

ASSESSING THE IMPORTANCE OF NSDI AND SPATIAL DATA TRANSPARENCY FOR BIODIVERSITY CONSERVATION AND THE ENVIRONMENT: MAKING A CASE FOR A GLOBAL NSDI INDEX

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Abstract

Biodiversity conservation and land use planning are inherently spatial, and as increasing pressures are placed on land use, it is vital for decision-making to be well-informed and integrated. Within the environment sector open, accurate, and exchangeable spatial data can empower the organisations responsible for environmental decision-making. Critically, it can help them prevent and resolve land use conflicts by encouraging early engagement in 'problematic' development projects. These are all functions that a NSDI can provide if effectively mobilized within a country. This study investigated spatial transparency issues in eight WWF-UK priority countries through interviews and questionnaires sent to in-country spatial data users and experts. The research also gained an insight into awareness of NSDI, use of NSDI, and potential applications and need for improvements, with the ambition of highlighting the importance and potential of effective spatial data infrastructures for the environment sector. The conclusion drawn was that a way of assessing progress towards SDI at a national scale was greatly needed. The scoring that a comprehensive and stakeholder relevant Index to assess NSDI provides will allow investment and decision-making to be directed towards problematic areas of NSDI development, and will promote collaboration and motivation between government departments and other stakeholders to improve their spatial data quality, management and availability. This would have long-term benefits for development and environment agendas.

Keywords: Spatial Data, NSDI, Transparency, Biodiversity Conservation, Indexing, The Sustainable Development Goals.

1. INTRODUCTION

This paper is culmination and summary of work primarily taken from a report written by the Author for WWF-UK (published internally in 2016); a Master's Thesis completed by the Author in fulfilment of an MSc Biodiversity Conservation and Management degree, September 2015, The University of Oxford, School of Geography and the Environment, supervised by Paul Jepson (Chandler, 2015); and a discussion paper, published May 2016, by the Smith School of Enterprise and the Environment (Chandler et al., 2016).

1.1. **Spatial Data is Vital for the Successful Achievement of the Sustainable Development Goals (SDGs).**

A key lesson learned from the Millennium Development Goals (MDGs), which ended in 2010, is that a lack of reliable data can undermine a government's ability to set and meet development goals, optimize investment decisions, and sufficiently measure progress (UN-SDSN et al., 2015a). As with the MDGs a requirement of the Sustainable Development Goals (SDGs), the recently adopted development targets which supersede the MDGs, is the need for countries to develop indicators to measure progress nationally and globally.

Spatial data underpins many national statistics (UN-SDSN et al., 2015b) and compliments most other traditional data systems. A report by the UN-SDSN notes that more than two-thirds of the SDG indicators can (and should) be visualised spatially, especially at the sub-national scale (UN-SDSN et al., 2015b) Not only is spatial data important to the conservation sector, it underpins a broader development agenda that is being adopted by countries globally, and has to potential to shape their effectiveness. It is therefore vital that systems such as National Spatial Data Infrastructure are in place to ensure the most accurate reporting and monitoring of target progress.

"If you look at the Sustainable Development Goals... all of them deal with information and all of that information has some relationship to where those events or where those activities are happening on the Earth. In order to make the Sustainable Development Goals really meaningful, they have to know where these events are happening."

(Trainor, 2015)

1.2. **Spatial Data Underpins and Supports Biodiversity Conservation.**

Spatial thinking is used in conservation to support a wide range of decisions, to monitor change, and to make 'sense' of the global environment; for example, widely used spatial schemes include: protected area networks, Important Bird Areas (BirdLife, 2016), and Key Biodiversity Areas (Eken et al., 2004). Access to

accurate and transparent spatial data has many benefits for conservation decision-making, and has profound implications for the quality of environmental and development planning. Such high-quality data can: reveal trends between different landscape relationships; facilitate spatially informed decision-making; and enable land use trade-offs to be more effectively managed. In illustration, work done by WWF has analysed World Heritage Sites (WWF-UK, 2015) and extractives concessions (such as mining, and oil and gas) using spatial data, the study determined that nearly 31% of globally important areas for nature have extractive concessions of various stages of activity overlapping them.

Spatial data evidence equips ENGOs to engage with industrial or development sectors on an equally informed level. These sectors are particularly poor at providing data on when, where, and how much activity is occurring, in particular the extractive, logging, and industrial fishing industries (which ENGOs frequently need to communicate with) are often significantly non-transparent at providing this data. Such lack of transparency can lead to less effective conservation decisions and engagement within these sectors. Spatial data provides environmental non-government organisations (ENGOs) with the ability to compare and keep track of natural resource use and to also include industry and social data to make the analysis of situations more powerful. Ultimately, spatial data facilitates ENGOs to enter debates and negotiations by providing essential, well-supported, and visual evidence which can be a powerful tool for changing potentially damaging development. “When something is mapped it is very easy to see where things are going wrong” (Chandler, 2015).

WWF is an excellent example of an ENGO using spatial data-centered initiatives to improve decision-making for conservation:

1. The WWF Global Observation and Biodiversity Platform (GLOBIL) launched in 2013, aims to unite, centralize, standardize, and visualize geospatial data from across the WWF network. It has the capacity to carry out mapping functions for different land-use scenarios to resolve and understand conflict in areas such as the Amazon biome and as a monitoring interface to track the progress toward ocean protection goals (Shapiro et al., 2015).
2. WWF-SIGHT is an early engagement spatial tool, which is a cloud-based ArcGIS mapping platform that integrates key development and environmental datasets. At present, there is a focus on extractives and infrastructure. The aim is that it will allow rapid evaluation of the potential environmental and social conflicts of specific developments. (Schmitt and Tibaldeschi 2016).

Without this kind of tool and spatially directed projects, it is difficult for conservation NGO's and stakeholders to engage with business to find more sustainable investment solutions.

1.3. An Effective NSDI is Vital for Natural Resource Management

It can be a challenge for conservation and development NGO's working in countries where governments are un-transparent with their spatial data. A NSDI provides countries with a way of reporting, storing and collecting spatial data. Through this system transparency, openness, accuracy, and interoperability of spatial data is promoted and the mechanisms put in place for their delivery. Indonesia's One Map Initiative (Samadhi, 2014) is an example where the establishment of a NSDI is directly connected to environmental motivations. Indonesia suffered, as many countries do, from land use and land cover maps that vastly differ in the information they portray, this had led to extensive overlapping concessions, made forest management difficult, and hindered the implementation of the REDD+ initiative. By Presidential Decree in 2007 the country: established an overseeing agency; developed a national competence framework for establishing professional education, training, and human resources; put in place legal decrees and information sharing laws to increase the dissemination and sharing of data; and is in the process of updating a series of base maps at a 1:50000 scale (Mulyani, 2014). These interoperable maps will be used as standard by all state ministries and stakeholders, and will be available on a free online portal to the public. In combination, the One Map Initiative is an NSDI solution to help tackle Indonesia's land-use and deforestation challenges through increasing the openness, transparency, accuracy, and interoperability of spatial data. This demonstrated the potential benefits such an infrastructure can have for effective natural resource management.

2. METHODS

2.1. Study Aim

This study investigated spatial transparency issues in eight WWF-UK priority countries through interviews and questionnaires sent to in-country spatial data users and experts. The research also gained an insight into awareness of NSDI, use of NSDI, and potential applications and need for improvements, with the ambition of highlighting the importance and potential of effective spatial data infrastructures for the environment sector.

2.2. Questionnaire and Interview Methods

The questions were developed around the themes of NSDI and data use, access, accuracy and transparency. These were then distributed, firstly to spatial data users/teams within the WWF-UK priority countries, and secondly, to a wider network of spatial data professionals including; NGOs, private companies and international organisations. The following results were derived from interviews and questionnaires sent to spatial data professionals and users within NGOs, government ministries, and private organisations in:

- Brazil - good survey response
- Peru - average/poor survey response
- Kenya - good survey response
- Tanzania - good survey response
- India - average survey response
- China - poor survey response
- Nepal - average survey response
- Bhutan - good survey response
- Pakistan - (unexpected) excellent survey response
- UK - poor survey response but excellent index input

The questionnaires were detailed and quite technically specific so response rates were preferred to be of high quality rather than high quantity. They were also aimed to be representative of other spatial data stakeholders, such as government ministries and private companies, as well as WWF offices.

3. RESULTS

Country-by-country analysis and specifically tailored results are available as a WWF-UK report on request. The following results are a summary of the analysis which describes the barriers to NSDI establishment and spatial data issues within the priority countries.

3.1. Conservation and Spatial Data Transparency Issues

Low data transparency when in-country organisations were trying to access and use data is a prominent problem across the countries included in this study. These transparency issues may take many forms; from highly regulated data use to reluctance to share data, especially on mining and infrastructure. Each transparency barrier carries its own issues for conservation and land use planning.

An example was given by Brazilian interviewees that opacity of standards has been used to hide environmental degradation in the Brazilian Savannah (Cerrado) over the last decade. The example given was that the criteria used when tracking deforestation were changed by the responsible ministries over the course of a few years; in 2009 criteria included degraded areas in their assessment and in 2015 they were not included. This resulted in a monitoring cycle that did not reflect the expansion of agriculture in the area, instead reporting minimal change in Cerrado cover. Issues such as this highlight the importance of transparency for environmental sectors even in a country which is considered to have excellent biodiversity and environmental data. It demonstrates that data can still be manipulated and used 'incorrectly' when transparency is low. A second example from within the East African study area is that low transparency and data sharing

has led to extensive duplication of datasets, which are scattered between ministries, meaning data use can be time consuming and expensive. Ministries in government will hold onto and duplicate datasets because this knowledge is a powerful asset while it remains opaque.

This study has demonstrated that transparency is a large issue in the countries which international ENGOs are operating in. For improvements to be made it is important for the organisation to work with governments and data users to find solutions specific to each country, and to use clear advocacy if such collaborative efforts are unsuccessful.

3.2. Key Barriers to NSDI (from Chandler, 2015)

Across the countries included in this study a key barrier to better data transparency, alongside siloed approaches to working, is political will. If there is no political support for NSDI, efforts often fall flat. For example, countries such as Indonesia have been very ambitious with their spatial data infrastructure, and, rather unusually, this motivation was driven at a presidential level which afforded a government-wide coordinated approach and better resources made available.

Pulses of funding are also particularly detrimental to consistent government support of NSDI. Funding for developing countries NSDI is often supplemented by external sources, such as development aid or grants, which come with short term or bulk financing characteristics. However, establishing a NSDI needs long-term and sustainable funding, because it should be a consistent process of improvement. At present, especially in East Africa and developing nations, these pulses of funding leave NSDI development vulnerable to inconsistent donor subsidies while governments divert funding to other “more pressing” issues of development. Thus, progress in countries’ NSDI establishment and improvement can be slow, causing low motivation within ministries to support it, and private investors to withdraw support due to lack of tangible results.

3.3. Potential Solutions

In solution, the interviews conducted in the preliminary work (Chandler, 2015) revealed that the way a NSDI presents or situates itself to government can greatly affect its acceptance and development. The results of this study reported that Governments need to make the connection between mapping and investing in mapping, and their national development plan. Often governments do not consider the processes needed for effective land-use planning, only the result for which they are aiming. To justify investment, it needs to come from a needs-based and problem-solving agenda, one which is used, and can prove its use from the outright and demonstrate such end results. If proven valuable to national development plans, the NSDI could also surpass the lack of government support from fear of transparent data. One organisation interviewed in East Africa is attempting to raise

NSDI profile through demonstrating to the government what can be achieved with accurate and transparent maps, and how they can save them time, money and resources, and boost their development agenda. (Chandler, 2015)

Across the surveys that were conducted several spatial data experts, especially in Brazil and India, stated that the trend for Smart Cities would improve the use of NSDI and investment in its improvement. A Smart City is an urban development agenda, which aims to use information technologies in a coordinated, high-tech, integrated way to manage a city's "assets", such as transport, water and waste control, emergency services etc. (Technische Universität Wien, 2015). Implementing a smart city infrastructure optimally requires open, accurate, transparent and integrated spatial data, all the qualities that an NSDI provides, and it is thought that this demand will trigger improvement in NSDI and its use. Smart cities are something governments can get behind and support because they can see a direct link between a development issue and spatial data management as a solution. There is great potential if the same problem solving attitude can be applied to natural resource management and the environment. More needs to be done to demonstrate this in a current issue that could be addressed similarly.

Another potential for NSDI to be supported is that many developing countries have an advantage due to the lack of legacy systems and technologies which restrict change; this will enable them to leapfrog some developed countries. Because of this, there is an opportunity to establish positive principles early on in infrastructure establishment; something WWF-Bhutan has demonstrated.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Recommendations to County Governments that ENGOs Should Be Making.

"Governments remain in a unique position to consider the requirements for geospatial information for society as a whole, and will continue to play a key role in providing a reliable, trusted and maintained geospatial information base."

(Carpenter and Snell, 2013)

Political will was identified as a key barrier to spatial data transparency and NSDI improvement. Governments need to see this foundational geospatial information for its "value", not for where it has come from or who owns it. Geospatial information needs to be treated as an essential component in decision-making processes, not just as a commodity that can be sold (Carpenter and Snell, 2013). ENGOs are in a position where they can work to promote and inform to change these attitudes, and recommendations that should be made across regional offices and to their government are:

- Improve the efficiency of resource allocation (using the NSDI Index proposed above) for developing their NSDI, or increasing it.
- Improve coordination across government and open datasets related to the SDGs (UN-SDSN et al., 2015b).
- Promote spatial data transparency at a regional and international level.
- Lobby for, and provide ideas on, secure funding for global environmental and social spatial databases (e.g. WDPA; IUCN Red list).
- Take note of, and invest in, making use of more 'Big Data' based solutions as they rapidly become available.

4.2. Recommendations to ENGOs

Spatial data use can be improved within ENGOs by making spatial data central to, and a key evidence base for, conservation decision-making, rather than just a supplementary piece of evidence. For example, rather than supporting work with a map of where something is happening, use spatial analysis to look at the trends and threats to biodiversity in an area and base decision-making on spatially underpinned evidence.

- Provide access to datasets important to the environment to the public and participate in country data initiatives.
- Share datasets and collaborate openly with other environmental stakeholders.
- Spatial data leadership, recognise the importance of spatial data to conservation decision-making, policy advocacy and early engagement with governments, companies and investors and ensure that it supports project work where appropriate to the best of its ability.
- Engage with stakeholders (especially governments) who have the resources to improve spatial data management in priority places/ government.
- Advocate for spatial data transparency and openness.

5. KEY RECOMMENDATION: THE NEED FOR A GLOBAL NSDI INDEX

5.1. The Need for an Index (Chandler et al., 2016)

NSDIs are important for the environment sector as they can provide a platform for data sharing that is interoperable, accurate, and transparent. NSDI also have the potential benefit, as Indonesia has demonstrated, to break down siloed work within governments and ensure better cooperation to reduce conflict between environment, sustainability and development agendas. However, there is currently

no widely used method of benchmarking NSDI progress across all countries. How can countries improve and develop their spatial data management infrastructure if they do not know where they currently stand, which aspects are doing well, or which need resources directed towards them? Similarly, for stakeholders using, conserving, and investing in the environment, to be as effective as possible and to help the country improve, they need to know its spatial data situation. Therefore, a method of comparing countries that offers steps to improvement is crucially needed. An Index is an effective way of communicating complex systems and situations into a measurable and consistent format. Indexes display data in a way that is communicable to policymakers and citizens, and can be used to assess the progress of a country, region, or organisation towards a goal. Well-known examples include the Human Development Index (World Bank) and the Corruption Perceptions Index (Transparency International).

This proposal recognises and acknowledges previous research, such as the INSPIRE State of Play reports (Vandenbroucke et al., 2011) and the work of Crompvoets et al., (2008) and others who have proposed or developed different indexes for NSDI Development. It is felt, however, that current Index for NSDI assessment are not interchangeable or applicable to the needs of the sustainable development agenda, or provide a simple enough platform to allow for global analysis and comparisons to be made in a way that can inform policy and be used by ENGO to advocate for change. This work recommends and calls for a globally applicable 'top-line' index that can be used to highlight key issues with human, legal, and technical aspects on NSDI by providing an initial assessment of the global state of spatial data transparency, accuracy, interoperability, and openness.

5.2. Benefits of a NSDI Index to the Wider Development Agenda

The United Nations Sustainable Development Solutions Network (UN-SDSN) reported that; while national statistical services have become centralized institutions, the responsibility for geospatial data remains fragmented. The same report states that spatial data infrastructure allows for coordinated but still decentralized data management across government agencies, a platform critical for multi-sector data monitoring for the SDGs (UN-SDSN, 2015b).

Deployment of a NSDI index would support the realisation of the SDG goals in relation to (Chandler et al., 2016):

- Building accountable and inclusive institutions (SDG 16);
- Reducing the opportunities for corruption (SDG 16.5);
- By focusing on a nation's capacity to conduct integrated spatial and land-use planning the NSDI Index directly addresses the references in SDGs 11a and 11.3. These outline the need for sustainable human settlement planning and for generating positive economic, social, and environmental links between

urban, peri-urban, and rural areas through strengthening national and regional development planning;

- Building resilient infrastructure (SDG 9) and ending hunger through food security and sustainable agriculture (SDG 2), link back to the need for coordinated and efficient spatial planning.

An NSDI Index would enable governments to benchmark the state of the NSDIs and set investment goals to strengthen their spatial planning institutions and thereby improve their NSDI ranking. International finance institutions and multilateral and bilateral donors could support this by integrating a NSDI ranking as the conditionality of their loans and grant aid and investing in their development. Ultimately, the scoring that the Index provides would allow investment and decision-making to be directed towards problematic areas, and at the same time allows for avocation for collaboration and motivation between government departments and other stakeholders to improve their spatial data quality, management, and availability.

6. NEXT STEPS

A report for WWF-UK, Master's Thesis (Chandler, 2015) and discussion paper (Chandler et al., 2016) have developed, conceptualised, and presented an initial Index to benchmark NSDI globally. The conceptual framework of the index has been further developed and its details will be finalised through collaborative work between the University of Oxford and the University of Leuven. It is hoped that from the time of writing (July 2016) a pilot test of the index will be achieved, presented, and workshopped at the GSDI conference Taiwan (December 2016).

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