8 Plenary, UN-GGIM-AP

Practices of Geo-Statistics Integration – China Experience

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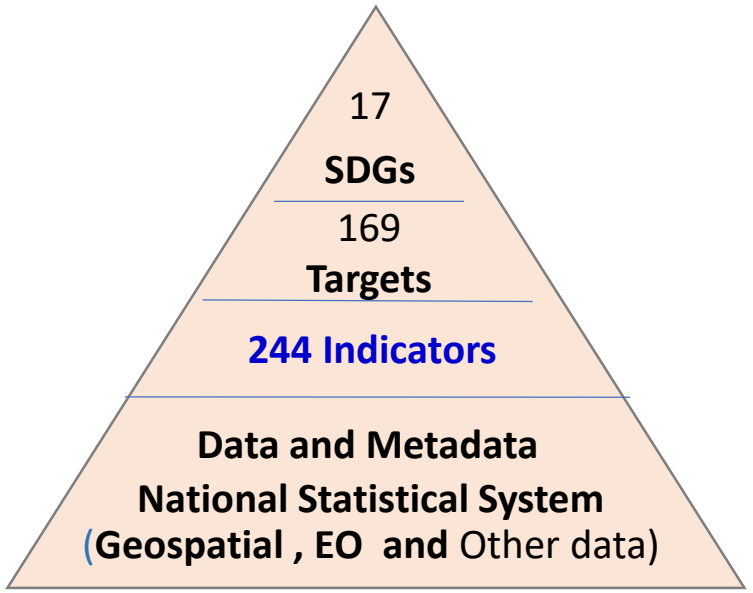
Nov, 3rd, 2019, Canberra, Australia

Contents

Measuring and monitoring progress towards UN 2030 SDGs

Becoming a crucial task for national/ local governments



- **UN called upon indicator-based monitoring**
  - with globally agreed indicator framework
  - by integrating geo-statistical data

Major Challenges

- **State-of-the -art**
  - More in theoretical/concept than in practical
  - Some individual indicators studied
  - Lack of comprehensive measurement and monitoring

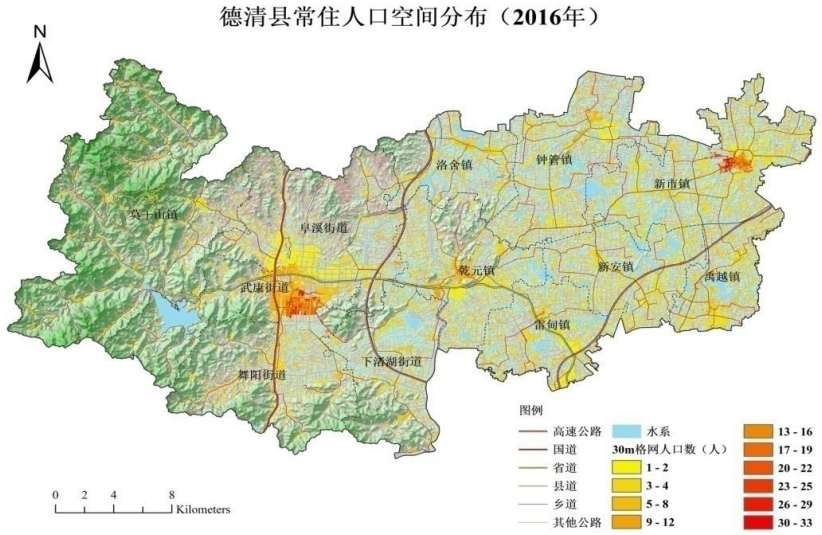
- **Challenges Facing**
  - **Indicators**– more or less? (definition， localization)
  - **Data** –available/ reliable? (geospatial/ EO data)
  - **Computing**– geographical angle?
  - **Assessment**- translating into actions?

Good practices needed for showcase and discussion

China’ s Pilot Practice in Deqing

Deqing county, Zhenjiang Province, selected as a pilot study area, when it became the venue of the first UN World Geospatial Information Congress (Nov.19-21,2018)

- 937.92 Km^2
- 430,000 permanent habitants
- GDP 6.91 billion US Dollars in 2017



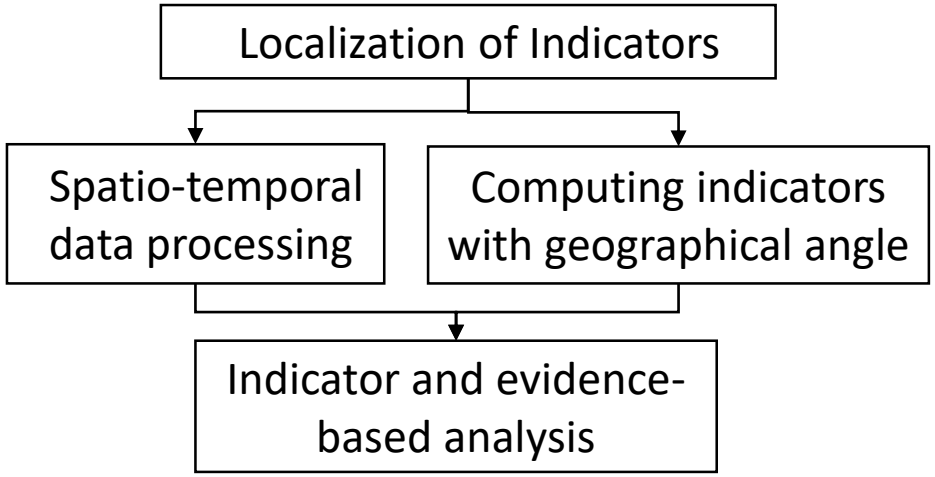
- Sustainable development concepts well accepted and implemented
- Geospatial and statistical information resources well established

Two tasks completed in last two years

- **Task 1 (2018):** Monitoring progress towards SDGs with geo-statistical data
- **Task 2 (2019)** : Develop a SDGs knowledge Service Portal

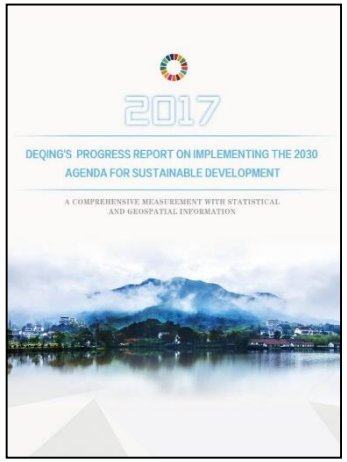
Task 1: Two Major Outputs

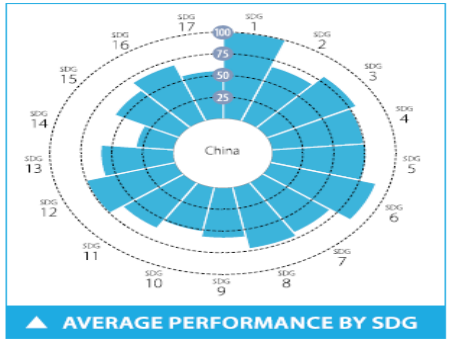
(1) A data-driven and evidence-based approach



- **How to measure the progress towards 2030 SDGs（如何去量测)?**

(2) Deqing's SDGs progress report

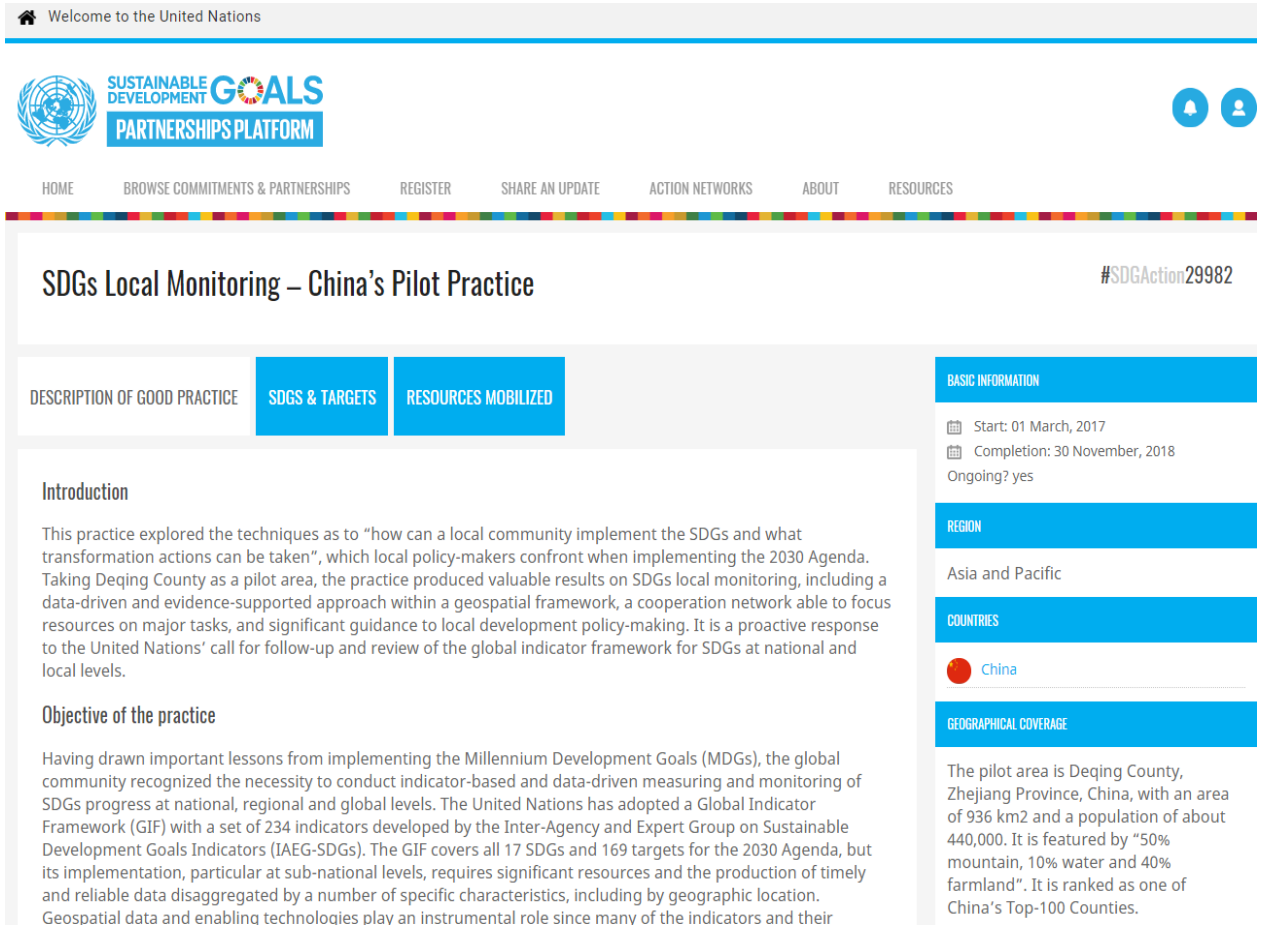




- **How far is Deqing from 2030 SDGs (德清离2030SDGs 有多远)?**

Task 1: Recognized as One of UN SDGs Best Practices

Released Officially at UN-WGIC, Nov. 20, 2018, Deqing, China



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SDGs Local Monitoring – China's Pilot Practice

#SDGAction29982

DESCRIPTION OF GOOD PRACTICE | SDGS & TARGETS | RESOURCES MOBILIZED

Introduction

This practice explored the techniques as to "how can a local community implement the SDGs and what transformation actions can be taken", which local policy-makers confront when implementing the 2030 Agenda. Taking Deqing County as a pilot area, the practice produced valuable results on SDGs local monitoring, including a data-driven and evidence-supported approach within a geospatial framework, a cooperation network able to focus resources on major tasks, and significant guidance to local development policy-making. It is a proactive response to the United Nations' call for follow-up and review of the global indicator framework for SDGs at national and local levels.

Objective of the practice

Having drawn important lessons from implementing the Millennium Development Goals (MDGs), the global community recognized the necessity to conduct indicator-based and data-driven measuring and monitoring of SDGs progress at national, regional and global levels. The United Nations has adopted a Global Indicator Framework (GIF) with a set of 234 indicators developed by the Inter-Agency and Expert Group on Sustainable Development Goals Indicators (IAEG-SDGs). The GIF covers all 17 SDGs and 169 targets for the 2030 Agenda, but its implementation, particular at sub-national levels, requires significant resources and the production of timely and reliable data disaggregated by a number of specific characteristics, including by geographic location. Geospatial data and enabling technologies play an instrumental role since many of the indicators and their

BASIC INFORMATION

Start: 01 March, 2017

Completion: 30 November, 2018

Ongoing? yes

REGION

Asia and Pacific

COUNTRIES

China

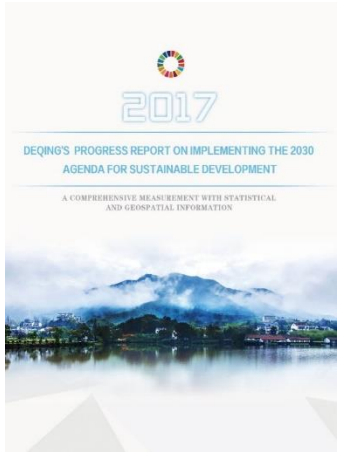
GEOGRAPHICAL COVERAGE

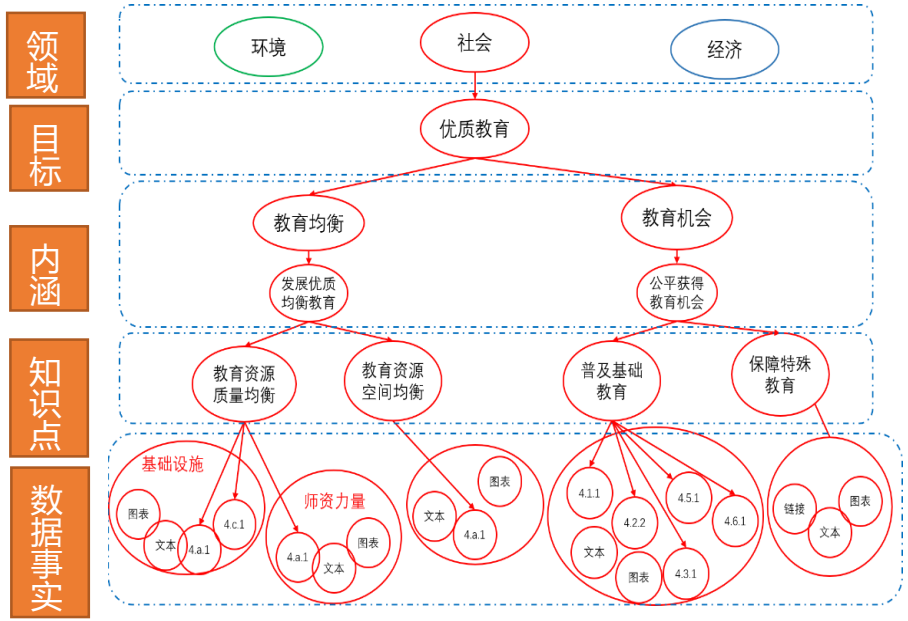
The pilot area is Deqing County, Zhejiang Province, China, with an area of 936 km2 and a population of about 440,000. It is featured by "50% mountain, 10% water and 40% farmland". It is ranked as one of China's Top-100 Counties.

Listed as best practices in SDGs implementation by UN

Task 2: A Knowledge Service System and its Application

(1) Develop a SDGs Knowledge Service System to facilitate the utilization

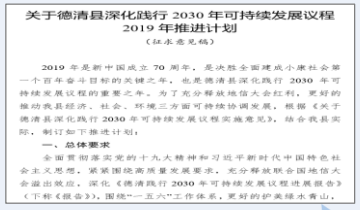




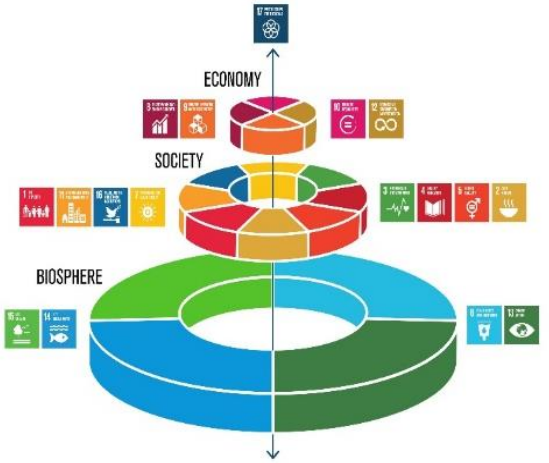
Task 2: Used for Formulating Three-years Action Plan

(2) Local policy-makers used to formulate a transformation programme and Three-Year Action Plan (2019-2021) with the monitoring results

Action plan

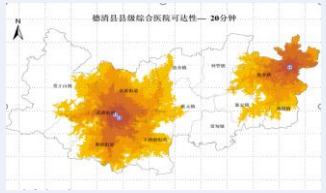

关于德清县深化践行2030年可持续发展议程2019年推进计划

- Optimize the hospital distribution
- Improve the road network
- Increase family doctor

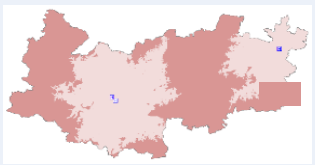


Target 3

System knowledge (Current stage)

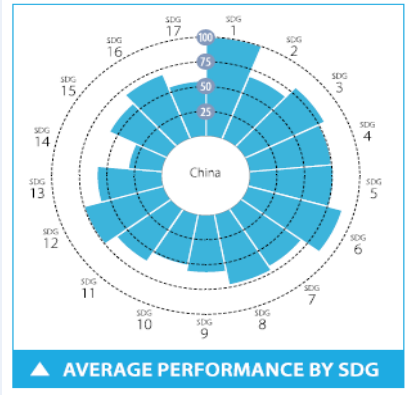


Residents can reach the general hospital within 50 minutes



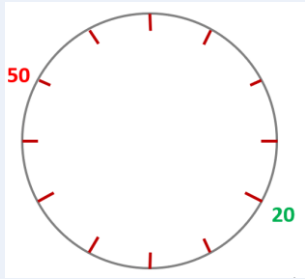
Area of residents need more than 20 minutes to reach the hospital

Transformation knowledge



How far is Deqing from SDGs?

Goal knowledge



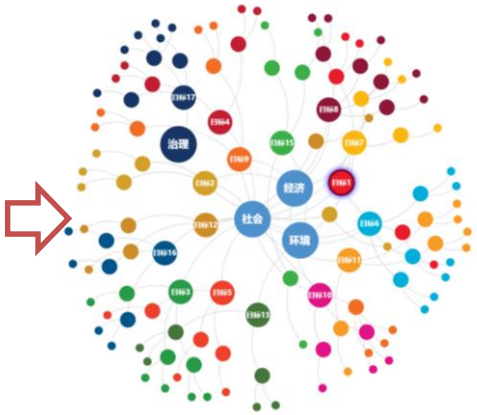
20 minutes medical service circle

Contents

From Local SDGs Profile to SDGs Knowledge Service

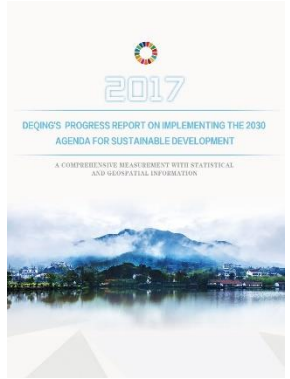
SDGs Knowledge Service

Constructive Modeling | **Knowledge Extraction** | **Knowledge Connection** | **Knowledge Representation** | **Knowledge Service**



Regional SDGs Assessment and Monitoring

Localization of Indicators | **Spatio-temporal data processing** | **Computing indicators with geographical angle** | **Indicator and evidence-based analysis**



Methodology

Progress

102 SDGs Indictors Selected for Deqing

■ A set of 102 indicators was selected for Deqing County

Criteria for Localization

- adaptability
- comprehensiveness
- measurability

A	Adopted	47
E	Extended	6
R	Revised	42
S	Substituted	7

definition → **calculation method** → **data requirements**

SDG	UN	Deqing	
1	14	**5**	1.1.1； 1.3.1； 1.4.1； 1.a.1； 1.b.1
2	13	**7**	2.1.2； 2.1.2； 2.2.1； 2.3.2； 2.4.1； 2.a.1； 2.c.1
3	27	**15**	3.1.1； 3.1.2； 3.2.1； 3.2.2； 3.3.1； 3.3.2； 3.3.3； 3.3.4； 3.4.1； 3.6.1； 3.7.1； 3.8.1； 3.b.1； 3.b.2； 3.c.1
4	11	**8**	4.1.1； 4.2.2； 4.3.1； 4.4.1； 4.5.1； 4.6.1； 4.a.1； 4.c.1
5	14	**4**	5.1.1； 5.5.1； 5.5.2； 5.c.1
6	11	**7**	6.1.1； 6.2.1； 6.3.1； 6.3.2； 6.4.1； 6.4.2； 6.6.1
7	6	**3**	7.1.1； 7.1.2； 7.3.1
8	17	**6**	8.1.1； 8.2.1； 8.5.2； 8.6.1； 8.9.1； 8.9.2
9	12	**10**	9.1.1； 9.1.2； 9.2.1； 9.2.2； 9.3.1； 9.4.1； 9.5.1； 9.5.2； 9.b.1； 9.c.1
10	11	**2**	10.1.1； 10.2.1
11	15	**9**	11.1.1； 11.2.1； 11.3.1； 11.4.1； 11.5.1； 11.5.2； 11.6.1； 11.6.2； 11.7.1；
12	13	**5**	12.2.2； 12.4.2； 12.5.1； 12.6.1； 12.7.1
13	8	**4**	13.1.1； 13.1.3； 13.3.1； 13.3.2
15	14	**7**	15.1.1； 15.1.2； 15.2.1； 15.3.1； 15.4.1； 15.4.2； 15.a.1
16	23	**6**	16.1.1； 16.1.3； 16.3.2； 16.5.1； 16.6.1； 16.1.a
17	25	**5**	17.1.1； 17.2.1； 17.3.1； 17.8.1； 17.11.1
总计	234	102	

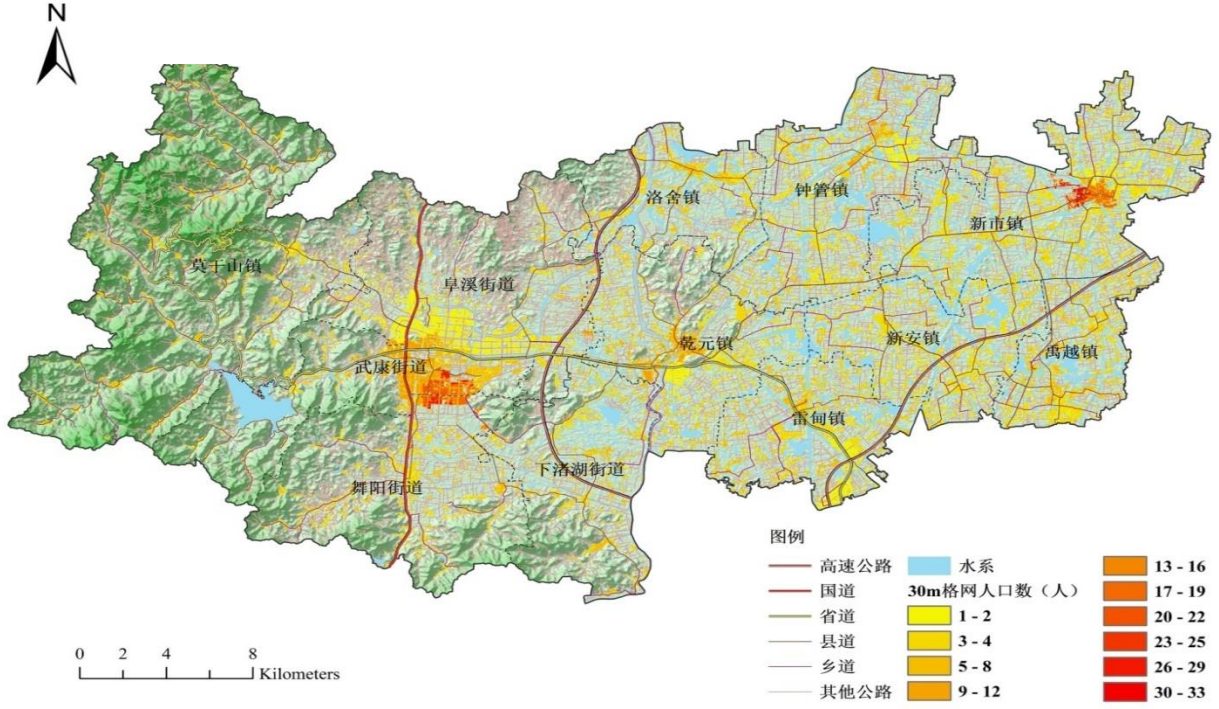
All the 16 SDGs are covered that is essential for a comprehensive measurement

Spatio-temporal Data Handling

45 geospatial datasets, 385 statistical datasets, 66 thematic datasets, and 27 other datasets were collected and processed.

镇名 Town names	人口 population
武康街道	89944
阜溪街道	26008
下渚湖街道	23999
舞阳街道	52180
洛舍镇	20553
钟管镇	43856
莫干山镇	31643
乾元镇	49644
雷甸镇	37592
新安镇	31730
新市镇	72395
禹越镇	33297

30-m Population density with topographic information



Enabling integrated geospatial and statistical analysis

Population were disaggregated at 30m spatial resolution using land cover/use data to facilitate integrated analysis of statistical and geographic data.

Data-driven Indicator Measurement

Three different ways to measure the 102 indicators

A **Direct calculation with statistical data** **85**

- using ratio (or proportion), rate of change, index or other calculations

B **Direct derivation from geospatial data** **10**

- using spatial density calculation, coverage classification and others

C **Integrated utilization of statistical and geospatial information** **7**

- based on quantitative measurement of spatial accessibility, coverage, spatial relations

Hierarchical Assessment

A hierarchical assessment with three levels

- **Indicator Level:** **79/102** were Contracted and ranked

  - with SDGs Index and Dashboard, National Plan mandate requirements etc.

- **Single SDG level**: **16** were assessed

  - through grouped focused analysis with quantified indicators and evidences

- **SDGs cluster Level:** **3** , economy, society and environment

  - coherency analysis with degree of coordination, coefficient of variation

Deqing's SDGs Progress Report-2017

Approach briefing

Assessment of each Single SDG

SDGs Cluster analysis

Directory

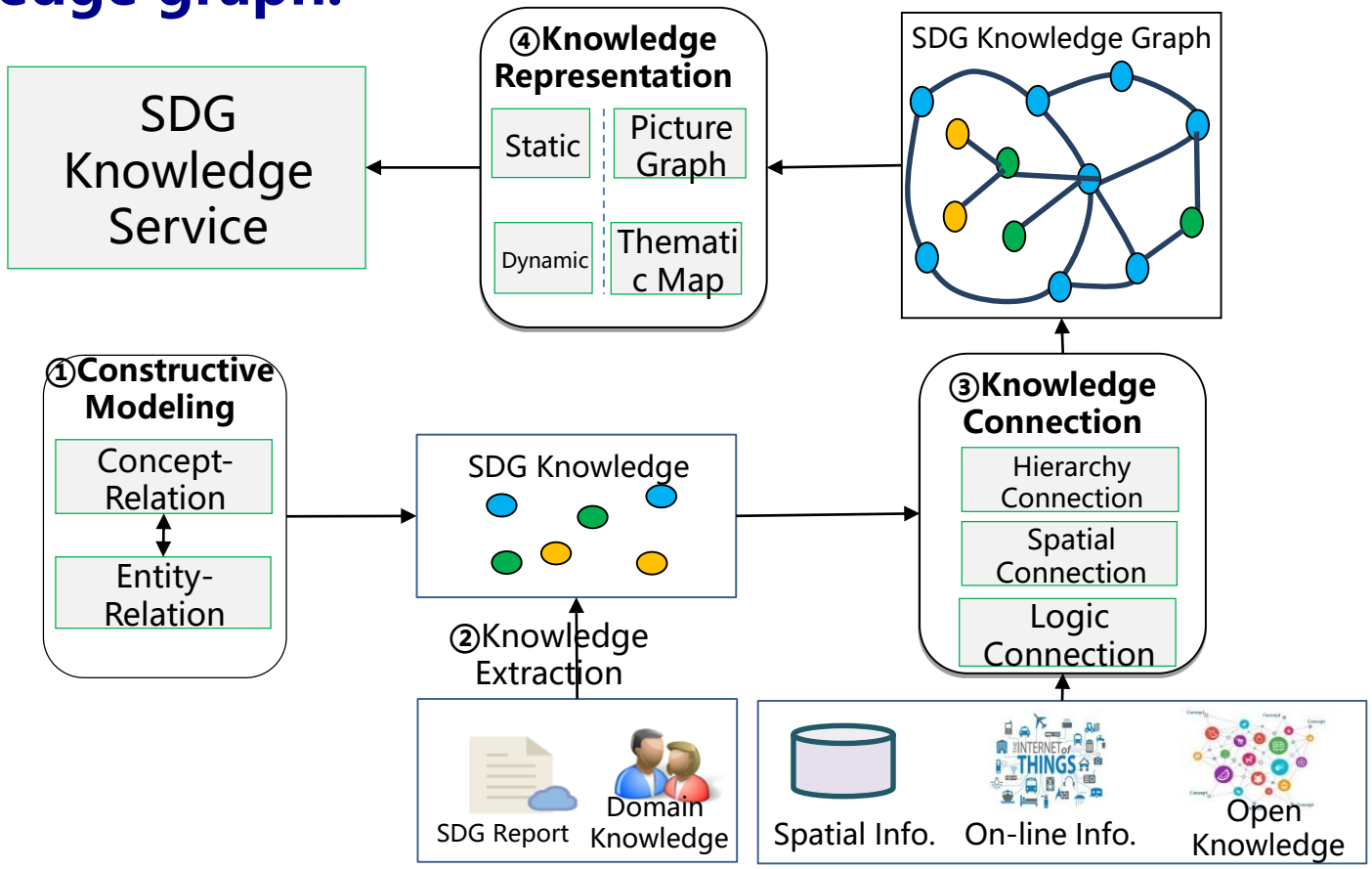
Chinese version- around 70 pages

English version- around 80 pages

1) How to measure progress towards 2030 SDGs ?
2) How far is Deqing from 2030 SDGs ?
3) What are next steps ?

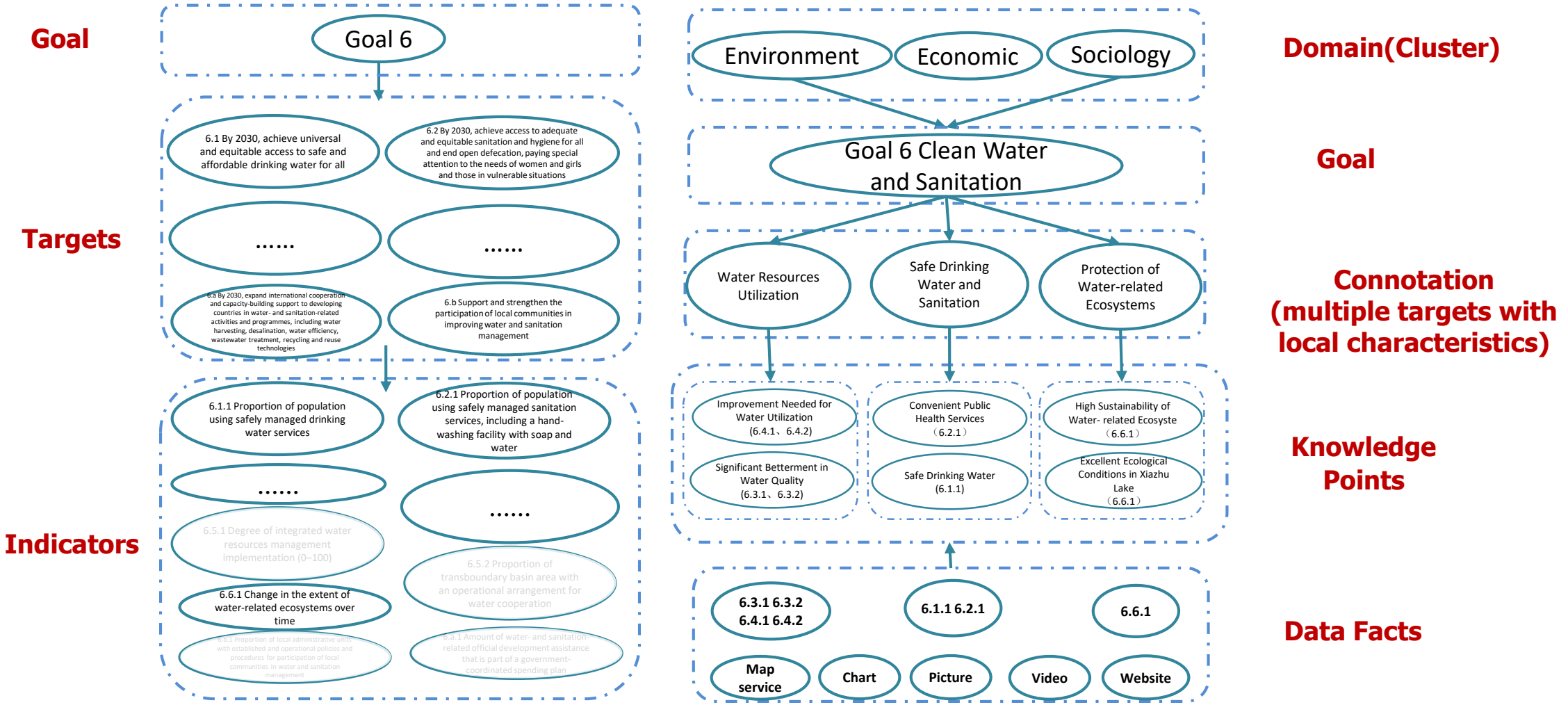
SDG Knowledge Modeling and Service

Based on the characters of SDG, the constructive model has been built , then extract knowledge from the report with the process of knowledge connection to form the knowledge graph.



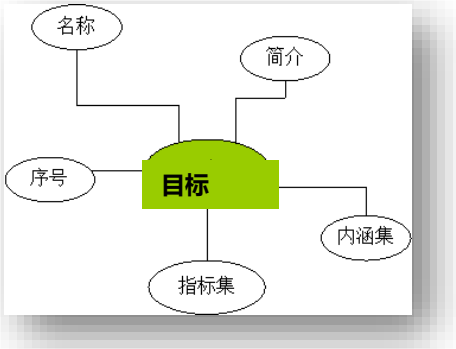
Constructive Modeling

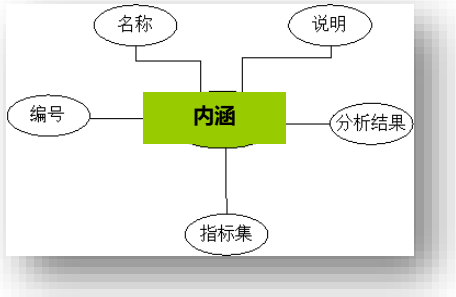
Expand a five Hierarchical model from the concept of UN GIF

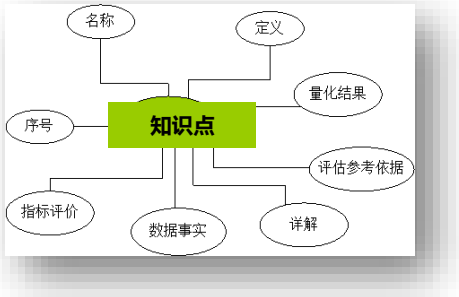


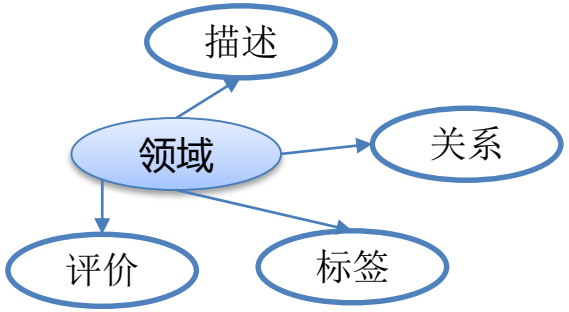
Constructive Modeling

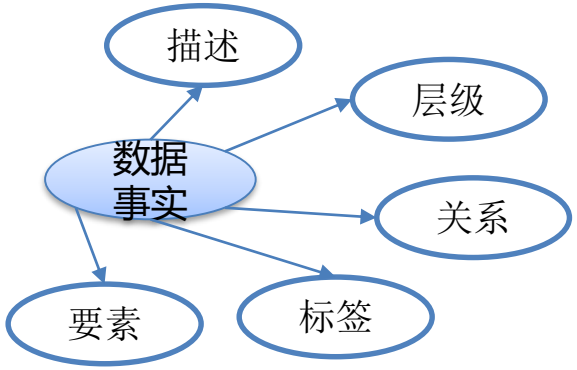
Define the entity-relation for each level to describe each level





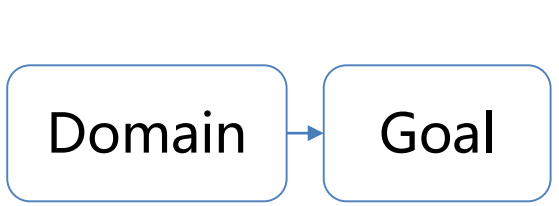


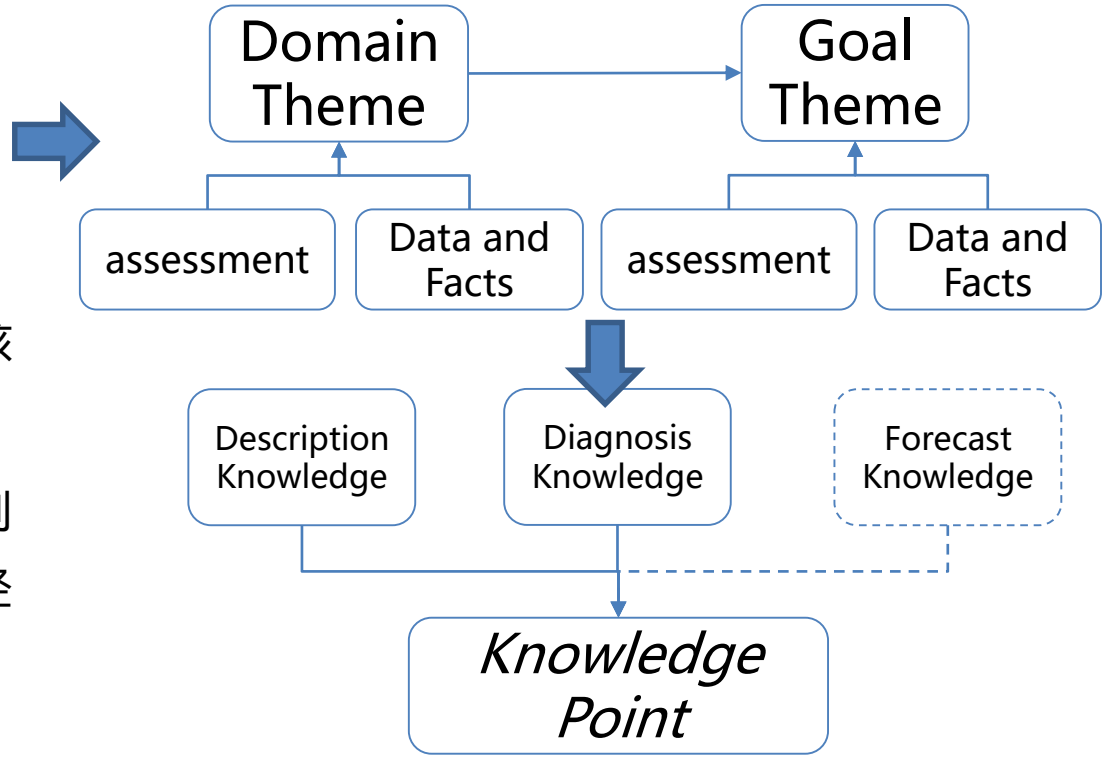




Knowledge Extraction

According to the domains and goals, integrate the quantitive assessment with facts to form the knowledge point



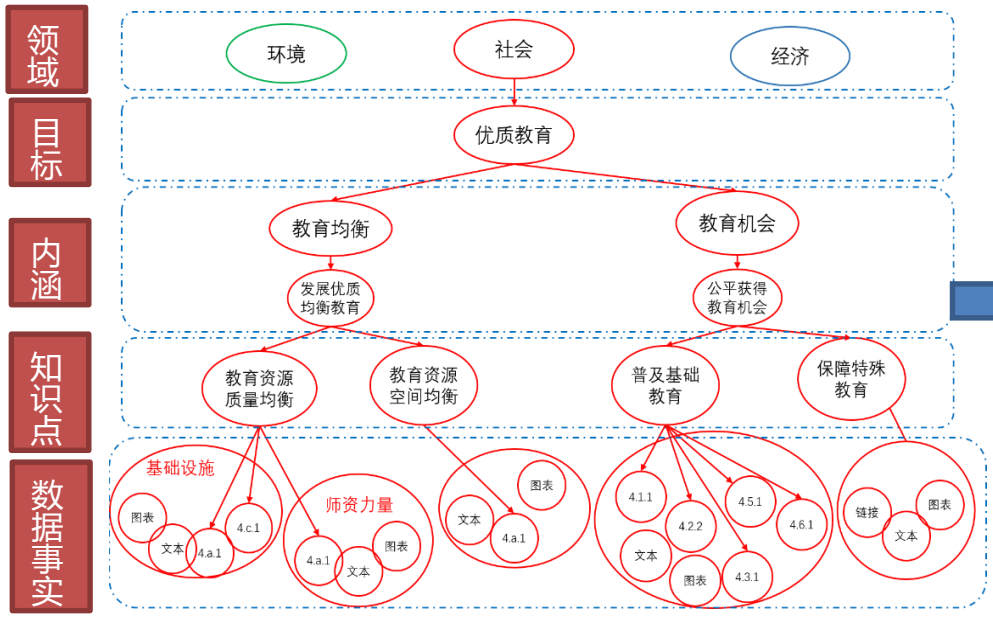


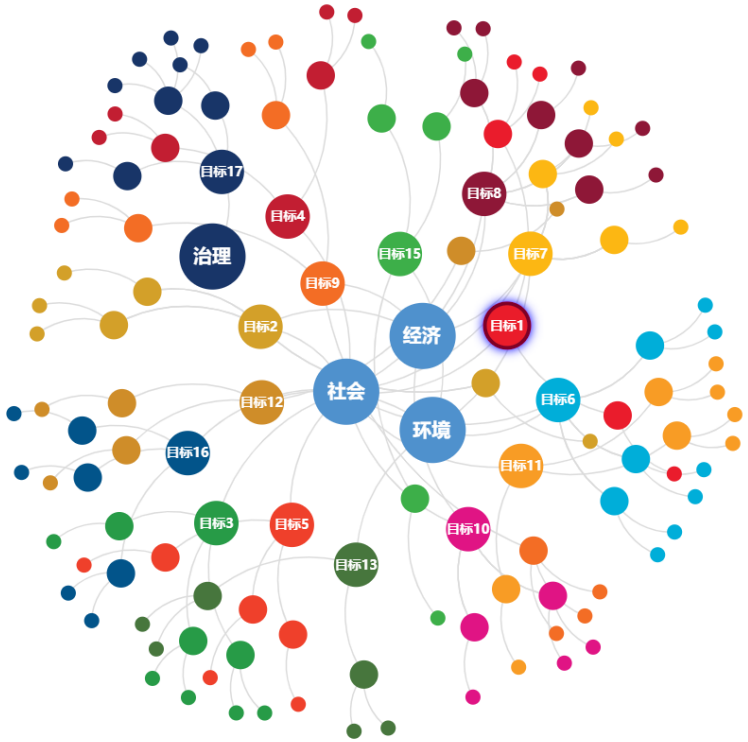
- 以领域、目标、内涵、指标为核心，抽取SDG核心知识内容
- 将核心知识内容与数据事实分别梳理成描述型、诊断型知识，经过组合，形成知识点

Over 130 knowledge points have been extracted from the progress report ,covered all domains and goals.

Knowledge Connection

According to the established SDGs hierarchical model, the knowledge nodes are connected hierarchically to form a knowledge network and construct a knowledge graph with hierarchy structure.

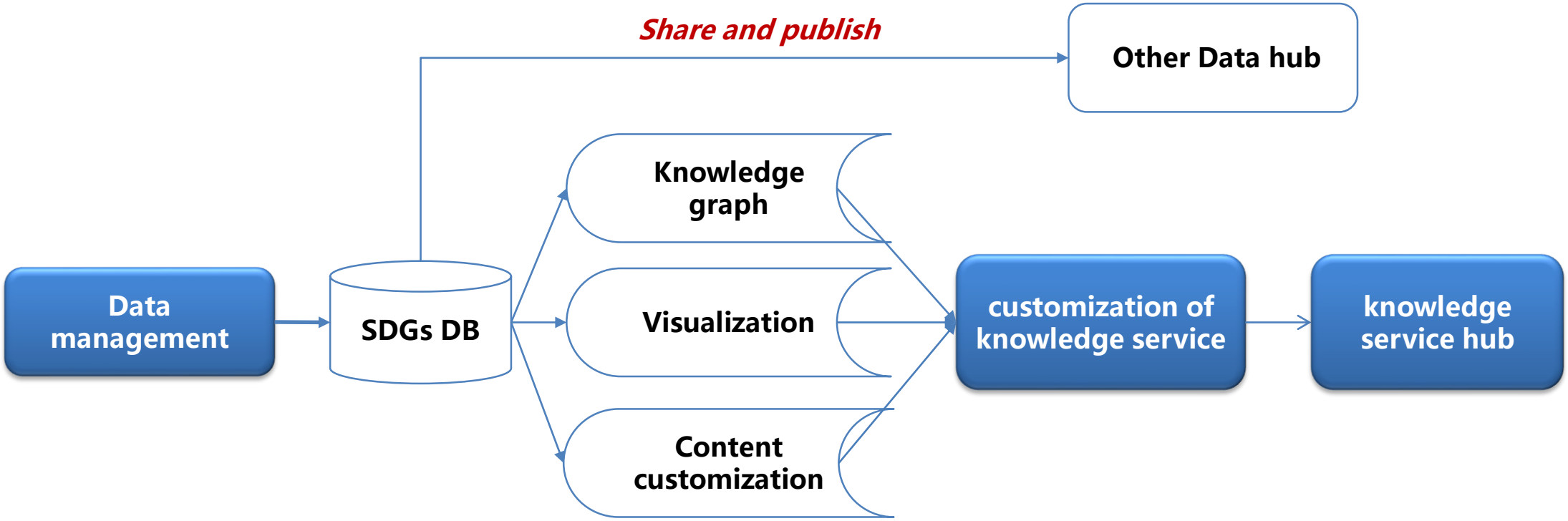




5 Levels of knowledge network，3 field nodes, 16 target nodes, 44 connotation nodes, 68 knowledge points， over 700 data facts.

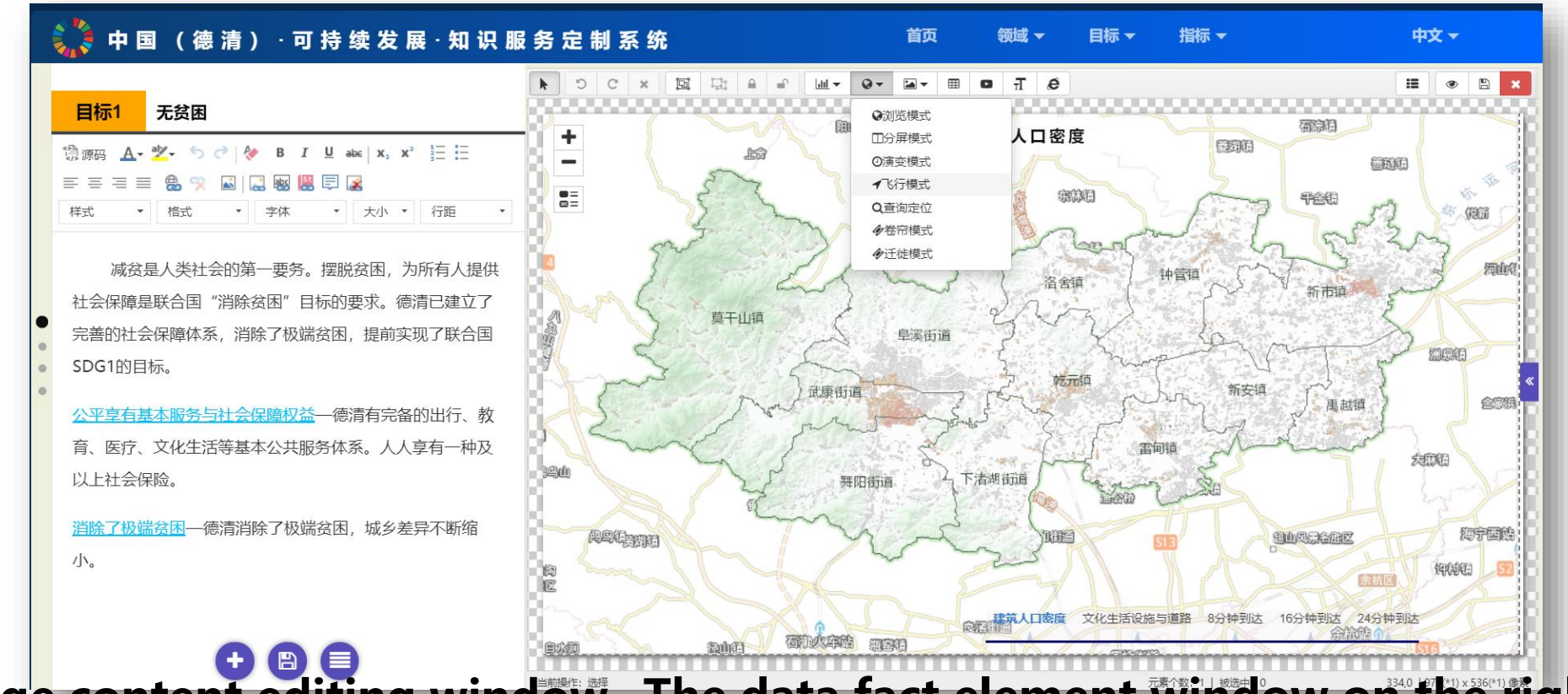
Service System Development

According to the idea of centralized management, customization and knowledge service, data and information resources are integrated and managed to realize customization of knowledge service and build knowledge service hub



Knowledge Service Customization Tool

Using component model to customize knowledge service page, what you see is what you get.

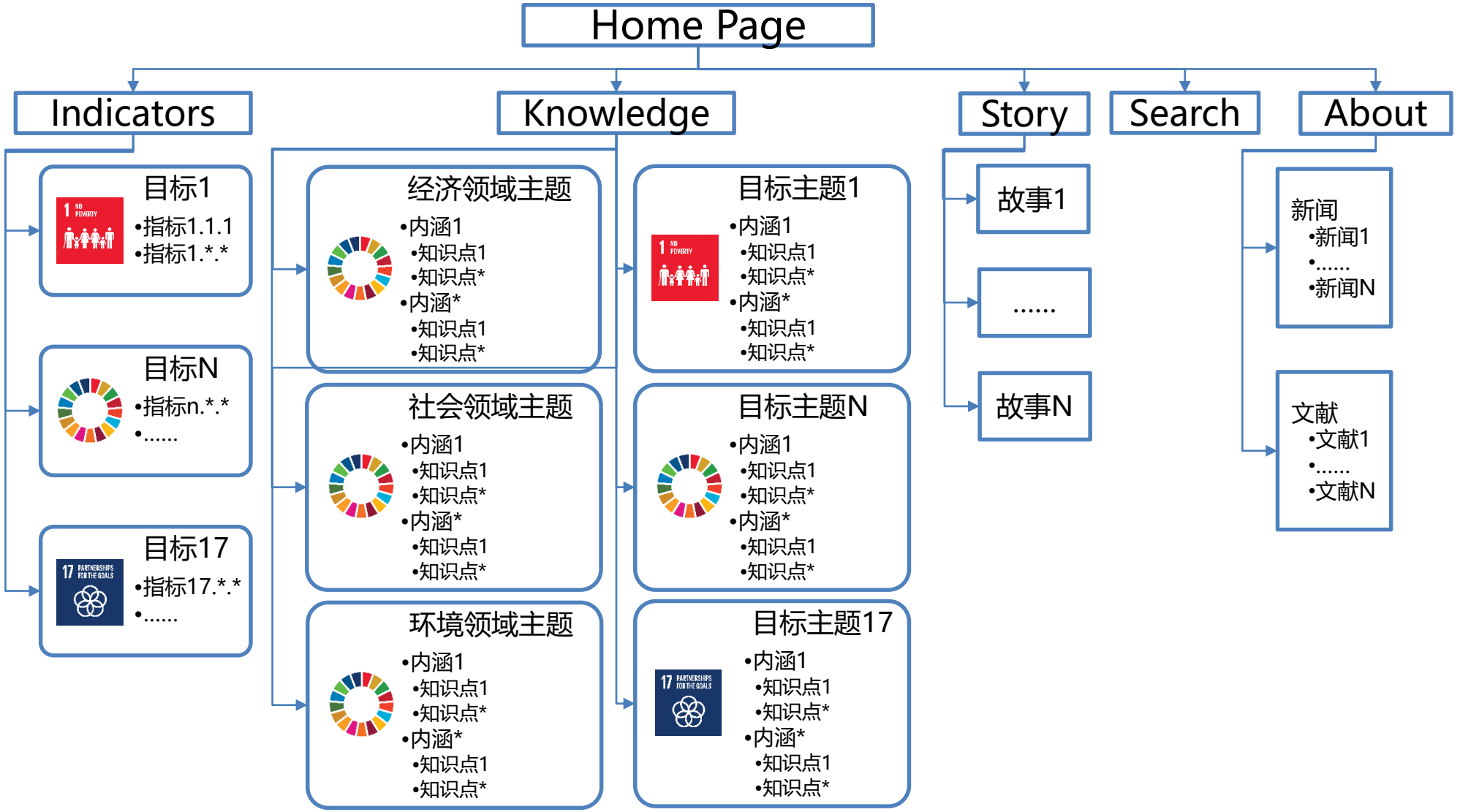


The knowledge content editing window on the left provides rich styles and multiple interactive response modes.

The data fact element window on the right provides multiple data visualization functions such as chart, geographic information configuration, etc.

Website Map of the Hub

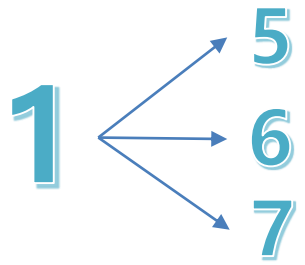
All pages of the website are customized by the customization tool



Hub Function

Seven Functional Modules

1. Menu
2. Language Switch
3. SDG Turntable
4. Domain Button
5. Introduction
6. Search Box
7. Story map Button



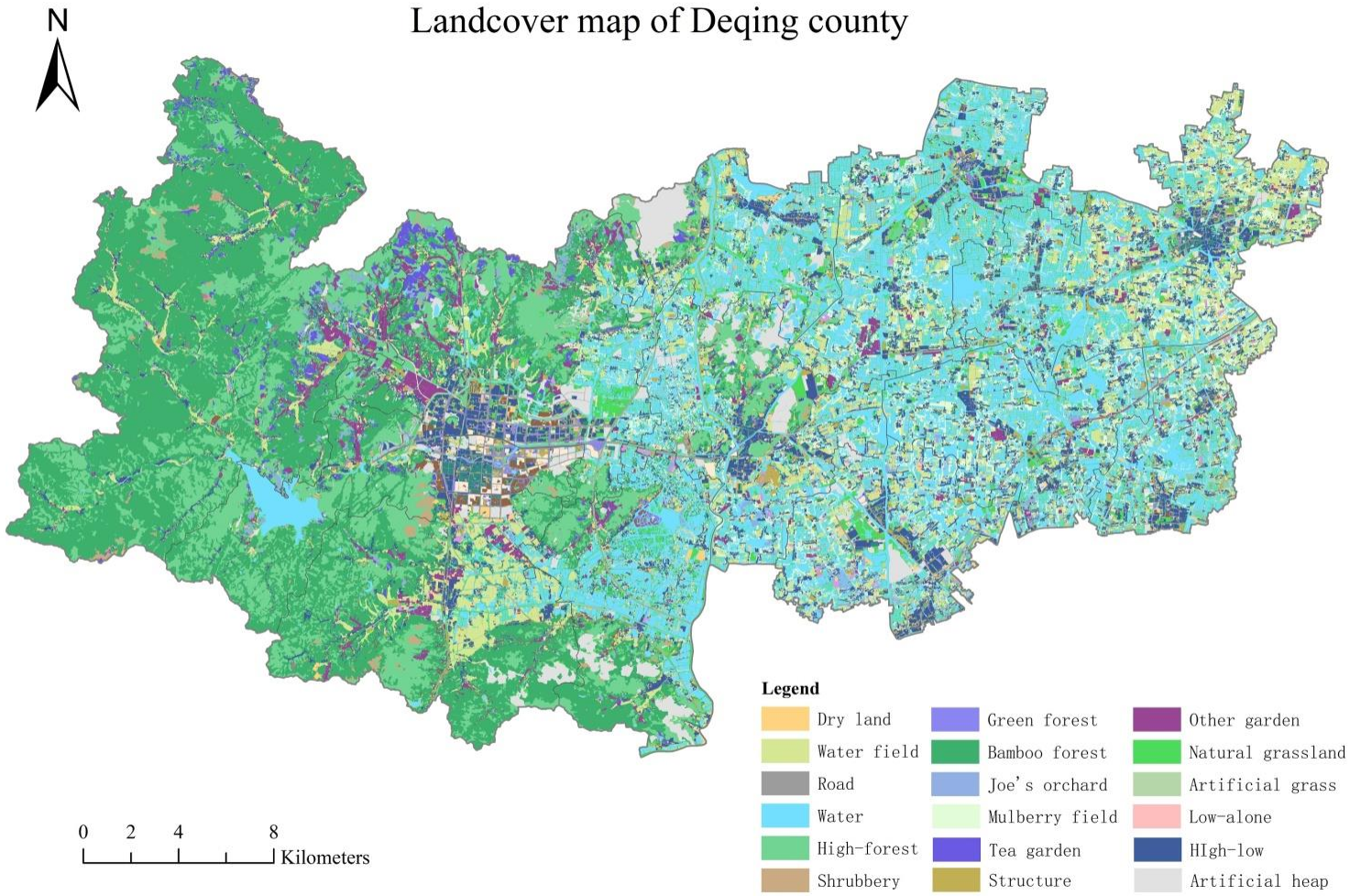
Multi-entrance and interactive

Contents

Geospatial Disaggregation of Statistical Data

Dasymetric & area weighting method will be adopted.

- According to:
  - the area distribution of Deqing County ,
  - High-resolution land-cover data,
  - population statistics (in towns),



How to disaggregate Population

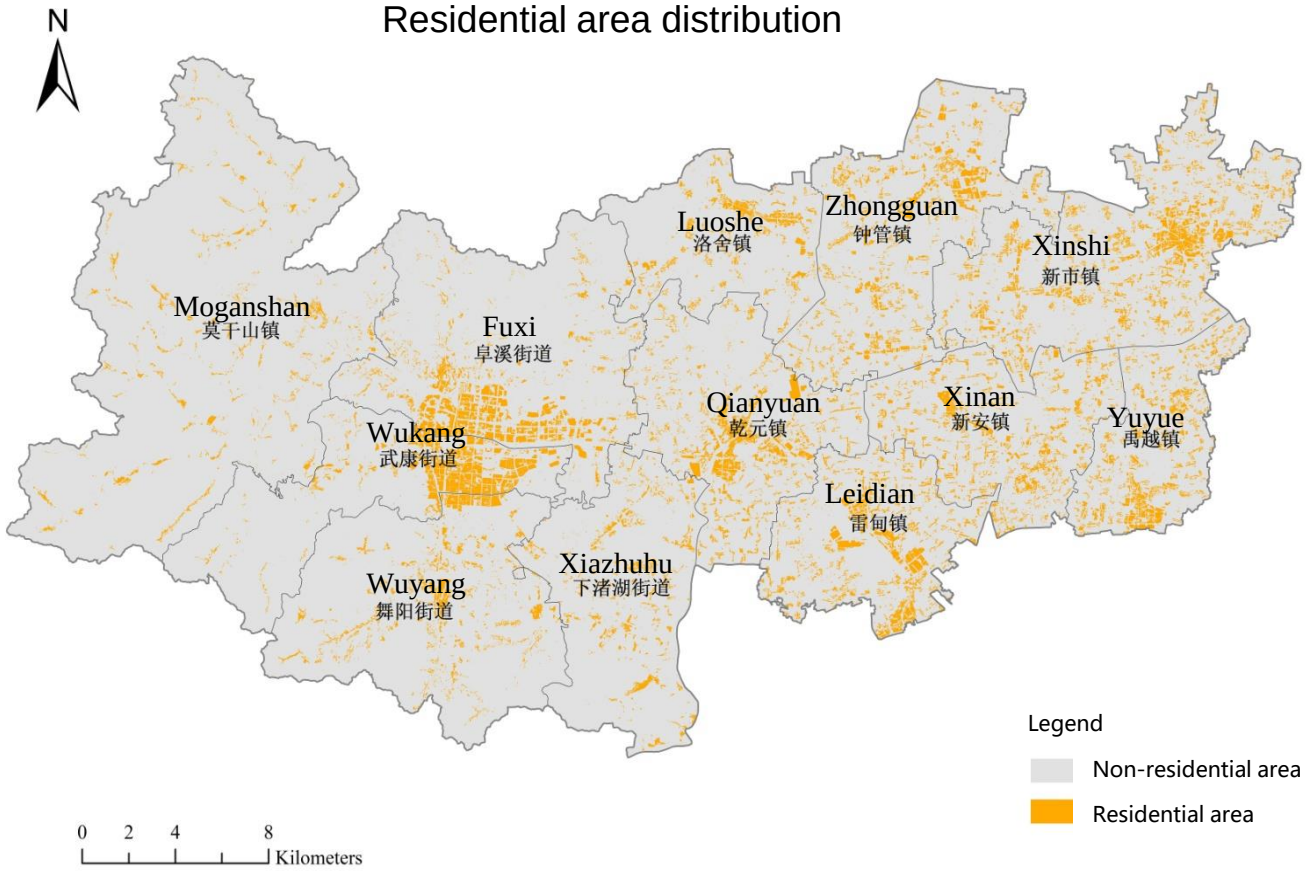
Four steps to disaggregate population into spatial grid.

a) **Dasymetric –** Dividing into *residential areas* and *non-residential areas*.

b) **Area weighting –**The *residential areas* should be weighted according to 6 types of residence.

c) **population calculation -**

d) **Spatial rasterilation –** according to 30m×30m cell.

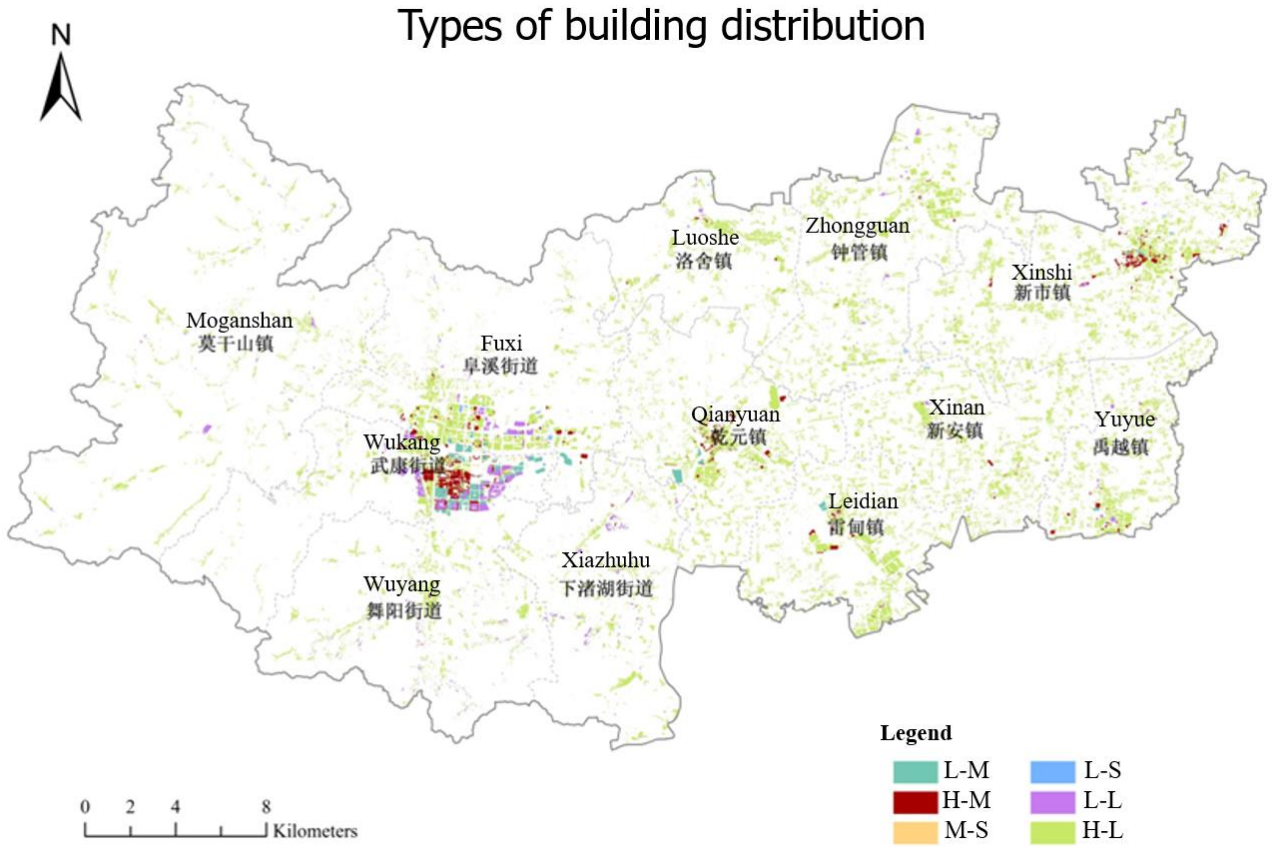


Classification scheme of building density

By the density and height of buildings in residential areas, it will be divided into 6 types

[according to the "*Survey Contents and Indicators of Geographical Conditions "(No.GDPJ 01—2013)*] :

Types	description	Building density	Number of floors
H-M	**H**igh density & **M**ulti-floor building	≧50%	≧4
L-M	**L**ow density & **M**ulti-floor building	﹤50%	≧4
H-L	**H**igh density & **L**ow-floor building	≧50%	﹤4
L -L	**L**ow density & **L**ow-floor building	﹤50%	﹤4
M-S	**M**ulti-floors & **S**ingle building		≧4
L-S	**L**ow-floors & **S**ingle building		﹤4



Calculation of disaggregated population

the weight p of a resident cell is determined by building dentisy and building floors .

- The weight *p* of a resident cell is

$$p = \lambda \times h$$

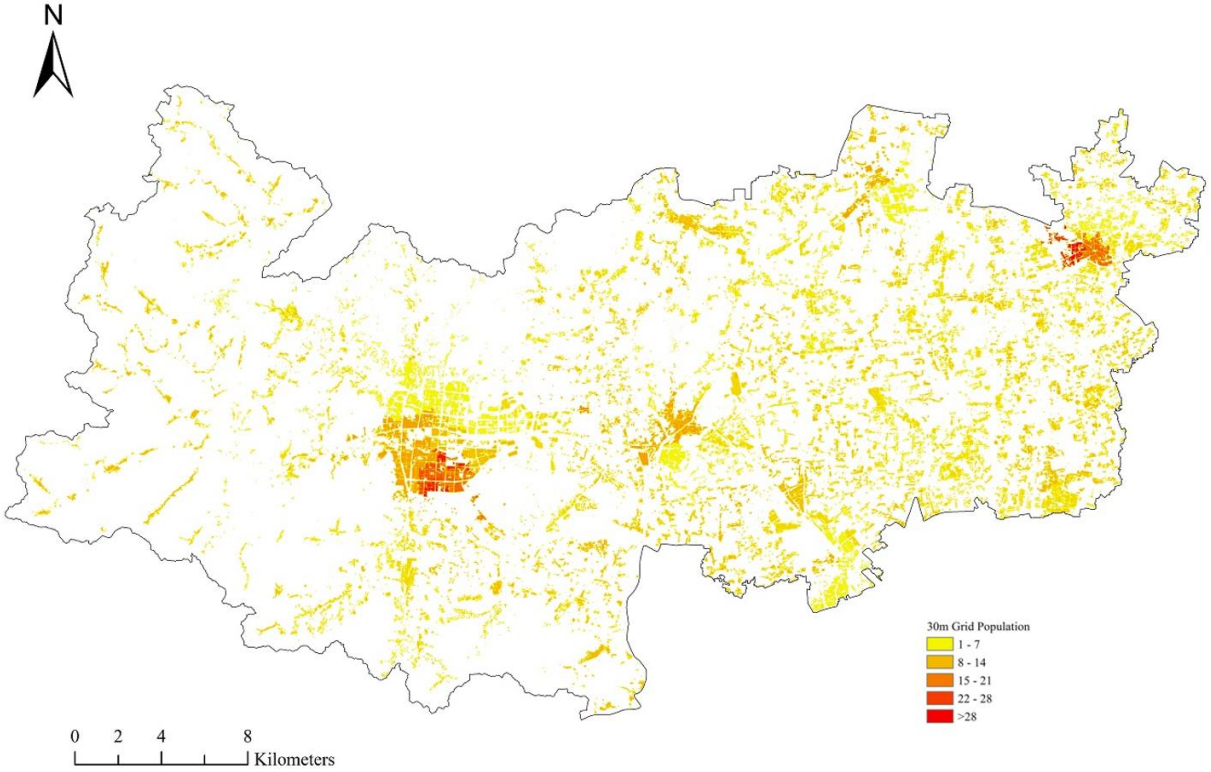
λ- building dentisy in a resident cell;
h – the average of all building floors in a cell.

- The population *n* of a resident cell is

$$n_i = \frac{s_i p_i}{\sum_{i=1}^{m} s_i p_i} N$$

s- area of a resident cell;
N – the whole population number in a administrite unit.

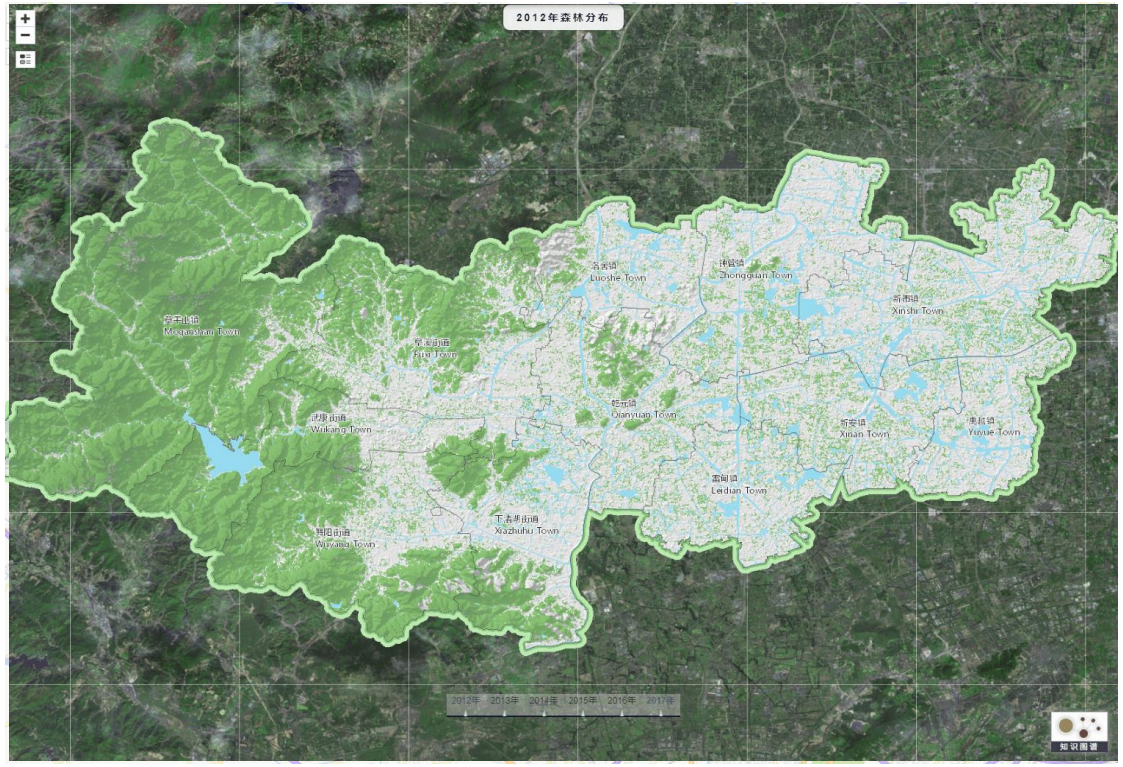
Spatial distribution of population in Deqing County



Indicators Measured with Geospatial Data

17 indicators are related to geospatial data or the integration of geo-statistical data

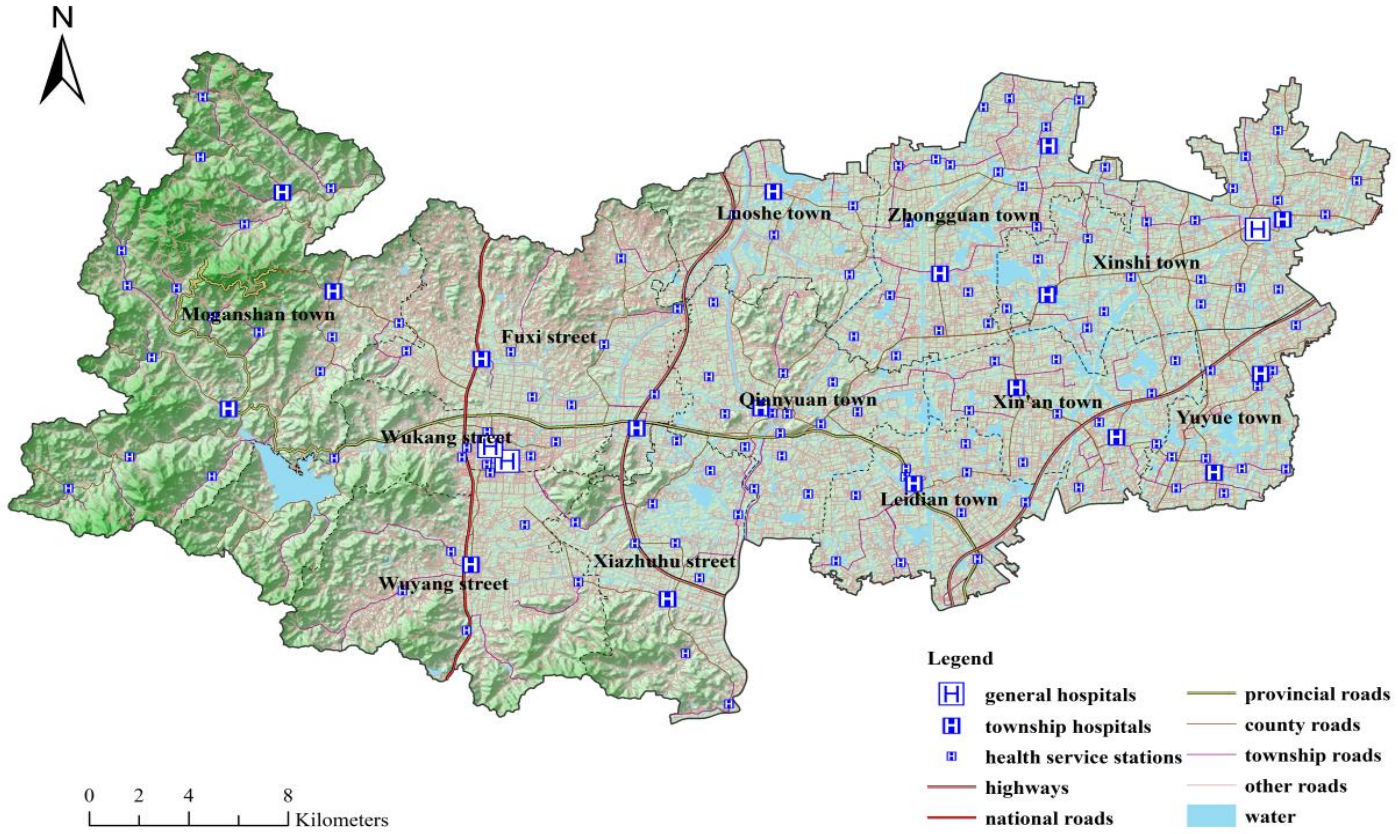
Indicator	Contents
1.4.1	population Proportion living in households with access to basic services
2.4.1	Proportion of agricult. area under productive/ sustainable agriculture
3.8.1	Coverage of essential health services
6.3.2	Proportion of bodies of water with good ambient water quality
6.6.1	Change in the extent of water-related ecosystems over time
9.1.1	Proportion of rural population living within 2 km of an all-season road
11.2.1	Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3.1	Ratio of land consumption rate to population growth rate
11.7.1	Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities
15.1.1	Forest area as a proportion of total land area
15.1.2	Proportion of important sites for terrestrial and freshwater biodiversity covered by protected areas, by ecosystem type
15.2.1	Proportion of forest change
15.2.1	Proportion of land that is degraded over total land area
15.4.1	protected area coverage of import. sites for mountain biodiversity



Indictor3.8.1 Coverage of basic health services

Deqing County has:

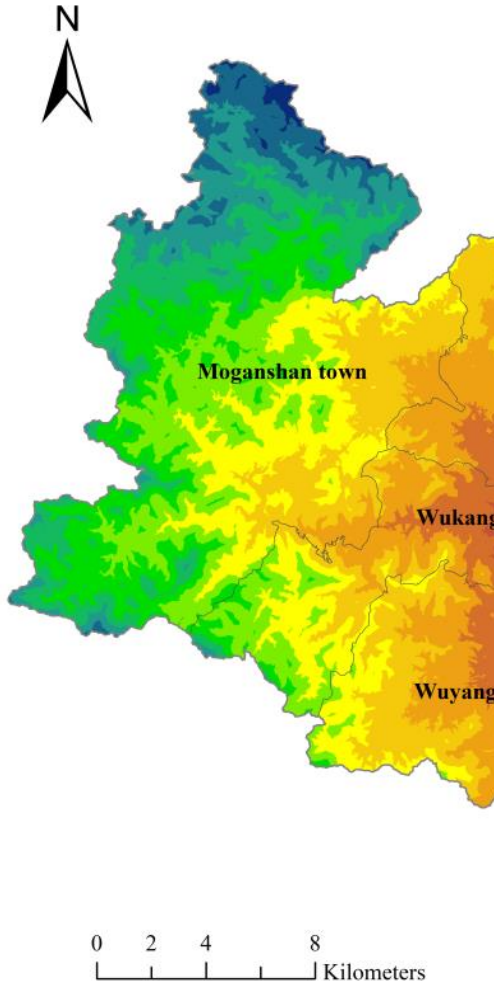
- *general hospitals- 3*
- *township hospitals -19*
- *Health service stations -134*

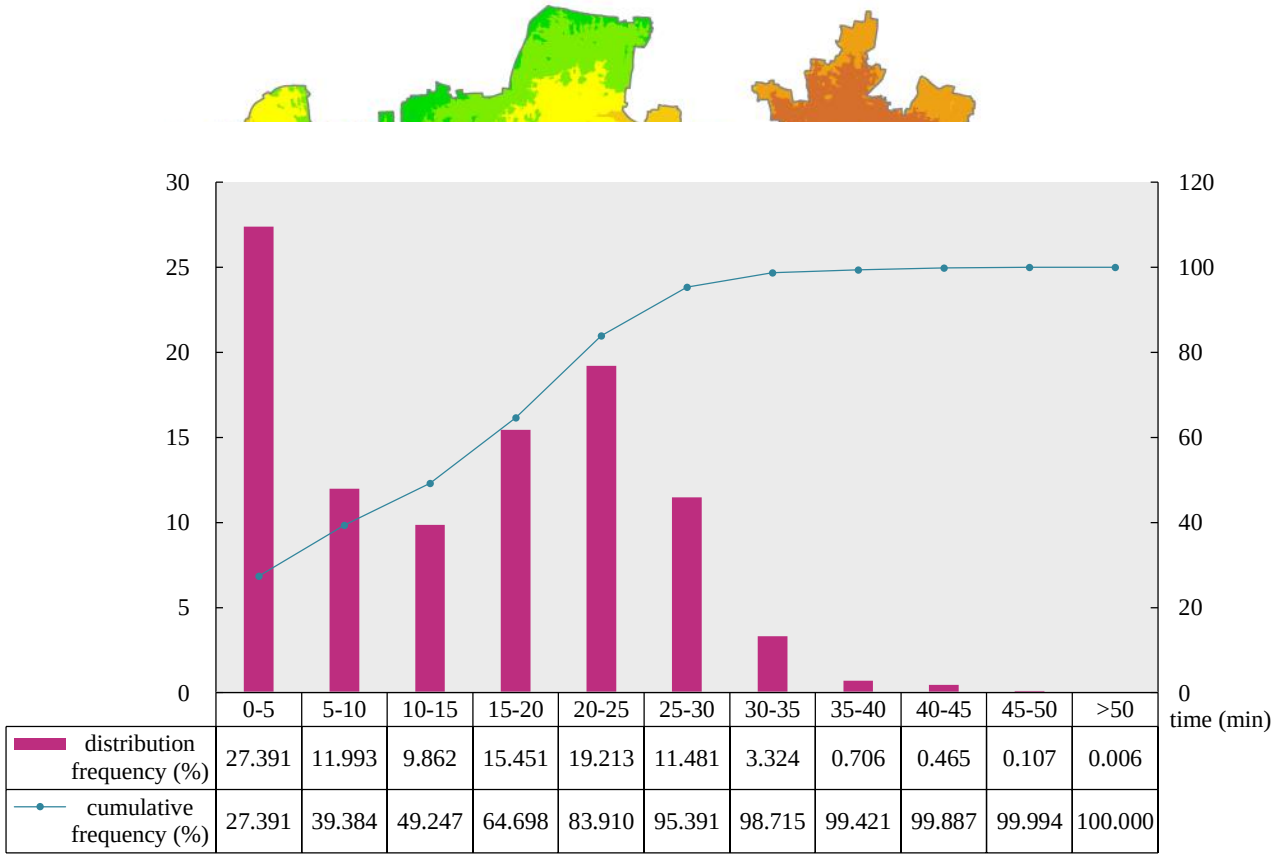


Layout of medical and health facilities in Deqing County

Accessibility of general hospitals

About all residents can reach general hospitals within 50 minutes.



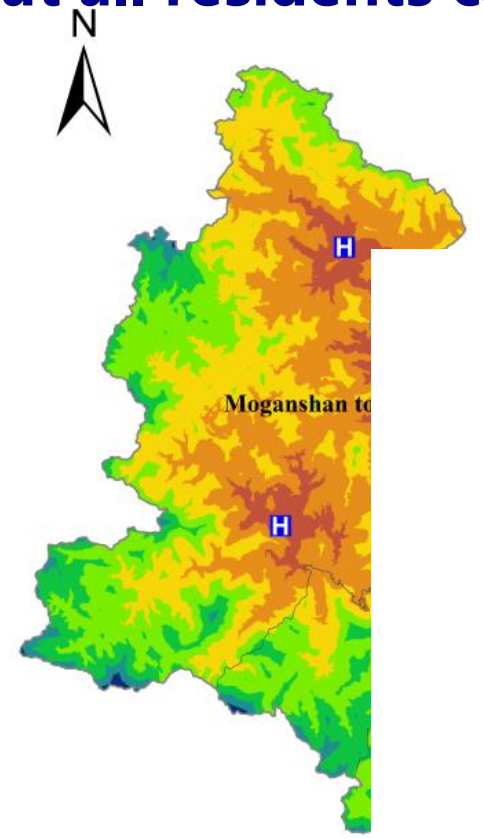


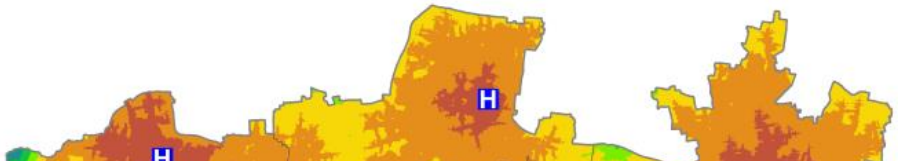
	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	>50
distribution frequency (%)	27.391	11.993	9.862	15.451	19.213	11.481	3.324	0.706	0.465	0.107	0.006
cumulative frequency (%)	27.391	39.384	49.247	64.698	83.910	95.391	98.715	99.421	99.887	99.994	100.000

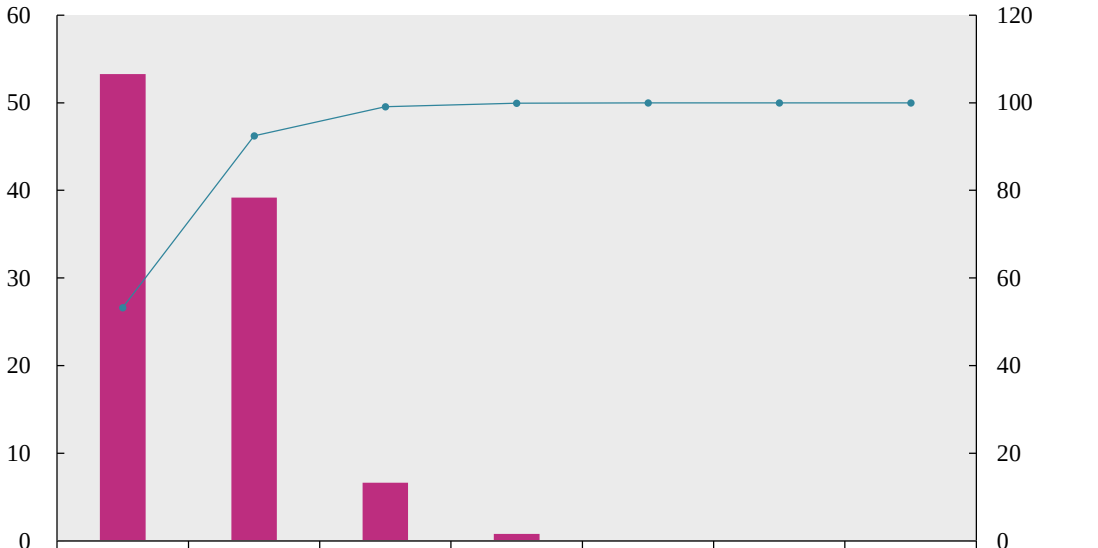
Distribution frequency and cumulative frequency of service population of general hospitals

Accessibility of township hospitals

About all residents can reach township hospitals within 30 minutes





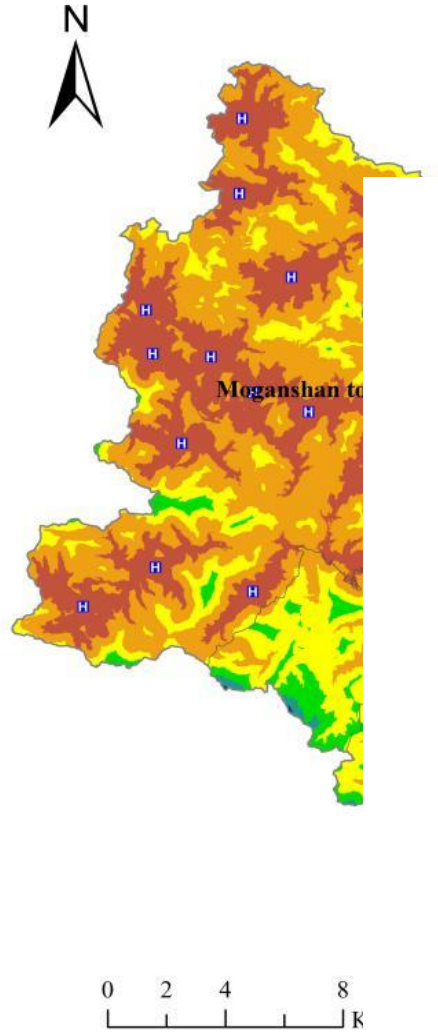


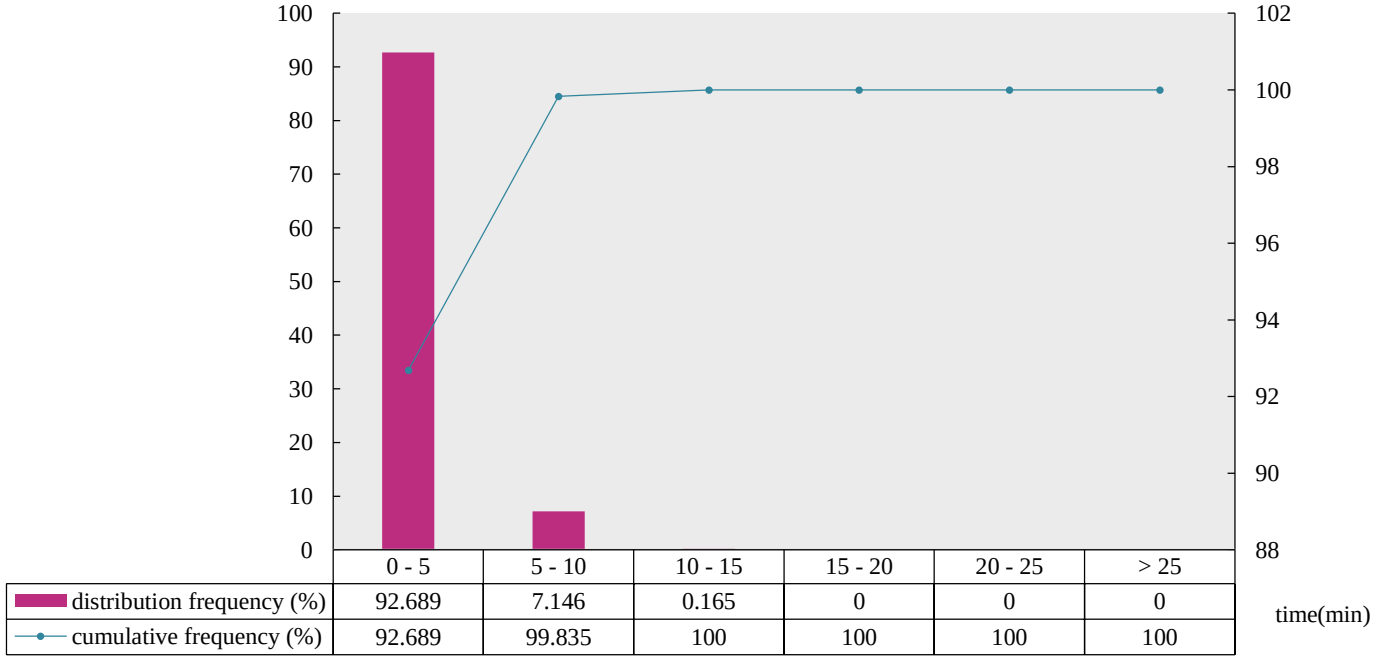
	0-5	5-10	10-15	15-20	20-25	25-30	>30
distribution frequency (%)	53.277	39.164	6.670	0.812	0.077	0.002	0.000
cumulative frequency (%)	53.277	92.441	99.110	99.922	99.998	100.000	100.000

Distribution frequency and cumulative frequency of service population of township hospitals

Accessibility of health service stations

About 92.7% of residents can reach health service stations within 5 minutes





	0 - 5	5 - 10	10 - 15	15 - 20	20 - 25	> 25
distribution frequency (%)	92.689	7.146	0.165	0	0	0
cumulative frequency (%)	92.689	99.835	100	100	100	100

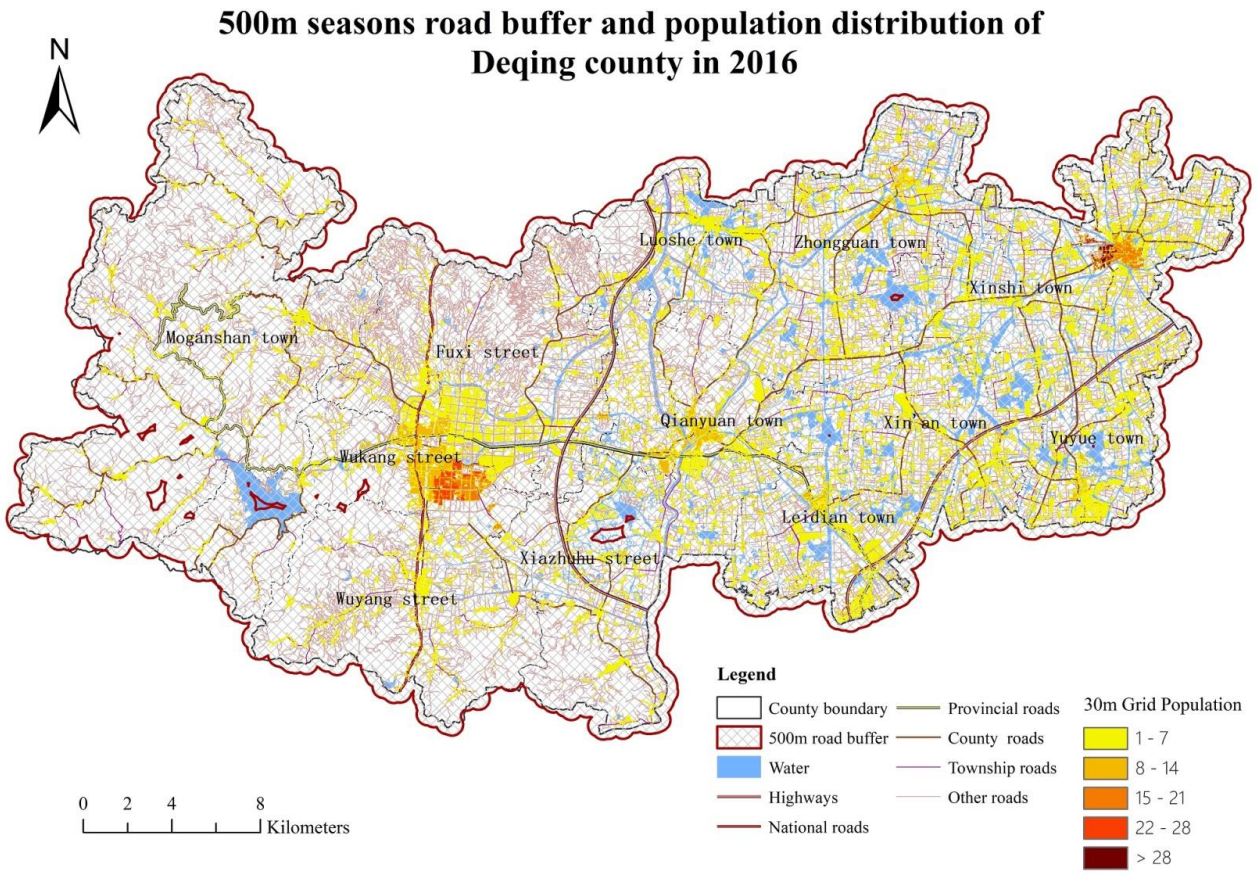
Distribution frequency and cumulative frequency of service population in health service station

Indicator 9.1.1

Indicator 9.1.1 has three indices:

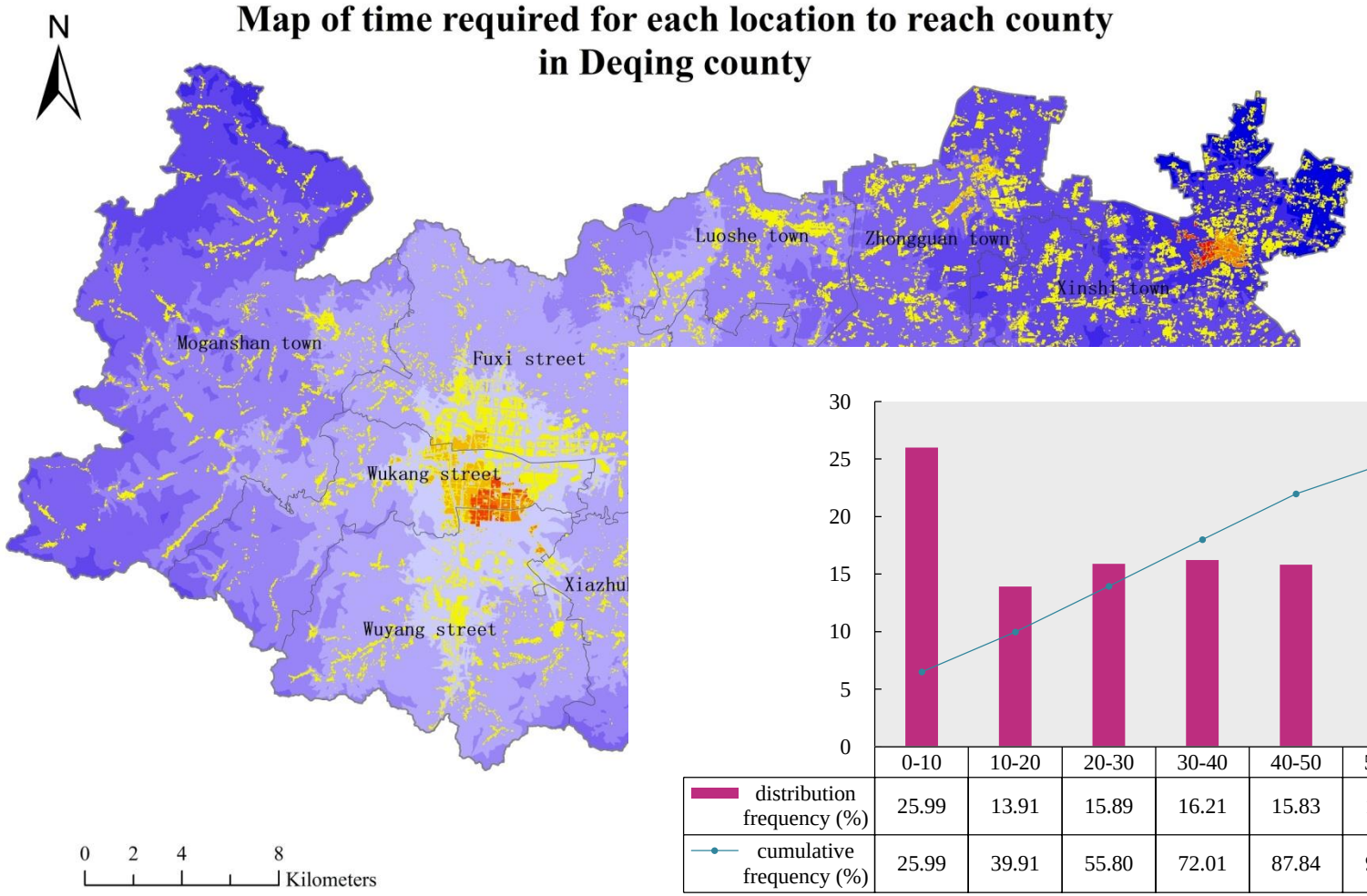
a. The proportion of rural population living within 2 km of the whole season highway
b. Traffic accessibility
c. X hour life circle

Indictor	2014	2015	2016	2017	2018
The proportion of rural population living within 500 meters	99.997 %	99.99 7%	100%	100%	100%
The proportion of rural population living within 1000 meters	100%	100%	100%	100%	100%
The proportion of rural population living within 2000 meters	100%	100%	100%	100%	100%



Traffic accessibility to urban

It takes less than 70 minutes to reach the county center from any location.

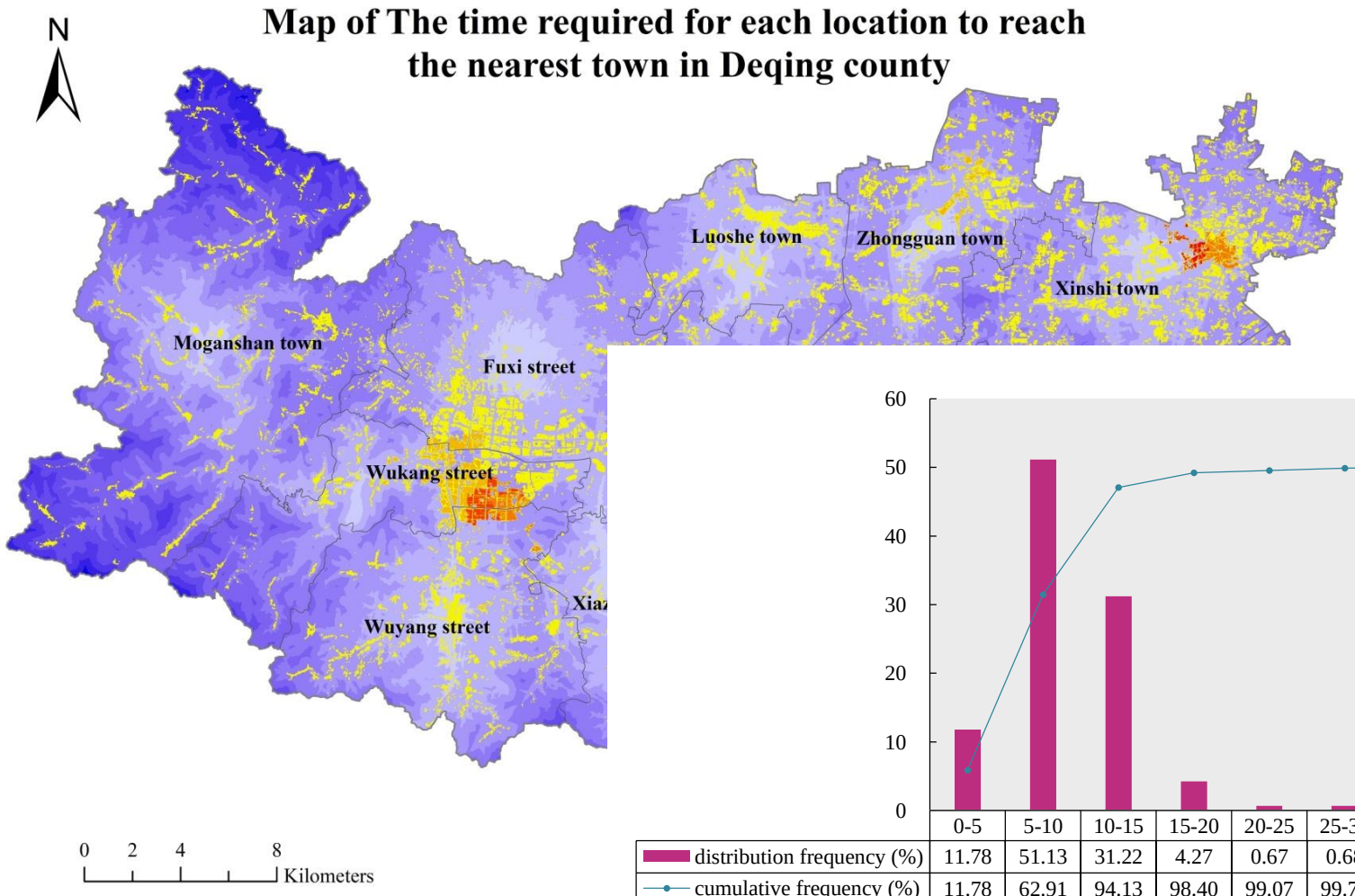


	0-10	10-20	20-30	30-40	40-50	50-60	60-70
distribution frequency (%)	25.99	13.91	15.89	16.21	15.83	11.12	1.04
cumulative frequency (%)	25.99	39.91	55.80	72.01	87.84	98.96	100

time(min)

X hour life circle to town

About all residents can reach the nearest town within 40 minutes.

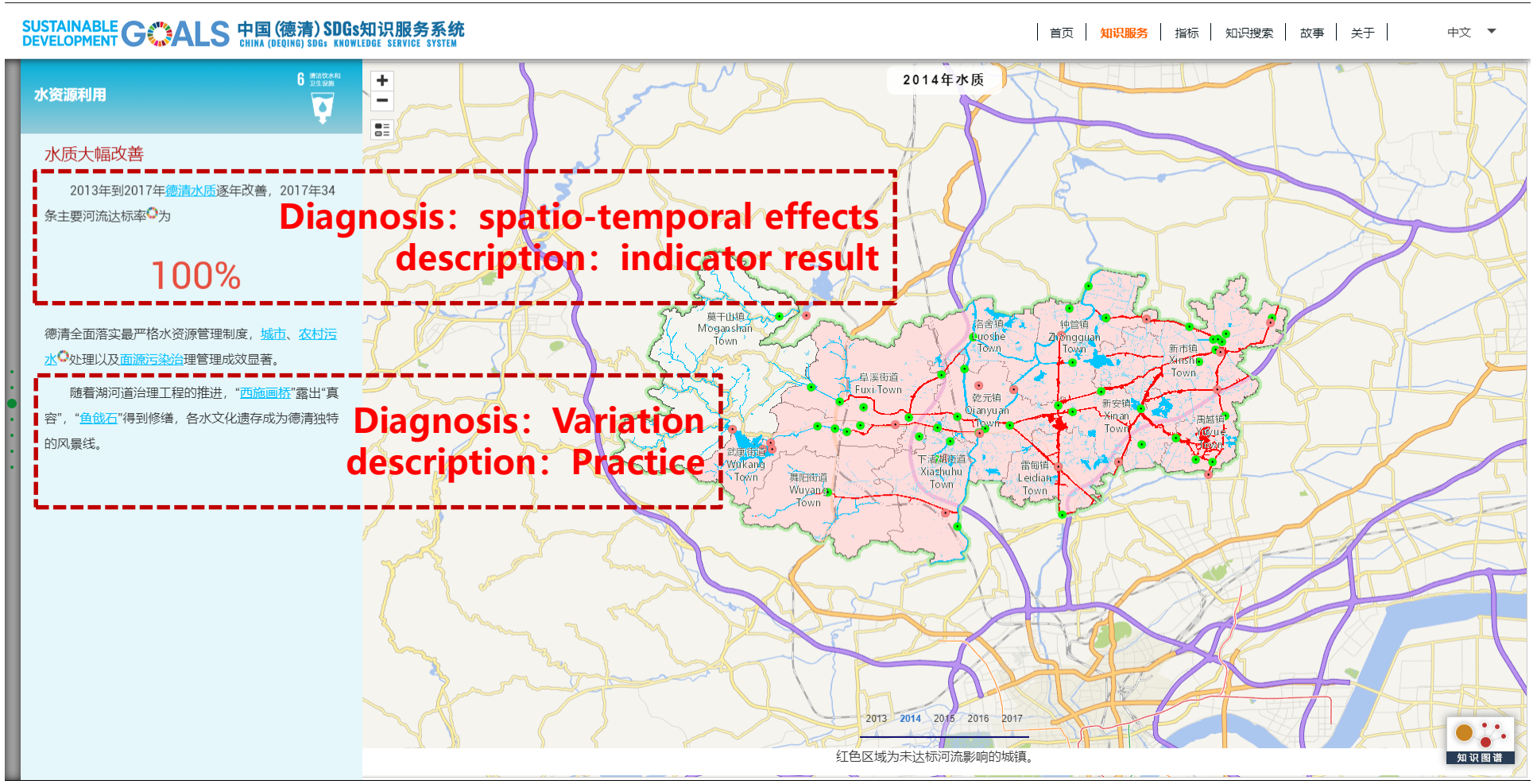


	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	>40
distribution frequency (%)	11.78	51.13	31.22	4.27	0.67	0.68	0.24	0.01	0
cumulative frequency (%)	11.78	62.91	94.13	98.40	99.07	99.75	99.99	100	100

Provision of spatial-temporal evidences

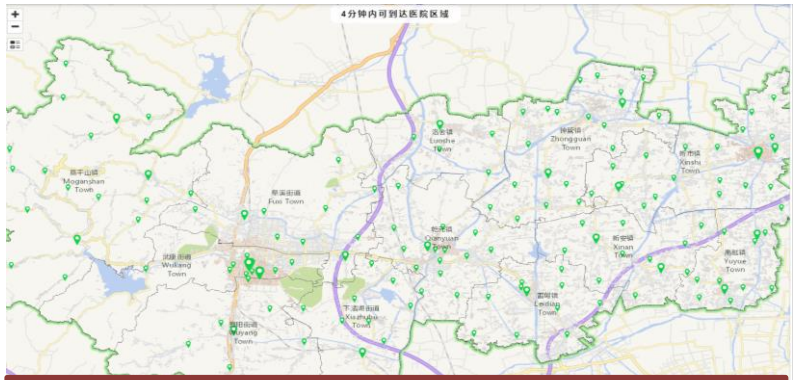
Description：assessment、practices，actions……

Diagnosis：indicator judgment 、variation，spatio-temporal effects……

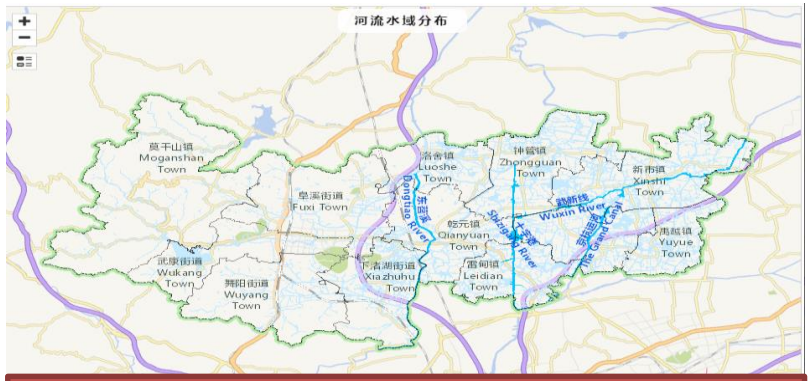


Visualization of spatial-temporal evidences

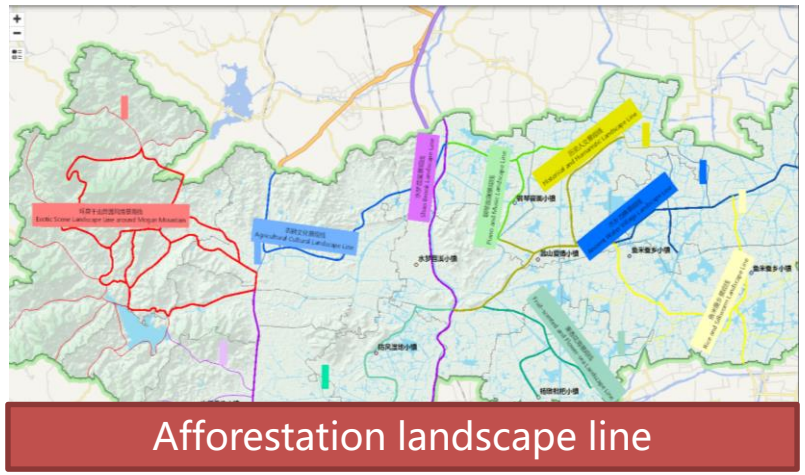
Using spatial connection to process the knowledge with spatial info.



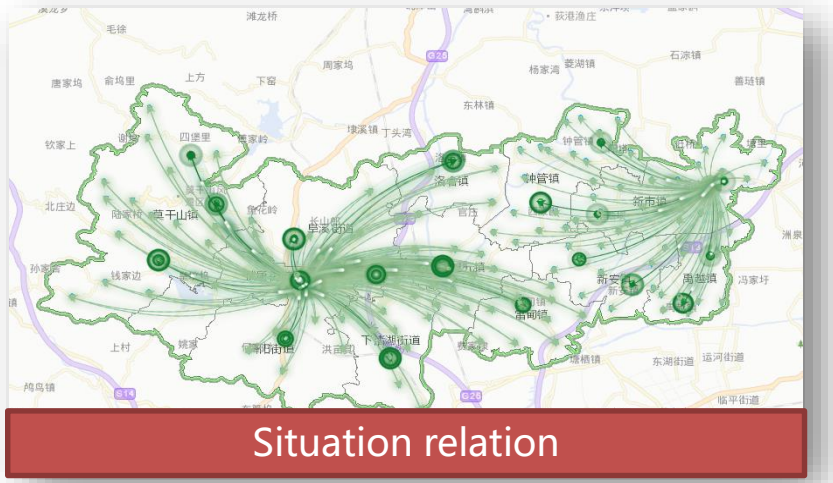
Hospital Distribution



Backbone channel



Afforestation landscape line



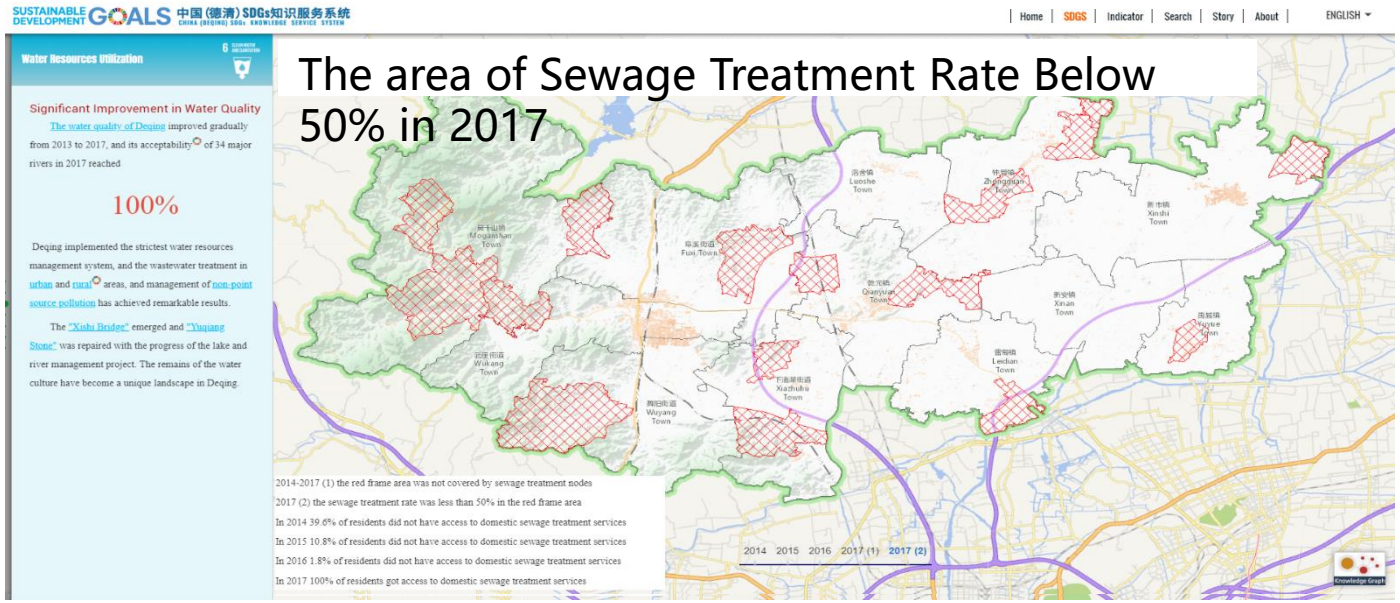
Situation relation

Spatial connection includes geocoding, semantic transformation and spatial situation simulation.

From spatial-temporal evidences to action plan

Goal 6: Rural sewage treatment

2017 achieve 100% coverage, but the treatment rate need to improve



Qualitative Analysis

Rural sewage treatment coverage has room for further improvement.

Three years-Development Goals

Improve sewage treatment system

Action Plan

Accelerate the construction of sewage pipe network and the new renovation and expansion of sewage treatment facilities. To achieve full coverage, full collection and full treatment of sewage treatment in the county.

From spatial-temporal evidences to action plan

Goal 6: Water Utilization

Abundant water resources, still has to face the water shortage stress

Qualitative Analysis

Water use efficiency is not high and needs to be improved. There is a potential shortage of water.

Three years-Development Goals

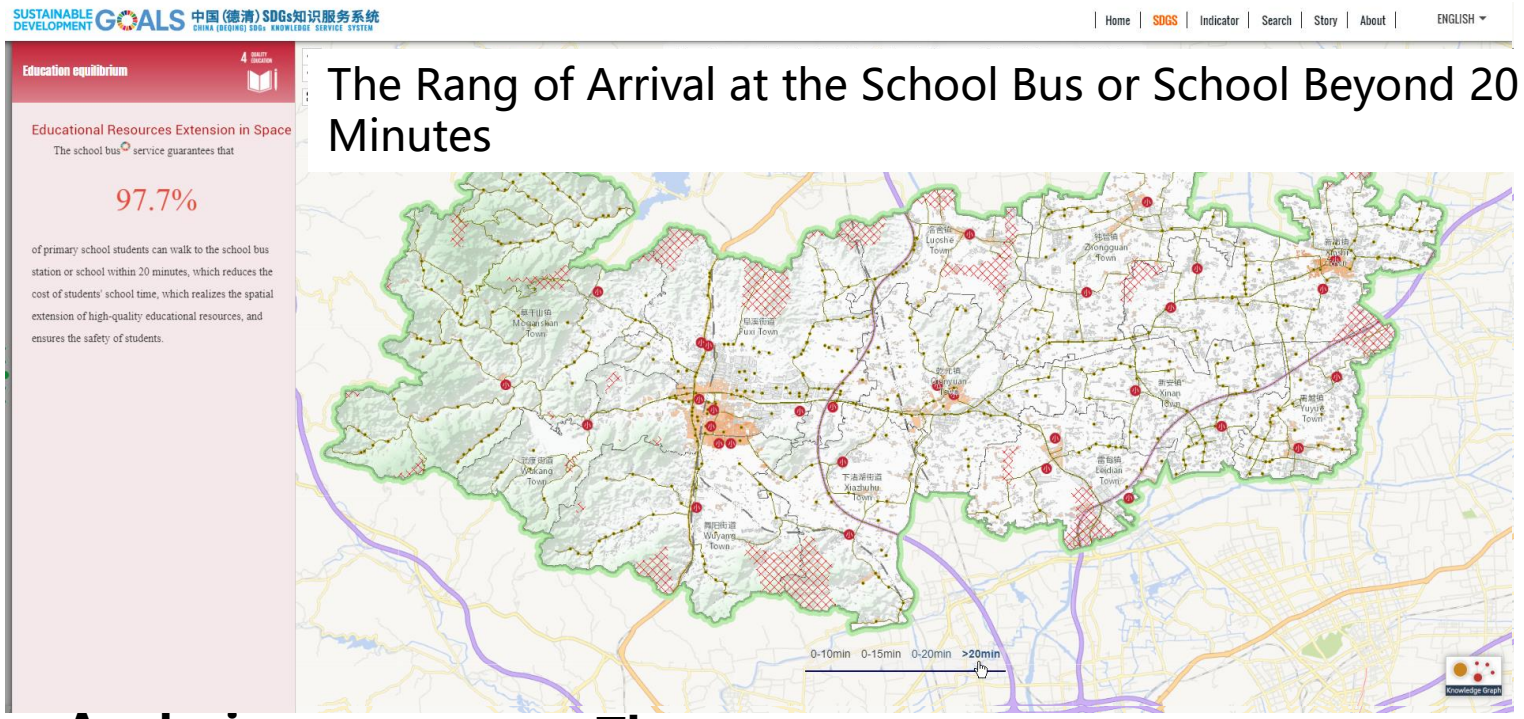
build saving society comprehensively, improve water use efficiency, and optimize the total amount and intensity of water resources consumption.

Action Plan

Accelerate implement the strictest water resources management system, strengthen water demand and water use management, and implement dual control actions on total water consumption and intensity; Improve the efficiency of municipal water use and encourage water conservation for all.

From spatial-temporal evidences to action plan

Goal 4: School bus



Qualitative Analysis

There is still room for further improvement in school bus coverage

Three-years Development Goals

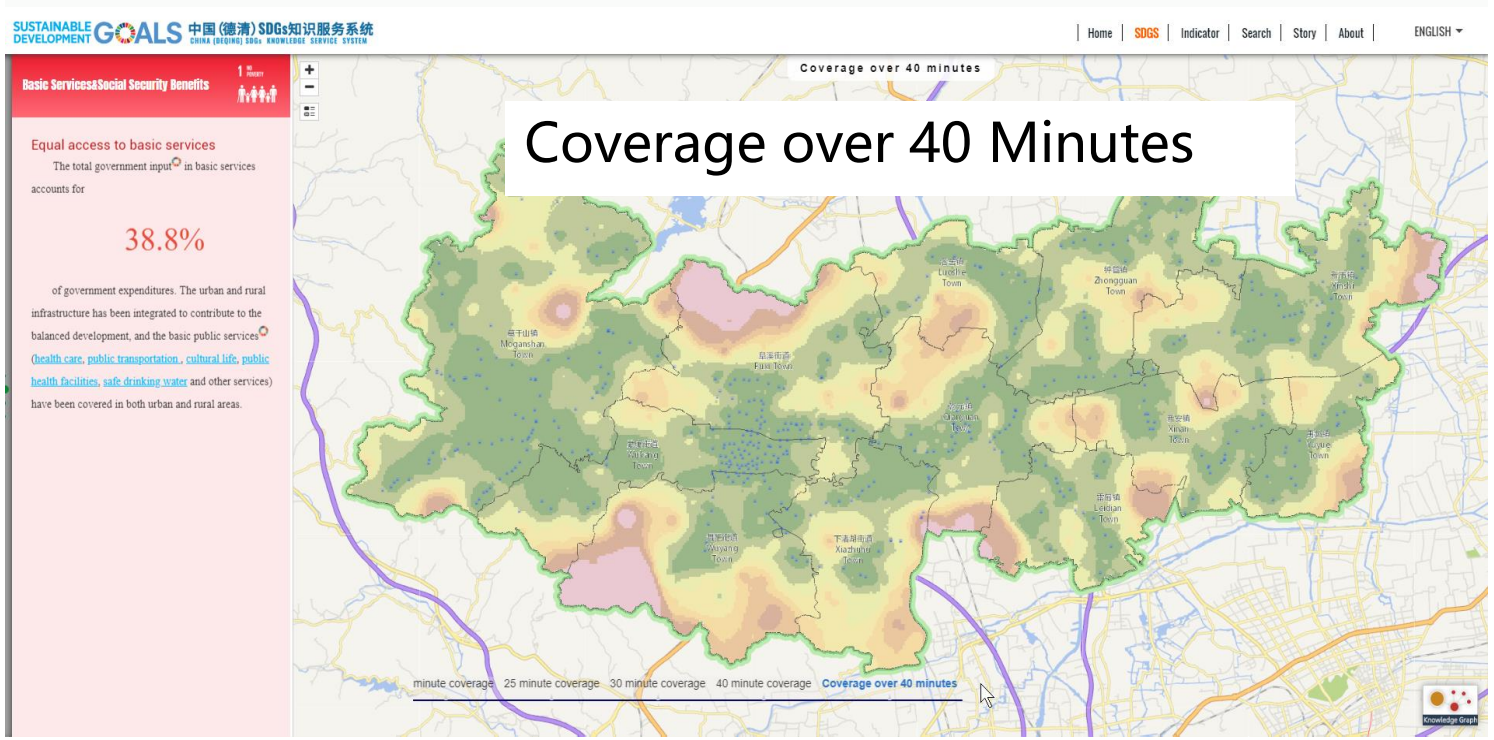
Improve the optimal allocation of various educational resources such as school buses

Action Plan

Increase the school bus station so that the school bus service can achieve full coverage of the county. Reasonably optimize the layout of school bus stations, improve the information management level of school buses, and further improve service quality.

From spatial-temporal evidences to action plan

Goal 1: public Transportation



Qualitative Analysis

Public travel services need to be further improved.

Three-years Development Goals

Increase the supply of public services, improve the quality of public services, and gradually achieve the equalization of basic public services.

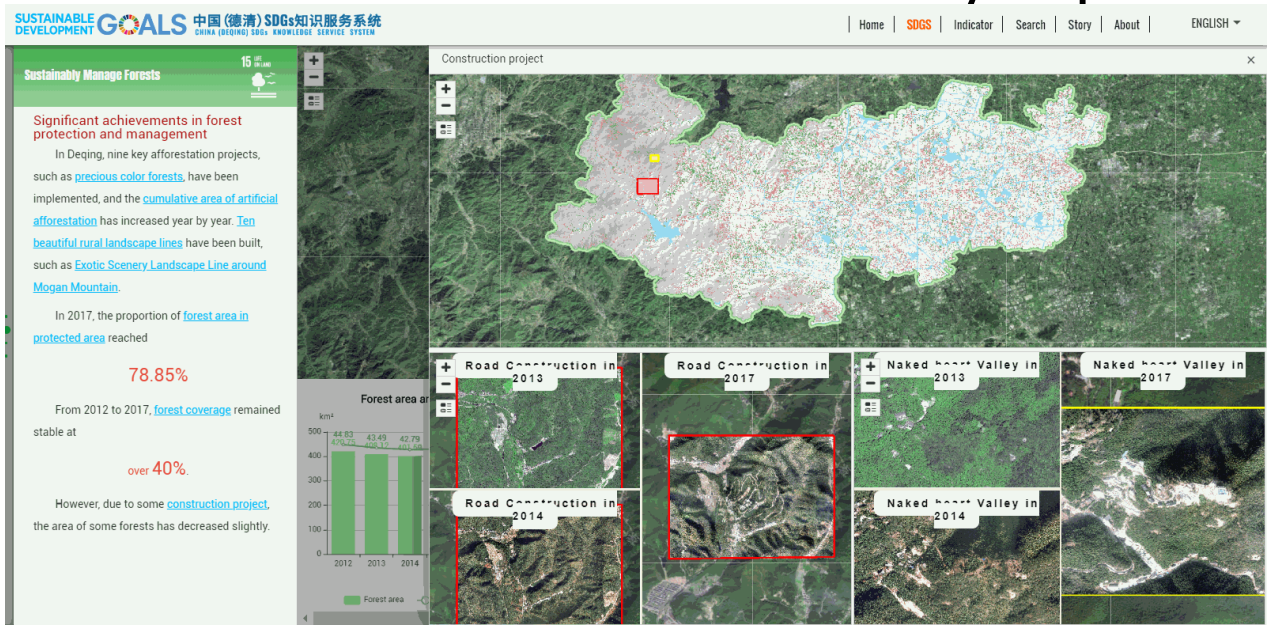
Action Plan

Promote the reconstruction of key roads, improve the quality of rural roads, improve the public transportation system, and realize the proportion of the population that can easily use public transportation (90% of urban areas (built-up areas) and 60%-80% of rural areas).

From spatial-temporal evidences to action plan

Goal 15: Forest Cover

forest reduce due to the road construction and homestay expansion in three years.



Qualitative Analysis

Three-years Development Goals

Action Plan

Forest protection and restoration in ecologically sensitive areas such as Moganshan Scenic Area needs to be strengthened

→

Rehabilitate forests and strengthen the construction and protection of ecologically sensitive areas

→

Strengthen the construction and protection of ecologically sensitive areas such as nature reserves, and standardize the orderly development of hotels

Contents

Summary

- This pilot project realize a practice to realize a comprehensive measurement of an entire administrative region' s progress towards SDGs by combing geospatial and statistical information.
- Three aspects for integration of statistical and with geospatial information to measure and analyze SDGs
  - geospatial disaggregation of statistical data
  - derivation of indicators with geospatial parameters (such as spatial density, accessibility, coverage and relations)
  - location-based visualization and knowledge representation as the provision of spatial-temporal evidences