Local SDGs Monitoring and Implementation Framework ("Evaluation-Monitoring-knowledge-Action plan")

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7th June 2024
1 Local SDGs Monitoring

2 Framework and SDGs Variables

3 From and to Data
A pilot study in Deqing, China

Deqing is the venue first UN World Geospatial Information Congress (2018), now the headquarter of UN Global Geospatial Information and Knowledge Center (UN-GGIKC)

- A County with 938 Km²
- 430,000 habitants

Three consecutive steps realized

- 2018: SDGs monitoring with a Geographic Lens
- 2019: A spatial Knowledge Service hub for SDGs
- 2020-2021: Formulating five-years action plan towards SDGs

A comprehensive monitoring
Transforming into actions
Dynamic Monitoring
with a geospatial perspective

- Most sustainable development activities take place in geospatial space
- Many goals, targets, and indicators have geo-spatial components
1.1 Indicator Alignment

By analyzing the characteristics of the pilot area, three aspects of adaptability, measurability and comprehensiveness are considered to determine a localized SDGs indicator set.
### A set of 102 indicators was selected for Deqing County

<table>
<thead>
<tr>
<th>SDG</th>
<th>UN</th>
<th>Deqing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>1.1.1 ; 1.3.1 ; 1.4.1 ; 1.a.1 ; 1.b.1</td>
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<td>2</td>
<td>13</td>
<td>2.1.2 ; 2.1.2 ; 2.2.1 ; 2.3.2 ; 2.4.1 ; 2.a.1 ; 2.c.1</td>
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<td>6.1.1 ; 6.2.1 ; 6.3.1 ; 6.3.2 ; 6.4.1 ; 6.4.2 ; 6.6.1</td>
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<td>6</td>
<td>7.1.1 ; 7.1.2 ; 7.3.1</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
<td>8.1.1 ; 8.2.1 ; 8.5.2 ; 8.6.1 ; 8.9.1 ; 8.9.2</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>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</td>
</tr>
<tr>
<td>10</td>
<td>11</td>
<td>10.1.1 ; 10.2.1</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>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 ; 12.2.2 ; 12.4.2 ; 12.5.1 ; 12.6.1 ; 12.7.1</td>
</tr>
<tr>
<td>12</td>
<td>13</td>
<td>13.1.1 ; 13.1.3 ; 13.3.1 ; 13.3.2</td>
</tr>
<tr>
<td>13</td>
<td>8</td>
<td>15.1.1 ; 15.1.2 ; 15.2.1 ; 15.3.1 ; 15.4.1 ; 15.4.2 ; 15.a.1</td>
</tr>
<tr>
<td>14</td>
<td>23</td>
<td>16.1.1 ; 16.1.3 ; 16.3.2 ; 16.5.1 ; 16.6.1 ; 16.1.a</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>17.1.1 ; 17.2.1 ; 17.3.1 ; 17.8.1 ; 17.11.1</td>
</tr>
</tbody>
</table>

**Criteria for Localization**

- **Adaptability**
- **Measurability**
- **Comprehensiveness**

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

**All the 16 SDGs are covered that is essential for a comprehensive measurement**
2 Spatio-temporal Data Handling

More than 200 types of data were processed, including topographic/LC maps, EO images, disaggregated socio-economic statistics, as well as some from social media.

<table>
<thead>
<tr>
<th>镇名</th>
<th>人口</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wukang</td>
<td>89,944</td>
</tr>
<tr>
<td>Fuxi</td>
<td>26,008</td>
</tr>
<tr>
<td>Xiazyhu</td>
<td>23,999</td>
</tr>
<tr>
<td>Wuyan</td>
<td>52,180</td>
</tr>
<tr>
<td>Luose</td>
<td>20,553</td>
</tr>
<tr>
<td>zhongguan</td>
<td>43,856</td>
</tr>
<tr>
<td>Moganshan</td>
<td>31,643</td>
</tr>
<tr>
<td>Qianyuan</td>
<td>49,644</td>
</tr>
<tr>
<td>Leidian</td>
<td>37,592</td>
</tr>
<tr>
<td>Xin’an</td>
<td>31,730</td>
</tr>
<tr>
<td>Xinshi</td>
<td>72,395</td>
</tr>
<tr>
<td>Yuyue</td>
<td>33,297</td>
</tr>
</tbody>
</table>

30-m Population density with topographic information
Enabling integrated geospatial and statistical analysis
3 Measuring local Indicators with a geospatial lens

A. Direct calculation with statistical data - ratio (or proportion), rate of change, index etc. 85

B. Direct derivation from geospatial data - Spatial density calculation, coverage classification etc. 10

C. Integrated utilization of Geo-statistical Info. -spatial accessibility, coverage, spatial relations 7

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4.1</td>
<td>population Proportion living in households with access to basic services</td>
</tr>
<tr>
<td>2.4.1</td>
<td>Proportion of agricult. area under productive/ sustainable agriculture</td>
</tr>
<tr>
<td>3.8.1</td>
<td>Coverage of essential health services</td>
</tr>
<tr>
<td>6.3.2</td>
<td>Proportion of bodies of water with good ambient water quality</td>
</tr>
<tr>
<td>6.6.1</td>
<td>Change in the extent of water-related ecosystems over time</td>
</tr>
<tr>
<td>9.1.1</td>
<td>Proportion of rural population living within 2 km of an all-season road</td>
</tr>
<tr>
<td>11.2.1</td>
<td>Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities</td>
</tr>
<tr>
<td>11.3.1</td>
<td>Ratio of land consumption rate to population growth rate</td>
</tr>
<tr>
<td>11.7.1</td>
<td>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</td>
</tr>
<tr>
<td>15.1.1</td>
<td>Forest area as a proportion of total land area</td>
</tr>
<tr>
<td>15.1.2</td>
<td>Proportion of important sites for terrestrial and freshwater biodiversity covered by protected areas, by ecosystem type</td>
</tr>
<tr>
<td>15.2.1</td>
<td>Proportion of forest change</td>
</tr>
<tr>
<td>15.3.1</td>
<td>Proportion of land that is degraded over total land area</td>
</tr>
<tr>
<td>15.4.1</td>
<td>protected area coverage of important sites for mountain biodiversity</td>
</tr>
</tbody>
</table>

The 102 indicators were measured in three different ways
### 4 Evidence-supported assessments at three levels

<table>
<thead>
<tr>
<th>Content</th>
<th>Indicators</th>
<th>Quantitative result</th>
<th>Evaluation reference</th>
<th>Metrics Used for ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clean Water</strong></td>
<td>6.1.1 Proportion of population using safely managed drinking water services</td>
<td><strong>Urban</strong>: 100%</td>
<td>Green≥98%</td>
<td>I - SDGs Dashboard of SDSN</td>
</tr>
<tr>
<td></td>
<td><strong>Rural</strong>: 99.6%</td>
<td><strong>Rural</strong>: 99.6%</td>
<td>Green≥95%</td>
<td>II - China’s National plan</td>
</tr>
<tr>
<td></td>
<td>6.2.1.a Penetration rate of sanitary toilets in rural areas</td>
<td>98%</td>
<td>By all parts of town, the nearest public toilet can be reached within 16 minutes</td>
<td>IV - Multiple World/National Standards</td>
</tr>
<tr>
<td></td>
<td>6.2.1.b Service coverage of urban public toilets</td>
<td>Urban: 100% Municipal: 92.4%</td>
<td>Municipal: 94%</td>
<td>IV --- others</td>
</tr>
<tr>
<td><strong>Volume, quality and efficiency of water resources</strong></td>
<td>6.3.1 Proportion of wastewater safely treated</td>
<td>Urban domestic sewage: 91.06%</td>
<td>Municipal domestic sewage: 92.4%</td>
<td>III - China’s National plan</td>
</tr>
<tr>
<td></td>
<td>Rural domestic sewage: 80.68%;</td>
<td>Coverage rate of the treatment of domestic wastewater (upper-middle-income countries): 59%</td>
<td>III --- Multiple World/National Standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trade effluent: N/A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.3.2 Proportion of bodies of water with good ambient water quality</td>
<td>68.75%, 100%**</td>
<td>76.9%</td>
<td>IV - Multiple World/National Standards</td>
</tr>
<tr>
<td></td>
<td>6.4.1 Change in water-use efficiency over time</td>
<td>water consumption per 10,000 CNY of GDP in 2017 was 67.5 m³, dropped 23.52% from 2015</td>
<td>By 2020, the efficiency of water use will be 23% lower than at of 2015</td>
<td>II - China’s National plan</td>
</tr>
<tr>
<td></td>
<td>6.4.2 Level of water stress: freshwater with withdrawal as a proportion of available freshwater resources</td>
<td>25.08%</td>
<td>Green≤25% Yellow: 25%&lt;x≤75%</td>
<td>I - SDGs Dashboard of SDSN</td>
</tr>
<tr>
<td></td>
<td>6.6.1 Change in the extent of water-related ecosystems over time</td>
<td>6.47%; High sustainable</td>
<td>0-20%; High sustainable; 21-40%; Local sustainable but threatens global stability; 41-60%; Border-line sustainability. Corrective actions are strongly recommended; 61-100%; Unsustainable. Urgent renewal is required.</td>
<td>III - China’s National plan</td>
</tr>
<tr>
<td></td>
<td>6.6.1.a Rate of change in the spatial extent of water-related ecosystems</td>
<td>11.14%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.6.1.b Rate of change in the water quantity characteristic of water-related ecosystems</td>
<td>8.26%</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>6.6.1.c Rate of change in the water quality of water-related ecosystems</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.6.1.d Health state of the typical wetland ecosystems</td>
<td>Xiazhuhu wetland: well</td>
<td></td>
<td></td>
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</table>

With the Minimum Factor Principle, the ranking of a single SDG is determined by the worst indicator.
4 Evidence-supported assessments at three levels

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

<table>
<thead>
<tr>
<th>1st Quarter</th>
<th>2nd Quarter</th>
<th>3rd Quarter</th>
<th>4th Quarter</th>
<th>No ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>23</td>
</tr>
</tbody>
</table>

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

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

- **Lower Coefficient of Variation**
  - Economy: 3.867, 0.352, 0.091
  - Environment: 3.810, 0.402, 0.106
  - Society: 3.872, 0.397, 0.102

- **Generally fulfilled**
- **Need to be improved**
- **Facing challenges**
- **Far behind**

Evidence-supported assessments at three levels
5 From Assessment to Knowledge

- **SDG Report**
  - Domain Knowledge
  - Spatial Info., On-line Info.

- **Constructive Modeling**
  - Concept-Relation
  - Entity-Relation

- **Knowledge Extraction**
  - Description
  - Diagnosis
  - Prediction

- **Knowledge Visualization**
  - Static
  - Temporal-Spatial

- **Association Establishment**
  - Logic
  - Spatial
  - Semantic

- **SDG Knowledge**

- **English version - 80 pages**
6.1 Knowledge-guided Gap analysis

“Failing to reach the criterion” Analysis

6.1.1 100% of residents in Deqing can enjoy safe drinking water service

6.2.1.b Service convenience of urban public toilets

“Further improvement” Analysis

Analyze Deqing’s non-compliance indicators, analyze the extent and causes of gaps, and determine priorities

Space Analysis

Obvious regional differences in distribution and convenience

Field survey data

Analyze the unstable factors in SDGs from the source: Illegal construction in an alternate water source

Strengthen the supervision and protection of drinking water sources
6.2 Formulating a five-year’s action plan

With the results of this comprehensive measurement, local people gained a better understanding of where they stand, what the gaps are, and actions to taken.

Gap Analysis
(Evidences)

Transformative Action
(Tangible Projects with investment)

Goal Setting
(Local Dev. Vision and Priorities)
7 Dynamic Monitoring
One of the first 16 Good Practices by UNDESA

On Dec. 2, 2020, UN DESA announced its first 16 Good Practices in SDG implementation. China’s pilot practice—SDGs local monitoring in Deqing was among the list.

- It tells a successful story about using geospatial information for a comprehensive SDGs monitoring at a local context and transforming into local actions.
- Geospatial information plays an irreplaceable role in SDGs implementation.
- The only one regarding the use of GI for supporting SDGs implementation.

1 Local SDGs Monitoring

2 Framework and SDGs Variables

3 From and to Data
Local SDGs Monitoring Implementation Framework

1. Indicator Alignment
   - Multi-scale
   - SDGs IF
     - UN SGIF
     - IF in different scale
     - Other Thematic IF

2. Dynamic Monitoring
   - Essential Variables
     - Natural
     - Soci-Eco

3. Assessment
   - Indicator level
   - Goal Level
   - Multi-Goal Level

4. Decision-making and Action
   - Data-driven Gap Analysis
   - Evidence-based Decision-Making
   - Knowledge-guided Actions

5. SDGs Knowledge Service
   - Generation Visualization Application

Knowledge Service
Spatial Decision-making
Monitoring and Assessment
Processing
scandlization
Collection

Data Integration
SDGs contain numerous indicators with complex meanings, making monitoring difficult. Reyers introduced the concept of Essential Variables into SDGs monitoring—ESDGVs

!) ESDGVs are identified based on the criteria of:

**Capture system essence**
Which key features, processes, and interactions are critical for describing and predicting their behavior in time and space?

**Link to system transformations**
Does the variable support the transformative agenda of SDGs?

**Key areas where coordination is needed**
Does the variable capture trade-offs or synergies between the SDGs especially those where coordination is weak?

**Are indispensable**
Is the variable foundational and multipurpose for tracking sustainable development?
SDG can be defined as a complex system. EV can reflect the key process and the dimension of the system. The definition and measurement of the relations of the variables can be used to recognize the correlations and patterns.
Refinement of “environment-economy” ESDGVs

The coupling relationships

**Dimensionality-breaking:**
Correlation of multidimensional indicators

**Data Source breaking:**
Fusion of data from multiple sources

**Environment**

**Economy**

**Society**

**Intra-area coupling**

*Environment variables:*
- LUCC, carbon stock, biomass stock

*Economic variable:*
- GDP, material footprint / consumption

*Linear coupling*

*Nonlinear coupling*

*Combined with economic-environmental coupling, human-land coupling and other models to further assist in analyzing the coupling relationships*

**Inter-regional coupling**

*What we want*
Consumption of wood in area A by economic activities in area B

*Data Acquisition*
Intensity of wood consumption by sector in area A; MRIO table

*Tele-coupling Analysis*
GDP
- Consumption Footprint
  - Land Cover
Refinement of “environment-economy” ESDGVs

Based on the DPSIR framework, a combined qualitative and quantitative methodology for the refinement of “environmental-economic” ESDGVs is proposed.

<table>
<thead>
<tr>
<th>DPSIR</th>
<th>ESDGVs for Land Degradation</th>
<th>Related Indicators</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving factors</td>
<td>Population distribution ; Population change</td>
<td>11.3.1</td>
<td>III</td>
</tr>
<tr>
<td></td>
<td>Annual precipitation ; Annual average temperature</td>
<td>2.4.1</td>
<td>II</td>
</tr>
<tr>
<td>Pressure</td>
<td>Cultivated land cover rate ; Cultivated land cover change</td>
<td>2.4.1</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Inland water cover rate</td>
<td>2.4.1 ; 6.6.1</td>
<td>I</td>
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<tr>
<td></td>
<td>The area of the land occupied by the city/urban area over a period</td>
<td>11.3.1</td>
<td>I</td>
</tr>
<tr>
<td></td>
<td>Forest cover rate</td>
<td>15.1.1 ; 15.2.1 ; 15.3.1 ; 15.4.2</td>
<td>I</td>
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<tr>
<td></td>
<td>NDVI</td>
<td>2.4.1 ; 15.4.2</td>
<td>I</td>
</tr>
<tr>
<td>State</td>
<td>NPP ; Cover rate of salinized land</td>
<td>2.4.1 ; 15.3.1</td>
<td>III</td>
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<tr>
<td>Response</td>
<td>Cover rate of nature reserves</td>
<td>15.1.2</td>
<td>I</td>
</tr>
</tbody>
</table>

**Extraction**

Criteria

Data collection

Quantitative calculation

Pearson correlation coefficient

Bibliography

SDGs indicator metadata respiratory UNCCD Good Practice Guidance DPSIR framework

Spatialization

Feasibility

Relevance

Data sources:

- Land cover Data set
- Meteorological Data set
Refinement of “environment-economy” ESDGVs

ESDGVs should not only be able to reflect environmental changes, but also be used to study the coupling mechanism of multi-domain SDGs.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Related Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>1.1.1; 1.2.1;</td>
</tr>
<tr>
<td>People affected by forest fires</td>
<td>1.5.1</td>
</tr>
<tr>
<td>Income from food per hectare</td>
<td>2.3.1</td>
</tr>
<tr>
<td>Food production value per hectare</td>
<td>2.3.2 ; 2.4.1</td>
</tr>
<tr>
<td>NPP</td>
<td>2.4.1, 15.3.1</td>
</tr>
<tr>
<td>Temperature; precipitation</td>
<td>2.4.1</td>
</tr>
<tr>
<td>LUCC</td>
<td>2.4.1, 6.3.2, 6.15.1.2.1.</td>
</tr>
<tr>
<td>NDVI</td>
<td>2.4.1, 15.4.2</td>
</tr>
<tr>
<td>Soil organic matter stocks</td>
<td>2.4.1, 15.3.1,</td>
</tr>
<tr>
<td>Soil biodiversity</td>
<td>2.4.1</td>
</tr>
<tr>
<td>Water quality parameters</td>
<td>2.5.2 ; 3.9.2 ; 6</td>
</tr>
<tr>
<td>CO2 emissions per unit of added value</td>
<td>9.4.1</td>
</tr>
<tr>
<td>Urban fine particulate emissions</td>
<td>7.1.2 ; 11.6.2</td>
</tr>
<tr>
<td>Population growth</td>
<td>11.3.1</td>
</tr>
</tbody>
</table>

1 Local SDGs Monitoring

2 Framework and SDGs Variables

3 From and to Data
GlobeLand30 is the first 30m-resolution global land cover data with 10 landcover first class, 3 version has been developed and gotten accessed include 2000, 2010 and 2020.
GlobeLand30 2020 covers the global land surface more completely. Using multi-source images including Chinese satellites, the dataset has better classification accuracy.

Reflect the changes of global land use and landscape in the past 20 years.
Urbanization of Guangdong-Hongkong-Macau Greater Bay Area

Land Cover 2000

Imagery 2000 (landsat5)
Cultivated Land Expansion in Egypt

Land Cover 2000

Imagery 2000 (landsat8)
A concrete manifestation of practicing multilateralism and promoting the construction of a community with a shared future for mankind. -by MFA Spokesman
Typical Applications

Applied in wider areas like climate change, environment monitoring, resource management, natural disaster mitigation, sustainable development...
Capacity Building for Developing Countries

Supported by MFA, UN-GGIM, ESCAP, over 300 technicians and experts from over 50 countries has been trained.

- Aug. 2018, Tanzania
- Sep. 2018, Nairobi, Kenya
- Apr. 2016 Addis Ababa, Ethiopia

2015年
- Workshop for countries surrounding China

2016年
- Inter. Seminar on GLC Supporting SDGs.
- UNGGIM HLF Side Event

2017年
- Workshop for countries surrounding China
- Training Program of MFA

2018年
- Workshop for countries surrounding China
- ISPRS Capacity Building

The new version is coming
A Collaborative Geospatial Information are needed to share the data, sample, algorithm, and model that can meet the requirements of data production, crowd-sourcing and validation, analyzing, modeling and application, based on which capacities can be built more easily and widely with the support of the setup of multi-participated mechanism, especially for the developing countries.

Develop innovative methods for deriving essential variables from data according to the application to improve the usability and decrease the difficulty for applying, which brings pathway to provide the tools and methodology that transform data into knowledge.

The variable data product integrated of statistical and geospatial information can enrich the supply of the global geospatial public goods that can improve the calculation efficiency and reduce the complexity of monitoring and assessment.
Local SDGs Monitoring and Implementation Framework ("Evaluation-Monitoring-knowledge-Action plan")

Thank You
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