



국토지리정보원

National Geographic
Information Institute



이상일 (서울대학교 지리교육과)
<https://sangillee.snu.ac.kr/>

공간사이언스 입문

2025년 8월 1일

소개

- ▶ 서울대학교 지리교육과 교수

- ▶ <https://sangillee.snu.ac.kr/>

- ▶ 공간데이터사이언스

- ▶ 겸임

- ▶ 서울대학교 **AI**융합교육학과 겸임 교수

- ▶ 서울대학교 데이터사이언스대학원 융합전공
응용데이터사이언스 겸임 교수

- ▶ 서울대학교 학습과학연구소 **AI**기반교육연구센터 겸임연구원



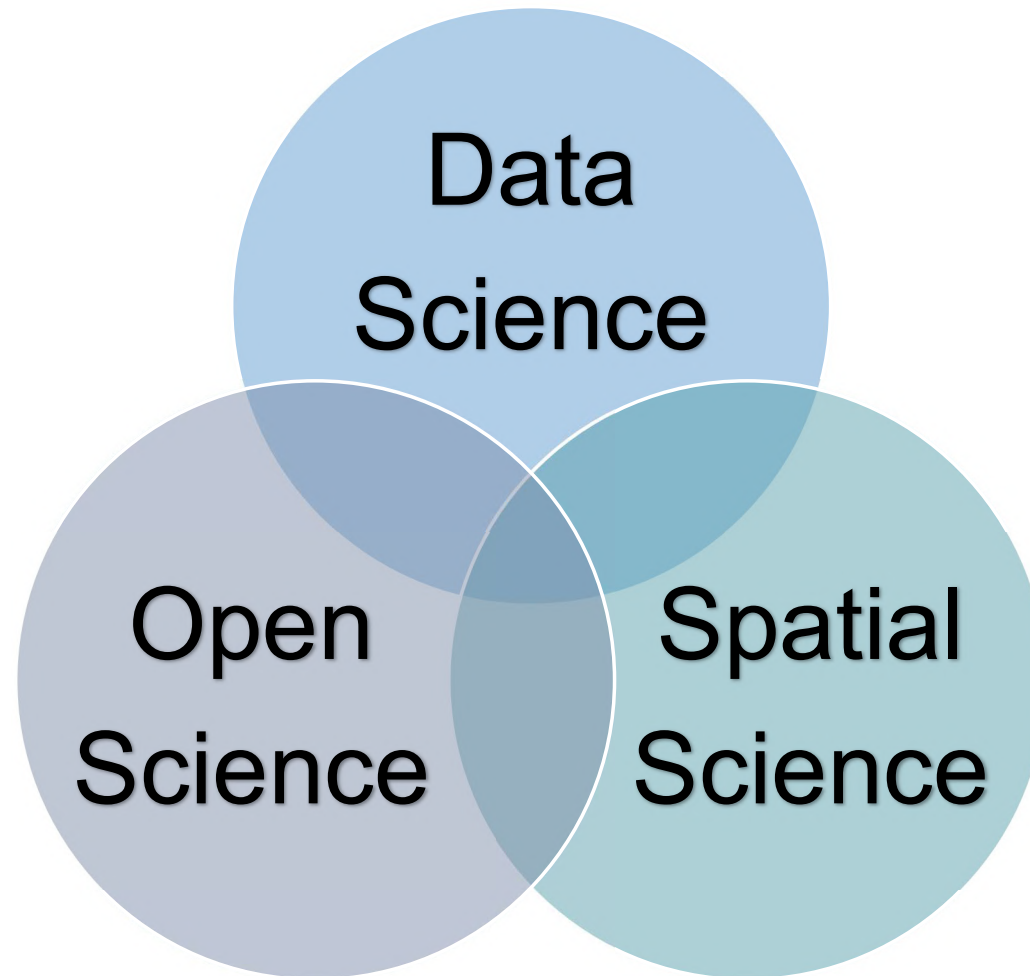
AI · 디지털 전환과 세 가지 사이언스의 융합

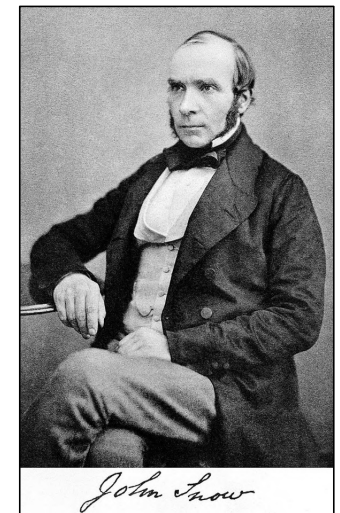
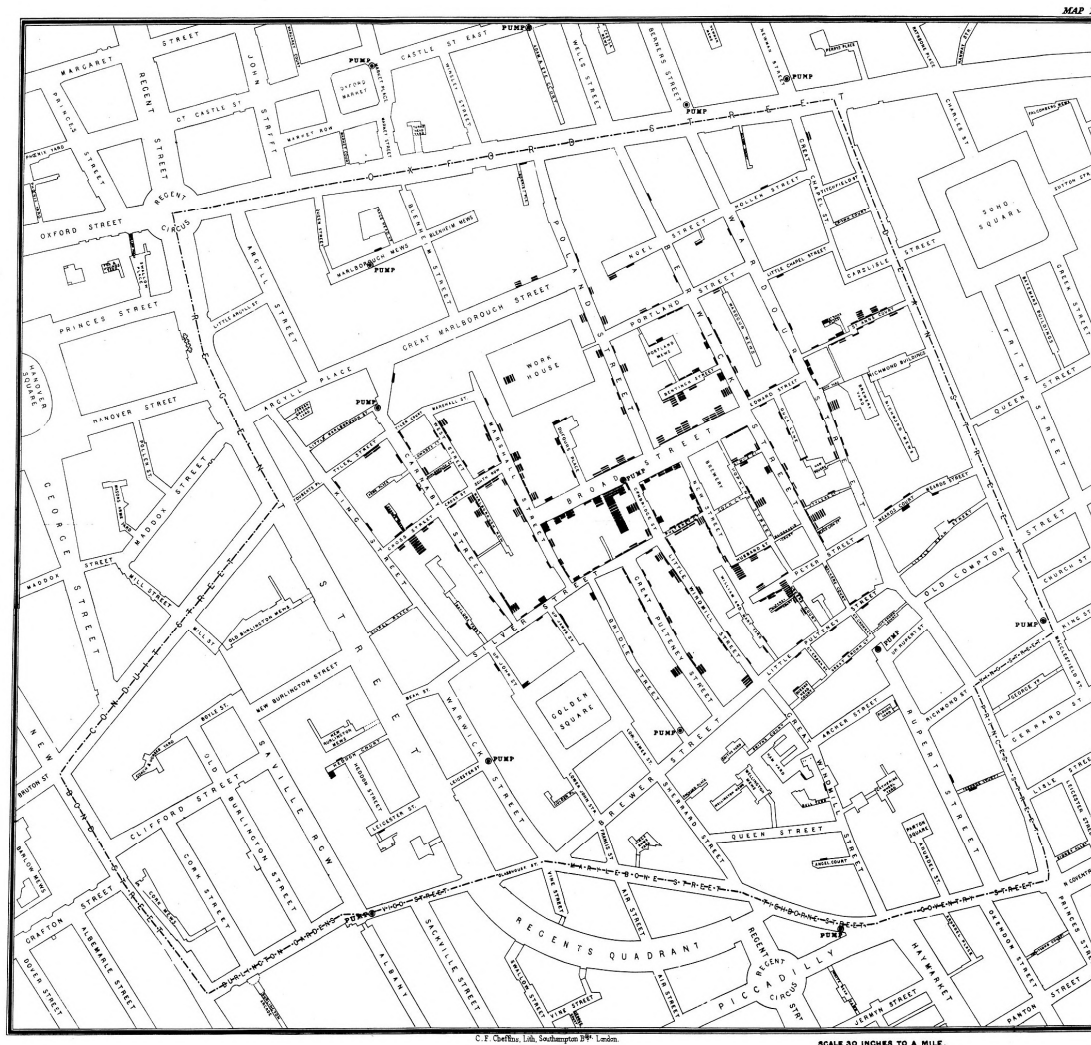




Google







존 스노
John Snow
(1813~1858)

Total deaths 1  15



Data source: Dr. Robin Wilson, ArcGIS

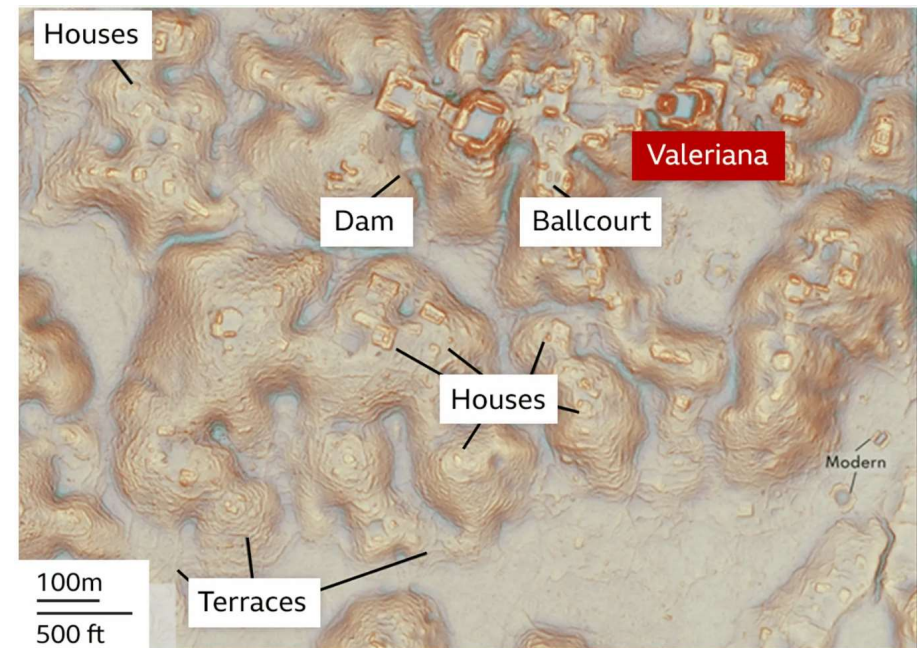


facebook

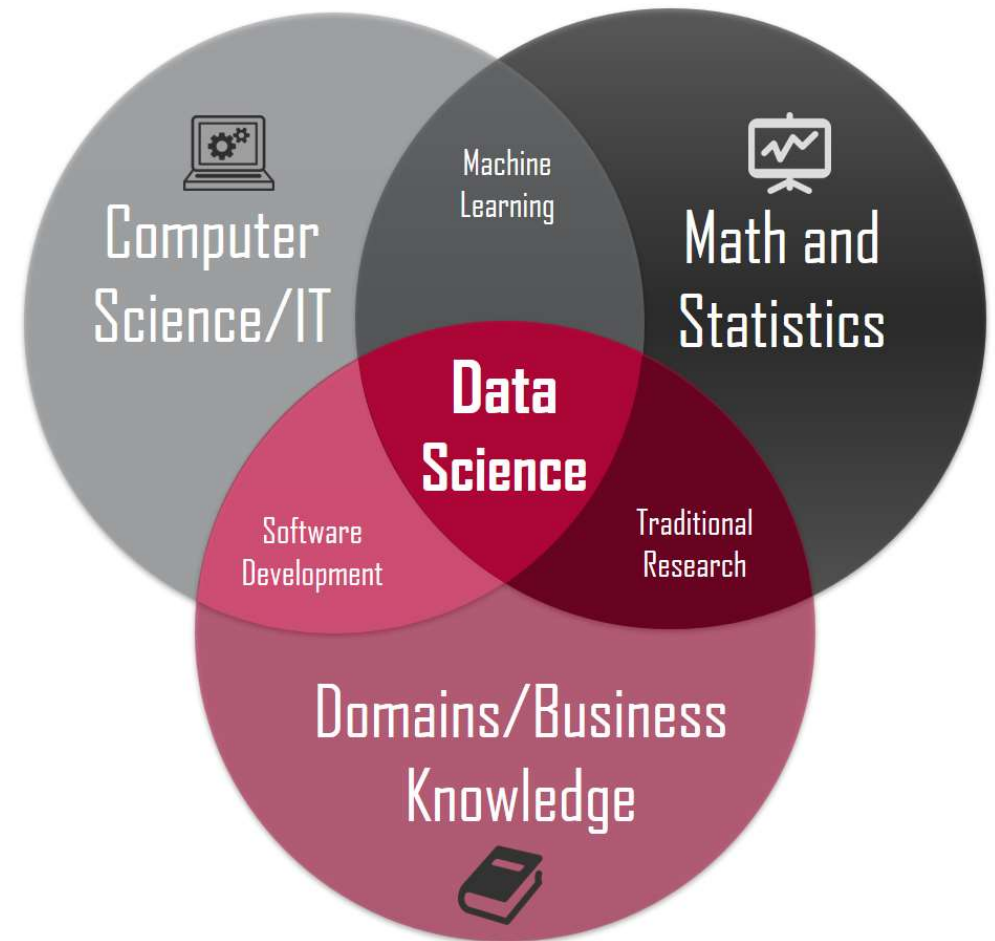
December 2010

루크 올드-토마스(Luke Auld-Thomas)

“29일(현지시각) BBC와 Newsweek 등 외신은 미국 툴레인대 고고학 연구팀이 멕시코 남동부 캄페체주에서 마야인들이 세운 피라미드와 원형극장, 도로, 운동장 등 6,764개의 건축물을 발견했다고 보도했다. 이러한 연구 결과는 영국 케임브리지대 고고학 학술지 ‘앤티퀴티’ 최신호에 실렸다.” (2024년 10월 29일)

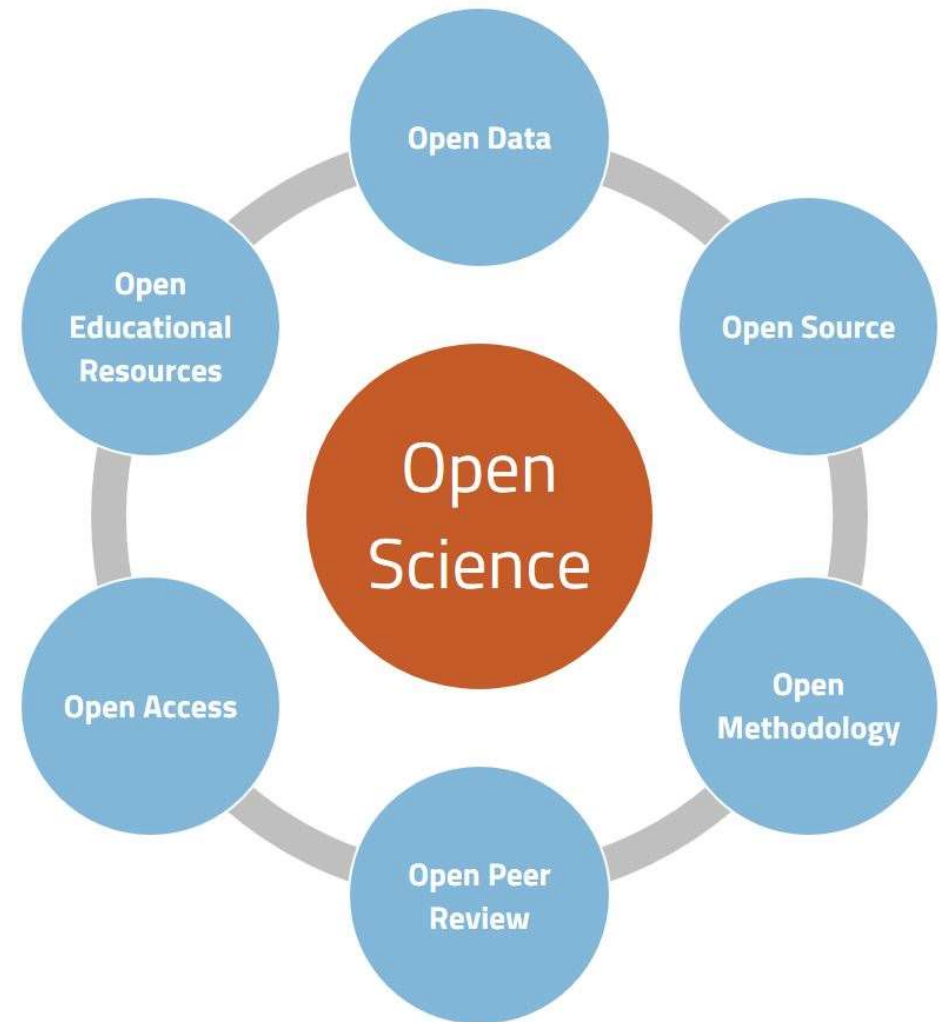


Data Science





Open Science



PRINCIPLES OF OPEN DATA

1. PUBLIC
2. MACHINE
READABLE
3. LICENSED
4. FREE OF CHARGE





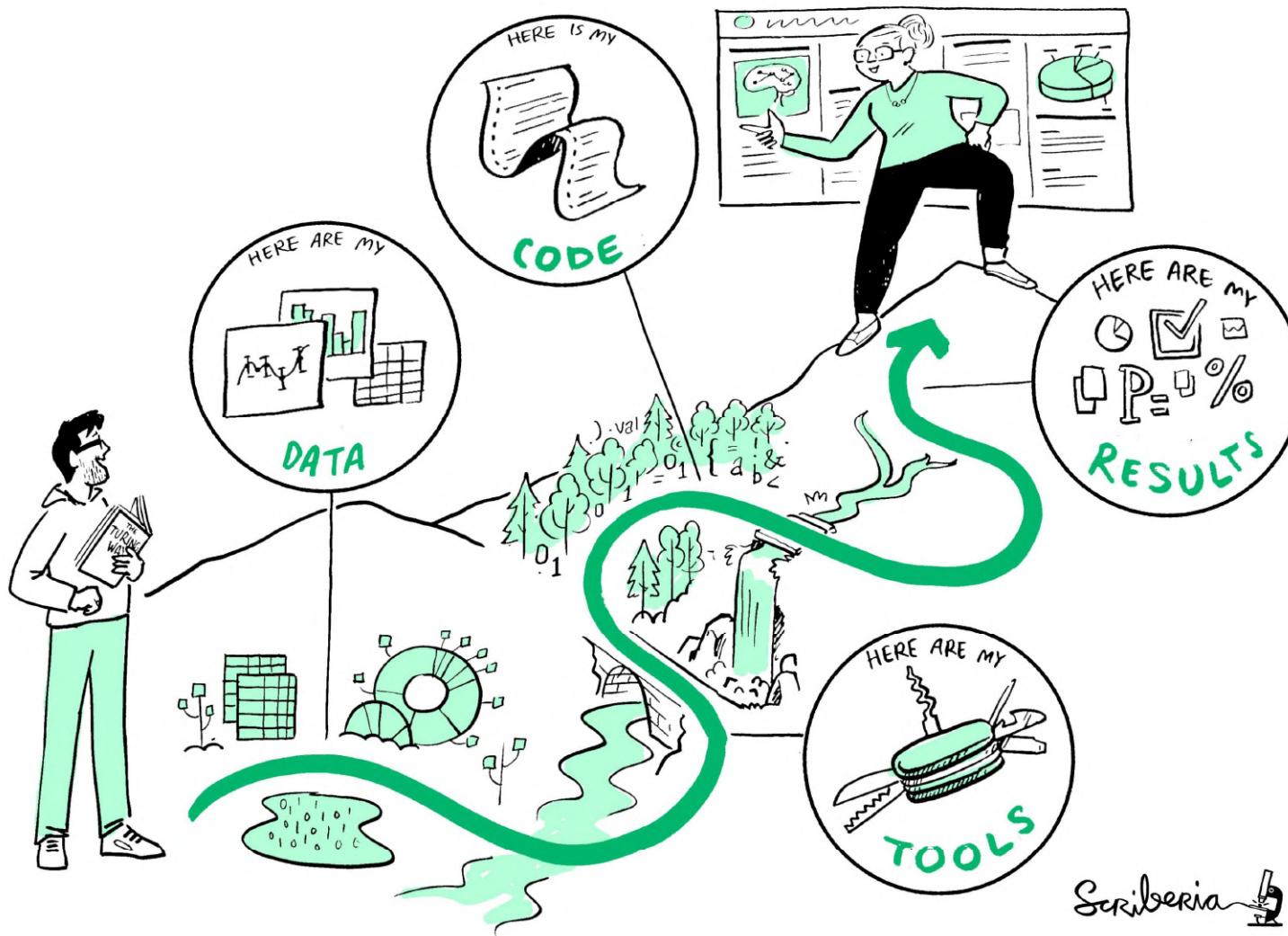
OPENAPI

INITIATIVE



**open source
initiative[®]**





Spatial Science

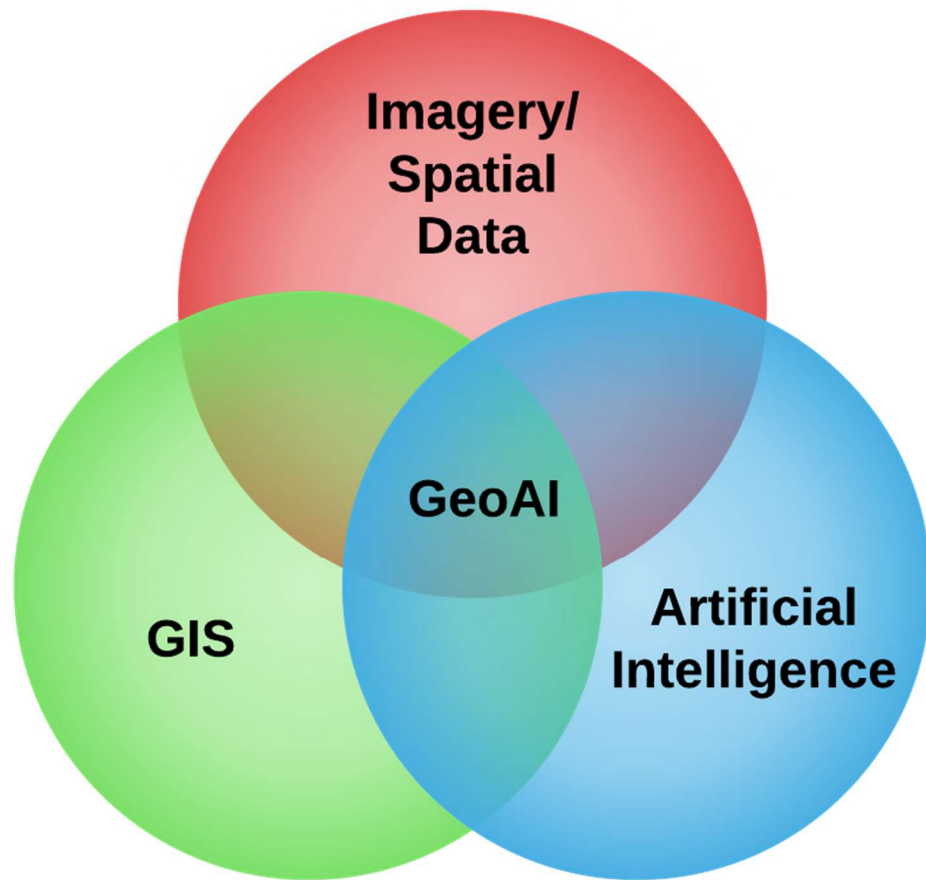
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graph LR; SS((Spatial Science)) --- Carto[Carto]; SS --- GIS[GIS]; SS --- RS[RS/GNSS]; SS --- SA[Spatial Analytics];
```

Carto

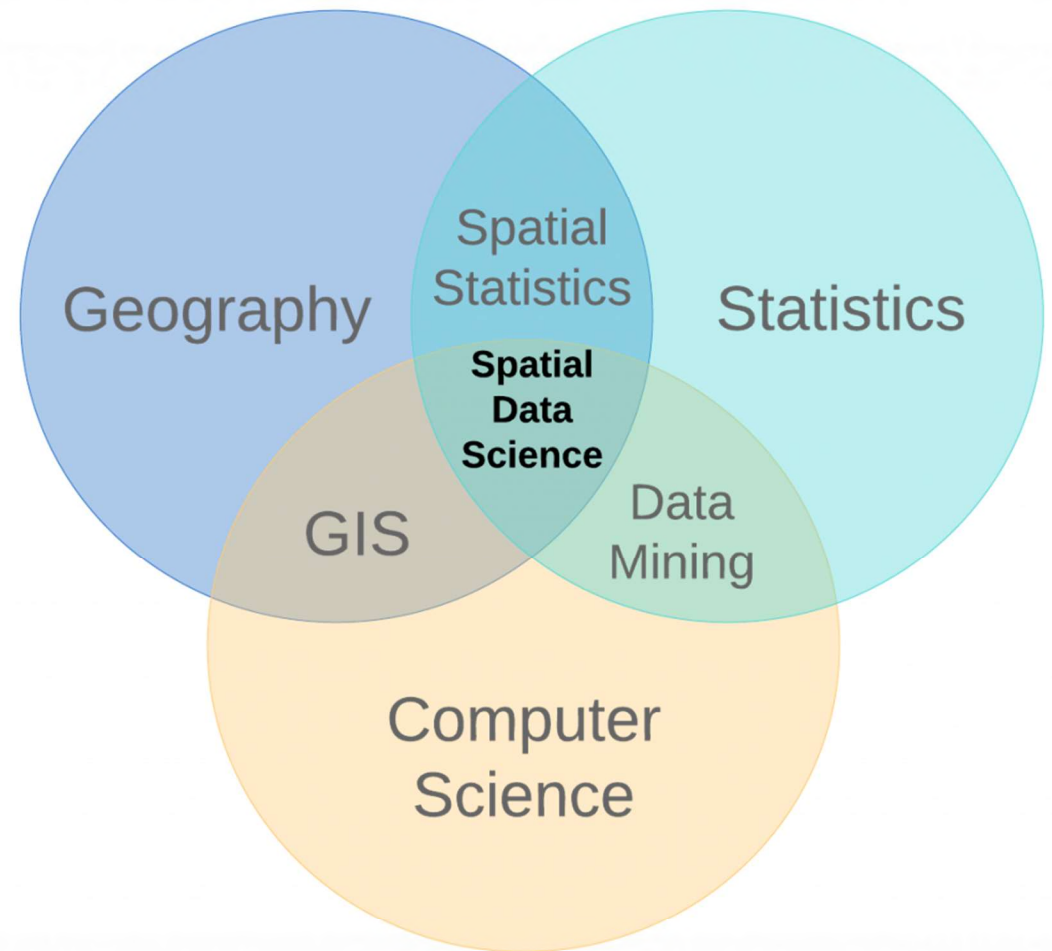
GIS

RS/
GNSS

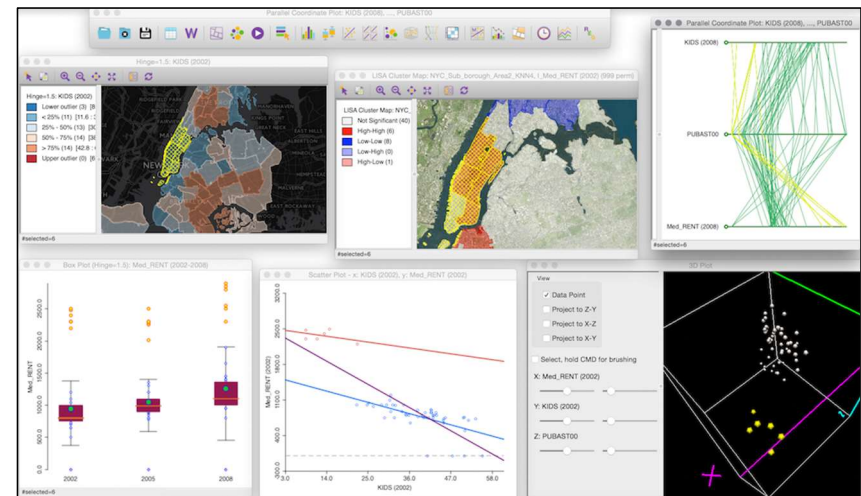
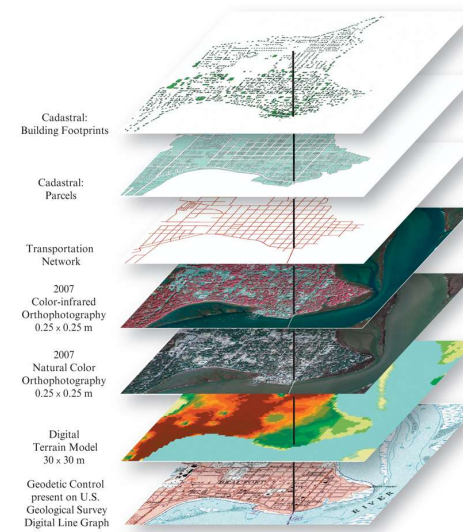
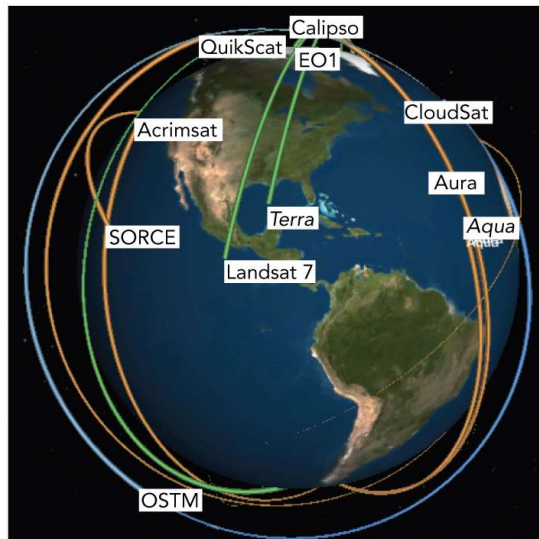
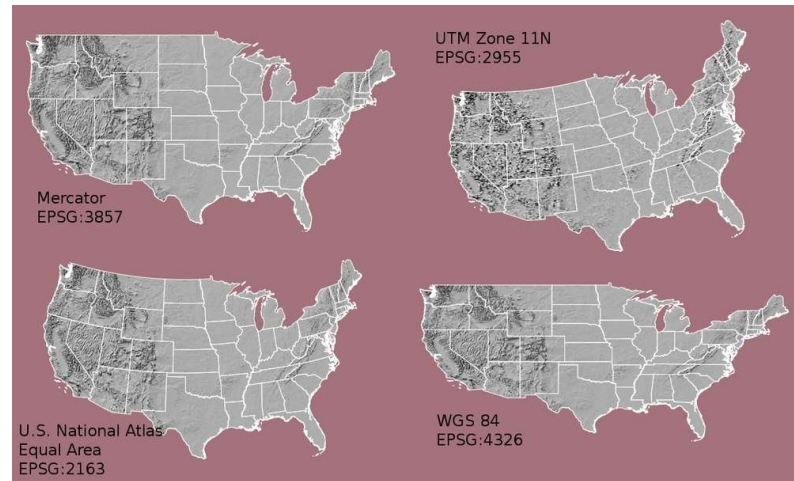
Spatial
Analytics



GeoAI = GIS + Artificial Intelligence

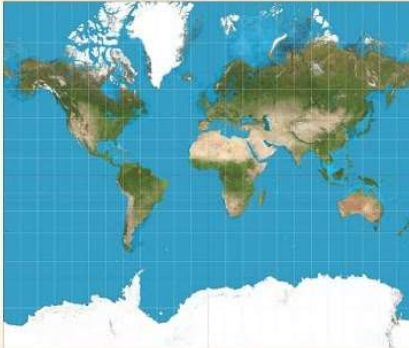


공간사이언스 맛보기

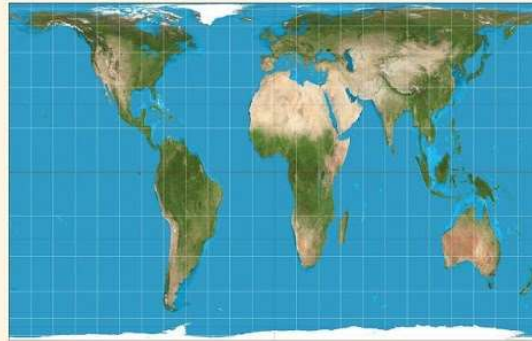


MAP PROJECTIONS

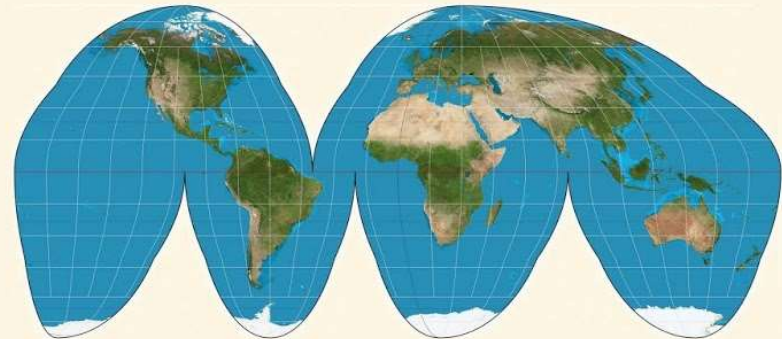
MERCATOR



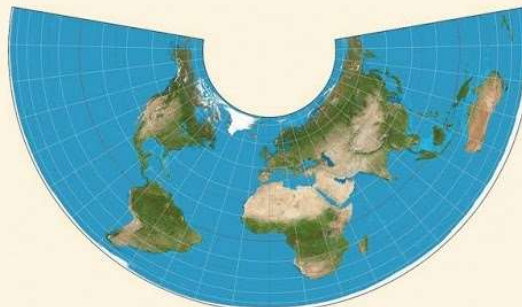
GALL-PETERS



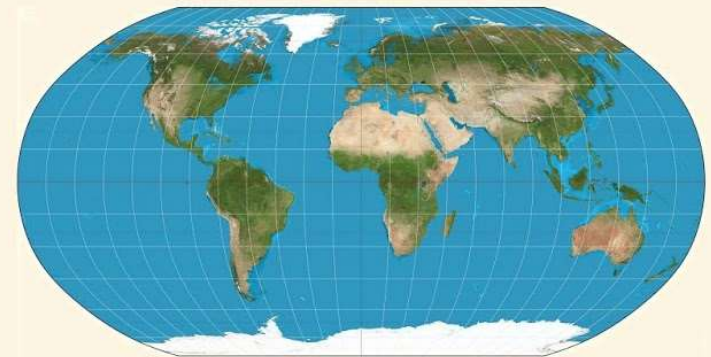
GOODE-HOMOLOGOSINE



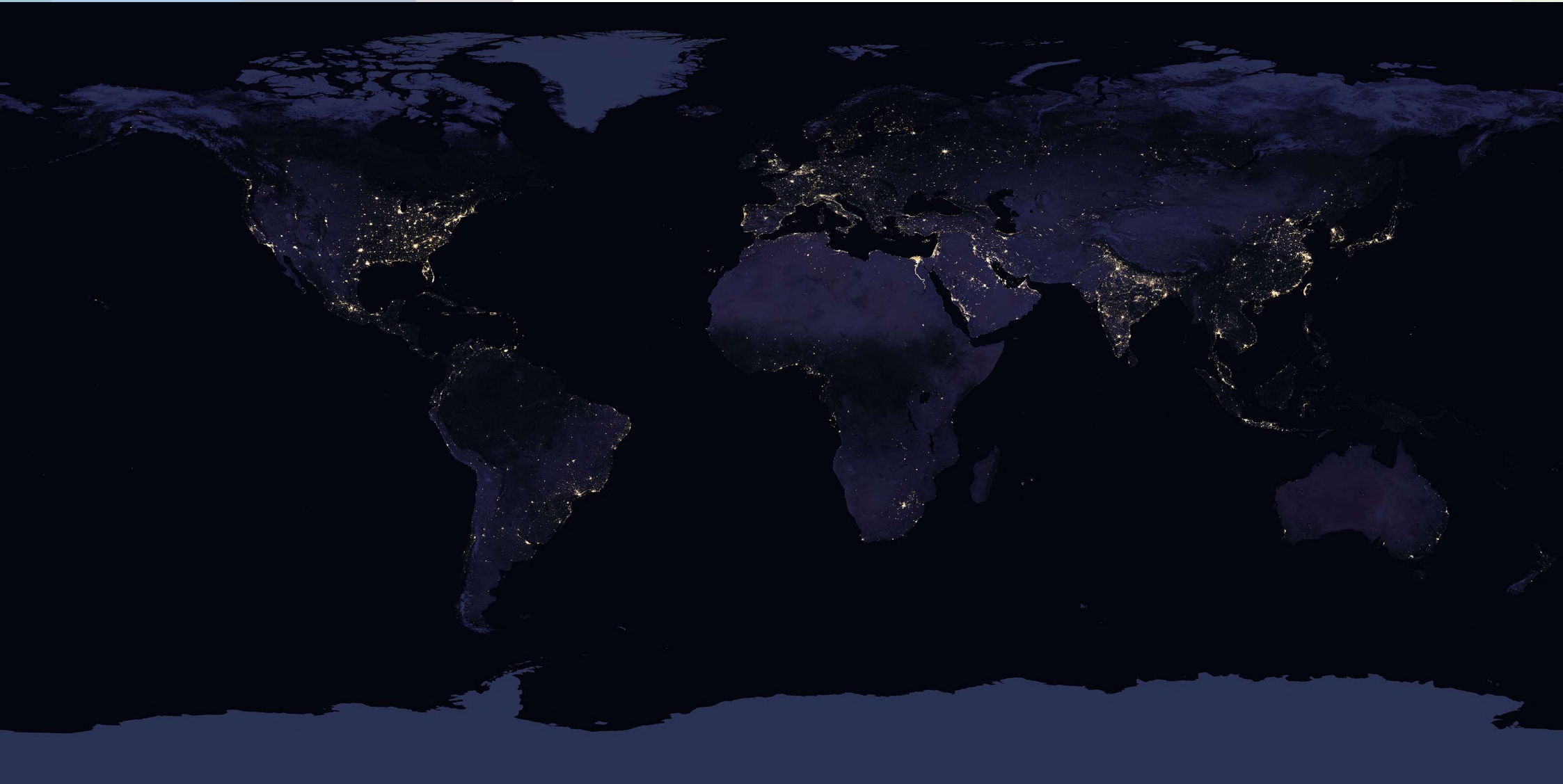
WATERMELON

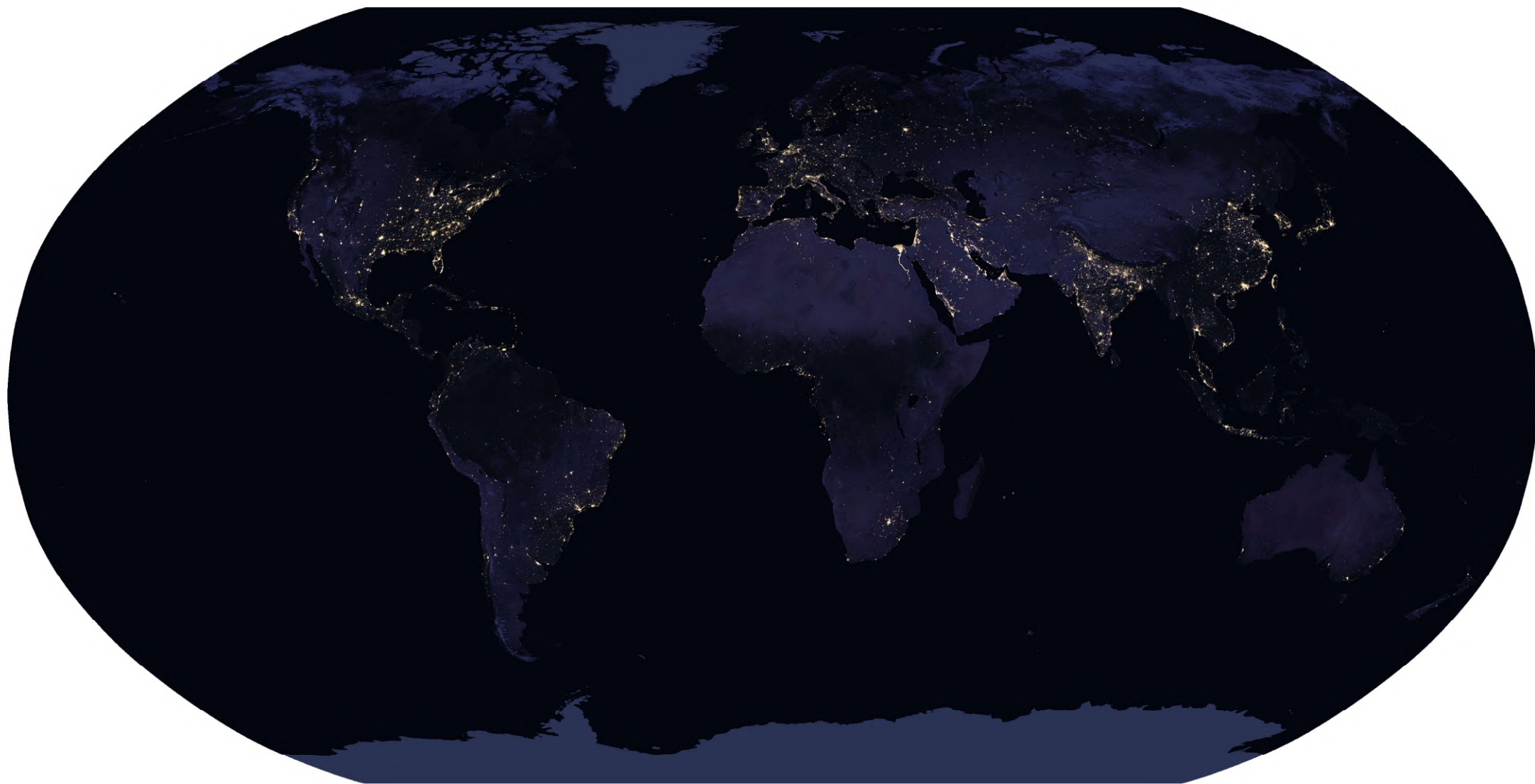


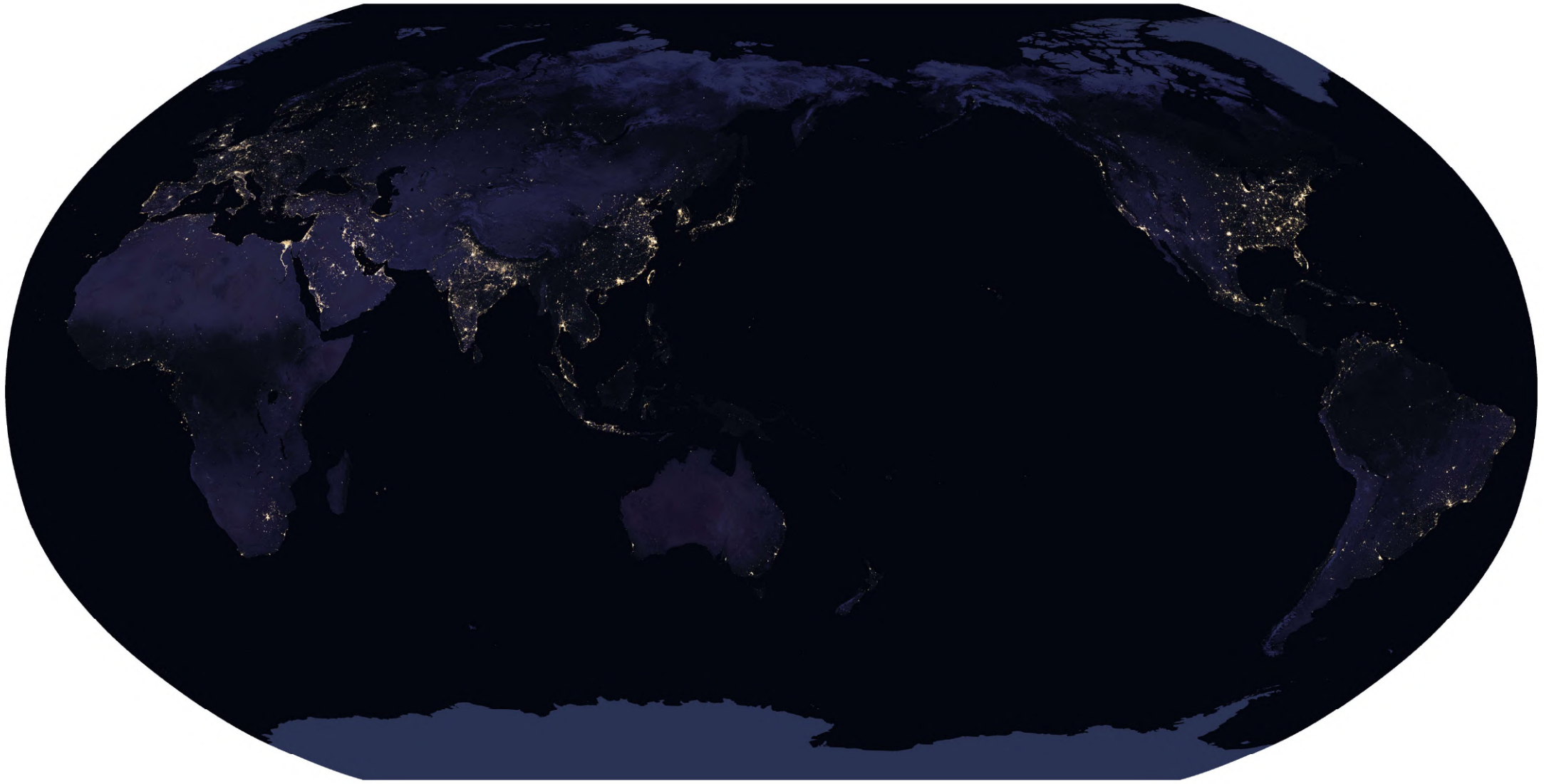
ALBERS

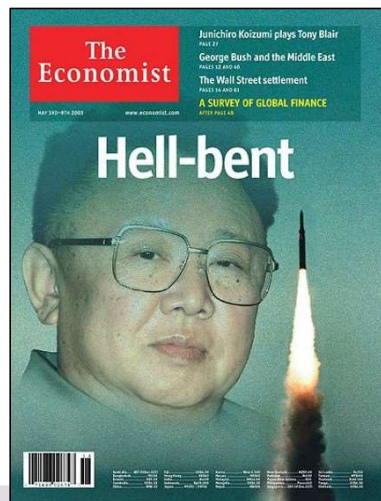
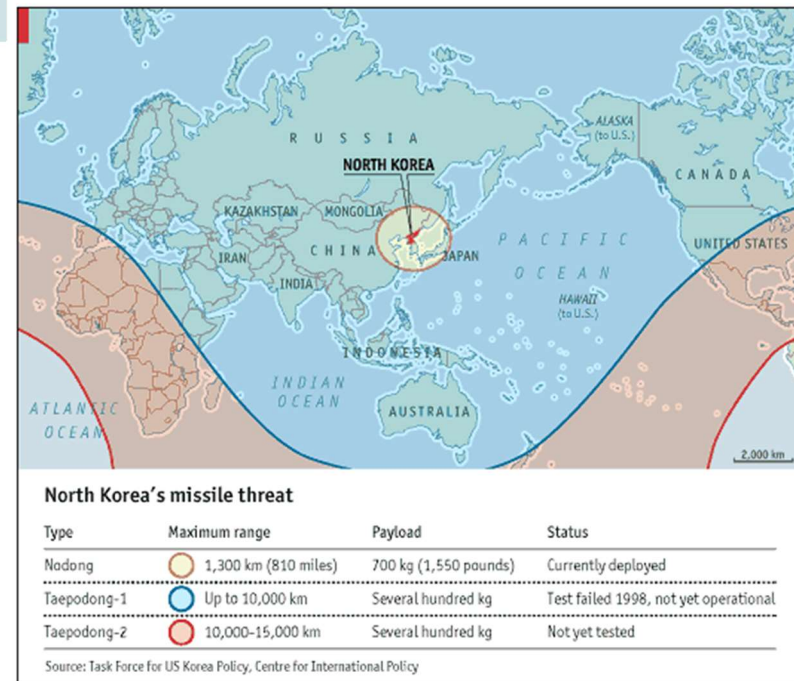
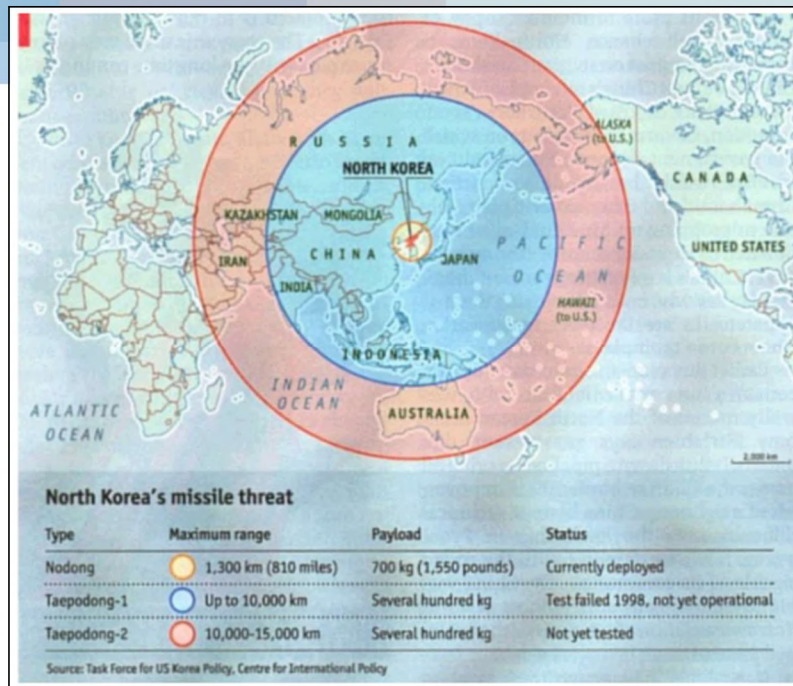


ROBINSON

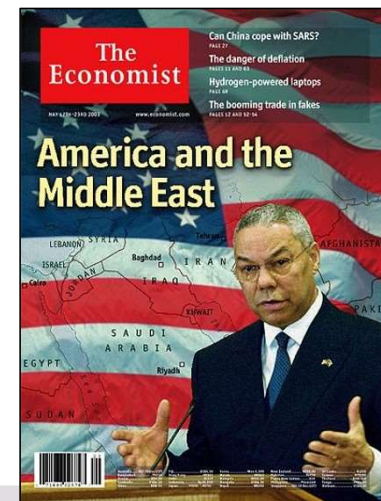


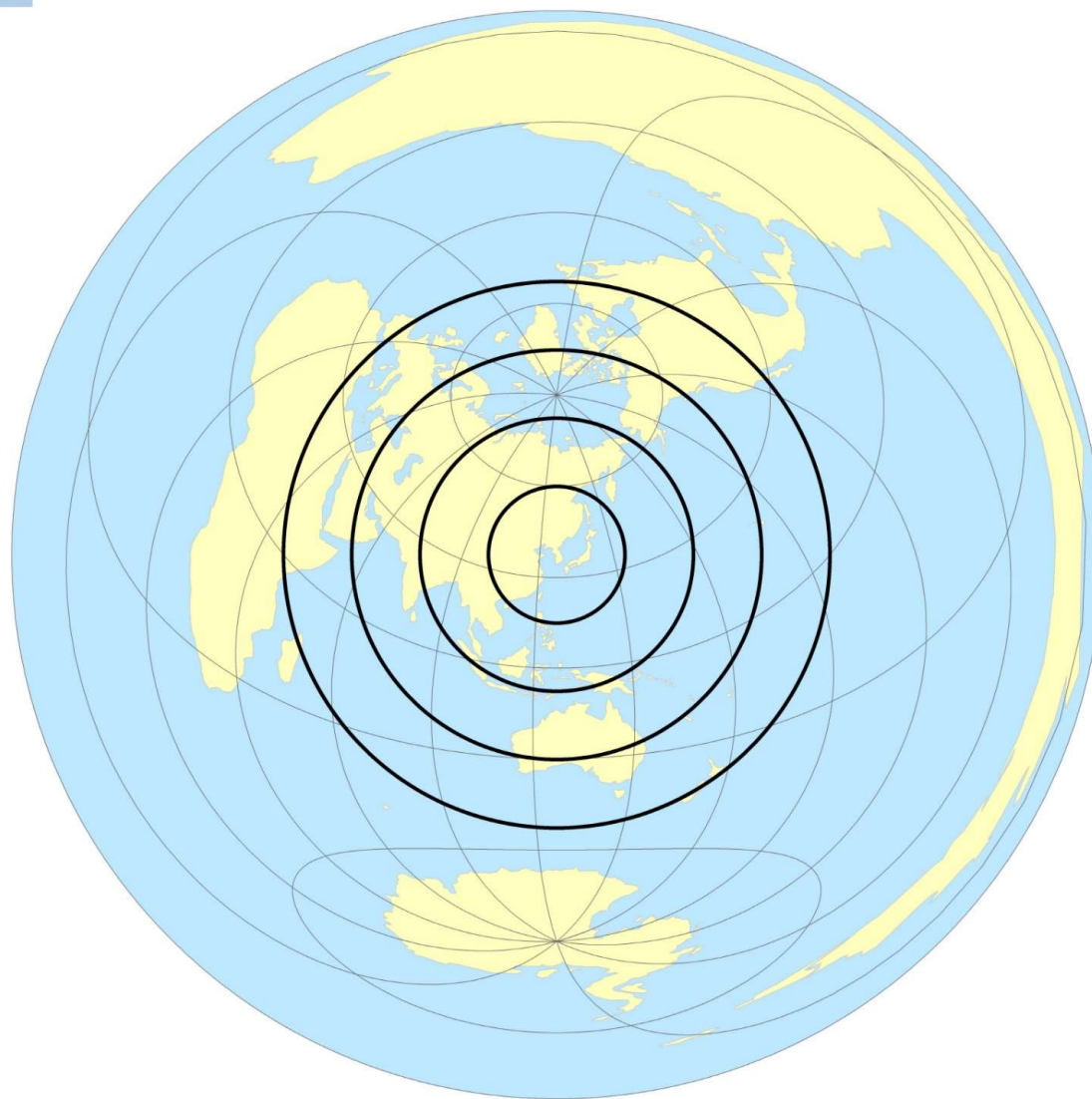


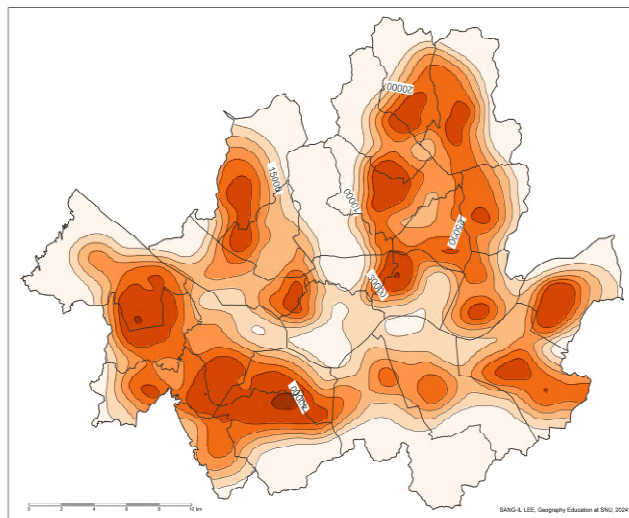
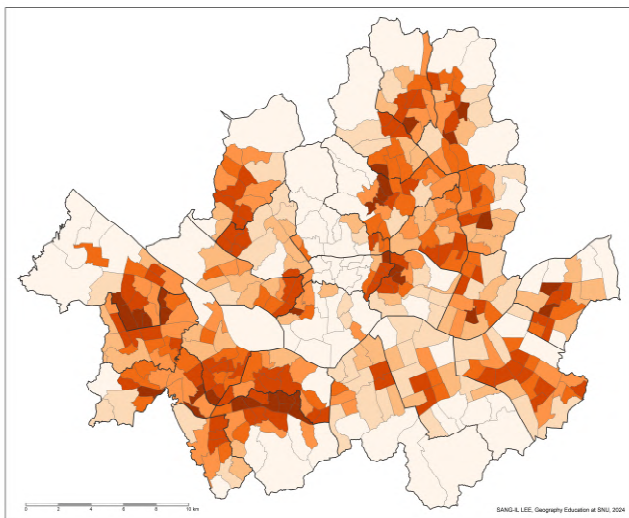
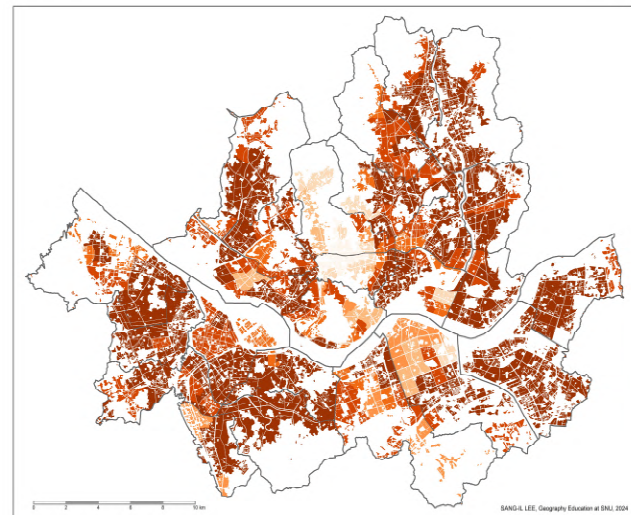
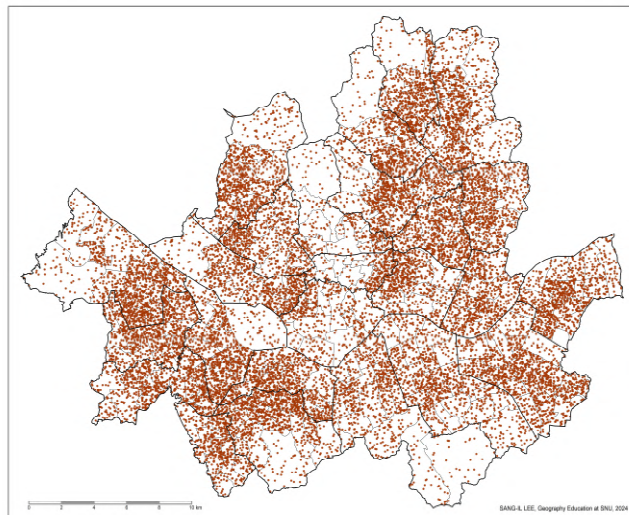
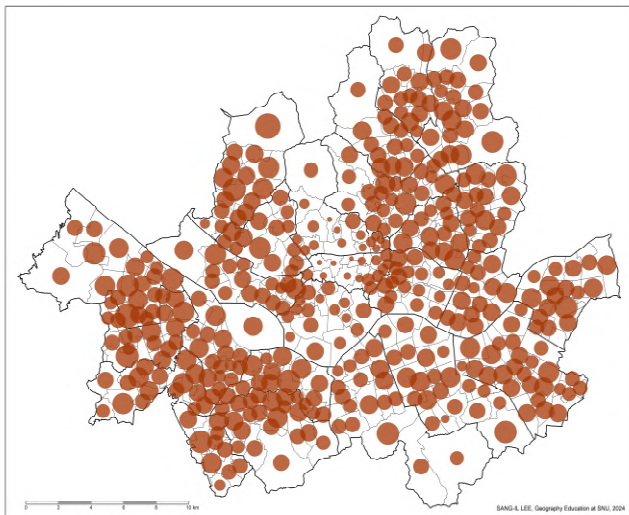




Tom Bole
(ESRI)







PuBuGn



PuRd



Purples



RdPu



Reds



YlGn



YlGnBu



YlOrBr



YlOrRd



BrBG



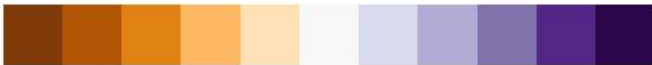
PiYG



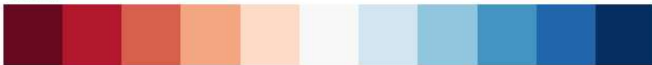
PRGn



PuOr



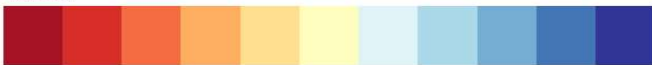
RdBu



RdGy



RdYlBu



RdYlGn



Spectral



Accent



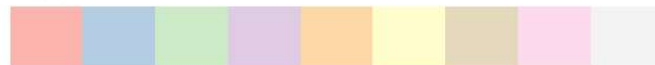
Dark2



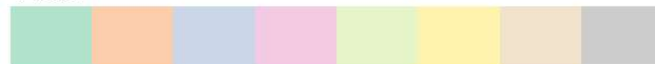
Paired



Pastel1



Pastel2



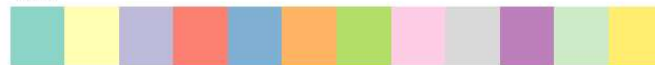
Set1



Set2



Set3



POPULATION DENSITY MAP
THE WORLD

BY @TERENCE@FOSSODON.ORG/@RESEARCHREMORA
IN #RSTATS WITH RAYSHADER (@TYLERMORGANWALL)



GRIDDED POPULATION OF THE WORLD, VERSION 4



SHADED RELIEF MAP
OF
AFRICA

VISUALISED BY @RESEARCHREMORA IN #RSTATS
WITH RAYSHADER (@TYLERMORGANWALL)
ELENA (@HOLIST)
AND MITCHELL (@BLAKEROMILLS)

FOR #30DAYMAPCHALLENGE 2022, DAY 20, MY FAVOURITE...

Cadastral:
Building Footprints

Cadastral:
Parcels

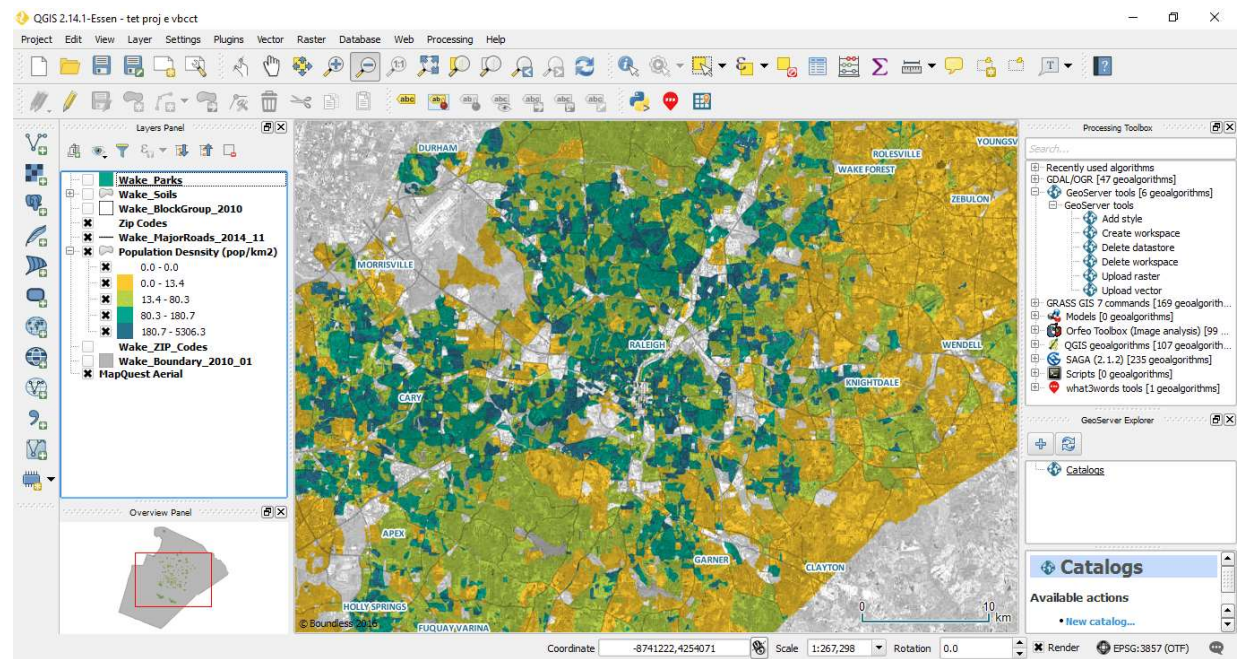
Transportation
Network

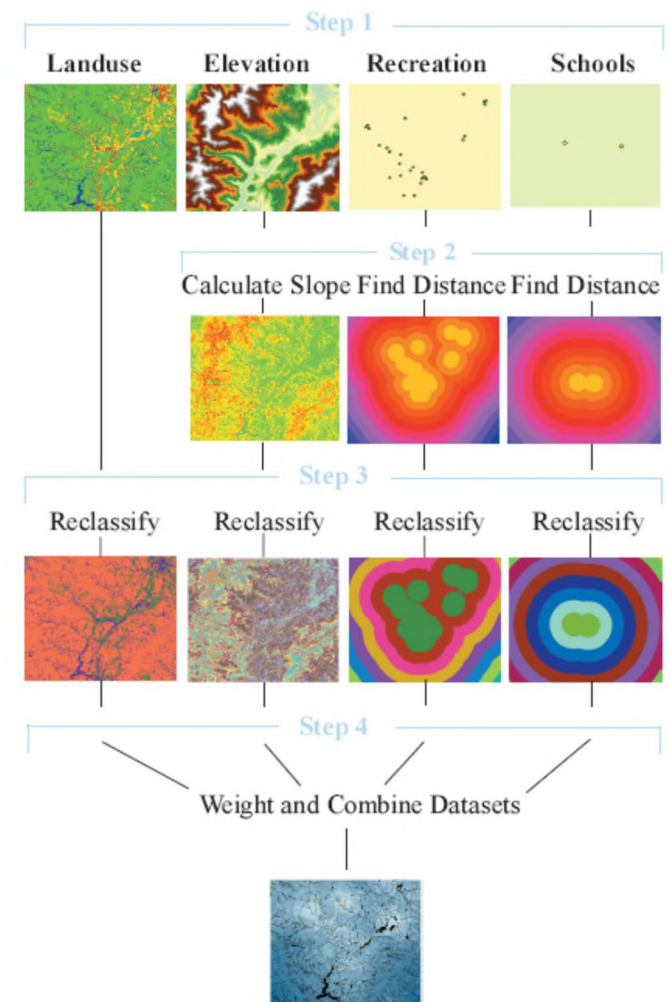
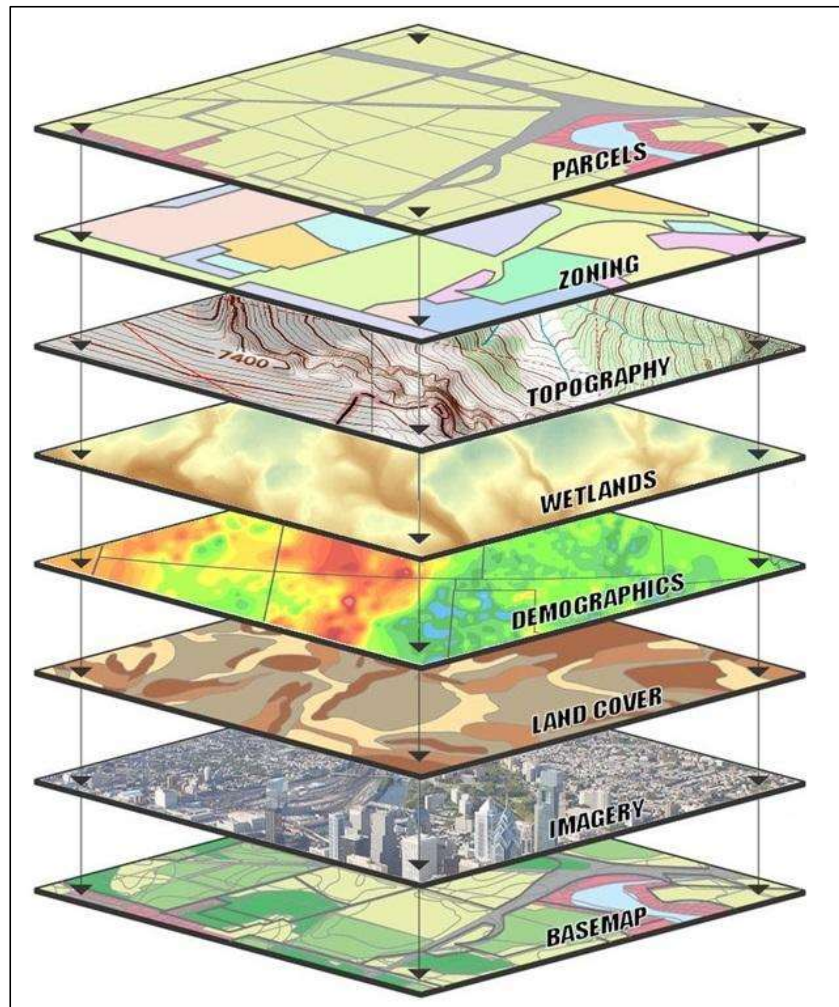
2007
Color-infrared
Orthophotography
0.25 x 0.25 m

2007
Natural Color
Orthophotography
0.25 x 0.25 m

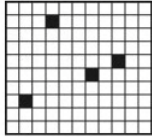
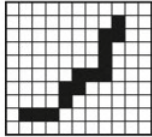
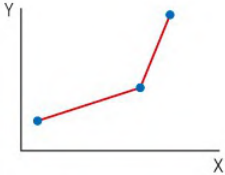
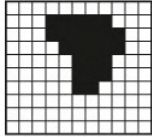
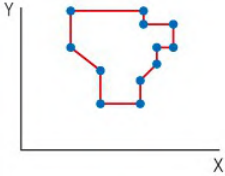
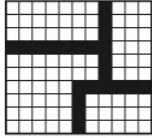
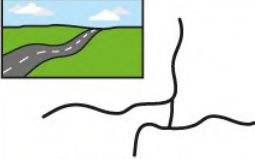
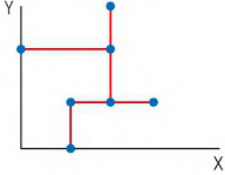
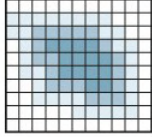
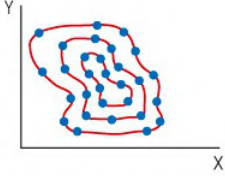
Digital
Terrain Model
30 x 30 m

Geodetic Control
present on U.S.
Geological Survey
Digital Line Graph





Raster Data

The raster view of the world	Happy Valley spatial entities	The vector view of the world
	 x x Points: hotels	
	 Lines: ski lifts	
	 Areas: forest	
	 Network: roads	
	 Surface: elevation	

Vector Data

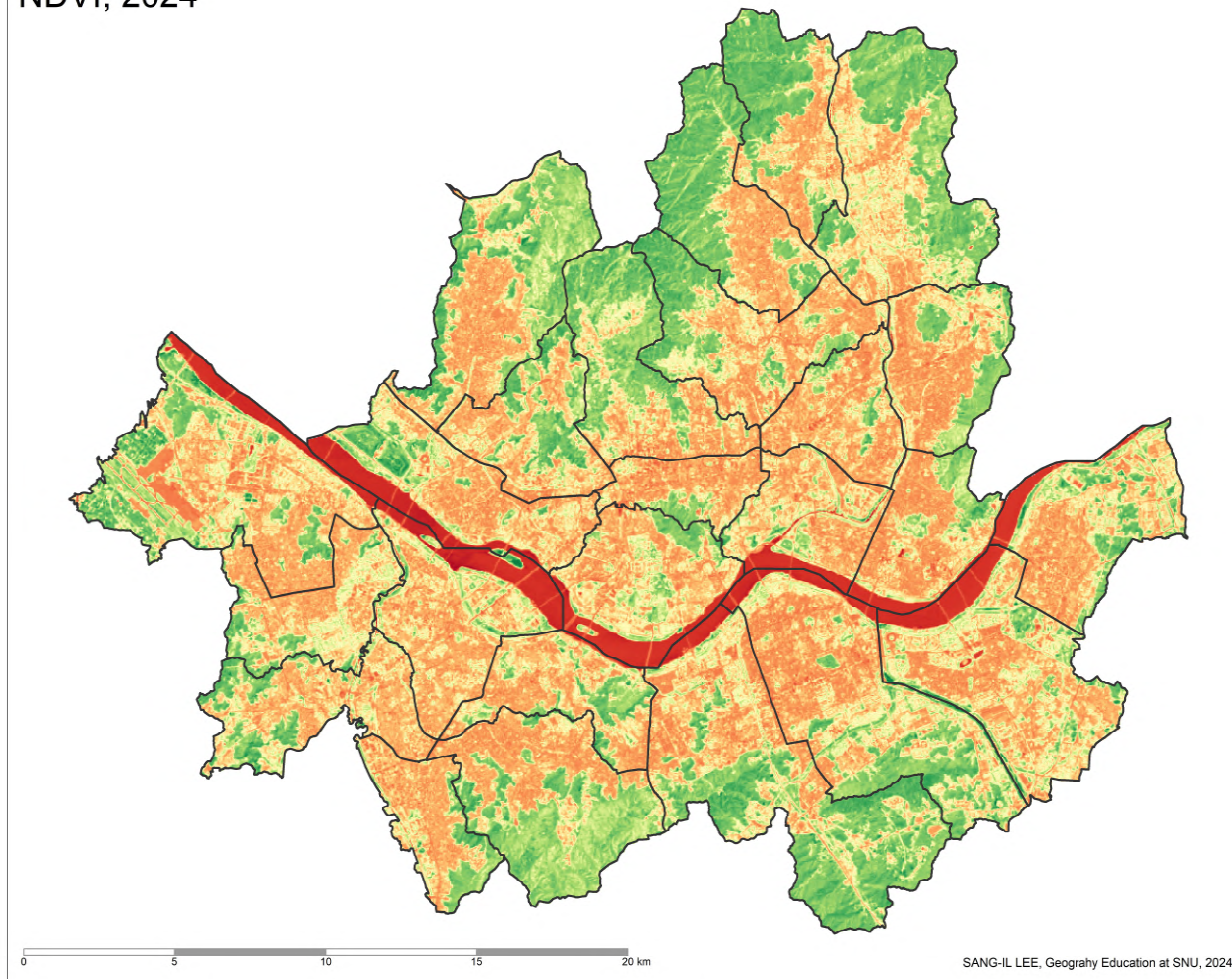
Feature Classes

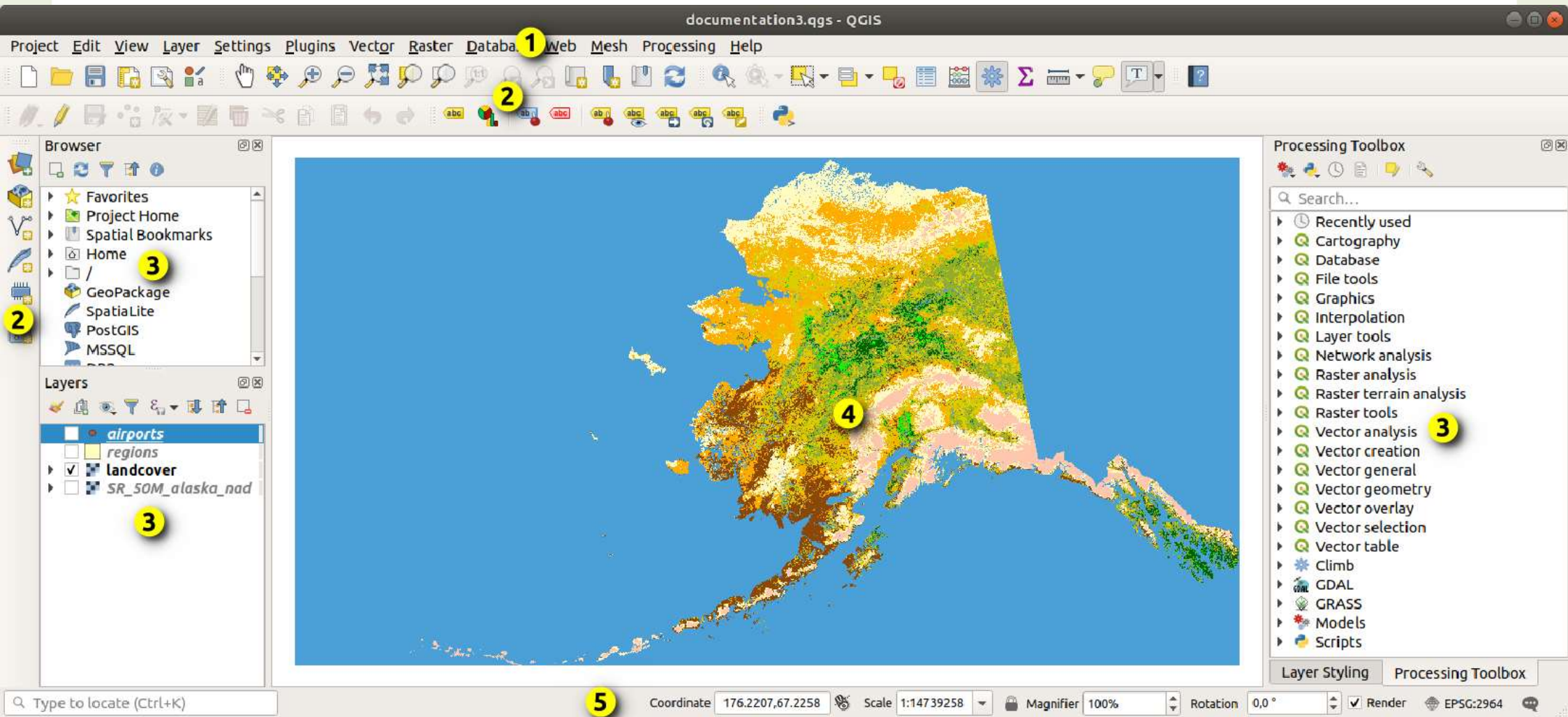


0 5 10 15 20 km

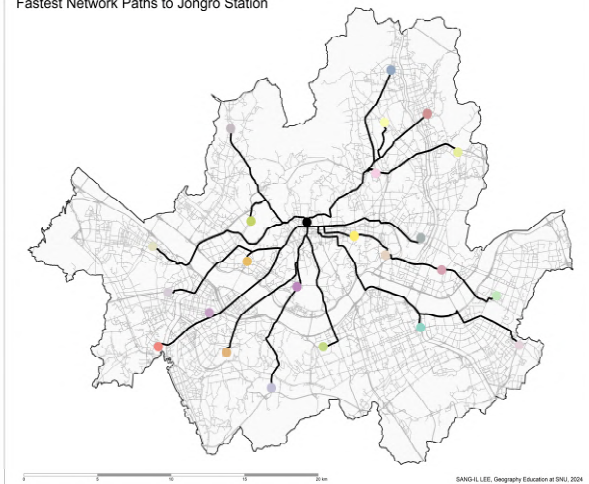
SANG-IL LEE, Geography Education at SNU, 2024

NDVI, 2024

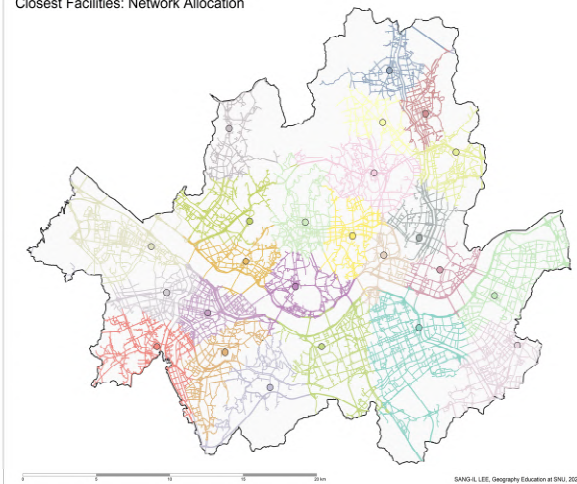




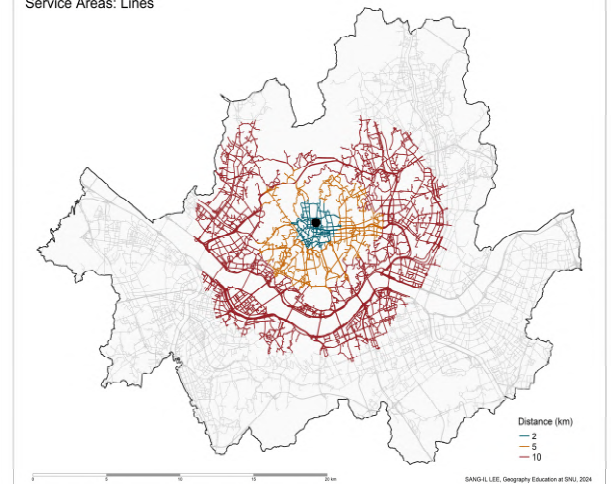
Fastest Network Paths to Jongro Station



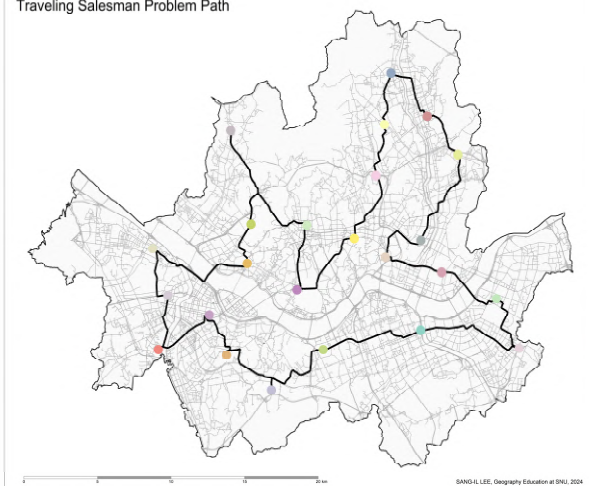
Closest Facilities: Network Allocation



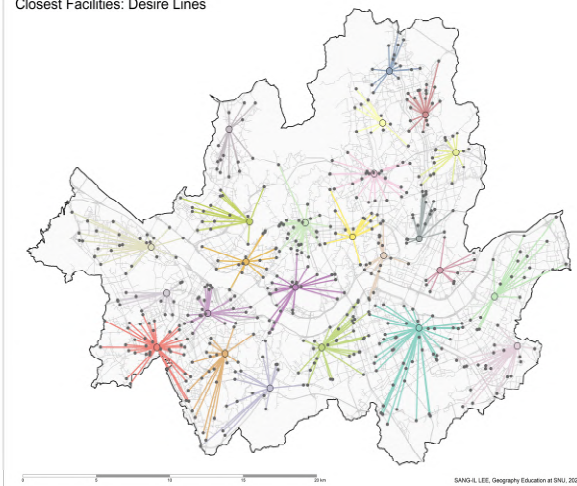
Service Areas: Lines



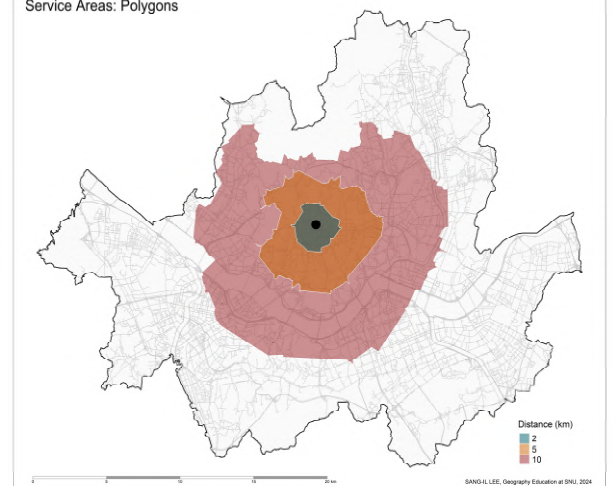
Traveling Salesman Problem Path



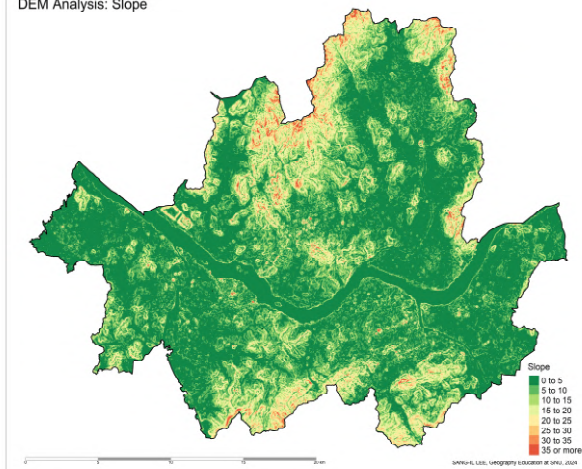
Closest Facilities: Desire Lines



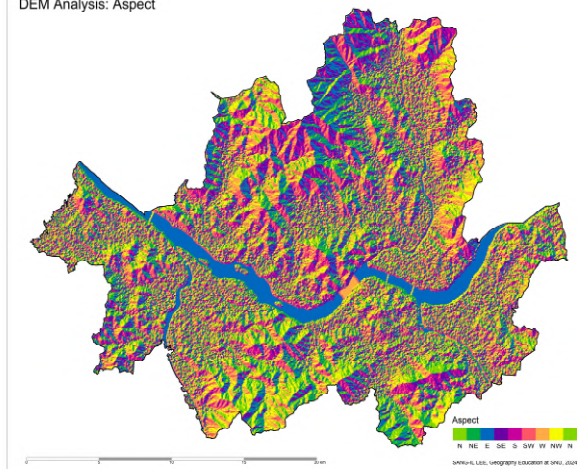
Service Areas: Polygons



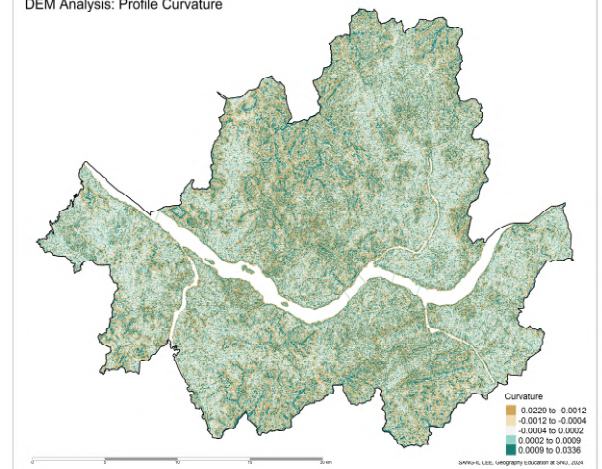
DEM Analysis: Slope



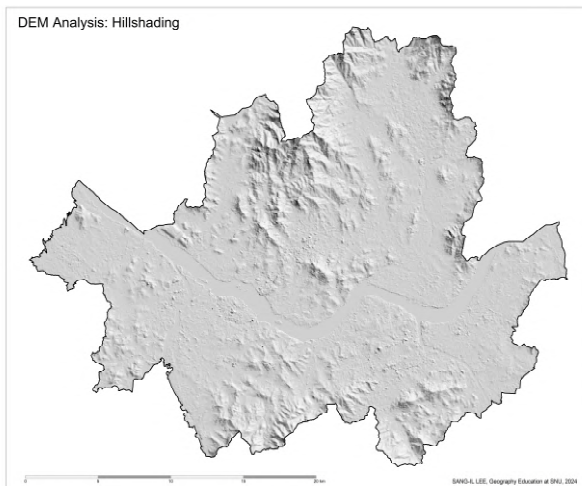
DEM Analysis: Aspect



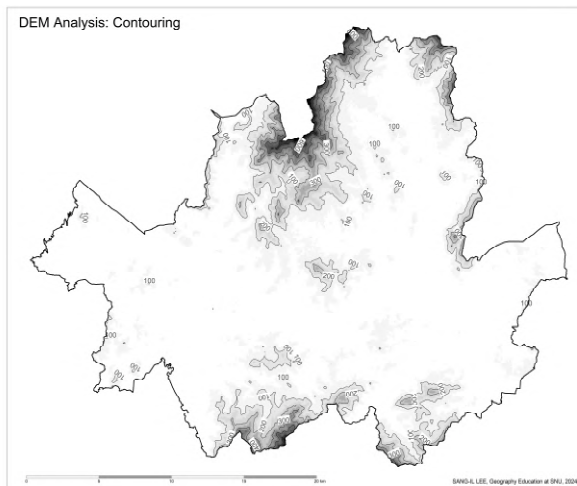
DEM Analysis: Profile Curvature



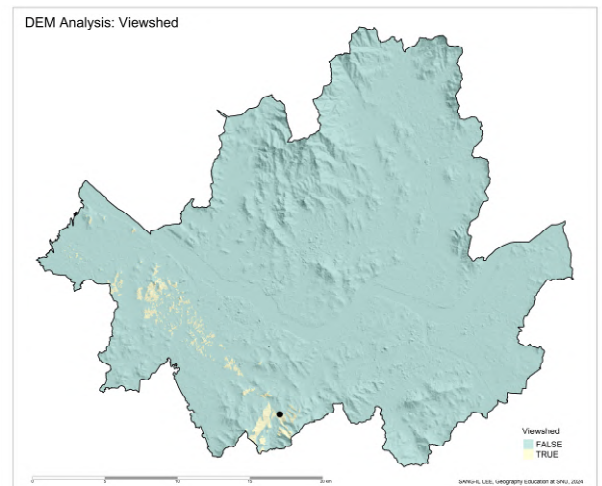
DEM Analysis: Hillshading

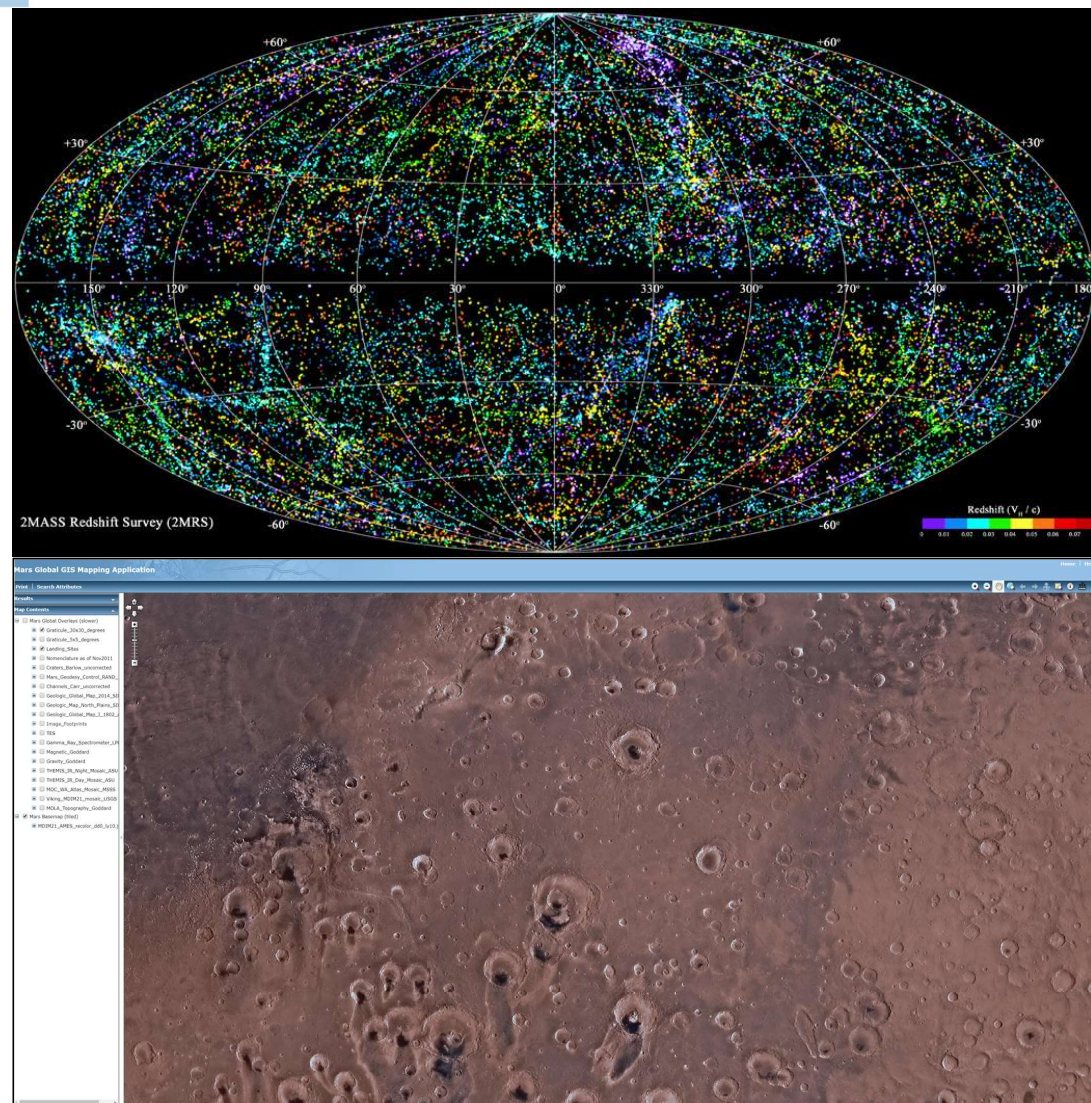


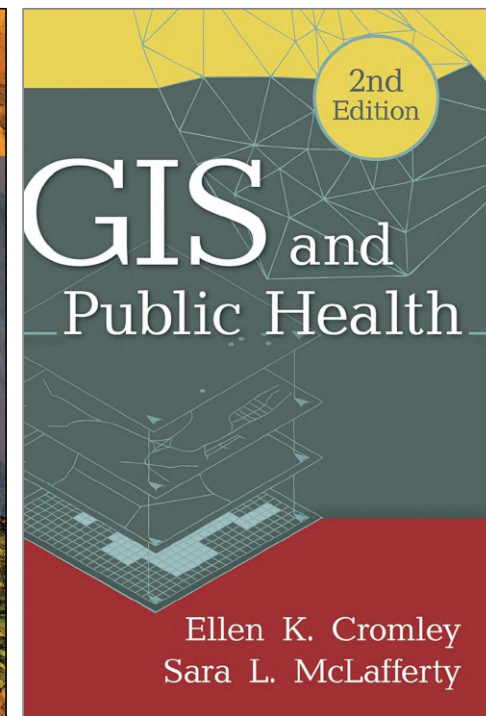
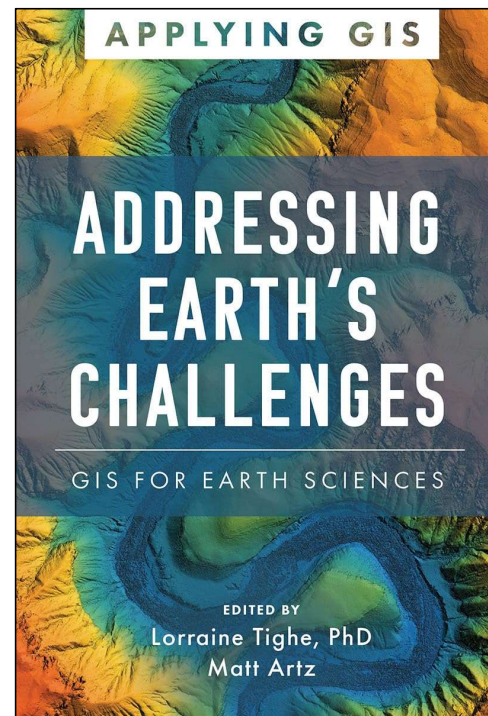
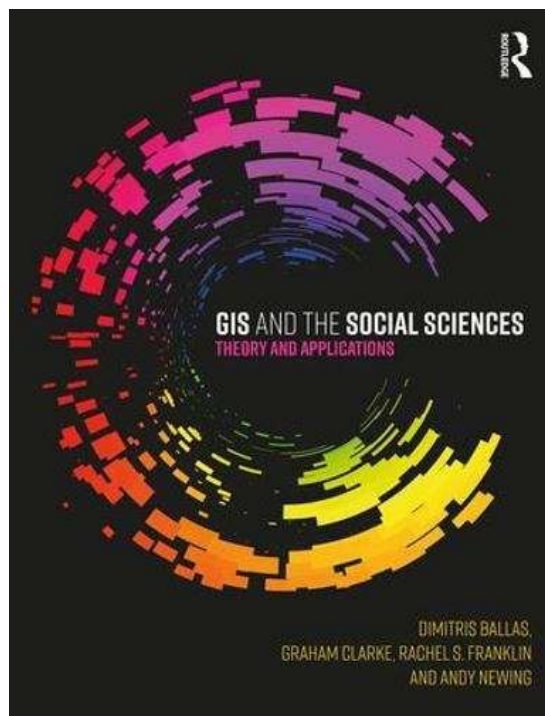
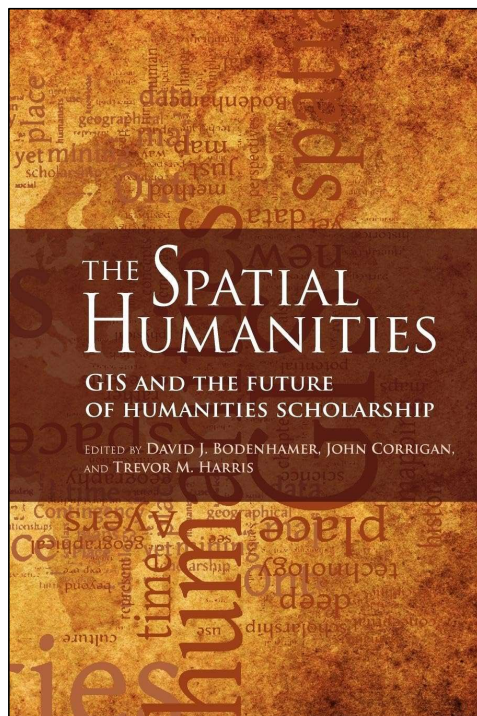
DEM Analysis: Contouring

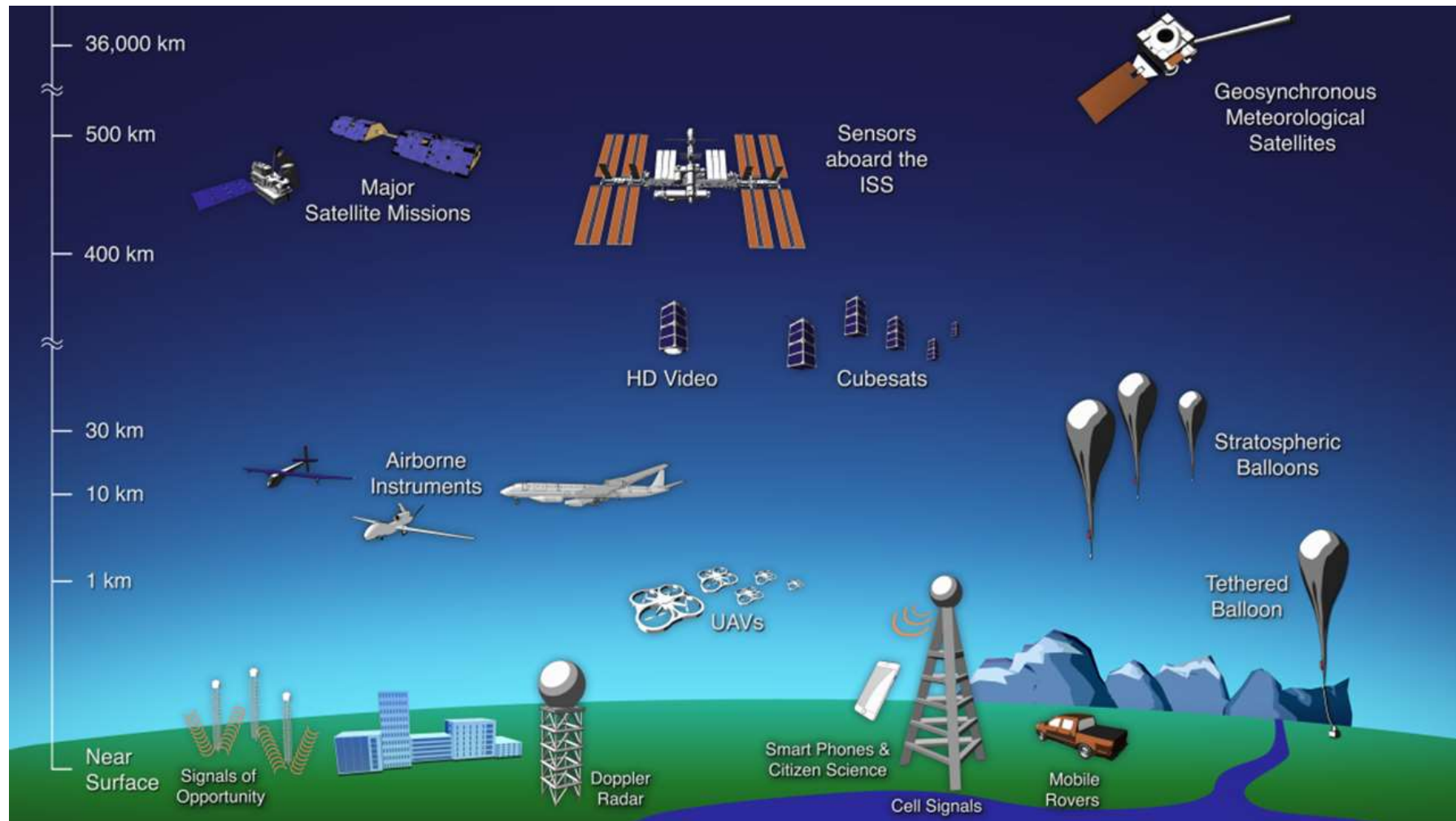


DEM Analysis: Viewshed

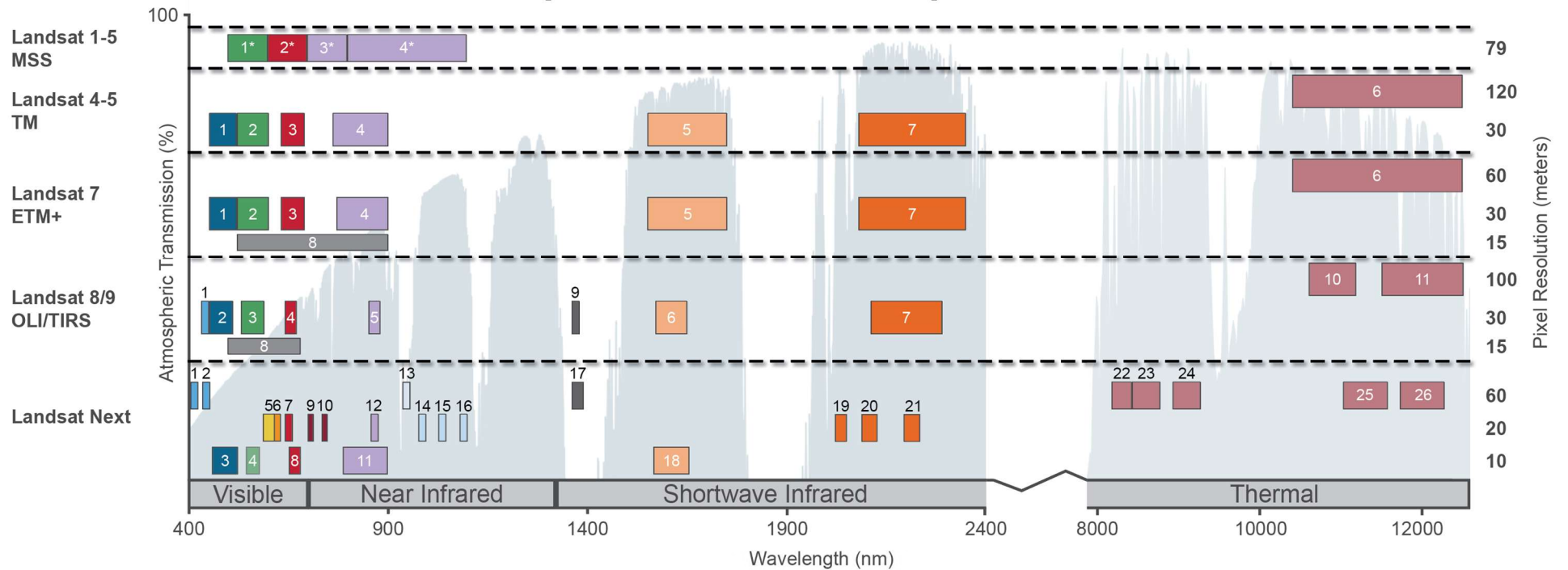






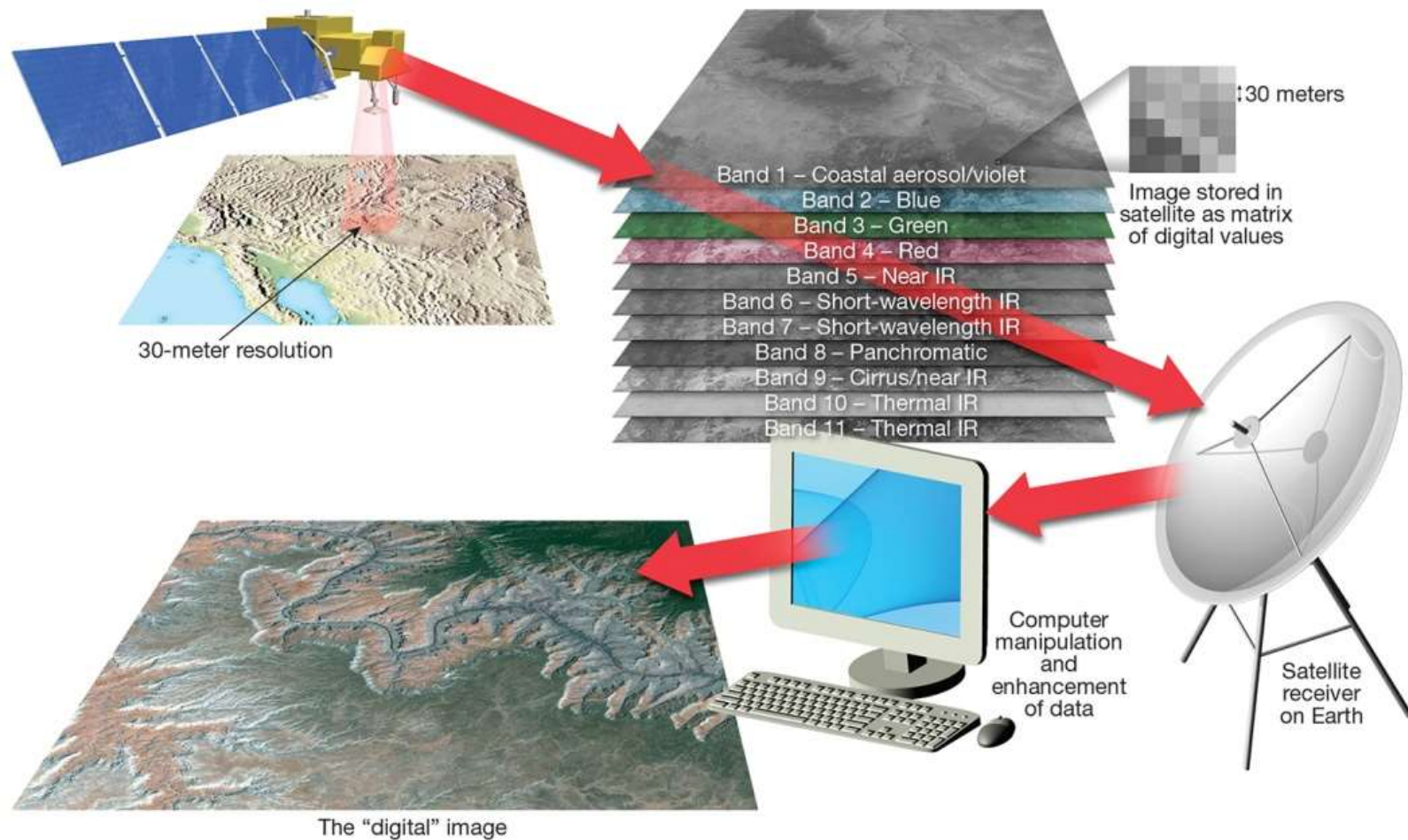


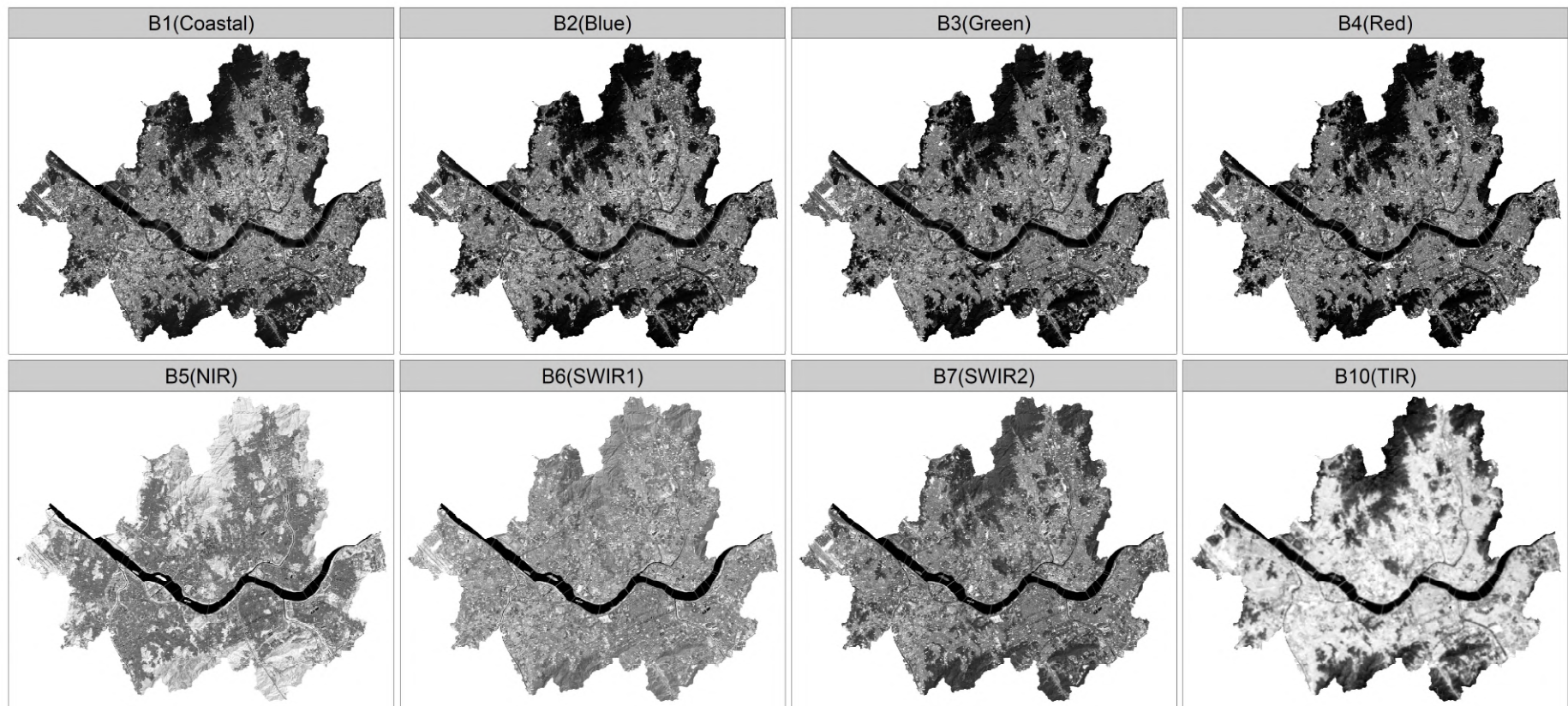
Comparison of Landsat Spectral Bands

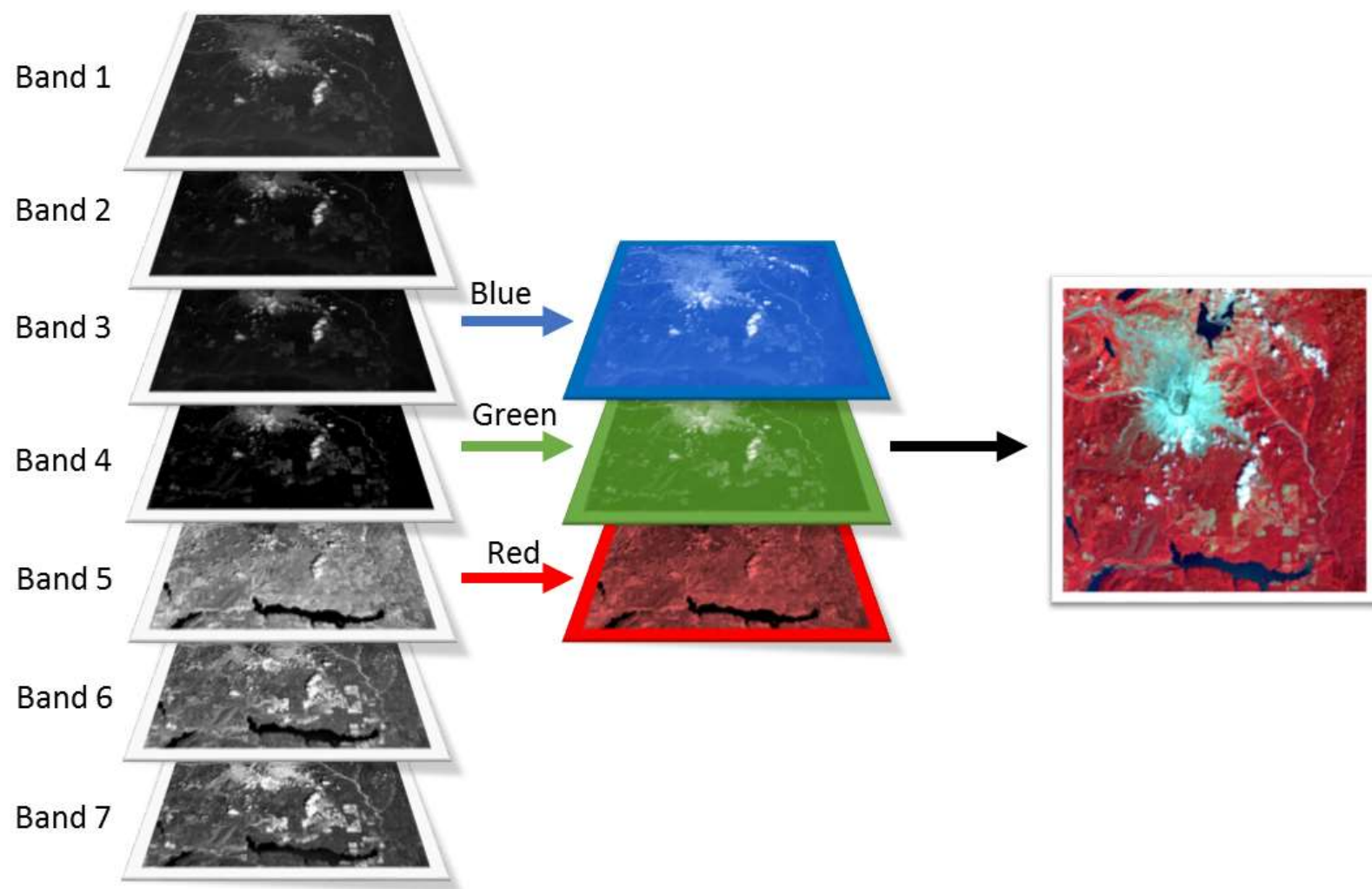


* MSS bands 1-4 were known as bands 4-7, respectively, on Landsats 1-3

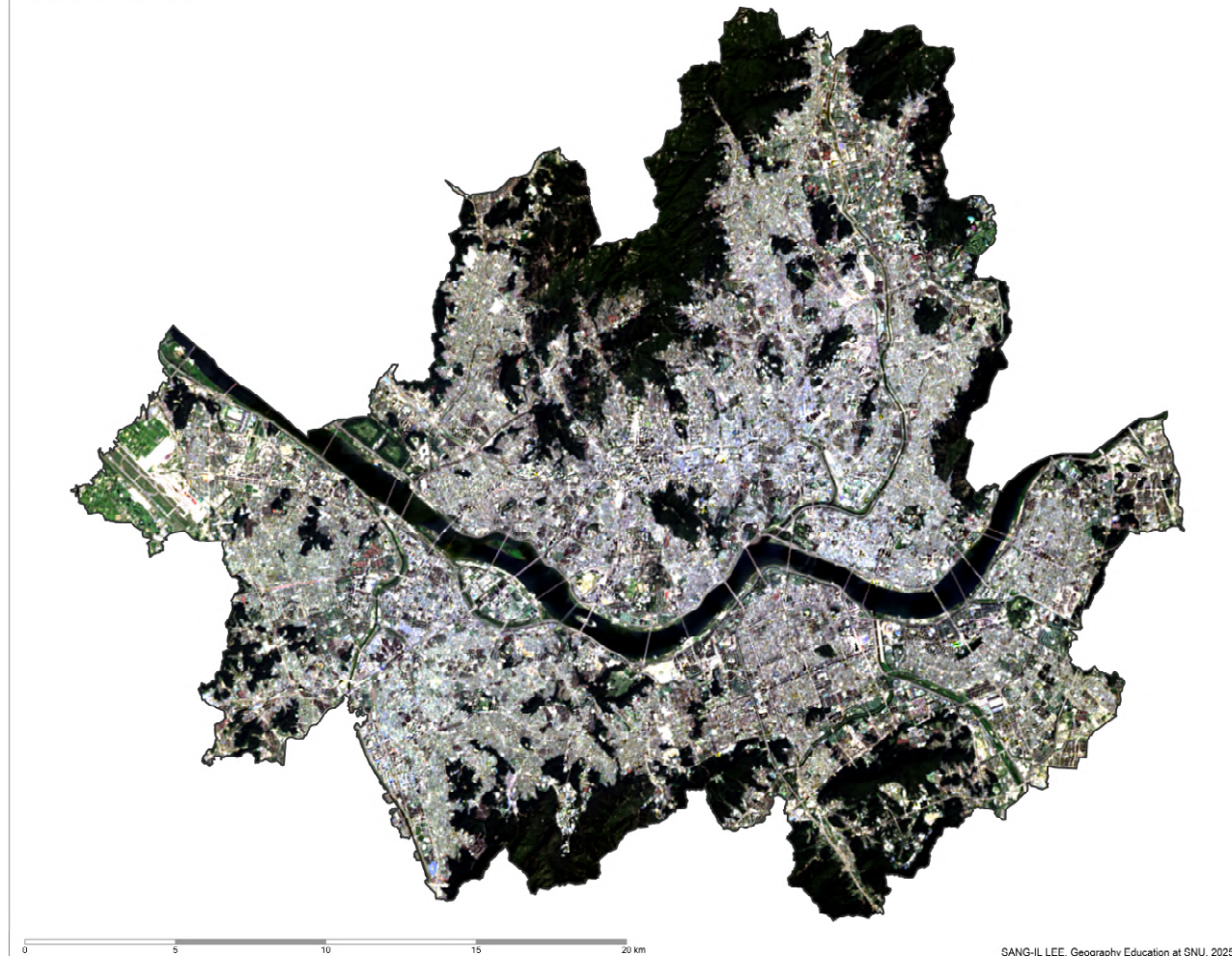
USGS, March 2024





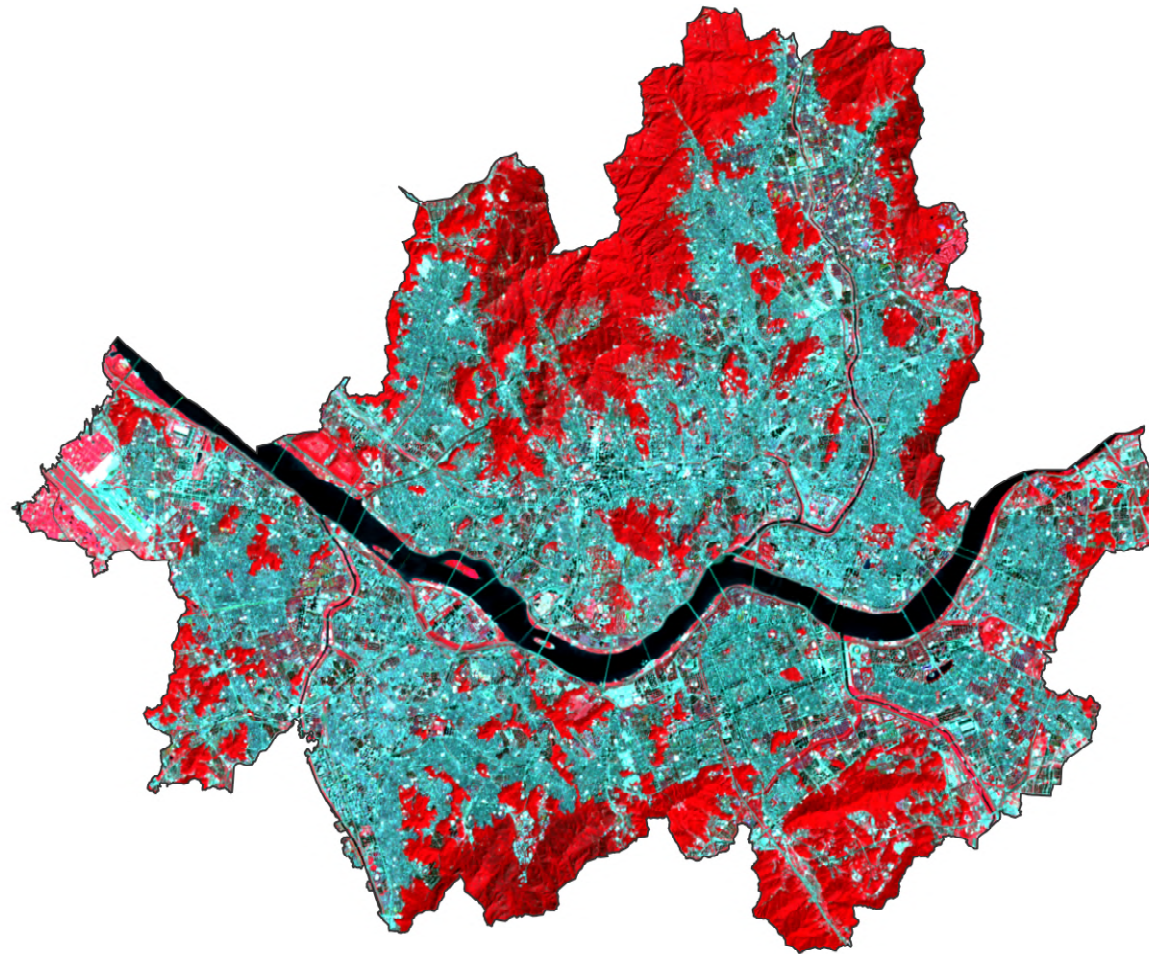


Natural Color



4(Red)
+
3(Green)
+
2(Blue)

Color Infrared



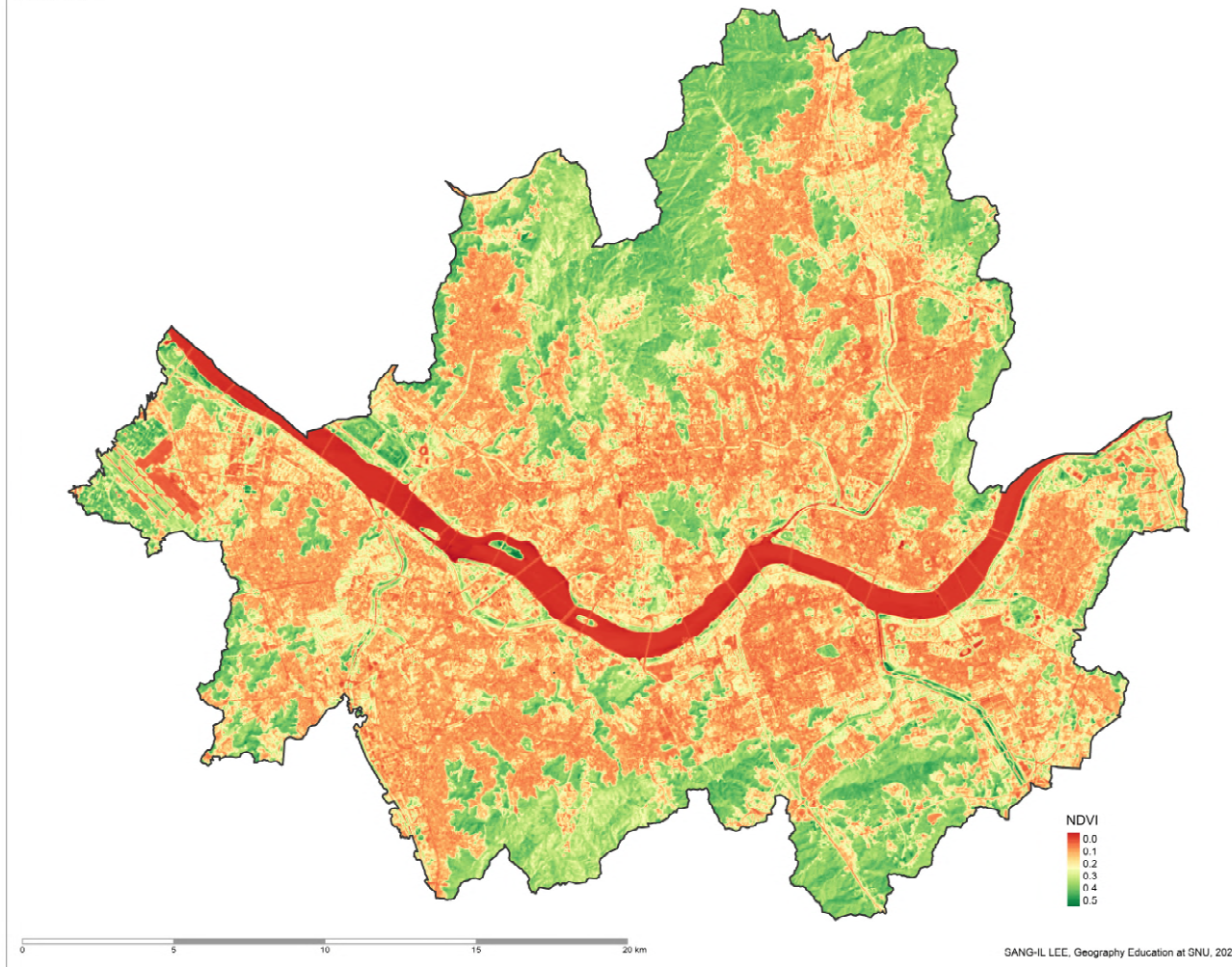
0 5 10 15 20 km

SANG-IL LEE, Geography Education at SNU, 2025

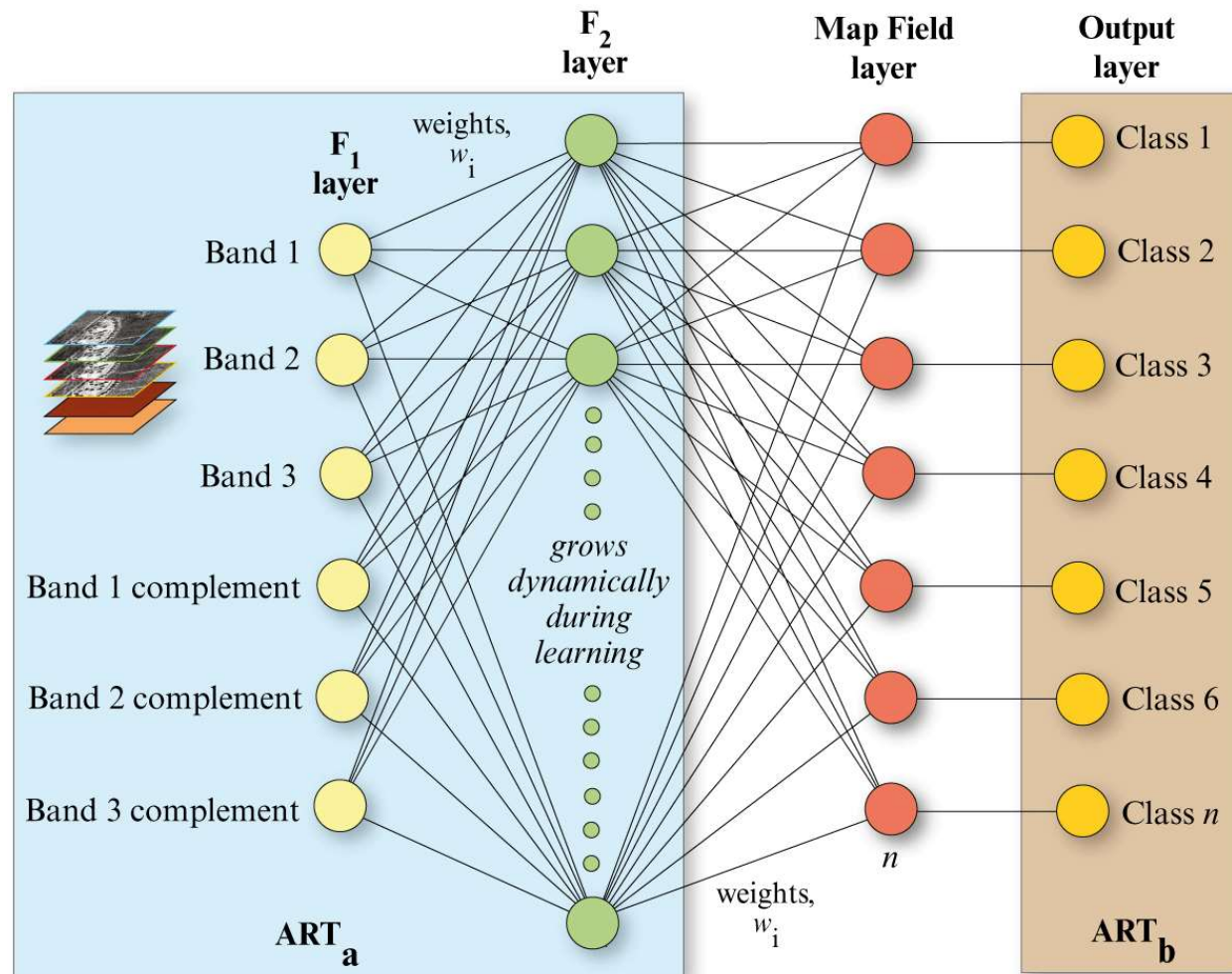
5(NIR)
+
4(Red)
+
3(Green)

NDVI

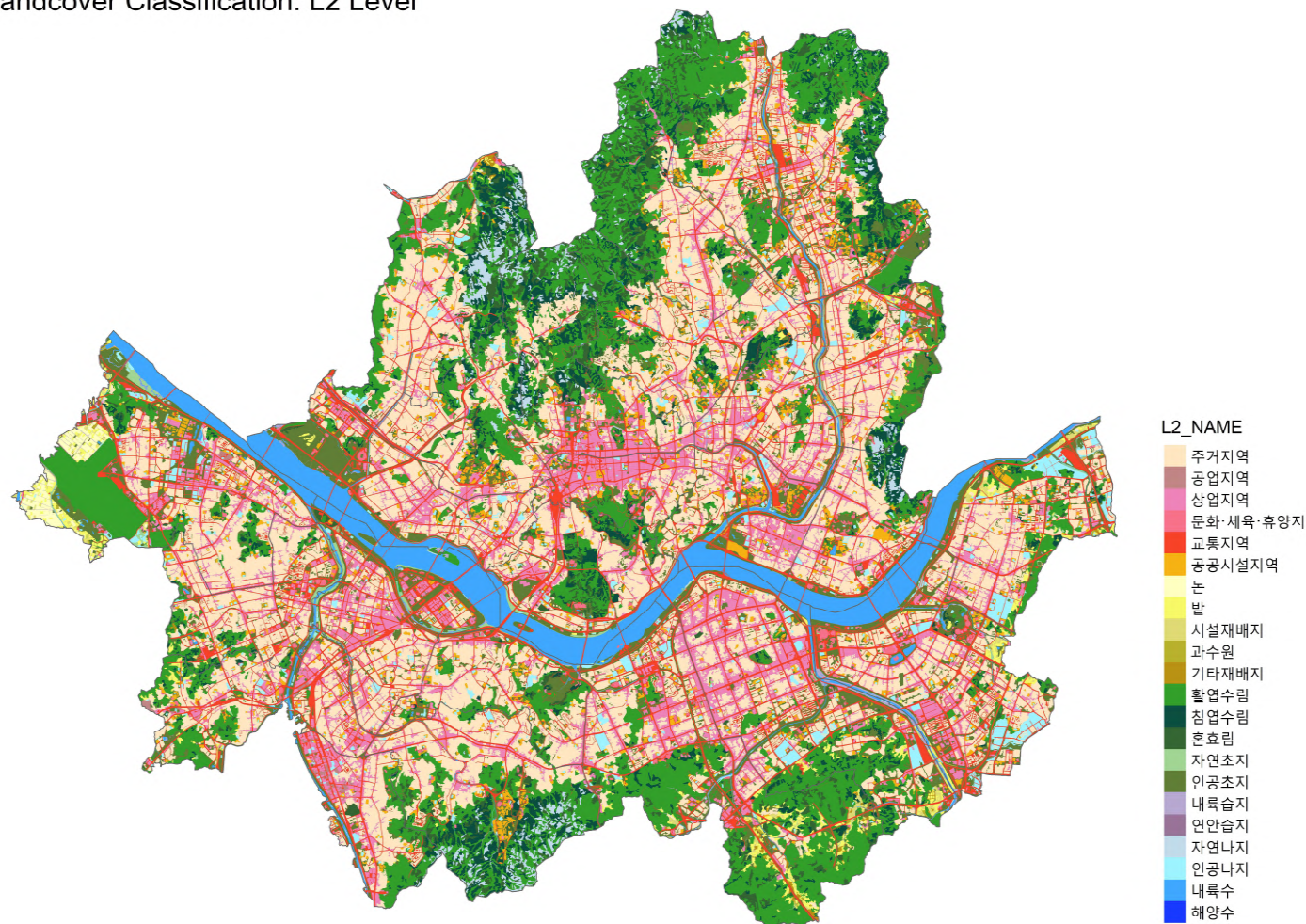
$$NDVI = \frac{\rho_{NIR} - \rho_{Red}}{\rho_{NIR} + \rho_{Red}}$$



Fuzzy ARTMAP Neural Network Architecture



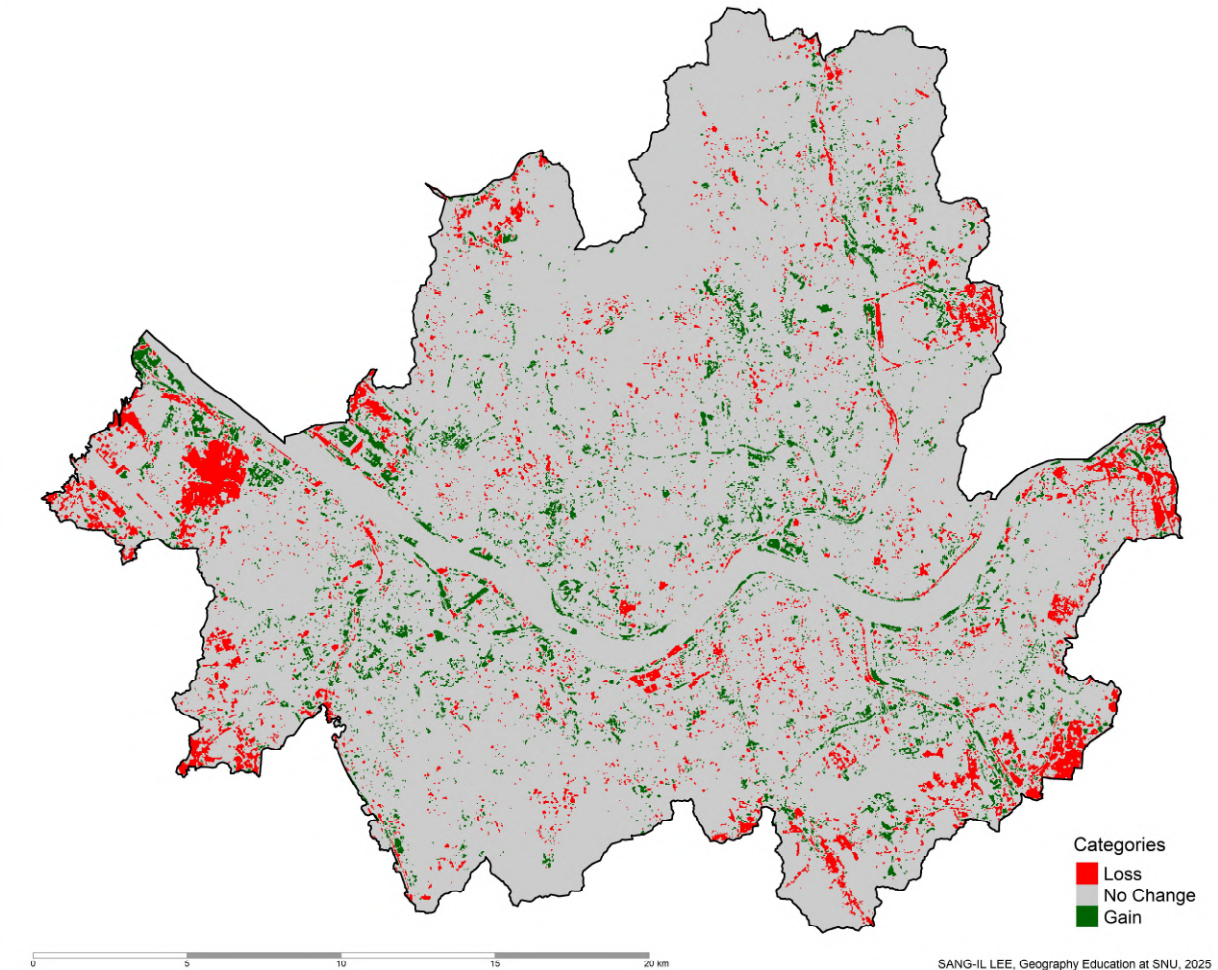
Landcover Classification: L2 Level



0 5 10 15 20 km

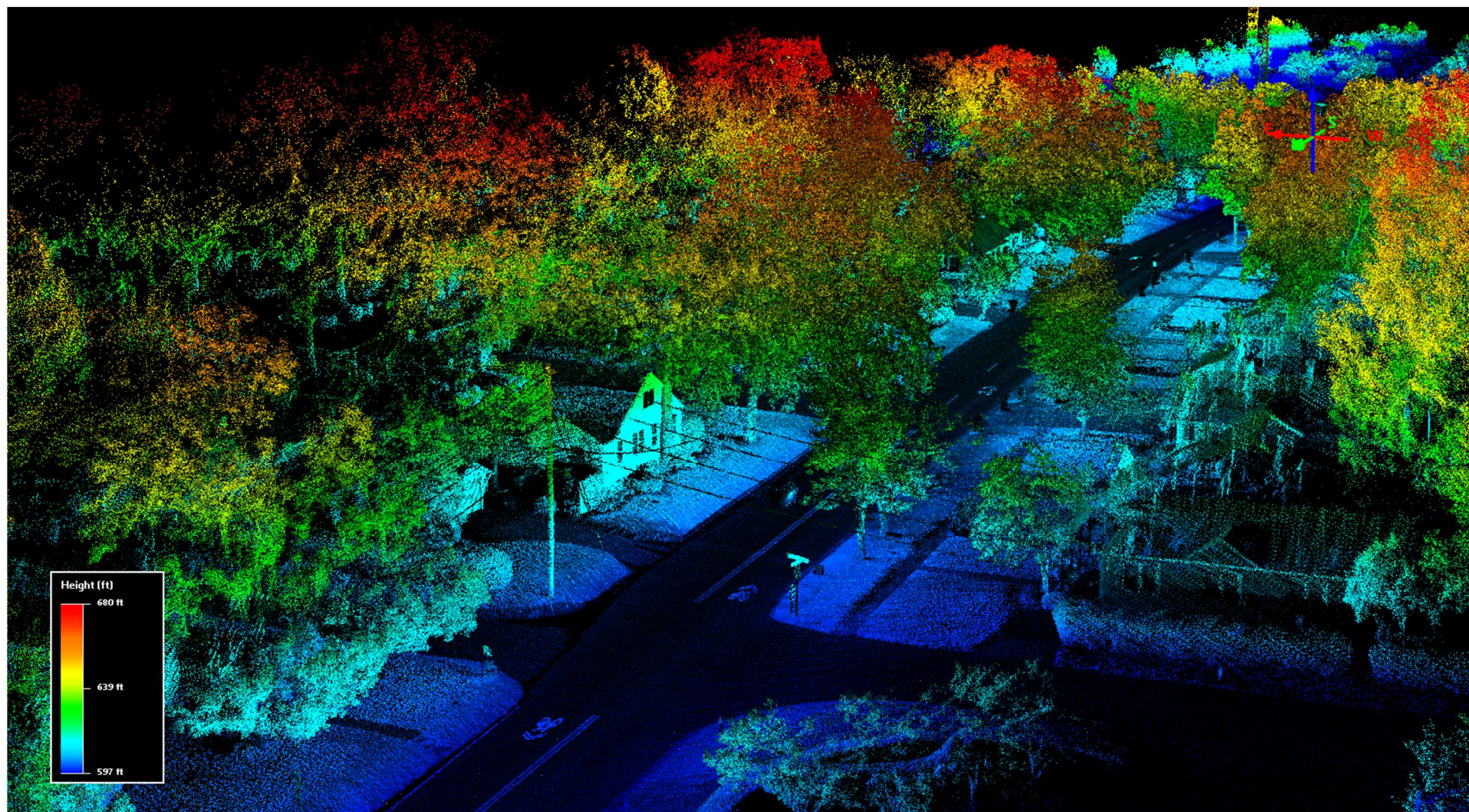
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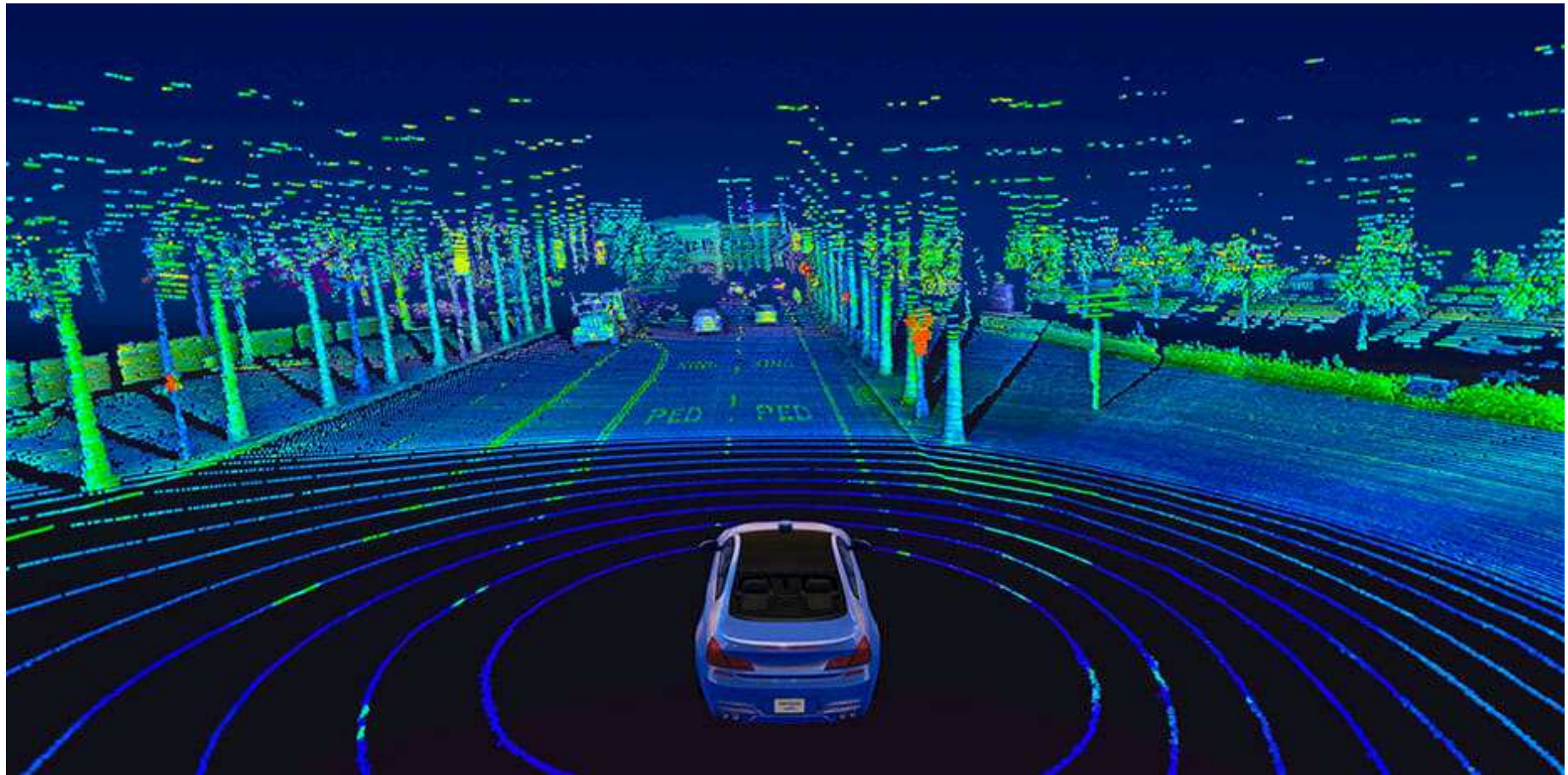
Change Detection: Vegetation



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LiDAR



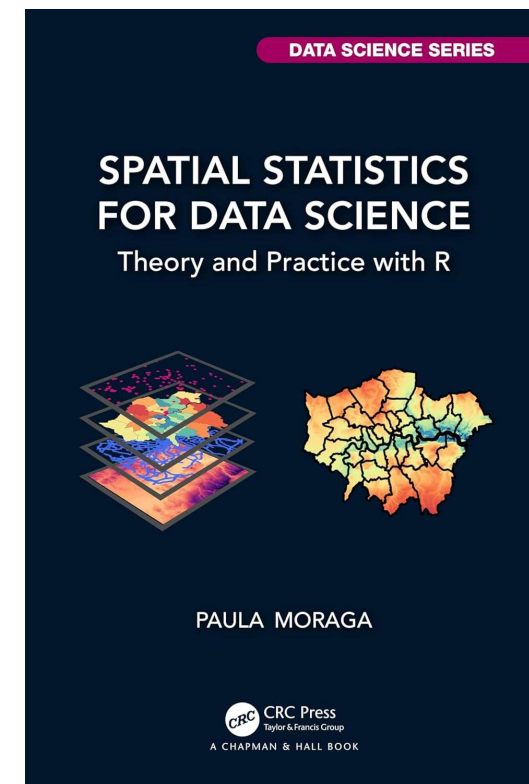
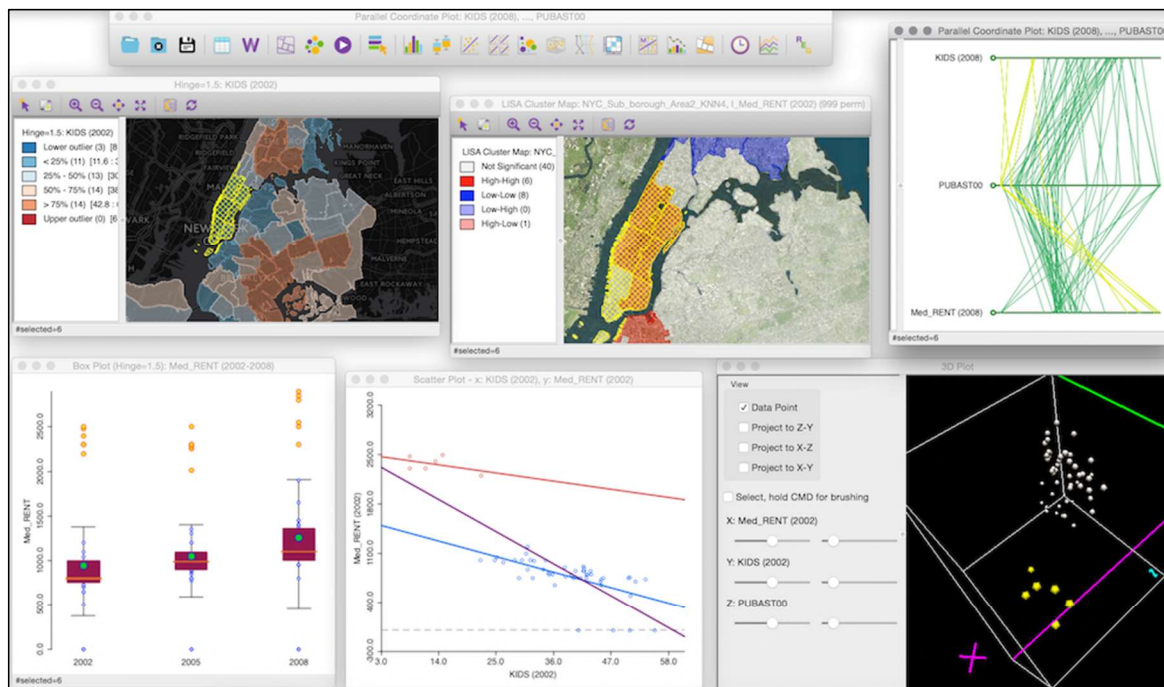


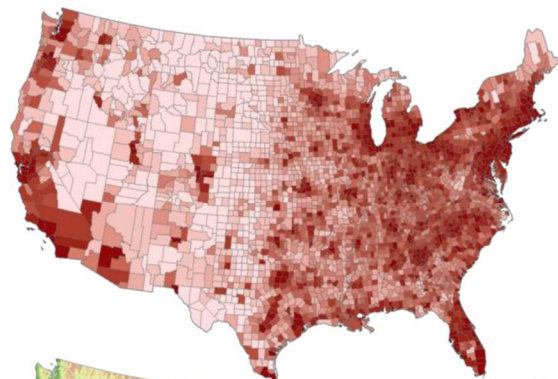
iPhone 16 (Concept)
@upintheozone on X/Twitter





Spatial Analytics

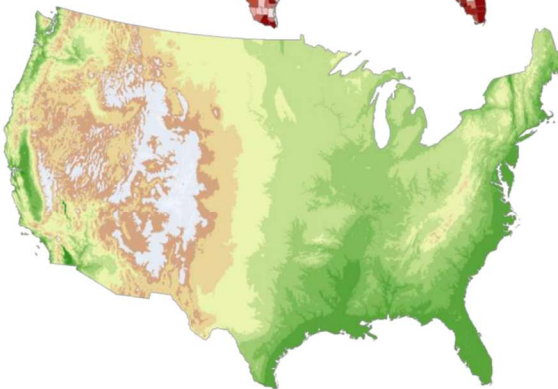
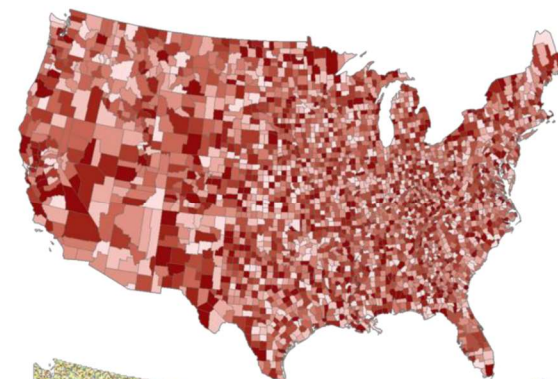




If features were
randomly distributed ...



... population
density map
of the US
would look
like this

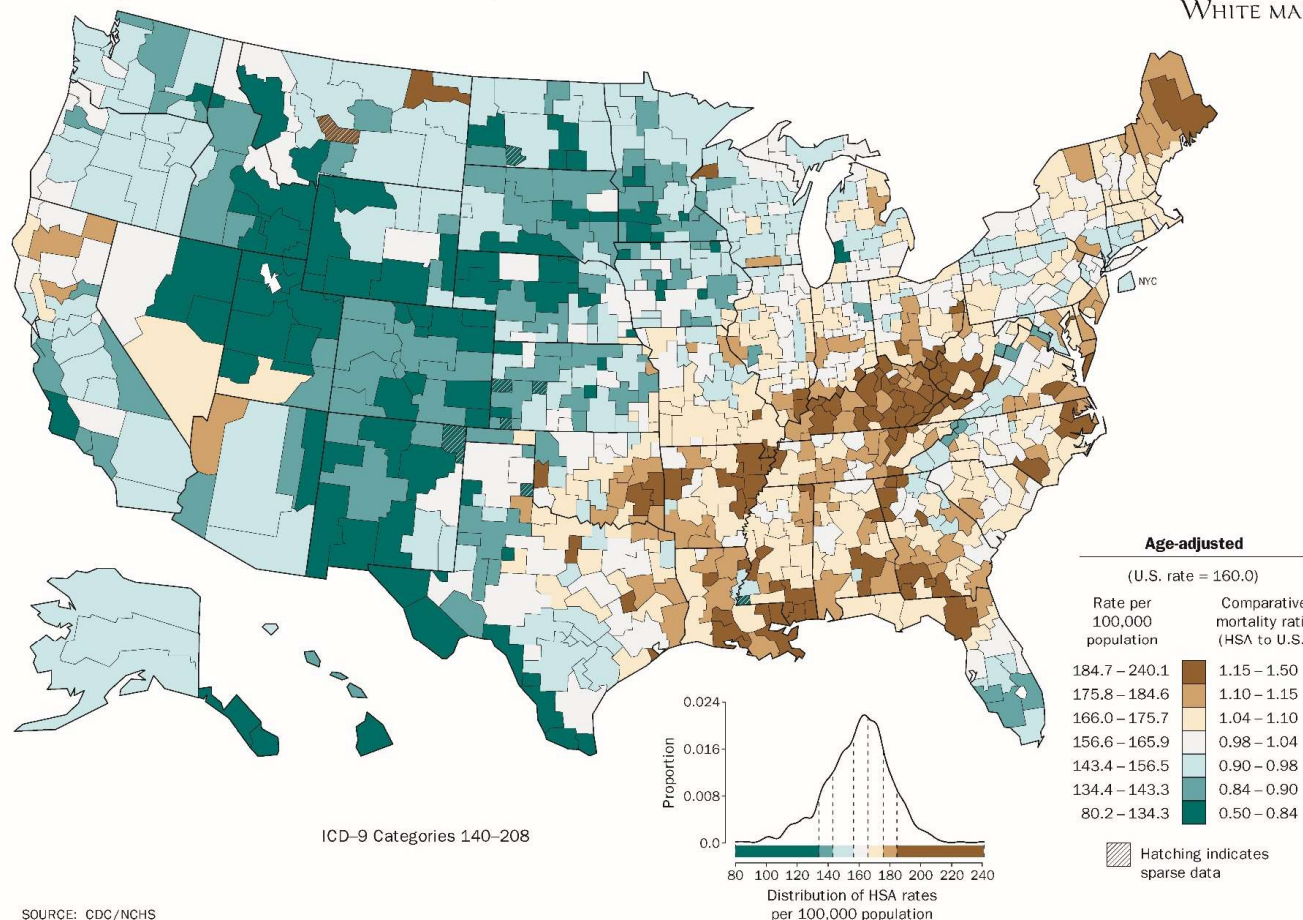


... elevation map
of the US
would look
like this

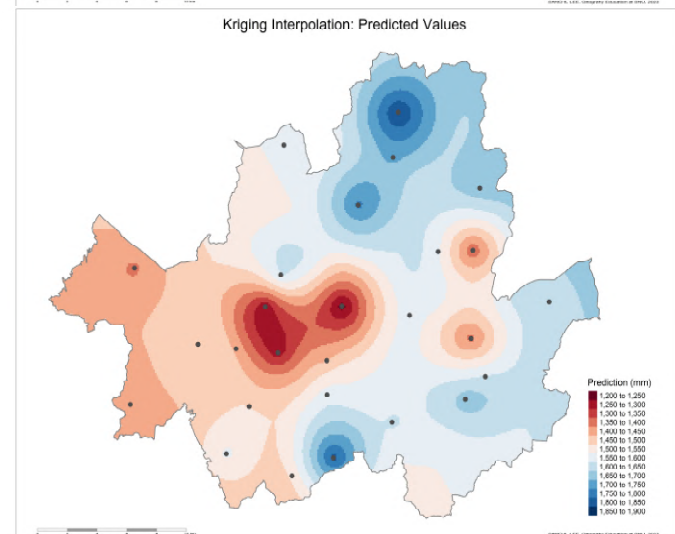
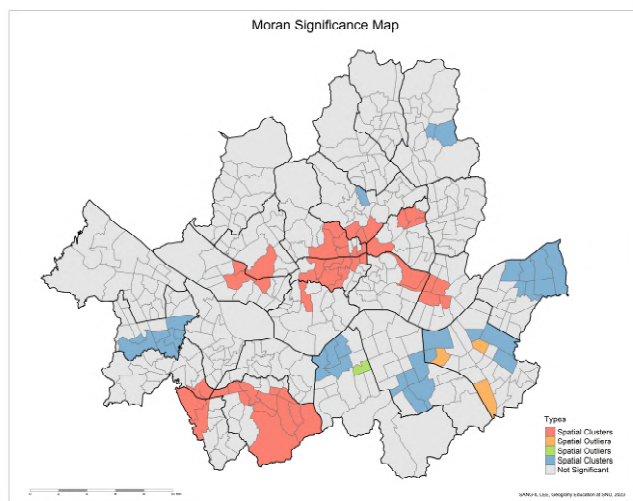
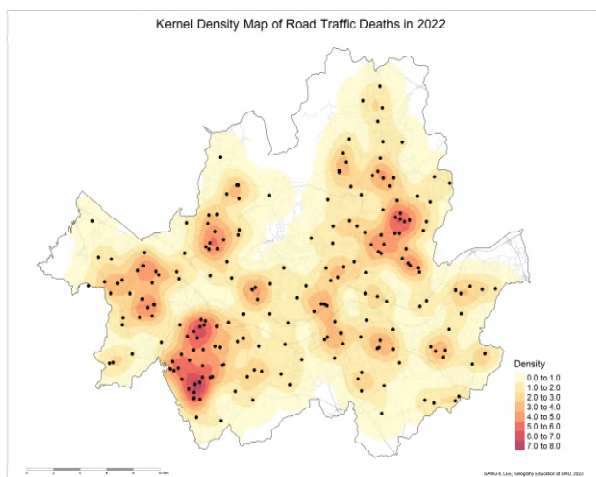
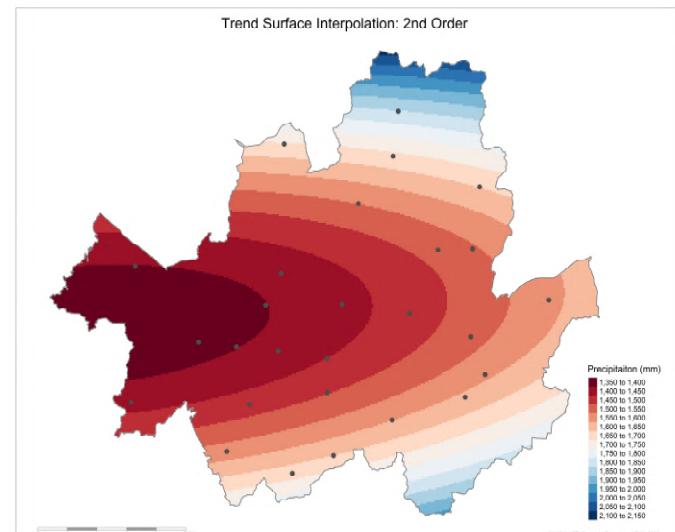
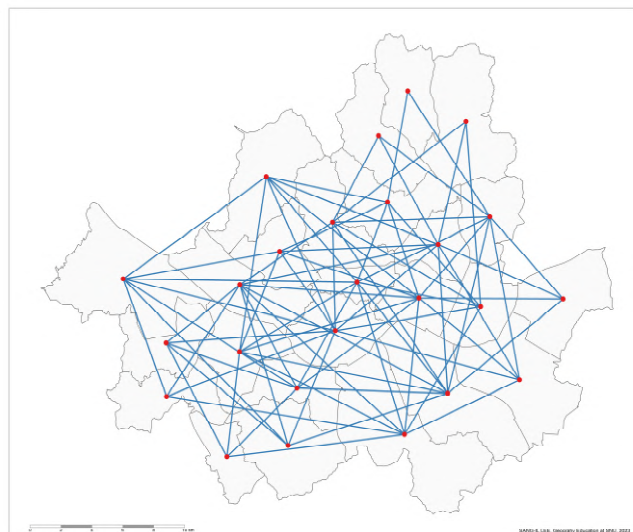
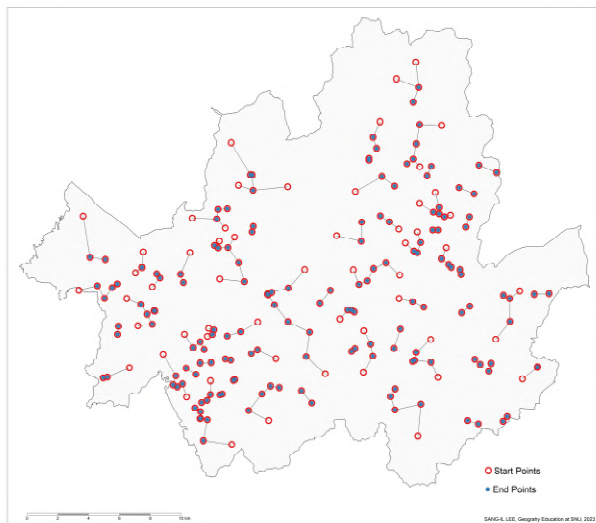


AGE-ADJUSTED DEATH RATES BY HSA, 1988-92

ALL CANCER
WHITE MALE

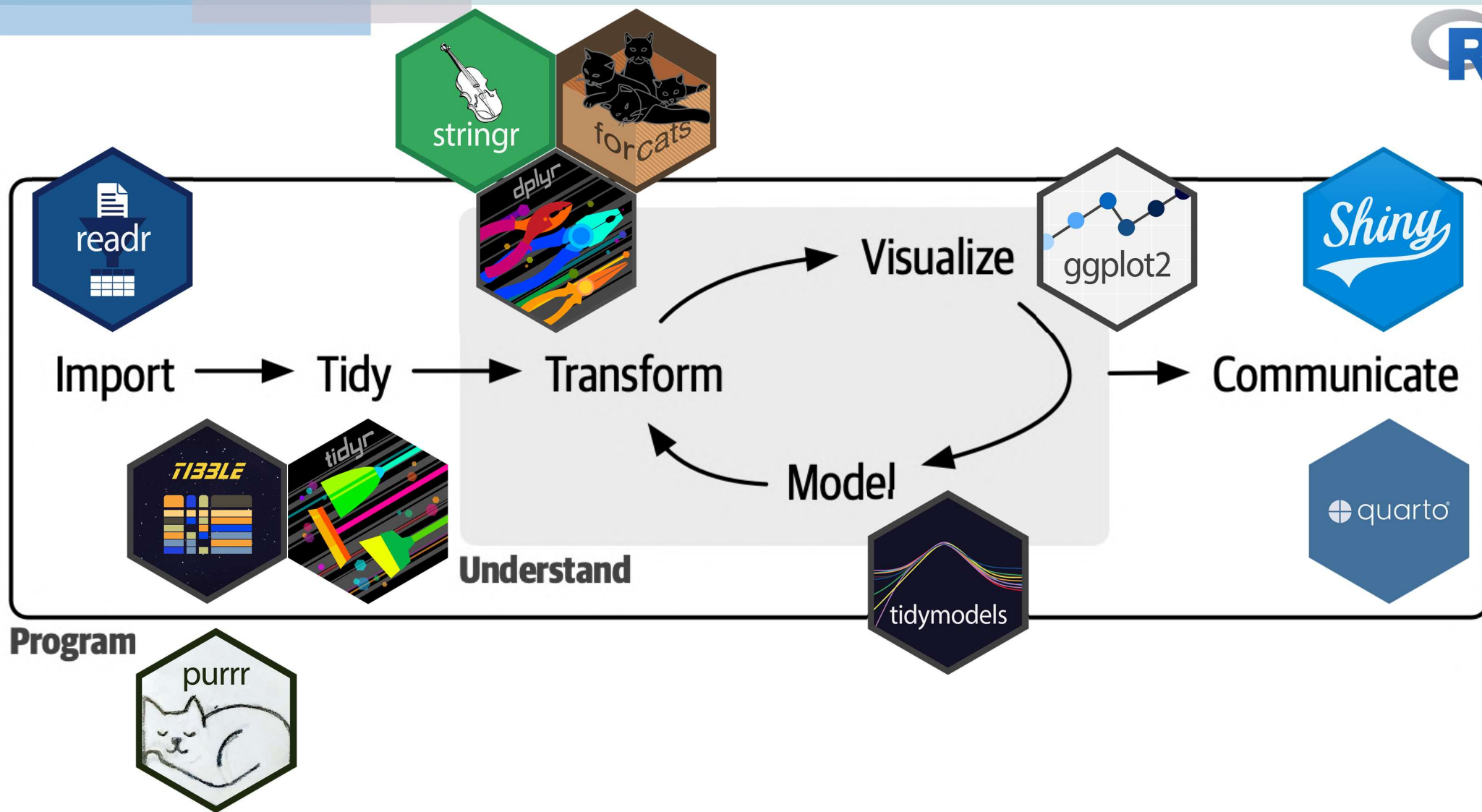


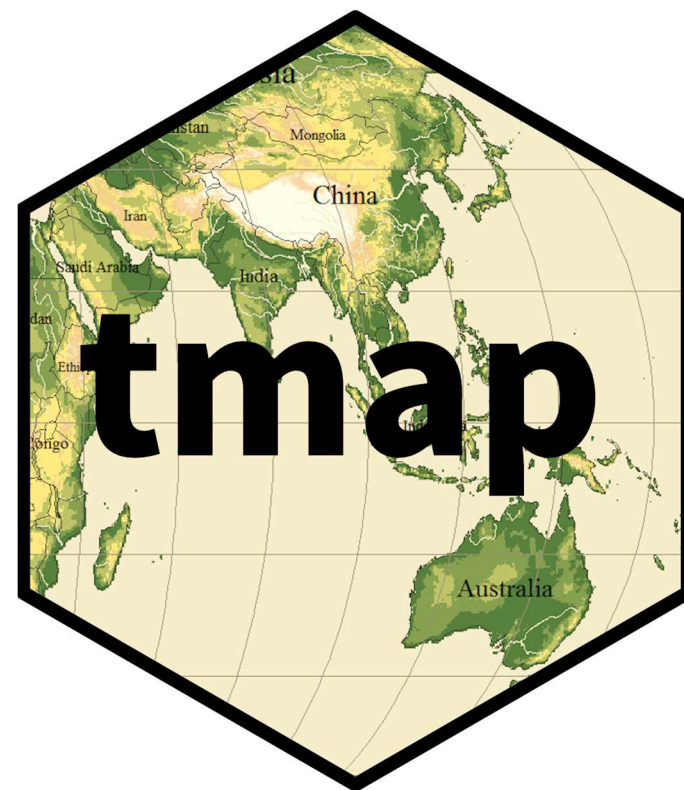
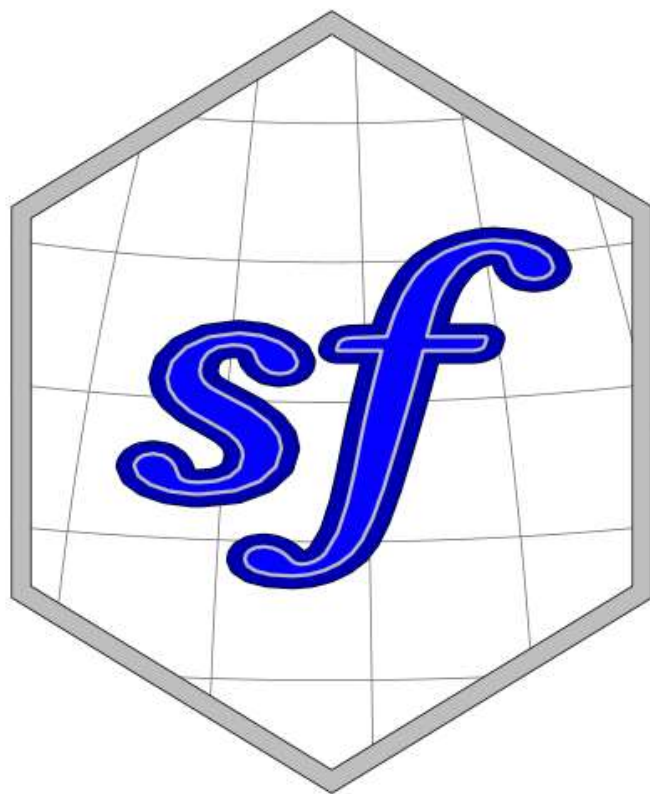
SOURCE: CDC/NCHS



오픈공간데이터사이언스의 실제

- ▶ 오픈 지리공간 데이터
 - ▶ [Natural Earth Data](#)
 - ▶ [USGS EarthExplore](#)
 - ▶ [NASA SEDAC](#)
 - ▶ [OpenStreetMap \(OSM\) Data](#)
 - ▶ [브이월드 디지털 트윈국토](#), 국토교통부
 - ▶ [국토정보플랫폼](#), 국토지리정보원
 - ▶ [공공데이터포털](#), 행정안전부
 - ▶ [통계지리정보서비스](#), 통계청





인터랙티브 지리공간 웹 앱

- ▶ <https://sangillee.shinyapps.io/ThiessenPolygon/>
- ▶ https://sangillee.snu.ac.kr/dashboard_popgeo/