Report on Scientific Initiative Project:
An ISPRS contribution to Transforming Our World: augmentation of GlobeLand30 with additional data for monitoring United Nations Sustainable Development Goals

Lead WG:
ICWG IV/III: Global Mapping: Updating, Verification and Interoperability

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Summary

This Scientific Initiatives project aimed to stimulate the ISPRS community's interest in contributing to the United Nations' Sustainable Development Goals (SDGs) by assessing the potential of GlobeLand30, when combined with other geospatial and socio-economic datasets as deemed appropriate, to measure, monitor and manage the SDGs. The primary project participants met in Beijing, China, in June 2017 to begin the scientific work. A subsequent meeting was held in Beijing in September 2017 to coincide with a workshop on GlobeLand30 validation and prepare for the main project workshop, held in Jinan on 16 September. The Jinan workshop, entitled "Collaborative and Dynamic Land Cover Information Services Supporting UN Sustainable Development Goals", was a great success and acted as a platform to announce two important project activities: (a) the prototype dynamic knowledge map, and (b) the call for participation in the Atlas Challenge competition. An abstract describing the project was accepted for poster presentation at the 2017 Geospatial Week in Wuhan and two manuscripts, arising from collaborative research, was submitted to a planned Special Issue of ISPRS Journal on the SDGs. Based on the promising outcomes, Newcastle University's Institute for Sustainability recently advertised a fully-funded international PhD studentship to continue the research. With the work packages now largely complete, this Scientific Initiatives project will conclude in October 2018 with the winning entry in the Atlas Challenge being showcased at the ISPRS Commission IV Symposium.

Background

In September 2015, the United Nations (UN) adopted "Transforming Our World: the 2030 Agenda for Sustainable Development" [1] as its new ambitious global development plan. Geospatial data describes the location and relationship of the features and / or phenomena on, above or beneath the Earth's surface, and has significant value in helping realize and

implement many of the 2030 UN Sustainable Development Goals (SDGs) [2] shown in Figure 1. Indeed, it has been estimated that approximately 20 % of the UN SDG Indicators (SDGIs) can be interpreted and measured either through direct use of geospatial data itself or through its integration with other statistical data [3]. Thus, obtaining reliable geospatial data has become a crucial task for member nations to prepare their national reports or for the UN to undertake global reporting. One of the most powerful geospatially-derived products from which SDGIs can be generated is provided through global land cover (GLC) information.

Figure 1: The 17 Sustainable Development Goals of the United Nations [2]

Aims and objectives

The principal aim of this ISPRS Scientific Initiatives proposal was to assess the potential of GlobeLand30, when integrated together with other geospatial and socio-economic datasets as deemed appropriate, to measure, monitor and manage the progress of sustainable development, as defined by the UN's 17 SDGs. In order to achieve this aim, the project addressed the following objectives:

1) To define the SDIs that can be quantified by GlobeLand30, when augmented with additional earth observation (EO) datasets of relevance to the ISPRS community and appropriate socio-economic data;

2) To examine the scientific challenges, and identify the technology gaps, behind each GlobeLand30 relevant SDI, as defined in objective (1), in order to propose potential future solutions;

3) To investigate approaches to visualise EO-derived SDIs and demonstrate effective communication with end users and policy makers through real-world examples delivered via a prototype dynamic map atlas.

Primary tasks and activities

Activities carried out since the project was launched in March 2017 are detailed below.

Task 1: Target SDIs from GlobeLand30 and augmented data [addressing objective 1]

This task was undertaken in order to define the SDIs to which the ISPRS community could potentially contribute, primarily through GlobeLand30. The Joint-PIs, Co-Is together with other relevant geospatial and socio-economic representatives, comprising academic, governmental, learned and professional bodies, organized two meetings in Beijing, China. The outputs of these meetings were exchanged with UN's Inter-Agency Expert Group, for example during the UNGGIM conference.

Findings from the meeting showed that the spatial distribution of land cover and its change over time is an essential requirement for a variety of SDGIs, including SDGI 6.6.1 (change in the extent of water-related ecosystems over time), 11.3.1 (ratio of land consumption rate to population growth rate), and 15.3.1 (proportion of land that is degraded over total land area). Significant progress has been made in the improvement of the spatial and temporal resolutions, as well as the classification accuracy, of GLC mapping in recent years, but significant challenges remain. There are several criteria to be considered when selecting suitable global data sources for use in the computation of SDGIs and national reporting. These include issues relating, for example, to data quality, conversion and augmentation, scale and integration, sensitivity analysis, as well as securing national ownership [3].

The SDGIs to which the geospatial community appear to be able to actively contribute are listed in Table 1.

SDG	**SDG Indicators**
1: No poverty	1.1.1; 1.2.1; 1.2.2; 1.4.1; 1.4.2; 1.5.1; 1.5.2; 1.5.3
2: Zero hunger	2.1.2; 2.4.1
3: Good health and well-being	3.6.1
4: Quality education	4.5.1; 4.a.1
5: Gender equality	5.a.1; 5.a.2
6: Clean water and sanitation	6.1.1; 6.2.1; 6.3.2; 6.4.2; 6.6.1
7: Affordable and clean energy	7.1.1
9: Industry, innovation and infrastructure	9.1.1; 9.4.1
11: Sustainable cities and communities	11.1.1; 11.2.1; 11.3.1; 11.5.1; 11.5.2; 11.6.2; 11.7.1; 11.a.1; 11.b.1; 11.b.2; 11.c.1
13: Climate action	13.1.1; 13.1.2
15: Life on land	15.1.1; 15.1.2; 15.2.1; 15.3.1; 15.4.1; 15.4.2

Table 1: SDGIs to which the geospatial community can contribute [3]

Task 2: Assessment of current status [addressing objective 2]

Following identification of the relevant SDIs in Task 1, a workshop entitled "Collaborative and Dynamic Land Cover Information Services Supporting UN Sustainable Development Goals" was held in Jinan, China on 16th September 2017. The workshop was supported by this SI project, and the purpose was to identify the knowledge and technology gaps in current thinking and practice to help meet the needs of the SDGs and to stimulate the ISPRS community to take action. More than 100 delegates from 20 research institutes attended the workshop, including four members of the ISPRS Council. A full report on the workshop was submitted to ISPRS and published in the ISPRS newsletter [4].

Figure 2: Images of the Jinan workshop.

Some of the particular topics and issues identified and addressed in the workshop included:

1) Awareness that collaborative and dynamic land cover information services will improve on-demand generation, facilitate efficient data sharing, and enhance the value-added applications of land cover information;

2) Recognition that land cover information, combined with other geo-spatial information and socio-economic data, could promote the measurement and monitoring of UN SDGs indicators;

3) Realization that a knowledge map could clearly and directly express distribution and change of land cover information and contribute to the measurement and monitoring of the UN SDGs with geo-spatial information and other statistical data.

Task 3: Representation of SDIs through the "Atlas Challenge" [addressing objective 3]

Building on the on-going research of one of the Co-Is from Hong Kong Polytechnic, an on-line atlas has been developed. This was and demonstrated at the Jinan workshop, is shown in Figure 3 and can be trialled at the website address http://www.globeland30.cn/knowledgemapen.html.

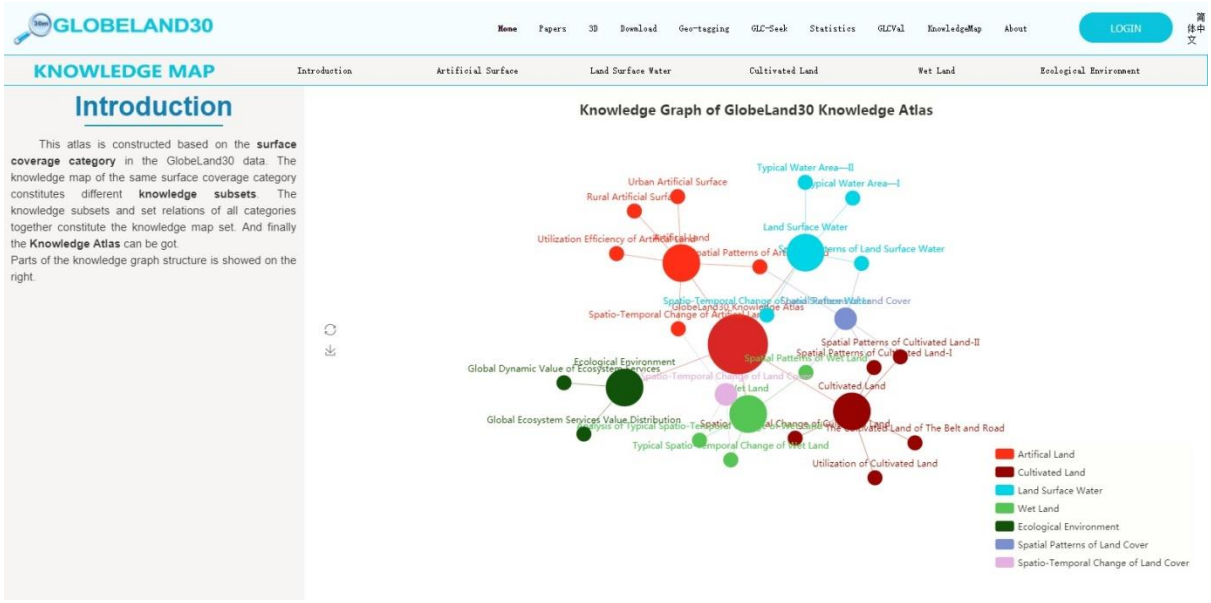

Figure 3: On-line dynamic atlas and knowledge map.

After the workshop, together with subsequent advertisement through ISPRS, a competition (entitled the "Atlas Challenge") was announced for researchers to demonstrate the applicability of geoinformatics towards addressing the SDGs [5]. The competition challenges the community to use data drawn from three different sources: global land cover (e.g. GlobeLand30), additional geospatial information and socio-economic data [5]. To encourage participation, a first place prize of CHF 2k, and a second place prize of CHF 1k is being offered to participants. The closing date for submissions is 30 April 2018, with the results to be demonstrated at the 2018 Commission IV Symposium in the Netherlands [6].

Associated activity and outputs

Alongside the main activities documented above in Tasks 1-3, a number of associated actions have taken place with the participation of the PIs and CoIs. These include:

- Jointly edited by CoI Sisi Zlatanova, ISPRS Journal of Photogrammetry and Remote Sensing will publish a special issue of ISPRS journal on the sustainable development goals in 2018.

- Two papers arising directly from the project were submitted to the ISPRS Special Issue, entitled "A GlobeLand30-based composite index approach to determine geospatially-related Sustainable Development Goal indicators worldwide" and "Dynamic Atlas for the Visualization of the UN Sustainable Development Goal indicators: A Framework and Prototype". These manuscripts are now being modifed for submission to alternative journals.

- A third paper, co-authored by Joint PI Jon Mills, was accepted for publication in the ISPRS Journal Special Issue [7].

- Based on the outcomes of the project, Newcastle University's Institute for Sustainability advertised a fully-funded international PhD studentship, entitled

"Quantifying the immeasurable: determination of tier II and III SDG indicators via an integrative geospatial framework" as part of its annual PhD funding competition (for September 2018 commencement). The studentship attracted a number of high quality international applications and three were shortlisted. Following interview, a candidate was nominated to the Institute for funding and an outcome is currently awaited.

- An abstract was submitted to the ISPRS Geospatial Week conference in Wuhan in September 2018 to coincide with the announcement of the Atlas Challenge competition. The abstract was selected for poster presentation, which is shown in Figure 4.

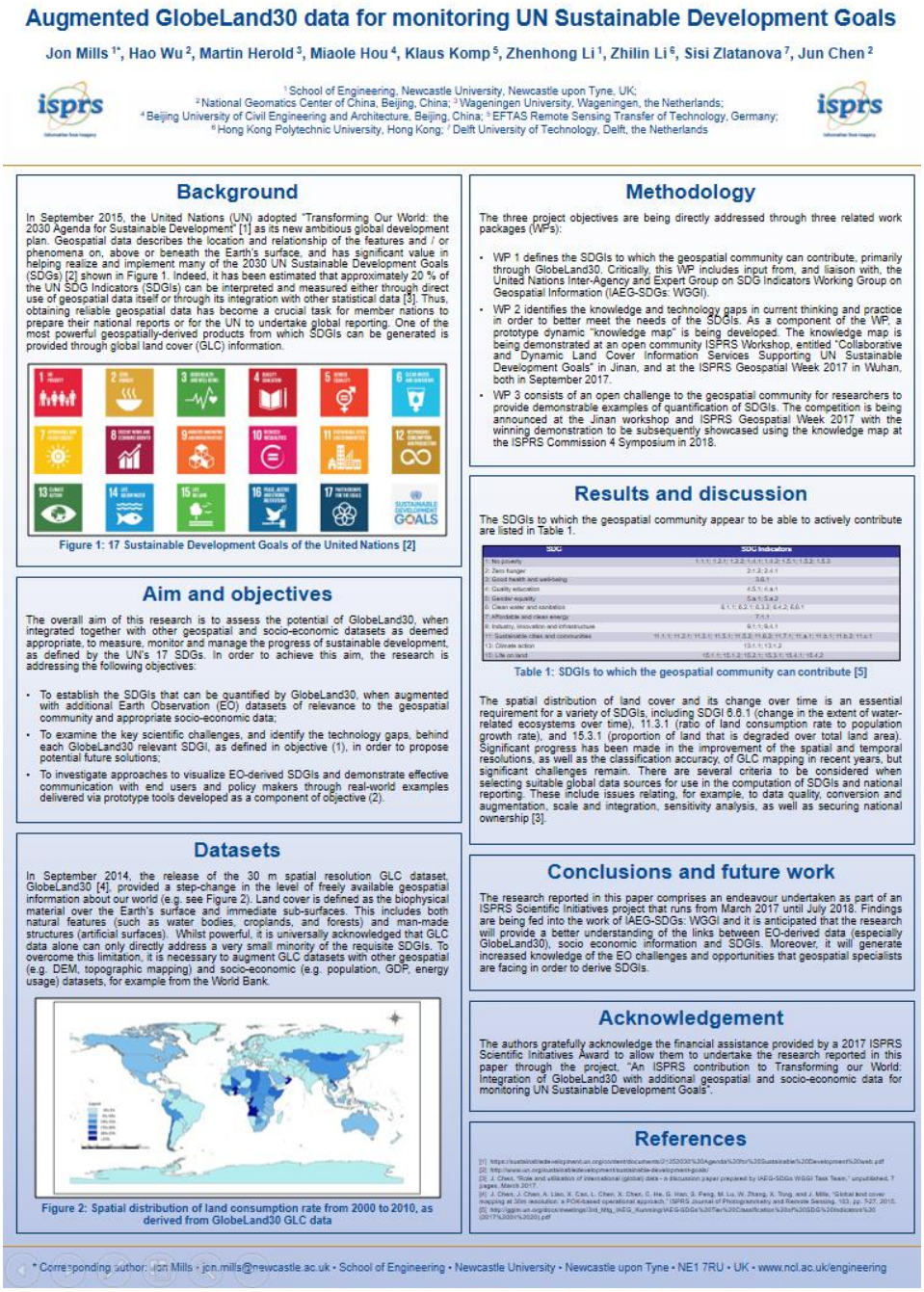

Figure 4: ISPRS Geospatial Week poster presentation.

Conclusions

This Scientific Initiatives project has generated activity that has helped stimulate the ISPRS community's interest in contributing to the United Nations' SDGs. With the bulk of the work packages now complete, the remaining activity comprises completion of the Atlas Challenge competition. The project will therefore not conclude fully until October 2018 with the winning entry in the Atlas Challenge being showcased at the ISPRS Commission IV Symposium.

Budget and expenditure

The budget for the project was CHF 8k. In 2017, CHF 4,442 was spent on hosting the Jinan workshop, including costs for meeting meals, meeting materials, registration services and venue hire. CHF 3k is being held back to be used in 2018 for award of the competition prizes. The remaining funding of CHF 558 will be used in support of the competition, including advertisement and promotion.

References:

[1] https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf

[2] http://www.un.org/sustainabledevelopment/sustainable-development-goals/

[3] Chen Jun, Ren Huiru, Geng Wen, Peng Shu, Ye Fanghong, 2018. Quantitative measurement and monitoring Sustainable Development Goals (SDGs) with geospatial information. *Geomatics world*. Vol.25 No.1, p: 1-7.

[4] http://www.isprs.org/news/newsletter/2017-04/55_171016Report_of_Jinan_Workshop.pdf

[5] http://www.isprs.org/news/announcements/170927-Call_for_participants_ofpapercompetition_on_the_Atlas_Challenge_0905_submit.pdf

[6] http://www.isprs.org/tc4-symposium2018/

[7] Xiao, W., Mills, J., Guidi, G., Rodríguez-Gonzálvez, P., Gonizzi Barsanti, S. and Gonzalez-Aguilera, D., 2018. Geoinformatics for the conservation and promotion of cultural heritage in support of the UN Sustainable Development Goals. *ISPRS Journal of Photogrammetry and Remote Sensing*. In press.