Forest Repository Maintenance System

T. Venkata sivarajan[1], Dr.E.Kesavulu Reddy[2]
[1] *Student, Dept. of MCA, SVU College of CS&CM*
[2] *Asst Professor, Dept. of MCA, SVU College of CS&CM, Tirupati, A.P*

Abstract- **Countries adopting forest and land-use-based climate change mitigation policies are investing in infrastructure and capacity to track the impacts of these policies. A major capacity gap is the lack of coordination among ministries and sub-national governments that regulate drivers of forest and land-use change from both inside and outside the forest sector. Improving communication, data integration and data access among institutions is a key step towards identifying land-use policies that can balance a range of cross-sector objectives, and tracking these policies over time. To accomplish this, countries should develop data management systems that integrate spatial and non-spatial data from multiple sources. This working paper focuses on the development of forest and land-use information systems (FLUIS), which are data management systems that integrate forest and land-use data. More specifically, this paper examines the institutional, human resources and financial capacities of three countries — Cameroon, Indonesia and Peru — that have developed a FLUIS, and highlights common enabling factors and challenges.**

I. INTRODUCTION

Recognizing the important role of forests and land use in reducing greenhouse gas (GHG) emissions, many countries are adopting and strengthening climate change mitigation policies that aim to reduce deforestation and forest degradation. The development of effective mitigation policies requires accurate and complete understanding of the drivers of forest and land-use change. Furthermore, evaluating the success of these mitigation policies requires ongoing tracking of forest and land-use change and the associated greenhouse gas emissions. With the support of international initiatives and funding, many countries have been investing in capacity building and infrastructure to track GHG emissions from forests and land-use change using spatial and non-spatial data. Though some progress has been made, capacity gaps still remain (Herold 2009; Romijn et al. 2012). Much attention has focused on closing the technical gaps, including, but not limited to, the lack of regular and frequent data collection, the absence of standardized methods for data collection, the lack of complete and up-to-date forest inventories, and others (Austin, Cheung, and Stolle 2012). This paper, instead, focuses on the need for increased institutional coordination for better management of spatial and non-spatial forest and land-use data.

II. RELATED WORK

The three countries selected – Cameroon, Indonesia and Peru – all initiated the development of a FLUIS for the purpose of improving institutional coordination and data management. While the initial motivations for developing these systems were not specifically for GHG emissions monitoring, the capacity building activities undertaken for and the data integrated in these systems are also needed for forest and land-use GHG tracking. Two of these countries, Indonesia and Cameroon, have explicit plans to expand the scope of their systems to enable GHG tracking

III. EXAMPLES OF FOREST LAND INFORMATION SYSTEM

The first step in developing the Forest Atlas was to identify and gather all available spatial and non-spatial forest and land-use data available within the government entities. From there, the team was able to assess what additional information was needed, and dedicate time and resources to filling data gaps and improving the quality of the data (Steil, pers. comm.). After four years of collaboration, WRI and the Ministry of Forestry and Wildlife (Ministère des Fôrets et de la Faune – MINFOF) released the first version of the Interactive Forest Atlas in 2004.

The Interactive Forest Atlas provides map-based information on the Cameroon forest sector, including forest allocation (e.g., forest management units, concessions, protected areas, community forests, and forest reserves, etc.), certification status, mining permits, volume of timber logged in concession areas, and location and capacity of sawmills. The Interactive Forest Atlas is a web-based tool built on a Geographic Information System (GIS) platform with a mapviewing application. The system lives within the MINFOF but can be accessed online by anyone with internet access. To reach those in remote regions and without internet access, the Forest Atlas is also available on CD-ROMs. Forest Atlas products (e.g., offline mapping applications, maps and reports) are widely distributed and available upon request. For example, ministries contributing data, as well as other ministries such as the Ministry of Economy, Planning and Regional Development (MINEPAT), as well as non-government organizations, civil society groups, universities and research institutions have requested Forest Atlas products (Mbouna, pers. comm.; Tessa, pers. comm.)6,7.

The Interactive Forest Atlas has shown marked success in improving forest management in Cameroon. With improved data quality, increased personnel capacity in using information and increased access to information, Cameroon has improved land-use planning and monitoring of its forest resources (WRI 2012). For instance, Cameroon uses maps of areas with logging permits and locations of roads to identify where illegal logging may be happening (WRI 2012). The availability of spatial information has significantly improved the Cameroon government's ability to enforce forest laws and monitor illegal logging activities (WRI 2012).

IV. LAND USING INFORMATION

Staffing The development of the Forest Atlas required three full-time staff at WRI headquarters in Washington, DC and five full time staff in Cameroon (Steil, pers. comm.). Right now, there is a maximum of three staff members in both offices working on the maintenance of the system (Mbouna, pers. comm.). At the MINFOF, two to five people are assigned to work on the Forest Atlas (Mbouna, pers. comm.). WRI and MINFOF plan to add more staff as needed for the next phase of work to enhance the system.

One difficulty faced by the project in developing and maintaining the Forest Atlas is the high turnover rate of local staff. To reduce the impact of staff turnover and recover capacity levels quickly, the next phase of Forest Atlas improvements aims to enhance the usability of the data-input platform to require less training of new staff (Steil, pers. comm.).

2.1.4 Financing Funding for the development of the Interactive Forest Atlas came from the U.S. Agency for International Development (USAID) through the Central Africa Regional Program for the Environment (CARPE) and the International Union for Conservation of Nature (IUCN). From 2003-2013, IUCN contributed around $1.3 million and from 2009 to

2013, USAID-CARPE contributed around $500,000 to the development of Cameroon's Forest Atlas. The Cameroon government contributes to the maintenance of the system by paying the salaries of the staff (Mbouna, pers. comm.).

2.2 Indonesia 2.2.1 The Context The Indonesian government currently lacks an official central database of geospatial information, including base maps for land cover and land allocation to support land-use decision making. It is common practice for the Ministry of Forestry, the Ministry of Development Planning, the Provincial government, and the District head to use different maps of the same area (Samadhi 2013), which often do not agree and frequently overlap. This fuels potential conflict when creating land-use policies, such as issuing permits or designating protected areas. The discrepancies occur between national ministries, and between local, provincial and national agencies. To address this problem, the President of Indonesia initiated the One Map policy to develop a National Spatial Data Network (JDSN – Jaringan Data Spasial Nasional) in order to harmonize data across ministries and jurisdictions.8 The goal of the policy is to improve coordination and data sharing among 13 different government agencies and to develop a single authoritative map on which land-use decisions can be based.9

V. APRIORI ALGORITHM

General Process Association rule generation is usually split up into two separate steps:

1. First, minimum support is applied to find all frequent item sets in a database.

2. Second, these frequent item sets and the minimum confidence constraint are used to form rules.

As is common in association rule mining, given a set of item sets (for instance, sets of retail transactions, each listing individual items purchased), the algorithm attempts to find subsets which are common to at least a minimum number C of the item sets. Apriori uses a "bottom up" approach, where frequent subsets are extended one item at a time (a step known as candidate generation), and groups of candidates are tested against the data. The algorithm terminates when no further successful extensions are found. [12]Apriori uses breadth-first search and a tree structure to count candidate item sets efficiently. It generates candidate item sets of length k from item sets of length k − 1. Then it prunes the candidates which have an infrequent sub pattern. According to the downward closure lemma, the candidate set contains all frequent k-length item sets. After that, it scans the transaction database to determine frequent item sets among the candidates.

A. Apriori Algorithm Pseudo code

Procedure Apriori (T, minSupport) {//T is the database and minSupport is the minimum support
L1= {frequent items};
For (k= 2; Lk-1 !=∅; k++) {
Ck= candidates generated from Lk-1
//that is Cartesian product Lk-1 x Lk-1 and eliminating any k-1 size item set that is not
//frequent
For each transaction t in database do{
#increment the count of all candidates in Ck that are contained in t
Lk = candidates in Ck with minSupport
}//end for each
}//end for
Return ⋃k, Lk;

B. Sample usage of Apriori algorithm

A large supermarket tracks sales data by Stock-keeping unit (SKU) for each item, and thus is able to know what items are typically purchased together. Apriori is a moderately efficient way to build a list of frequent purchased item pairs from this data. Let the database of transactions consist of the sets {1,2,3,4}, {1,2,3,4,5}, {2,3,4}, {2,3,5}, {1,2,4}, {1,3,4}, {2,3,4,5}, {1,3,4,5}, {3,4,5}, {1,2,3,5}. Each number corresponds to a product such as "butter" or "water". The first step of Apriori is to count up the frequencies, called the supports, of each member item separately:

Item	Support
1	6
2	7
3	9
4	8
5	6

Step 1:

Item	Support
1	6
2	7
3	9
4	8
5	6

Step 2:

Item	Support
{1,2}	4
{1,3}	5
{1,4}	5
{1,5}	3
{2,3}	6
{2,4}	5
{2,5}	4
{3,4}	7
{3,5}	6
{4,5}	4

VI. CONCLUSION

The development of forest and land-use information systems is increasingly important, as forests come under increasing pressure from forestry, agriculture, and mining activities, and the emphasis continues to grow on monitoring greenhouse gas emissions, implementing climate mitigation policies and tracking the progress of these policies. Successful development of a FLUIS is not an end goal, but rather serves as the means to achieve the larger goals of enabling tracking of forest-based mitigation policies and making informed and sound policy decisions.

REFERENCE

[1] Austin, K., A. Alisjahbana, T. Darusman, R. Boediono, B.E. Budianto, J. Busch, C. Purba, G.B. Indrarto, E. Pohnan, A. Putraditama, and F. Stolle. 2014. Indonesia's Forest Moratorium: Key Findings and Next Steps. Working paper. Washington, DC: World Resources Institute..

[2] Lambin, E. F., and P. Meyfroidt. 2011. "Global land use change, economic globalization, and the looming land scarcity." Proceedings of the National Academy of Sciences 108: 3465–3472.
[3] Larson, A. M. 2005. Democratic decentralization in the forestry sector: lessons learned from Africa, Asia and Latin America. In: The Politics of Decentralization: Forests, Power and People, edited by C. J. P. Colfer and D. Capistrano, 32-62. London, UK: Earthscan.
[4] Onsrud, H. J. 1998. "A Global Survey of National Spatial Data Infrastructure Activities." Accessed January 6, 2014. http://www.spatial.maine.edu/~onsrud/gsdi/surveysum.htm.
[5] Pohnan, E. 2013. Spatial Planning Progress: Enabling and Constraining Factors for Improving and Accelerating Spatial Planning in Indonesia. Unpublished.