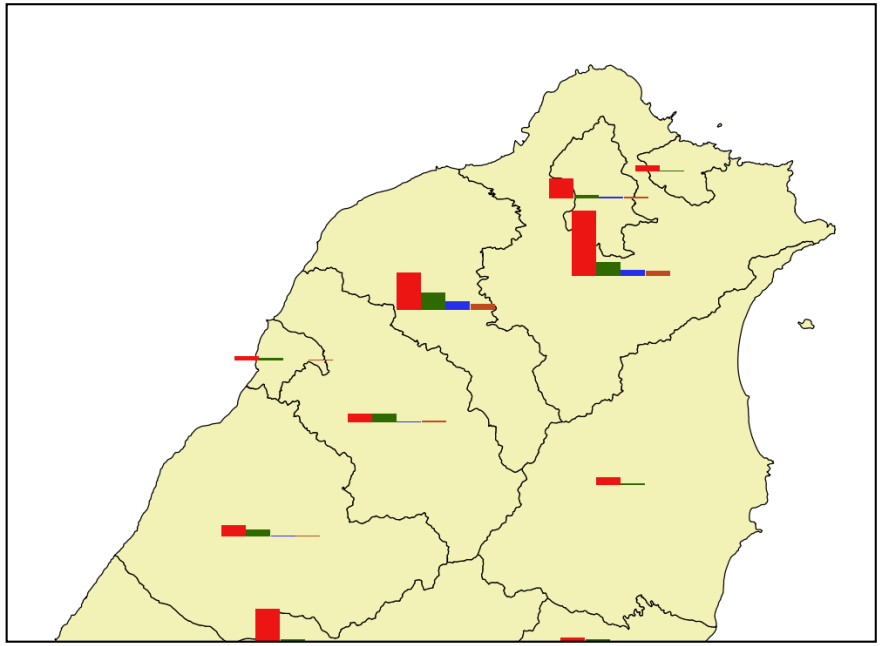
new :: Features total: 22, filtered: 22, selected: 0

	COUNTY_ID	COUNTY	Area	Child	Adult	Old	Total	_marriage_縣	ı_marriage_縣市	_marriage_越南	_marriage_印尼	_marriage_泰國	narriage_菲律賓
1	10016	澎湖縣	135.24	11486	76198	15569	103253	10016	澎湖縣	552	318	0	8
2	67000	臺南市	2258.81	236571	1389761	259500	1885832	67000	臺南市	7537	1064	500	405
3	10014	臺東縣	3581.85	27326	160416	33022	220764	10014	臺東縣	956	259	29	87
4	63000	臺北市	269.85	375128	1901446	418420	2694994	63000	臺北市	5177	1093	481	599
5	66000	臺中市	2239.79	409212	2056123	301663	2766998	66000	臺中市	9980	2242	832	791
6	10007	彰化縣	1244.54	175423	928761	182860	1287044	10007	彰化縣	6599	1723	484	380
7	10010	嘉義縣	1952.76	52919	370167	92176	515262	10010	嘉義縣	3613	1170	139	121
8	10020	嘉義市	59.72	38588	195018	36235	269841	10020	嘉義市	877	195	45	59
9	10004	新竹縣	1411.56	91690	391751	63973	547414	10004	新竹縣	2267	2410	313	524
10	10018	新竹市	124.39	76283	312913	48079	437275	10018	新竹市	1300	664	156	241
11	65000	新北市	2066.28	507423	3005876	465354	3978653	65000	新北市	16728	3578	1617	1448
12	10009	雲林縣	1399.58	84610	491499	118693	694802	10009	雲林縣	4119	1803	214	155
13	10017	基隆市	137.57	40508	279643	51870	372021	10017	基隆市	1673	282	104	92
14	64000	高雄市	2995.07	343793	2061974	373392	2779159	64000	高雄市	11174	2065	629	867
15	68000	桃園市	1217.21	329307	1599031	219195	2147533	68000	桃園市	9697	4625	2268	1585
16	10005	苗栗縣	1826.69	76178	400240	82692	559110	10005	苗栗縣	2884	1868	255	249
17	10013	屏東縣	2805.06	93786	614990	126936	835712	10013	屏東縣	4687	1709	202	786
18	10008	南投縣	4097.76	58294	366734	80078	505106	10008	南投縣	3166	903	172	114
19	10015	花蓮縣	4605.70	41252	241010	48584	330846	10015	花蓮縣	1068	526	66	66
20	10002	宜蘭縣	2201.43	56836	332894	67737	457467	10002	宜蘭縣	2179	449	118	88

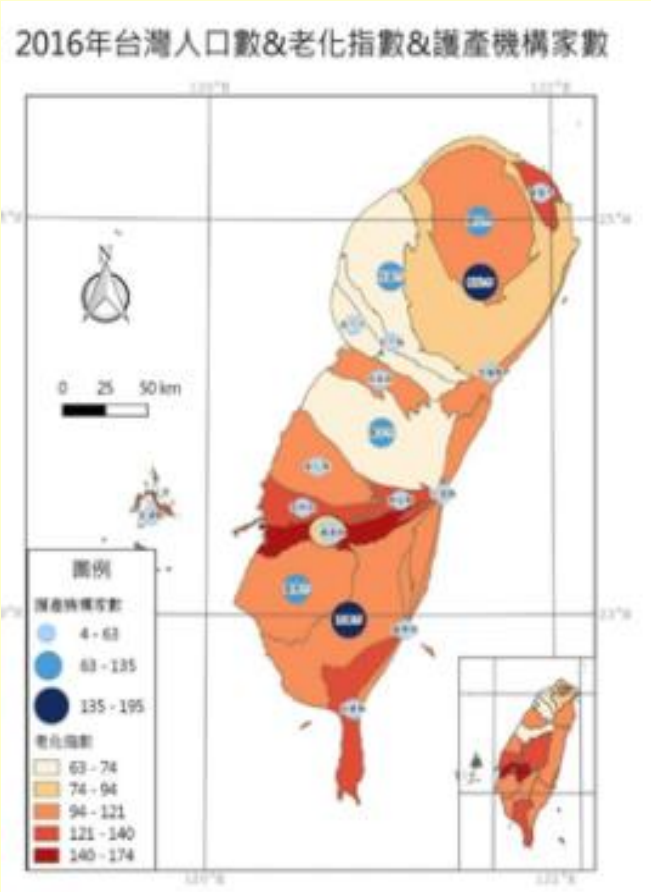
Show All Features

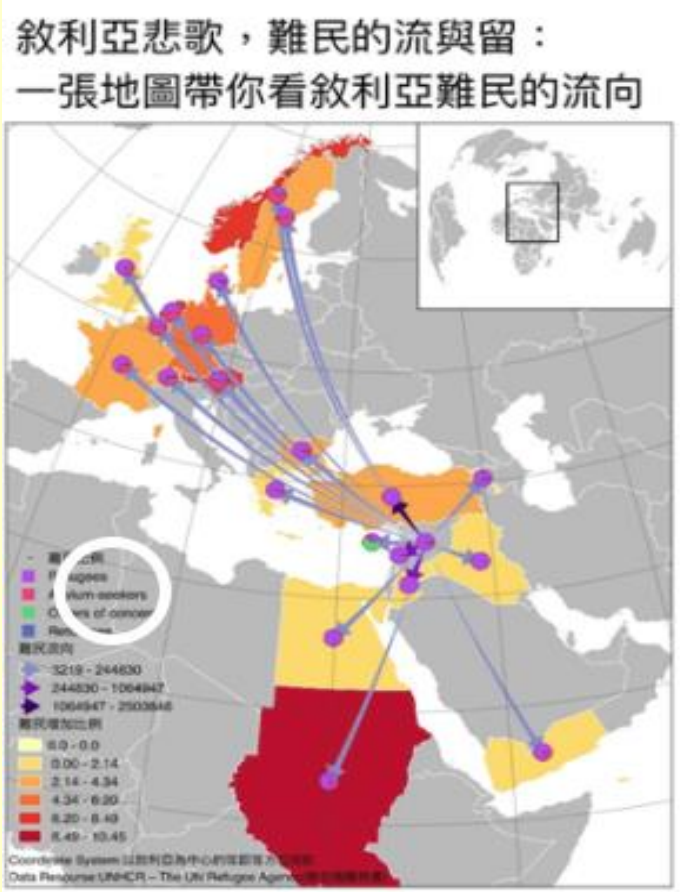
地圖實作 (預期成果)：統計地圖 (data join)



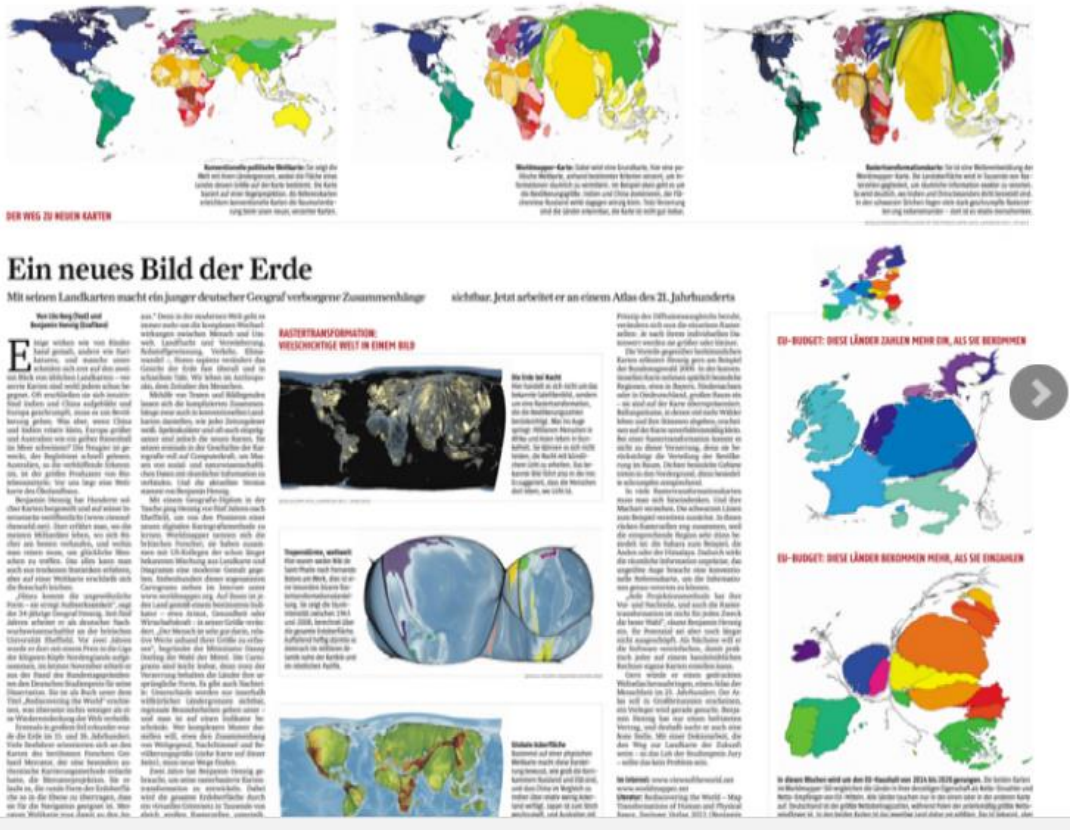


2/16 下午課程：面積變形圖與流動地圖





WORLD MAPPER



DER WEG ZU NEUEN KARTEN

Ein neues Bild der Erde

Mit seinen Landkarten macht ein junger deutscher Geograf verborgene Zusammenhänge sichtbar. Jetzt arbeitet er an einem Atlas des 21. Jahrhunderts

RASTERTRANSFORMATION: VIELSCHICHTIGE WELT IN EINEM BILD

EU-BUDGET: DIESE LÄNDER ZAHLEN MEHR EIN, ALS SIE BEKOMMEN

EU-BUDGET: DIESE LÄNDER BEKOMMEN MEHR, ALS SIE EINZAHLEN

Tropische Stürme

Die Karte zeigt das Auftreten von tropischen Wirbelstürmen in Relation zur Bevölkerungsdichte. Am stärksten betroffen sind Menschen in Nordamerika und in weiten Teilen Südostasiens

Die Neuvermessung der Welt

Eine neue Kartografierungs-Methode kann selbst komplexe Zusammenhänge visualisieren

Weltbevölkerung

Große Teile Asiens weisen eine hohe Bevölkerungsdichte auf und sind dementsprechend groß in der Weltkarte dargestellt. Das dünn besiedelte Sibirien hingegen ist nur ein schmaler Streifen

Die Erde bei Nacht

Die nächtliche Satellitenaufnahme zeigt die Bevölkerungsdichte und das Licht, das von den Ballungszentren ausgeht

VON MICHAEL HEINE

Wer erinnert sich nicht an die guten alten Schuladanten mit ihren holzschnittartigen Weltkarten? Bodenschätze waren mit farbigen Symbolen gekennzeichnet und die Bevölkerungszahlen oder Niederschläge wurden lediglich durch unterschiedliche große Balken visualisiert.

Kürzlich können Schüler mit Kartenmaterial arbeiten, das weitaus detaillierter ist. Mittels der sogenannten Rastertransformationskartografie werden geografische und auch sozialwissenschaftliche Inhalte schlüssig dargestellt. Entwickelt hat sie Benjamin Hennig: Der in Sheffield forschende deutsche Geograf wurde für seine Innovati-

http://www.worldmapper.limited/

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地理計算科學 研究室
Laboratory for Geospatial Computational Science
NTU Geography

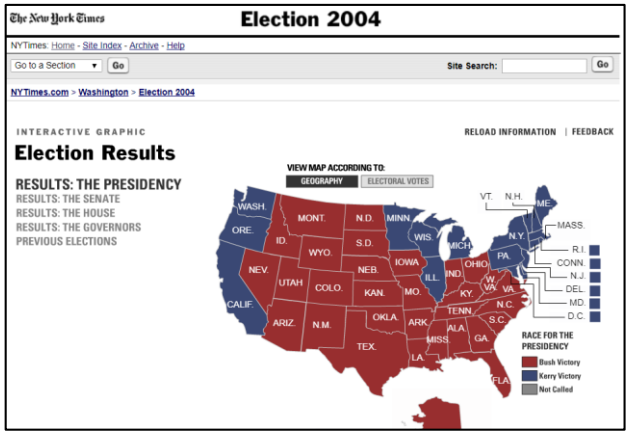
The New York Times

INTERACTIVE GRAPHIC

Election Results

RESULTS: THE PRESIDENCY

RESULTS: THE SENATE
RESULTS: THE HOUSE
RESULTS: THE GOVERNORS
PREVIOUS ELECTIONS



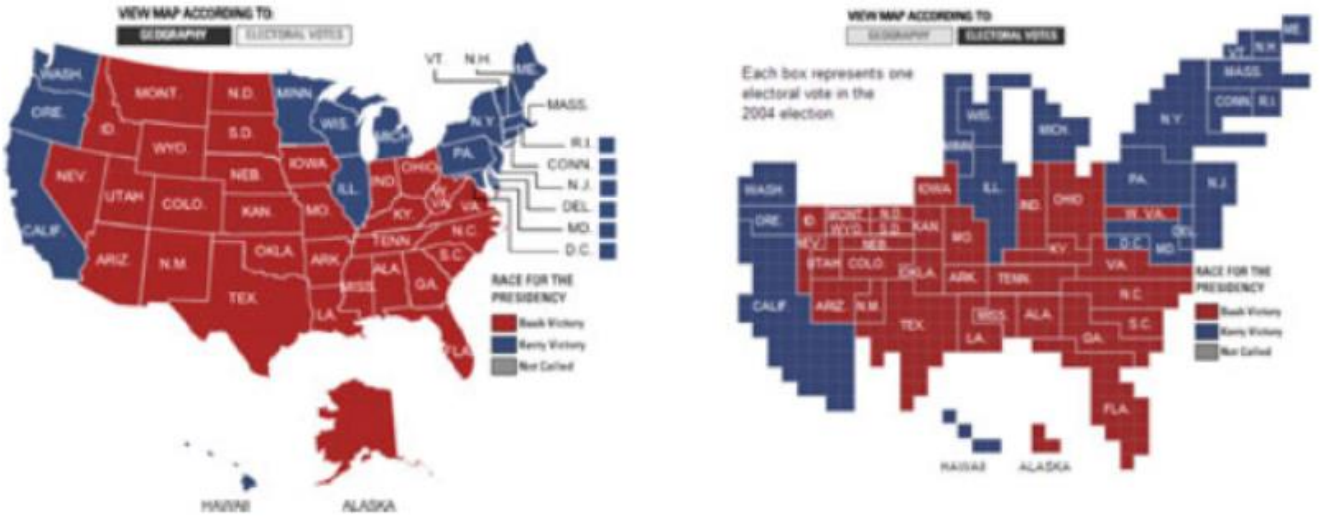


Fig. 1. Geographic map and a cartogram for the 2004 US election [1].

http://www.nytimes.com/packages/html/politics/2004_ELECTIONRESULTS_GRAPHIC/

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面積變形地圖 Cartogram

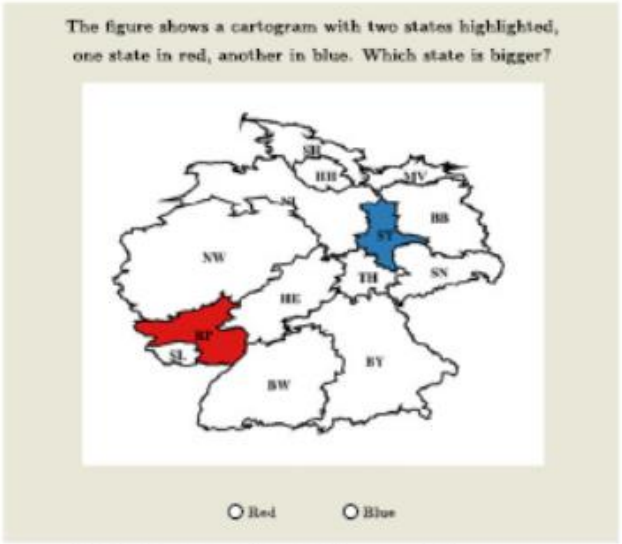
IEEE TRANSACTIONS ON VISUALIZATION AND COMPUTER GRAPHICS, VOL. 24, NO. 2, FEBRUARY 2018

Evaluating Cartogram Effectiveness

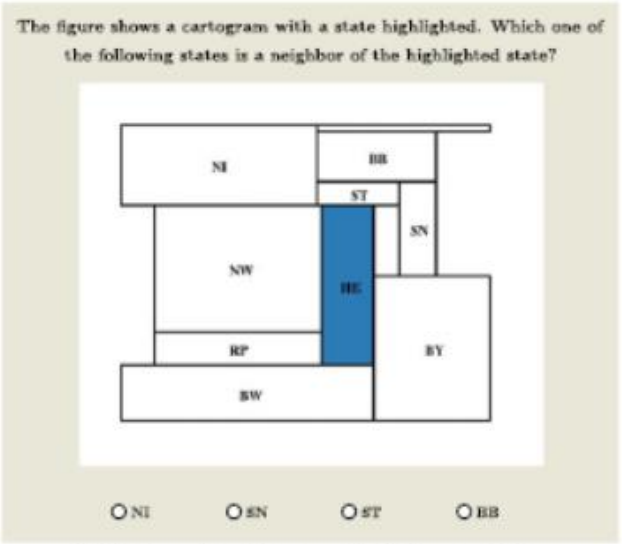
Sabrina Nusrat, Md. Jawaherul Alam, and Stephen Kobourov

Abstract—Cartograms are maps in which areas of geographic regions, such as countries and states, appear in proportion to some variable of interest, such as population or income. Cartograms are popular visualizations for geo-referenced data that have been used for over a century to illustrate patterns and trends in the world around us. Despite the popularity of cartograms, and the large number of cartogram types, there are few studies evaluating the effectiveness of cartograms in conveying information. Based on a recent task taxonomy for cartograms, we evaluate four major types of cartograms: contiguous, non-contiguous, rectangular, and Dorling cartograms. We first evaluate the effectiveness of these cartogram types by quantitative performance analysis (time and error). Second, we collect qualitative data with an attitude study and by analyzing subjective preferences. Third, we compare the quantitative and qualitative results with the results of a metrics-based cartogram evaluation. Fourth, we analyze the results of our study in the context of cartography, geography, visual perception, and demography. Finally, we consider implications for design and possible improvements.

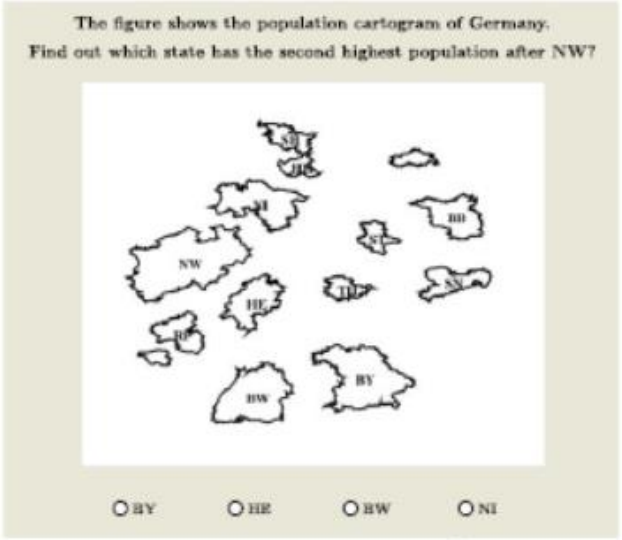
Index Terms—Cartograms, geo-visualization, subjective evaluation



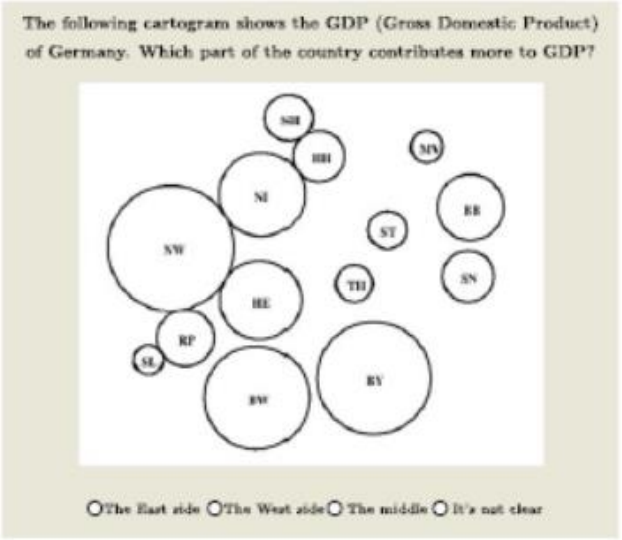
(a) Contiguous cartogram, *Compare* task



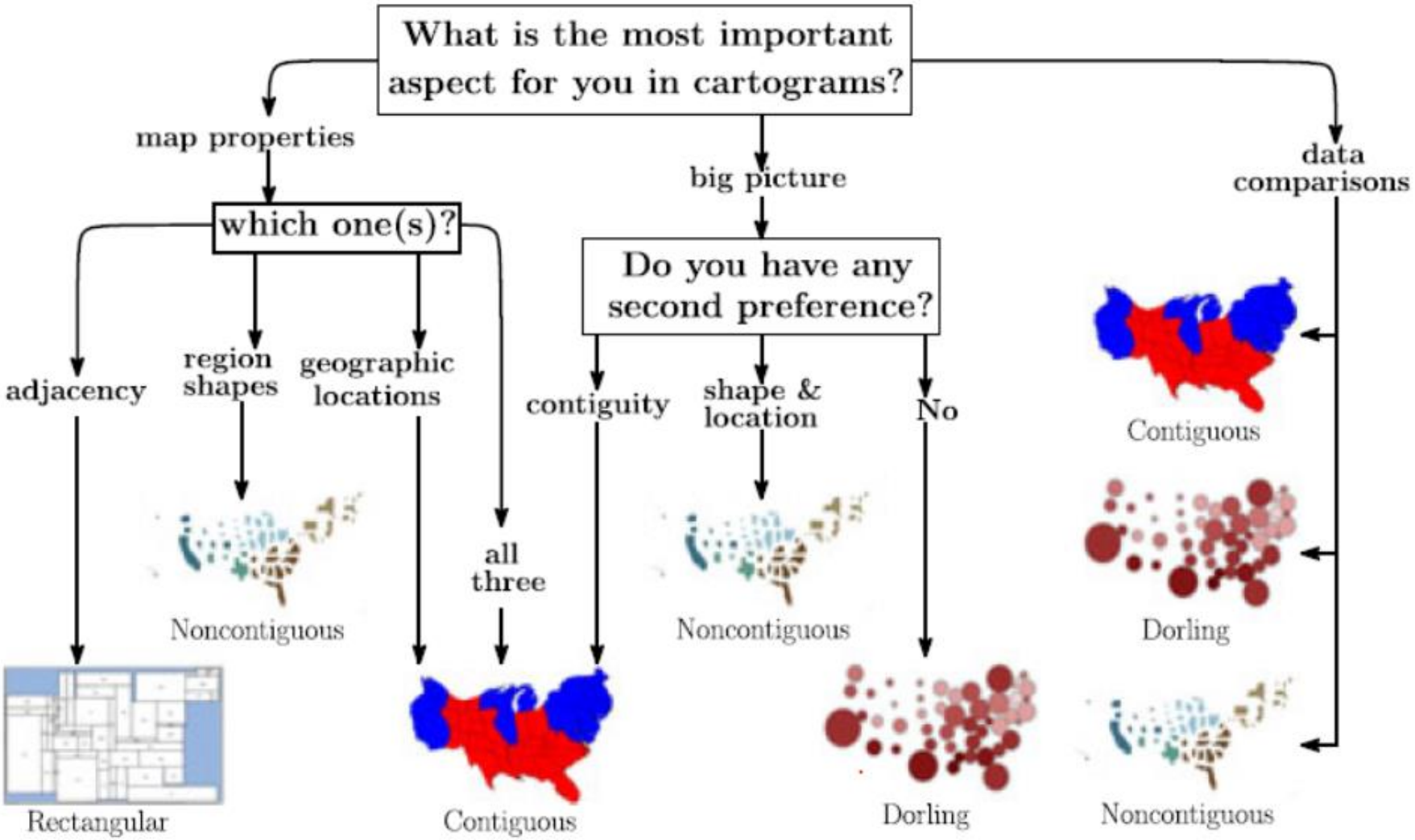
(b) Rectangular cartogram, *Find adjacency* task



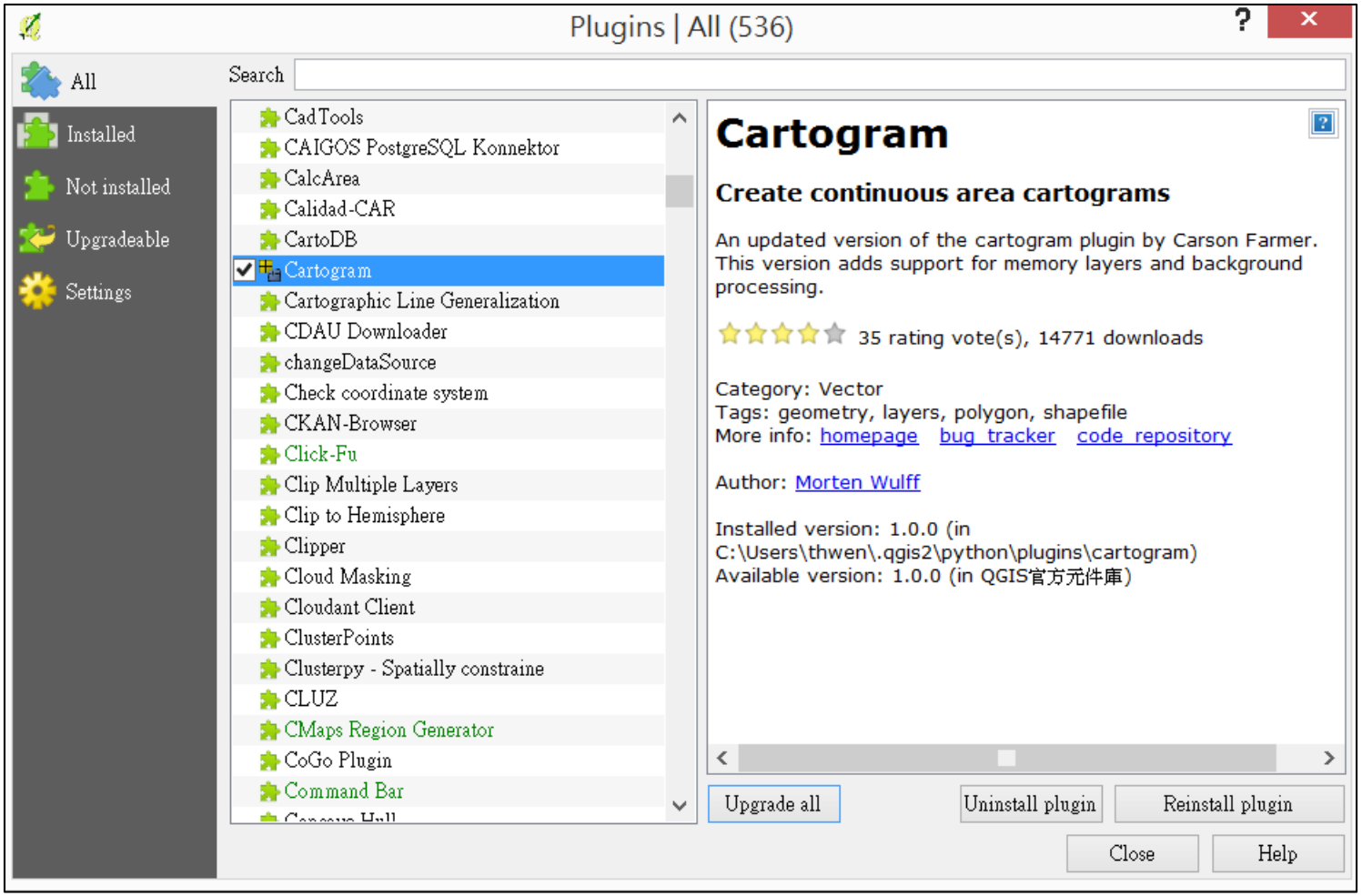
(c) Non-contiguous cartogram, *Find top-k* task



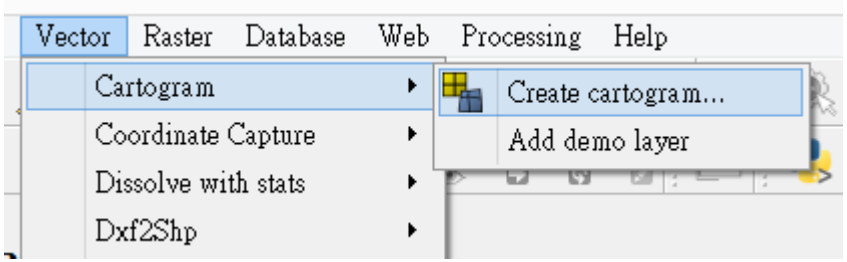
(d) Dorling cartogram, *Summarize* task

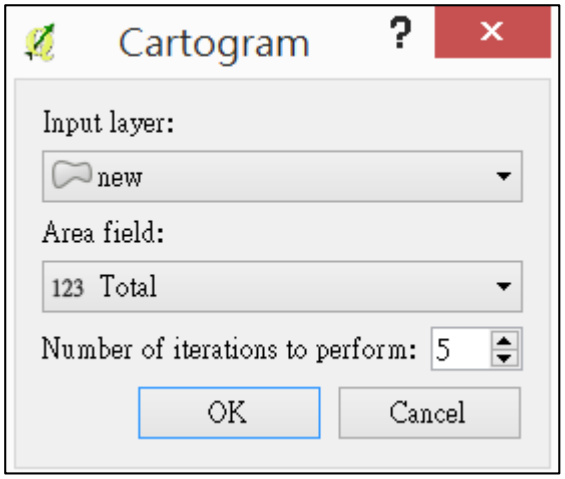


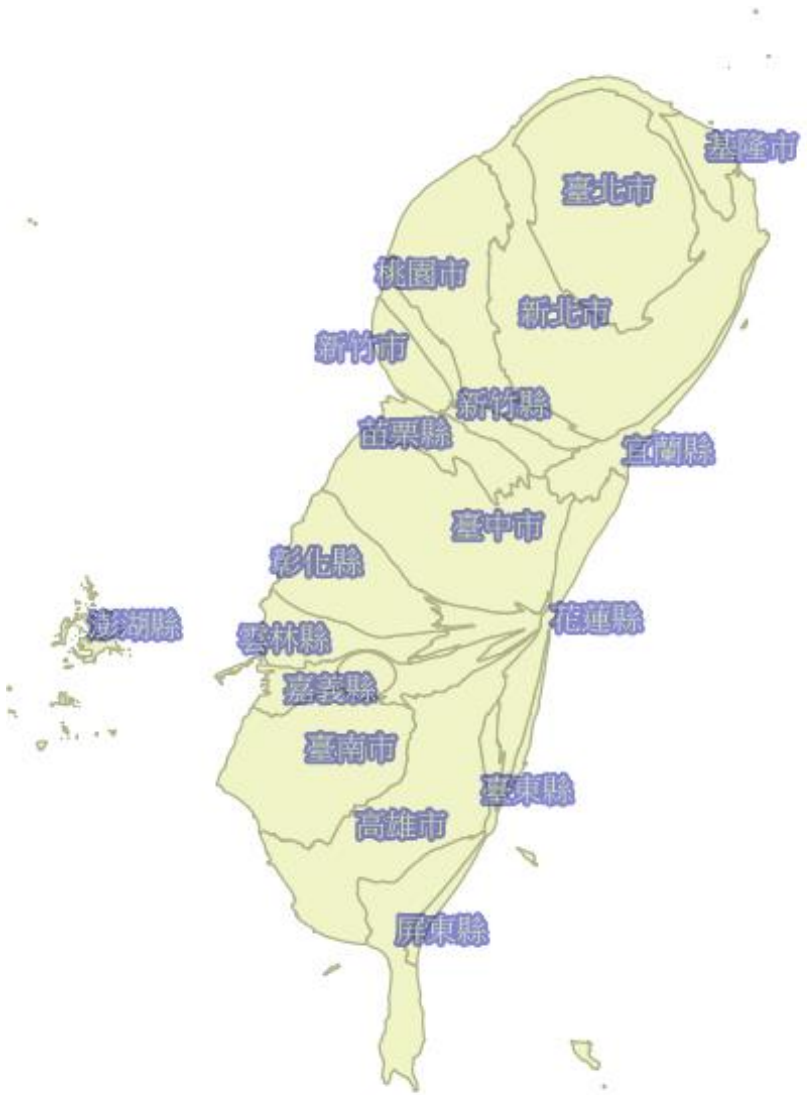
安裝QGIS套件： Cartogram



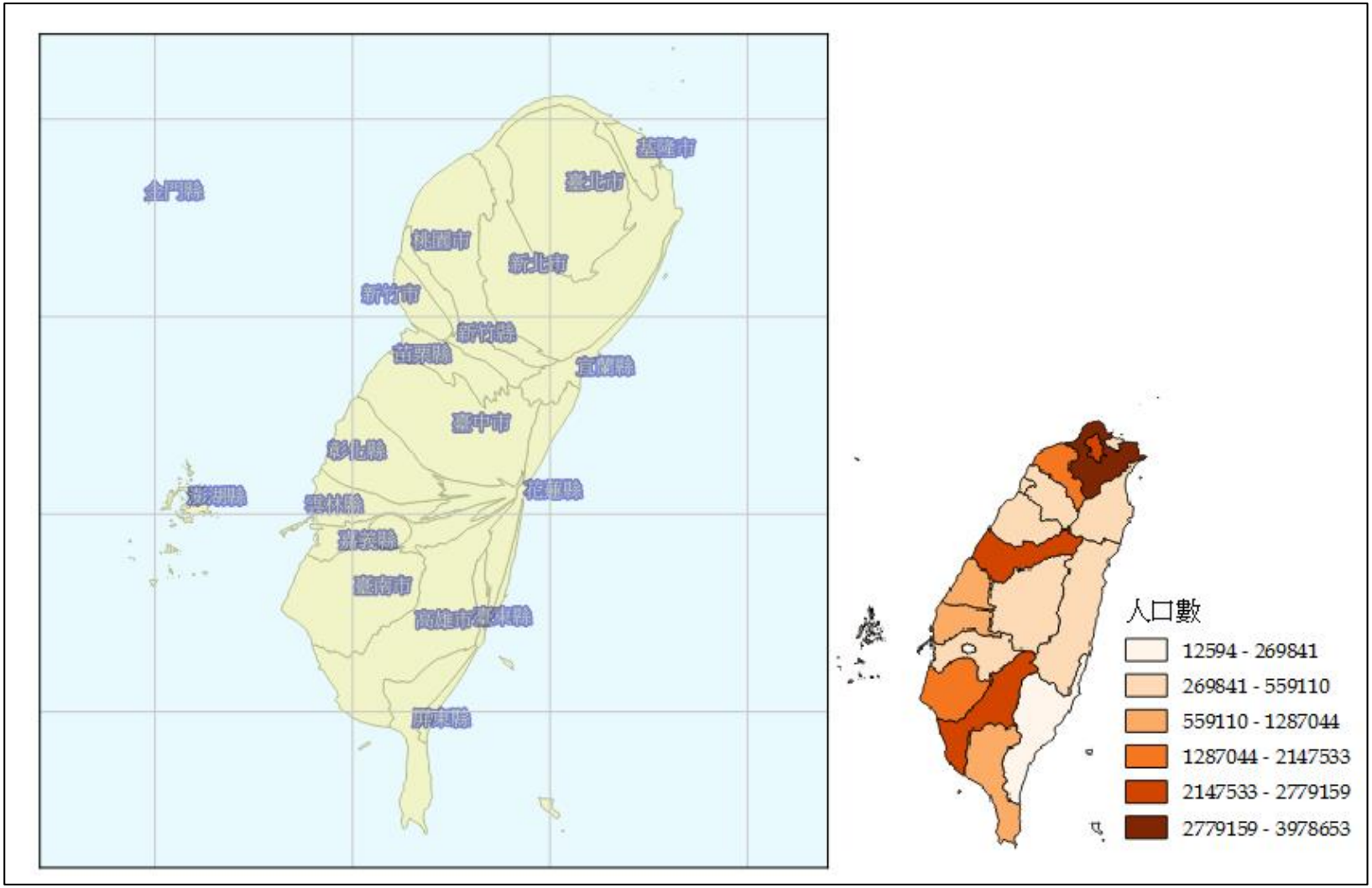
Cartogram in QGIS



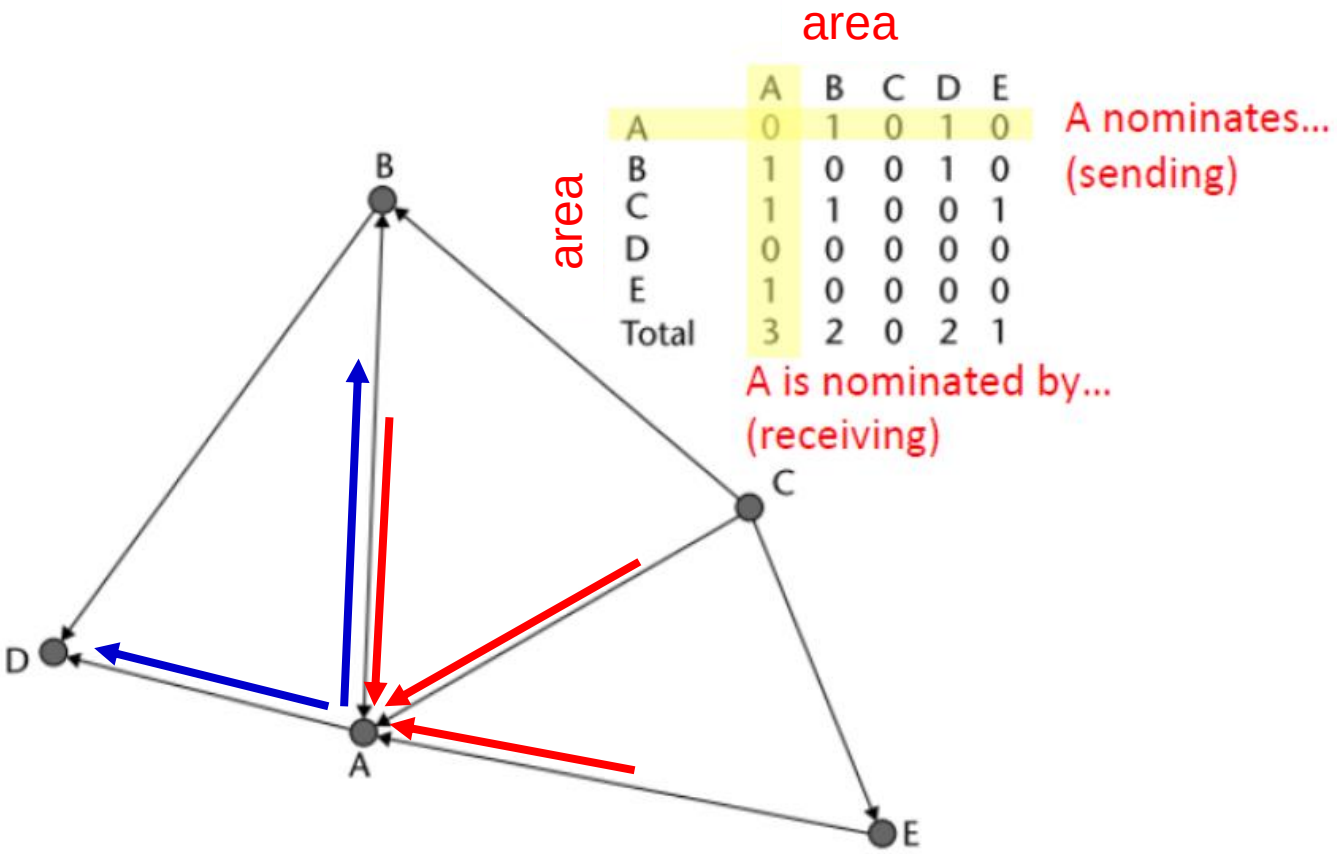




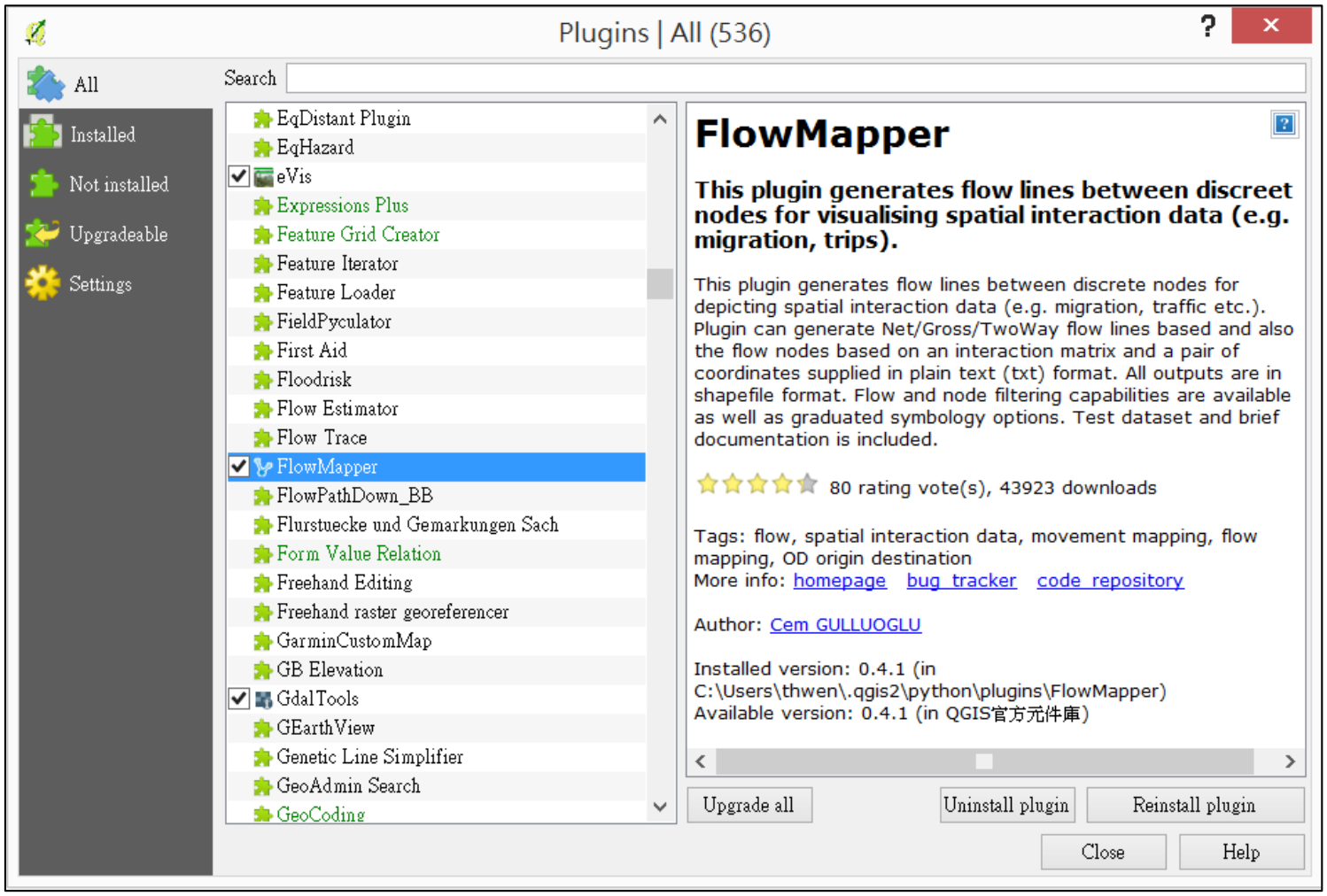
地圖實作 (預期成果)：Cartogram



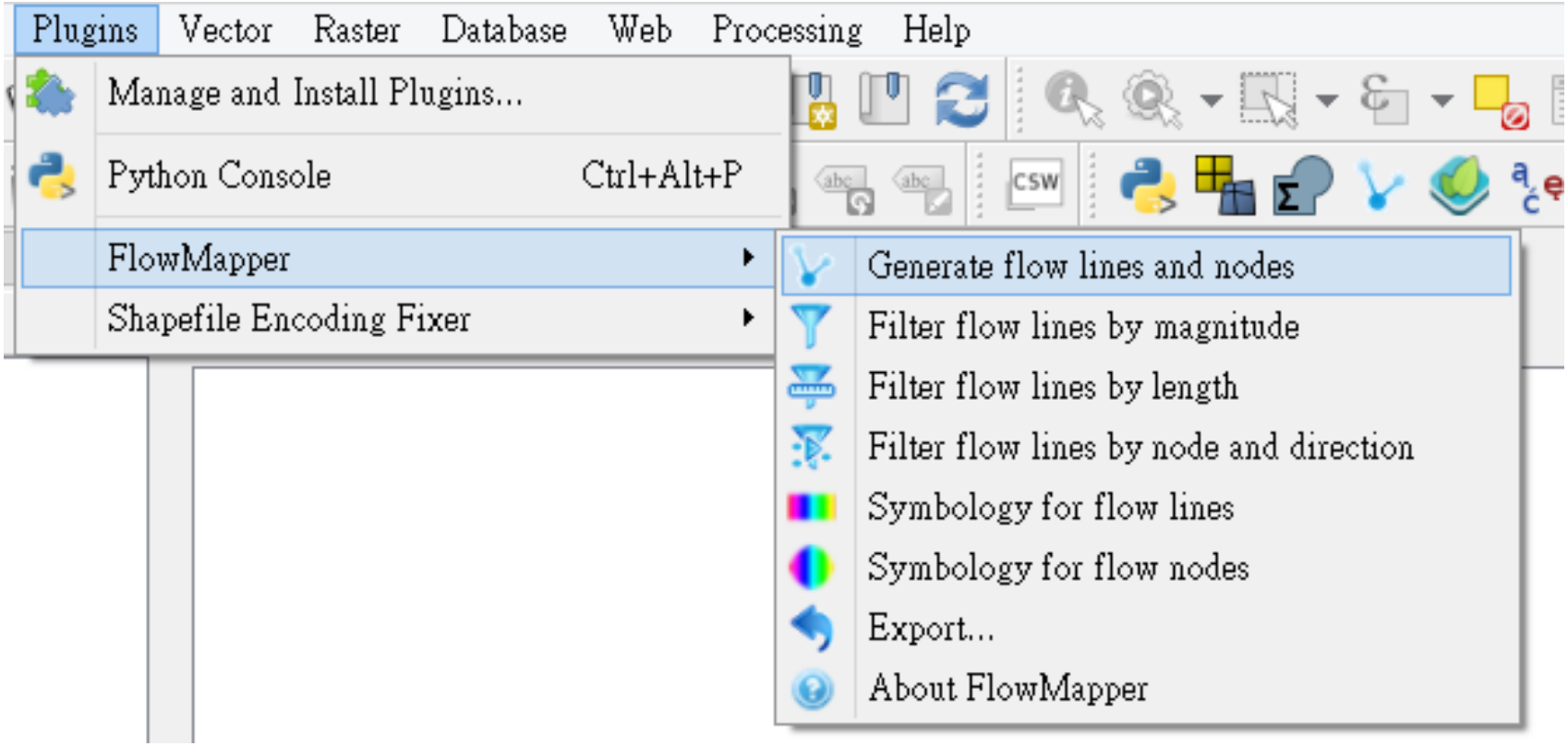
流動地圖的基本概念

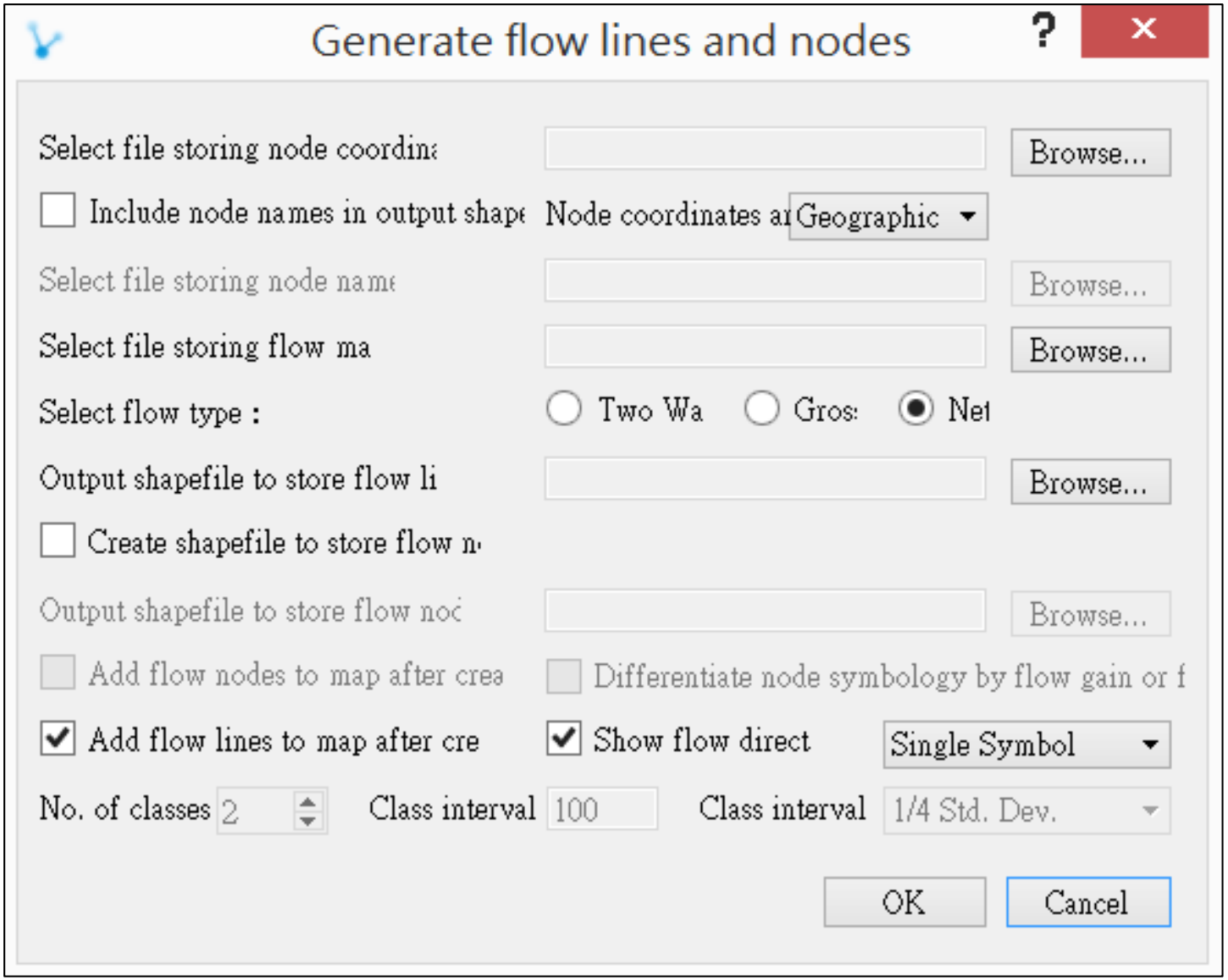


安裝QGIS套件： FlowMapper

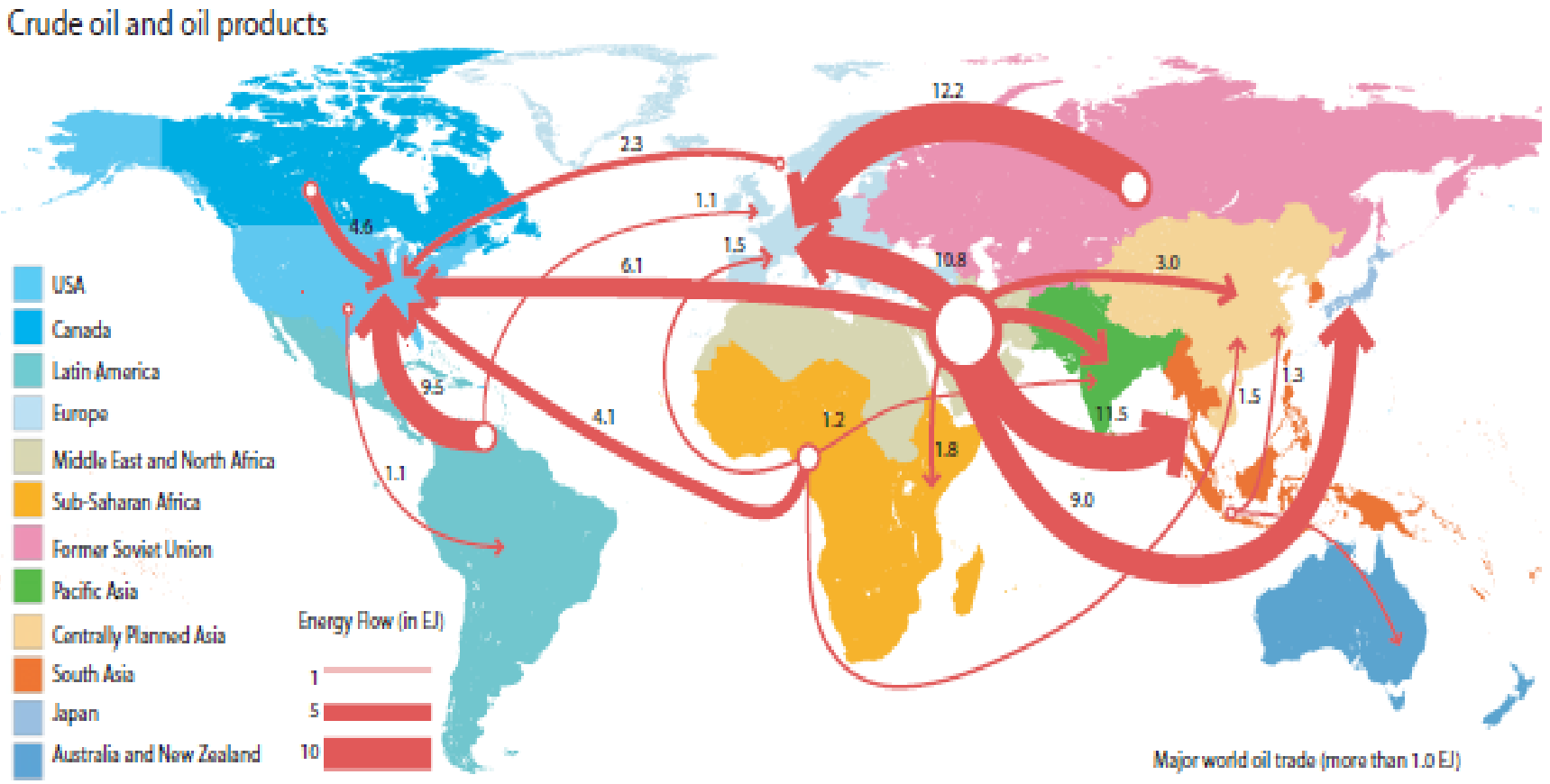


Generating flow lines in QGIS





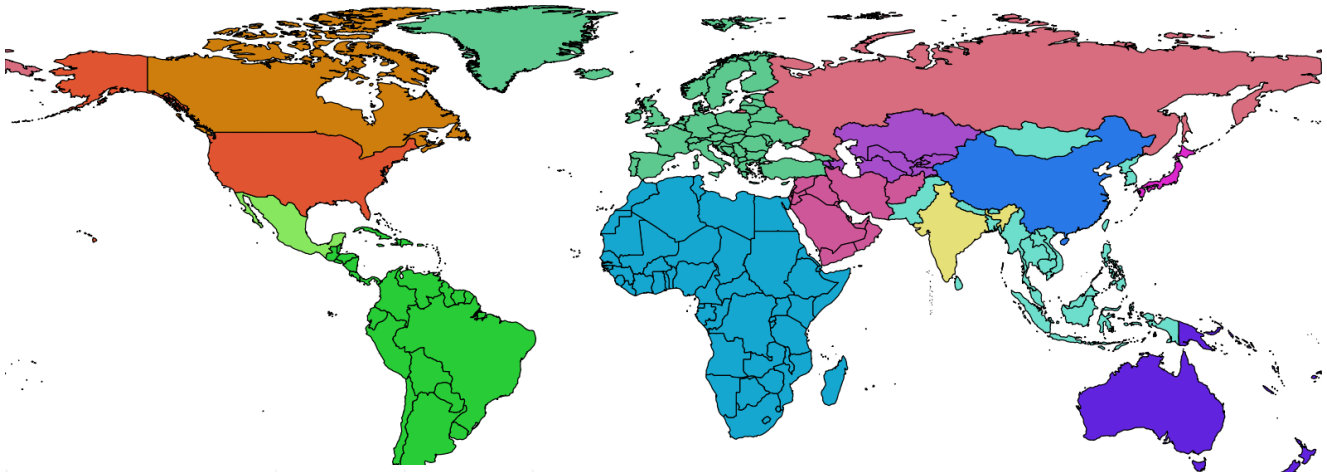
International Crude Oil Flow



Flow Data: nodes

country.shp

世界國家邊界



CrudeFlow2015.xlsx

國際原油交易

	A	B	C	D
	ID	Name	X	Y
Africa	1	US	-112.492	45.69558
Australasia	2	Canada	-98.2655	61.39204
Canada	3	Mexico	-102.533	23.95046
China	4	S. & Cent. America	-61.648	-13.9701
Europe	5	Europe	-7.88424	61.55354
India	6	Russia	96.69193	61.98838
Japan	7	Other CIS	65.98129	45.77121
Mexico	8	Middle East	50.36606	28.20909
Middle East	9	Africa	18.28737	6.41873
Other Asia Pacific	10	Australasia	136.5631	-25.3071
Other CIS	11	China	103.8342	36.56309
Russia	12	India	79.61623	22.8836
S. & Cent. America	13	Japan	137.9907	37.56216
Singapore	14	Singapore	103.8081	1.35162
US	15	Other Asia Pacific	102.7787	22.67643

Flow Data: links

CrudeFlow2015.xlsx

國際原油交易

單位：百萬噸

	US	Canada	Mexico	S. & Cent.	Europe	Russia	Other CIS	Middle East	Africa	Australasia	China	India	Japan	Singapore	Other Asia
US	0	21	0	0.4	1.8	0	0	0.2	0.3	0.05	0.1	0.05	0	0.1	0.4
Canada	157.8	0	0.05	0.05	1.4	0	0	0	0	0	0.1	0.05	0	0.05	0
Mexico	34.3	0	0	0.4	13.7	0	0	0	0	0	41.7	29.2	3.2	0.1	3.2
S. & Cent. America	79.7	0.6	0	0	14.6	0.05	0	0	0	0	41.7	29.2	3.2	0.1	3.2
Europe	1.3	0.8	0	1.2	0	0.05	0.05	0.05	0.4	0.05	2.1	0.7	0	0.05	3.6
Russia	1.4	0	0	0.9	158.5	0	23.2	0.2	0.9	1.6	42.4	0.1	14.2	0.9	10.3
Other CIS	0.7	0.6	0	0	56	2.9	0	6.6	0.7	0	5.3	1.4	1	0.1	5.8
Middle East	74.1	4.1	0	4.9	108.3	0.05	0	0	12.9	6.3	170.4	114.5	139.7	37.5	206.9
Africa	14	5.5	0	11.9	133.75	0	0	0.3	0	2.4	64.5	37.3	1	0.3	14.6
Australasia	0.5	0	0	0.4	0.05	0	0	0.05	0.05	0	2.4	0.05	0.05	0.9	5
China	0	0	0	0.05	0	0	0	0.4	0.05	0.05	0	0.4	1.5	0.05	0.4
India	0.1	0	0	0.05	0.05	0	0	0	0	0.1	0	0	0	0.05	0.05
Japan	0	0	0	0	0	0	0	0	0	0.05	0.05	0.3	0	0.05	0.05
Singapore	0	0	0	0	0	0	0	0	0	0.05	0.05	0	0	0	0.1
Other Asia Pacific	2.2	0	0	0.05	0.05	0	0	0.1	0	14.1	5.9	4.9	4.9	5.8	0

Data Preparation: Node and Link files

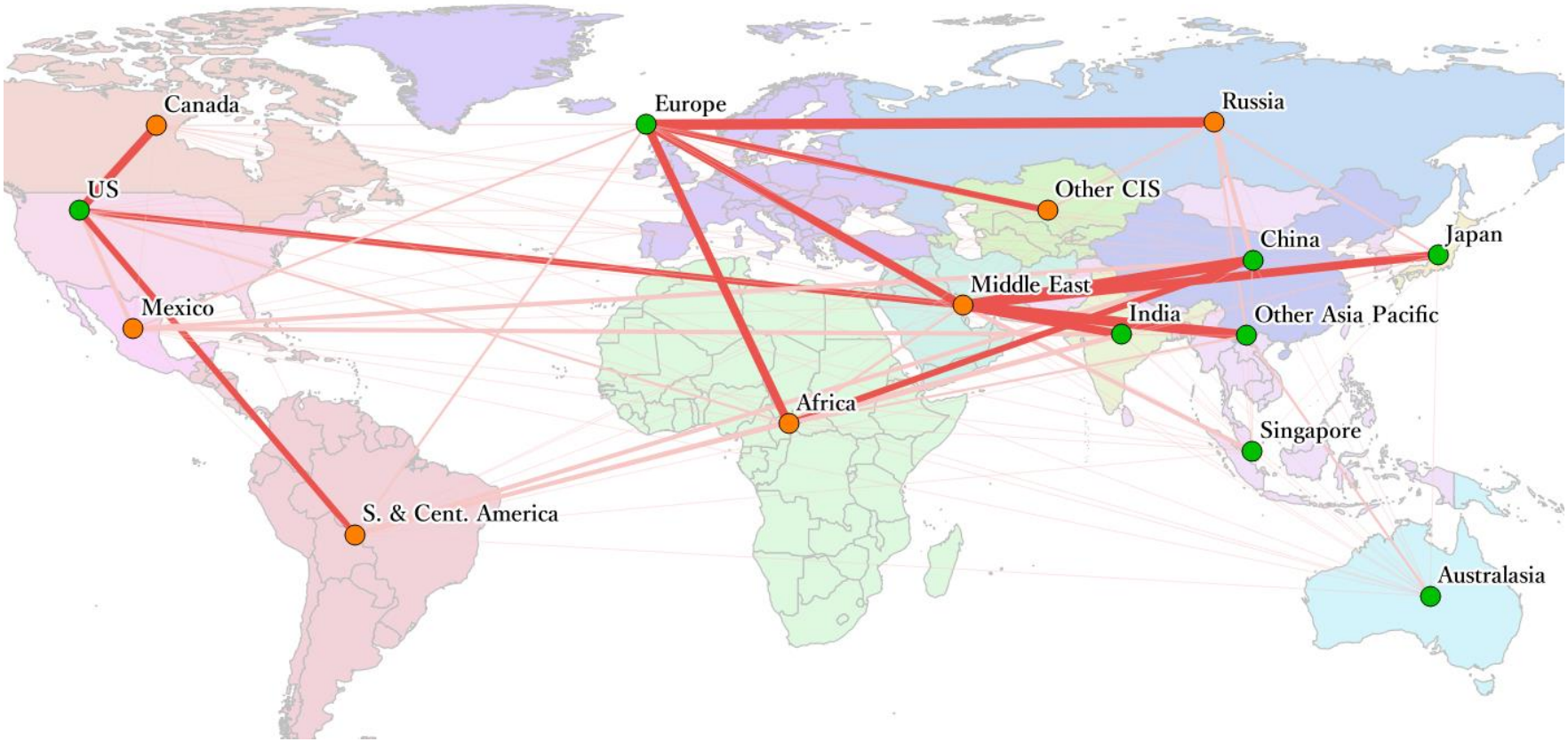
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

-112.49152	45.69558
-98.26545	61.39204
-102.53287	23.95046
-61.64801	-13.97012
-7.88424	61.55354
96.69193	61.98838
65.98129	45.77121
50.36606	28.20909
18.28737	6.41873
136.56306	-25.3071
103.8342	36.56309
79.61623	22.8836
137.99074	37.56216
103.80805	1.35162
102.77869	22.67643

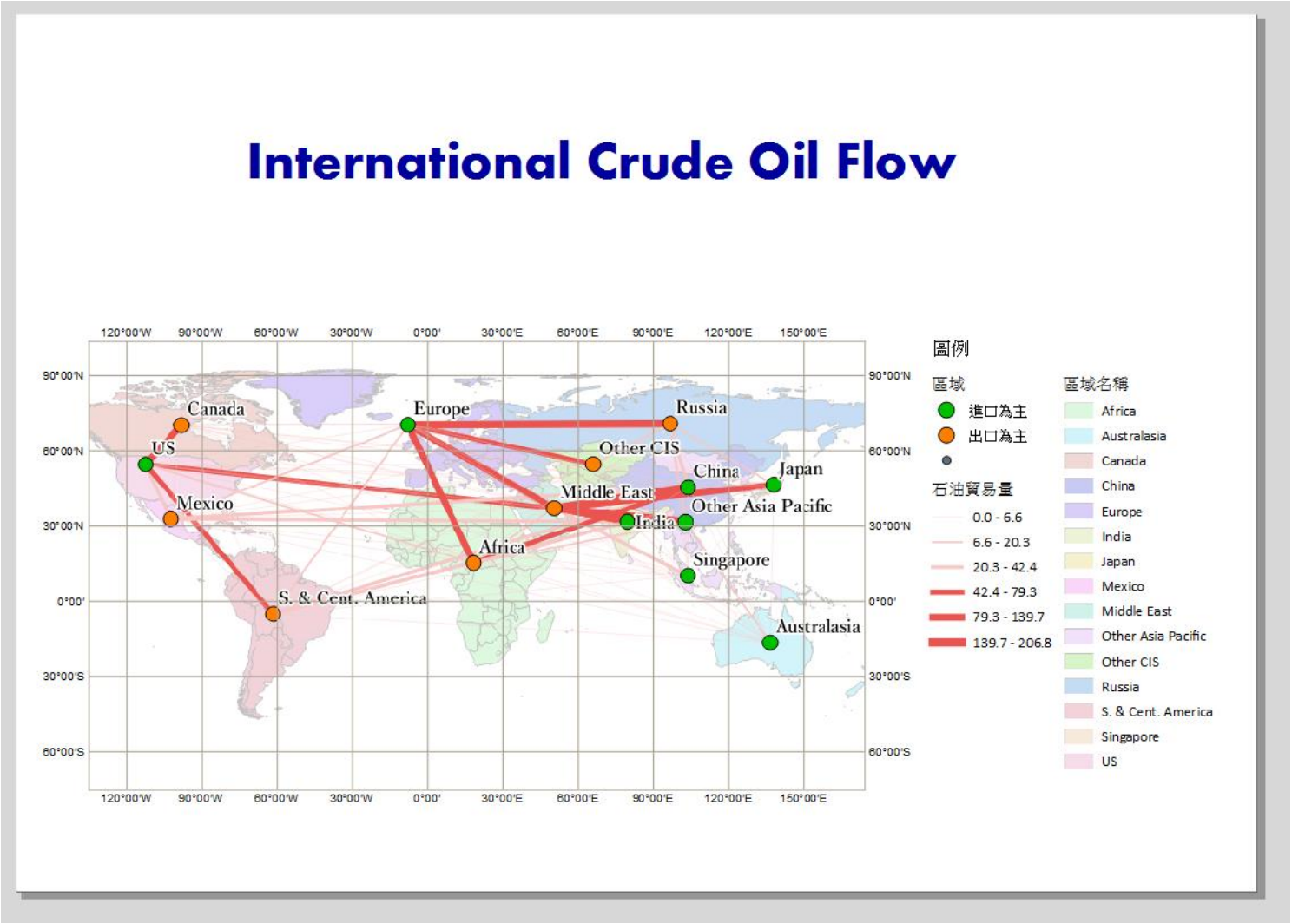
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)

0	21	0	0.4	1.8	0	0	0.2	0.3
157.8	0	0.05	0.05	1.4	0	0	0	0
34.3	0	0	0.4	13.7	0	0	0	0
79.7	0.6	0	0	14.6	0.05	0	0	0
1.3	0.8	0	1.2	0	0.05	0.05	0.05	0.4
1.4	0	0	0.9	158.5	0	23.2	0.2	0.9
0.7	0.6	0	0	56	2.9	0	6.6	0.7
74.1	4.1	0	4.9	108.3	0.05	0	0	12.9
14	5.5	0	11.9	133.75	0	0	0.3	0
0.5	0	0	0.4	0.05	0	0	0.05	0.05
0	0	0	0.05	0	0	0	0.4	0.05
0.1	0	0	0.05	0.05	0	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
2.2	0	0	0.05	0.05	0	0	0.1	0

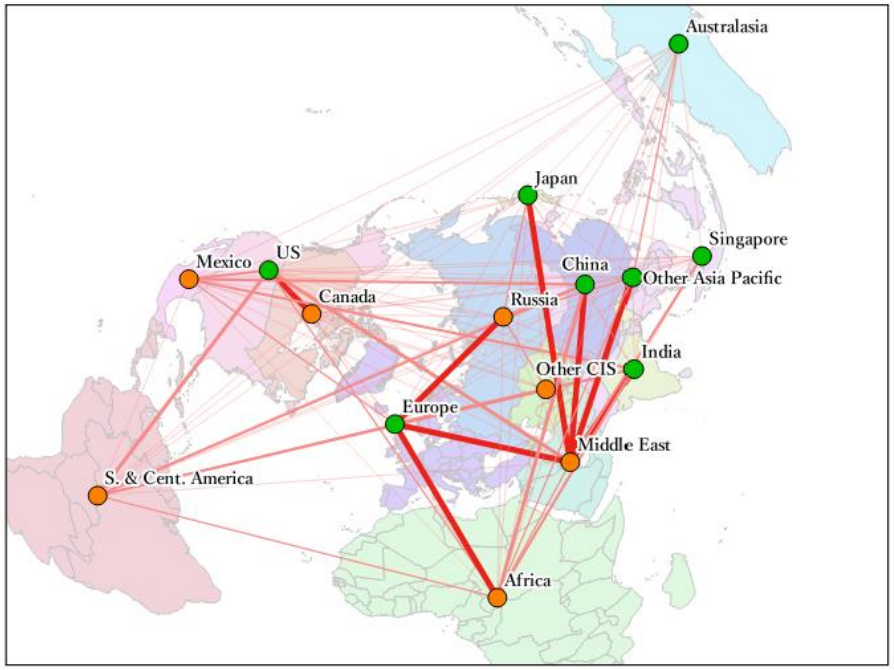
Flow Mapping



地圖實作 (預期成果)：Flow Mapping



地圖實作 (預期成果)：Flow Mapping (等距方位投影)



UN Logo

Review

- 點子圖 Dot Map (reflecting density)
- 面量圖 Shaded Map (graduated color)
- 泡泡圖 Bubble Map (graduated size)
- 統計地圖：圓餅圖與長條圖 Pie Chart vs. Bar Char Maps
- 面積變形地圖 Cartogram
- 流動地圖 Flow map

January 15-16, 2018

That's all for 2-day QGIS workshop;

Thanks for participation in the workshop.

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國立台灣大學地理環境資源學系

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NTU Geography