



# Responsible Land Governance: Towards an Evidence Based Approach

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## Development of Pro-poor and Gender Responsive System (ProGResS) of Land Governance in Nepal

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ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
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## **Abstract**

The Land Administration System (LAS) of Nepal experiences two major lacking from pro-poor and gender responsive perspective of governance:1) Pro-poor and gender responsive socio-economic data of the land owners are unavailable 2) It lacks information on informal land tenure under which significant population are living with unsecured tenure and without formal spatial recognition.

Most of the people suffering from these two-major pitfalls of Nepalese LAS are poor, marginalized and Socio-Economically Disadvantaged (SED), especially women. Due to lack of pro-poor and gender responsive information in the existing LAS, it is difficult to formulate evidence based policies and make informed decision to ensure equitable access and meaningful control over land for the target group.

This study investigates and develops a proto-type of open-source Pro-poor and Gender Responsive System (ProGResS) for land governance. Existing LAS in Nepal is extended with the development of three new modules for Data Acquisition, Data Analysis and Data Dissemination. Identification, Verification and Recording (IVR) process was carried out in participatory approach in selected study area to collect primary data on informality and socio-economic status of land owners and/or settlers. The ProGResS module was tested and validated widely among the stakeholders and results were found encouraging.

## **Key Words:**

Informal Land Tenure, IVR process, Land Administration, ProGResS, SED people



## **1. Introduction and Related Work**

There are mainly two types of land tenure in Nepalese Land Administration System (LAS); Formal or Statutory land tenure and Informal land tenure. Statutory land tenure is formally registered in the official cadastre whereas the informal land tenure is not registered. People exercise informal land tenure by unofficially occupying the land. The Nepalese LAS has two major drawbacks from pro-poor and gender perspective of land governance: 1) it contains only the spatial information on land parcel which has limited attributes such as name and address of the land owners, type of land tenure and rights associated to it. It lacks pro-poor and gender responsive socio-economic data of the land owners such as marital status, income level, economic condition, family size, physical and social status, literacy, status of conflict and any kind of vulnerability they are facing. 2) The Nepalese land administration system doesn't deal with informal land tenure, meaning a large area of land is out of official cadaster, thereby, significant Nepalese population are living in informality with unsecured land tenure and without formal spatial recognition.

Most of the people suffering from these pitfalls of Nepalese LAS are poor, marginalized and Socio-Economically Disadvantaged (SED) including women. Due to lack of pro-poor and gender responsive information in the existing LAS, it is difficult to formulate evidence based policies and make informed decision to ensure equitable access and meaningful control over land and related resources for the target group (poor, marginalized, SED group and women). Likewise, regularization of informal tenure, management of informally settled people and land, and addressing landlessness is tough. Large amount of land remains out of formal land market as well as the informal occupants are deprived of tenure security. Consequently, land related economic activities and optimum utilization of land cannot be ensured. Therefore, socio-economic status of the poor and SED people remains vulnerable.

This study aims towards developing a complete and up-to-date land administration system which can address the above-mentioned shortcomings of the existing Nepalese LAS. The information on socio-economic status of the officially registered land owners are incorporated in the system. Similarly, an up-to-date information on informal land tenure and people associated with this informality is acquired and attached to the system. In this way, the existing LAS can be upgraded and made Pro-poor Gender Responsive System (ProGResS) of Land Governance.

### **1.1 Brief Overview of Land Administration Systems in Nepal**

Nepal had a history of different land tenure system (M. C. Regmi, 1977). After the introduction of land reform in 1963, mainly two systems of land tenure do exist. Statutory system is one which deals with the registration of legally recognized land tenure. The land parcels are measured, mapped



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



and recorded officially in together with land tenure information in the national cadastre. Under this system, mainly three types of land ownership exist; Raikar, State and Guthi (Subedi, 2009). Raikar is private land which is legally hold by legal person (person, group or institution) and enjoys absolute bundle of rights to own, rent, sell, mortgage etc. State land is further classified as Government and Public land (Acharya, 2008). The government land is hold by different government institutions; forest, national parks and other land under control of the government. Public lands are those which are commonly used by the society and community for public benefits. Finally, the Guthi land is that land that is hold by different organizations or community in the form of trust and managed for running different social, cultural and religious purposes. Ministry of Land Reform and Management is responsible for governing all these kind of land tenures. The other system by which the land is hold is informal and the tenure information is not registered in the cadstre. There are several modes of non-registered tenureship in Nepal which are mainly classified as Non-formal, Informal and Encroachment. Non-formal land tenure is recognized by the state law, and accepted by the local community; however, this type of tenure is not formally registered in the national cadastre. Informal tenure is accepted by the local community but, it is neither recognized by the state law nor is registered in the cadastral record. Encroachment (Adhikari, 2002; U. Regmi, Bhusal, P. , Bhandari, K. , Karki, J. & Sharma Paudel, N. , 2015) is category of land which has been occupied by people for a long period, but neither accepted by the community nor recognized by the state law. Religious and Customary tenures as are commonly understood worldwide, were illegitimated after the introduction of land reform in 1963 and do not exist as such in Nepal. A brief overview of land tenure system in Nepal is given in Figure 1.

Nepalese LAS is still managed manually in large extent. Application of digital technology is in preliminary stage. The modern cadastre, which was originally established for fiscal and legal purpose, is graphical in nature. It was initiated almost 90 years ago and now covers almost whole of the arable land and settlements. It occupies 28% of the total area of Nepal. The other land such as forest, national parks, several barren lands, meadow, mountains, snow cover etc. are out of existing LAS. The cadastre consists of series of geo-referenced maps based on national coordinate system (spatial information), and registers with descriptive record of parcel, their owners' and rights over the land parcels (Attribute information).

After establishment of democratic system in the country, people voice in favor of good land governance is rising. Society is seeking equitable access and meaningful control of SED people over land. Concerns are raised that current LAS is designed in favor of elite group of society. There



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



is no information on poverty, socially excluded and marginalized families and groups leaving in informal tenure. This lack of inclusiveness and gender disaggregated data in existing LAS is a serious drawback which restricts making informed decision and evidence based policy formulation in favor of poor and SED people. The major drawbacks of current LAS can be briefly outlined as:

- The cadastre comprises the record of cultivated and settlement land. It doesn't have any information on other land such as forest, mountain, riverine, shrubs, wetlands, meadow, and barren lands. These other lands are also very important resources for the society.
- The land administration system administers the formally registered land tenure only. It doesn't consist the information on informal land tenure. Informality is also a big issue to be addressed for security of tenure for sustainable peace and prosperity in the society.
- The cadastre and land administration system mainly information which are necessary for fiscal and legal purposes. It doesn't have any information that supports other social aspects such as poverty, equity, inclusiveness, marginalization, vulnerability etc. This information plays vital role for formulation of effective policy and taking informed decision.
- Land information acquisition, processing and recording system is traditional and manual. It is less accurate, labor intensive, time consuming and inefficient. It is much more process oriented as well as lacks transparency. People face difficulty in receiving effective and reliable land related services on time and hence, good land governance is a major issue in the Nepalese administration.
- The attribute data currently stored in various systems are based on the existing land ownership certificate, which are mainly issued to formally registered land parcel. The certificate contains limited personal information of the land owners. This information contained in the land ownership certificate is not up to date to define complete legal situation of a land parcel as well as complete socio-economic status of the owners.

Since a decade, process of digitalization of both types of land information (Maps and Registers) has started. So far, various digital LAS has been studied, developed and tested by different wings of Ministry of Land Reform and Management (MoLRM). A short description of these systems is as following:

- **District Land Information System (DLIS):** DLIS (Department of Land Information and Archive, 2012) is a tool especially designed to handle attribute data on land. It cannot be used to store, analyze and process spatial data or maps. Therefore, it couldn't be used for integrated land database.



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



- **Parcel Editor (PE):** PE (Survey Department, 2010) is an extension developed for ArcGIS commercial software. It was specially designed for handling spatial data. This tool seems more useful for handling newly acquired field data, process them and prepare cadastral database and maps.
- **Spatial Application Extension (SAEx):** SAEx (Department of Land Information and Archive, 2010) is an extension developed for ArcGIS commercial software. It was specially designed for handling spatial data. This tool seems more useful for handling spatial data acquired from existing source such as scanned maps and updating daily transaction and parcel subdivision. As it cannot store owners' information, the tool couldn't be used for providing integrated land services.
- **Land Record and Information Management System (LRIMS):** LRIMS (Maharjan, 2015) is an online tool especially designed to handle attribute data on land. It cannot be used to store, analyze and process spatial data or maps. Therefore, it couldn't be used for integrated land database.
- **Solution for Open Land Administration (SOLA):** In principle, SOLA (Pullar, McDowell, Solovov, Manoku, & Rizzo, 2012) is different than all of the above-mentioned solutions. It is the only open source tool for land administration in Nepal. Moreover, it was designed to handle both spatial and attribute data. It is a centralized system that offers land related facilities through web services. Therefore, this solution has edge over the other as it is cost effective and efficient.

## 1.2 Review of previous work

Developing countries' land administration systems are often paper based which are mostly inefficient and poorly structured. This results partly from the lack of customized and flexible software tools to standardize structure and support the processes that maintain cadastre and land registration systems. Open source software specially designed to meet the needs of the cadastre and land registration systems of a country are now available that will make land administration automation accessible to the developing countries. Open source software can be modified and customized as per the requirement of a country specific land administration law. Open source solutions are more flexible and adaptable to local conditions and languages than proprietary software.

In December 2012, the Food and Agriculture Organization (FAO) successfully concluded the Solutions for Open Land Administration (SOLA) project. The open source software produced by



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



the SOLA project is based on international good practice for service delivery, responsible governance of tenure (including transparency of process and transparency of tenure details), robust data management and the need for enterprise scale software. The underlying data structure used by SOLA is based on the Land Administration Domain Model (LADM), now published as ISO 19152 (Lemmen, van Oosterom, & Bennett, 2015) by the International Organization for Standardization (ISO).

As the laws and practices governing land administration are often unique to a given country, SOLA was designed to be customizable so that it could suitably reflect the laws and practices of the host country. To test the effectiveness of the software and the approach used for customization, the SOLA software was piloted in three FAO member countries: Ghana, Nepal and Samoa.

After its customization in Nepal to fit into the Nepalese context, the system was tested at Sindhupalchok district land revenue and survey offices. Different comments and suggestions were collected from the users at the offices. Incorporation of the comments and further strengthening of the system need to be done. A study was conducted to know the strength, weakness, and challenges for its smooth implementation (PEES & Yomari, 2015). The investigators developed lists of functional and non-functional requirements for LIS and compared the features available in SOLA with their list of requirements. The reviewers found some shortcomings for implementing the system in Nepal. Tamrakar and Chhatkuli (2015) found that it lacks socio-economic and gender disintegrated data. Given the context different investigators conclude that SOLA is still the most desirable and integrated system to be implemented in phase wise at the present condition.

There have been extensive implementations of original SOLA and its extensions in several countries. FAO started working with a set of FLOSS (Free Libre Open Source Software) tool to promote the implementation of Voluntary Guidelines on the responsible governance of land tenure, SOLA was deployed and customized to different extent in Samoa, Ghana, Nigeria, Tonga, Lesotho etc. (FLOSSOLA, 2017; Tjia & Coetzee, 2013). A SOLA version customized for Systematic Registration, are applied in seven states of Nigeria. Likewise, SOLA was customized to support lease management in Lesotho. SOLA was deployed in Tonga to assist in managing and tracking lease applications and land grants. Numerous extensions of the original SOLA have been developed through these implementations including support for systematic registration, lease management, inclusion of ortho-photo layers and financial systems.

The Arabic, French and Russian versions of SOLA and the preliminary work for the Mass Property Valuation extension to SOLA is sponsored by the European Union (FLOSSOLA, 2017). Spanish,



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



Portuguese and Chinese versions of the original SOLA software, known as Registry, are also exist (FLOSSOLA, 2017). A web based portal for recording and moderating the tenure rights captured by a community is also available (FLOSSOLA, 2017). The server is integrated with the Open Tenure mobile solution but can also be used independently.

While Nepalese version of SOLA is designed to administer land with formal tenure, Social Tenure Domain Model (STDM) is designed to record and manage land with any kind of tenure (Augustinus, 2010). It is a pro-poor, gender responsive and participatory land information system developed by the Global Land Tool Network (GLTN)/UN-Habitat. STDM has been developed to bridge the gap between formally registered land and land that is not registered. It is an affordable land tool for representing a person-to-land relationship along the land rights continuum.

Unfortunately, most of existing Nepalese LAS are not able to address the above-mentioned major drawbacks. Some systems are designed to handle spatial data only whereas the others help to manage attribute data only. Most of them are not as per the principle of fit-for-purpose as they are based on commercial software and cost a huge amount of money which may not be feasible for a developing country like Nepal. Similarly, none of these Nepalese systems do contain information on informal land tenure as well as detailed pro-poor and gender based socio-economic attribute information. However, the SOLA, in principle, has been found able to handle spatial and non-spatial data and is treated as per fit-for purpose concept as it is an open source software and has option to customize as per need of the individual organization which is also shown by the above-mentioned stories from different countries, and was initiated in Nepal as explained.

Therefore, this study intends to develop a new tool named ProGResS, which not only can handle both types of data but can also accommodate pro-poor and gender friendly disaggregated data. The new system will retrieve formal land related data from SOLA. As Nepalese version of SOLA is designed to administer land with formal tenure only, the investigators opted to study the use of STDM for completing IVR process of land with informal tenure and bridging with SOLA to develop a complete land tenure information system.

## **2. Objective of the Study**

The main objective of this study is to develop a pro-poor and gender responsive tool to support land administration system. Specifically, this study is concentrated on designing new modules for land data acquisition, analysis and dissemination of not only the technical cadastral information but also pro-poor and gender responsive socio-economic data on SED people, i.e. women, poor, marginal and vulnerable people in the society to ensure pro-poor gender responsive land



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



governance. It also aims to design a fit for purpose land administration tool which can record the existing situation of informal land tenure in the specified area. It further intends to test the application and usability of STDM in identification, verification and recording of spatial and non-spatial information on informal land tenure. The final result will be a dedicated land administration system which deals with not only the formal but also the informal land tenure and helps government institutions and policy makers to deliver effective land services for poor and marginalized group of the society.

### 3. Materials and Methods

#### 3.1 Materials and Study Area

This study is carried out on top of the several other study reports on shortcoming of Nepalese LAS. It has reviewed some existing LAS, identified their shortcomings and tries to develop a new LAS with enhanced capacity of land governance. Therefore, the materials used for this study are several earlier reports highlighting shortcomings of Nepalese LAS, existing cadastral data of Morang, Nawalparasi and Surkhet districts. Three local administrative areas called Village Development Committees (VDC) are selected for pilot study. Existing LAS such as DLIS, PE, SAE<sub>x</sub>, LRIMS and SOLA are also studied. Well known fit-for-purpose land tool; STDM, developed by Global Land Tool Network (GLTN) is also studied and tested. High resolution satellite images of the study area, Digital Cadastral data of the study area are also used to develop the tool.

#### 3.2 Methodology

The following four steps are carried out for this whole study. Desk study is carried out to short out the limitations of the existing systems and identify the potential information that needs to be incorporated in the new system. Field work is carried out to collect pro-poor and gender responsive primary information on land owners. Questionnaire survey and IVR process is completed during the field work. Three new modules data acquisition, data analysis and data dissemination are designed and developed to respectively input and process data and to disseminate the results. Finally, the system is tested and validated. The detailed activities under each step are shown schematically in Figure 2 and described in the following subsections:

##### 3.2.1 Desk Study and Analysis: In this first step of the study, available literature was reviewed.

Especially, reports on previous works on several other LAS, needs and aspirations of the stakeholders of concerned field area, gaps in the existing systems, international trends and developments in the field were studied. Later, various parameters to explain gender based socio-economic status are selected to be incorporated in the database and a questionnaire is developed for field survey to collect such information.



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



SOLA and its comparison with other existing LIS system in Nepal (PEES & Yomari, 2015), and its baseline study for pro-poor gender-responsive land administration (Tamrakar & Chhatkuli, 2015) carried out for IoM, UN-Habitat and Ministry of Land Reform and Management was studied. Deep insight in functioning of SOLA and further guide in developing new system/ module using its data were obtained by studying different versions of SOLA.

Data gap in the current system was studied and analyzed. This task was carried out after having studied the existing data at SOLA local level server at Sindhupalchok district survey and land revenue offices, central SOLA server.

Detailed study of existing situation from gender perspective is carried out. The constitutional provision for poor and women were critically analyzed and parameters were selected accordingly. The questionnaire was developed based on such parameters. Similarly, the goals and targets defined by Sustainable Development Goal (SDG) were also taken in account to consider equitable access to the land and related properties for women. Under this task, assessment of existing system from gender perspective was performed by using Gender Evaluation Criteria (GEC). Similarly, need assessment for future system to support pro-poor and gender responsive land governance was carried out. This assessment was completed after carrying out first round of field visit, discussion and interaction with stakeholders, vulnerable groups and women of the targeted field area. Several rounds of discussion with sociologists, economists and gender experts were also carried out.

After gap assessment is complete, certain parameters on social and economic status of land holders were suggested by the authors, to make a pro-poor and gender responsive land information system, besides basic information of party and parcels. A discussion on the preliminary parameter list was held with Ministry of Land Reform and Management (MOLRM) representatives and other stakeholder agencies and the list was refined as per the suggestions. Further, the refined parameter list was presented at the local level and appropriate suggestions were as well incorporated. Parameters on the following groups were suggested:

- Education
- Occupation
- Poverty
- Social factors



- Family members details
- Land tenure and other land related parameters

A questionnaire was prepared based on the selected list of parameters for data collection.

**3.2.2 Field Work and Data Collection:** Field work for data collection is carried out in three steps. In first step, field study is done for assessing the needs of the stakeholders and identifying secondary data available in the district level at the government and non-government institutions. In second step, after analyzing the gap between existing data and need of the people, necessity of additional data is identified, a questionnaire is developed to collect such data and field work is carried out. In the third step, Identification, Verification and Recording (IVR) of informal settlements and tenure of the settled people is done and STDM database is prepared to recognize the issue of informal tenure in one of the study area. To carry out IVR process, Google image is acquired, printed and taken to the field. Identification of the informally acquired land property is done in presence of the community, possession and rights of individual or family is verified with the help of available documents such as electricity, telephone and water supply bills, municipality records and services provided by local government etc. Finally, the description is recorded together with proof documents in STDM database supporting the concept of fit-for-purpose land administration.

**3.2.3 Design and Development of Pro-poor Gender Responsive System (ProGResS):** Three new modules are developed to acquire, analyze and disseminate field data. Data Collection Module aims to collect data from primary and secondary sources for pro-poor gender responsive land governance. Secondary data source includes exiting data in current LAS and data obtained from various government and non-government institutions. Data obtained from household survey (through structured questionnaire) is the source of primary data. A database is designed and created to store fields obtained from existing LAS as well as from primary household survey. The system design is depicted in Figure 3.

Data Analysis Module utilizes data imported from other LAS and those collected from household survey. The module provides integration, filter, query and analysis of data through household surveys as well as land integrated data retrieved from existing LAS. Interfaces are developed for filtering, querying and analysis based upon the provided parameters. This is based on open source system. The developed interfaces fetch data from ProGResS database and present results to the user according to user's demand and



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



conditions both in the form of tables and charts. Two types of reports are generated as a result of the query: i) Individual reports ii) Aggregated reports. Whereas individual reports display personal and land related information for all records meeting query condition, aggregate reports present summary of information. While individual reports are generated in tabular form only, aggregate reports present the information in the form of table as well as through charts. The system provides answers to pre-defined static questions which are quite easy to execute and understand by non-computer experts. Moreover, it also presents interface where a user can prepare a query to the database by combining individual conditions as per the question s/he want to get answer by selecting condition's parameter through easy graphical interface. This feature needs basic understanding of Structured Query Language (SQL) and is therefore, meant for computer experts or those who understand formulation of SQL statements.

Data Dissemination Module distributes collected data and processed results. Data distribution is made in terms of reports, tables and intuitive charts. The generated reports are in pdf format which can be saved, shared or printed.

- 3.2.4 **Test and Validation:** Two separate interfaces are developed for data import: i) Collecting data from existing LAS database and ii) importing newly acquired primary data. The first interface retrieves and synchronizes data from existing LAS (from SOLA database). Another interface retrieves household survey data from Excel sheets in predefined format. First, household survey data are entered in Excel sheets in predefined format which is then imported to ProGResS through data acquisition module. Data analysis and dissemination modules facilitate generating and sharing reports in the form of tables and charts. The developed system is fully validated with the data from pilot project sites. Different tests are performed; integration testing, black box and white box testing are some of them. These tests ensure correct functioning of database as well as the application. Problems found during these continuous tests are fixed.

STDM is used for IVR process of informal lands. The STDM workflow consists of selection of parameters, questionnaire preparation, field data collection through household survey, data entry, analysis and reporting. Similar set of parameters as well as similar questionnaire are used for STDM too. For obtaining spatial location of parcels with informal tenure Google image is used. Local people digitized the land parcels on printed google image during Identification, Verification and Recording (IVR) process. They also provided documents as proof that the land is being used by the person. Later,



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



the spatial location of each parcel was digitized in STDM and the documents are recorded together with socio-economic data collected through the structured questionnaire during the field visit. Different reports are then generated from STDM. Integrating STDM results into ProGRES is yet to be worked out.

## 4 Results and Discussion

The system is found easy to handle information on informal settlements. The data can be entered, stored and retrieved very efficiently. Further data can be added in the system if required. Data can be retrieved as and when necessary. The database can be appended with other similar databases. The system is found very suitable to identify the status of settlements by generating different custom reports. All the stakeholders (informal settlers, civil society, NGOs, local institutions and government officials) who have attended dissemination workshops are found satisfied with the system and its usability and recommended that the government should use it for formalization process in solving the problem of tenure security of landless and informal settlements.

STDM is quite useful tool to manage efficient database of informally settled people. The large number of landless/internally displaced people have acquired several sites and have been using land with informal tenure. State doesn't have actual information on number of such people, amount of land acquired by them and location where they have been settled. All this information can be managed scientifically with the help of STDM. Not only the attribute data on the informal tenure of land and their relationship with the people, but also the spatial location of such land/settlements can be effectively recorded. The informal tenure information from STDM and formal tenure information from SOLA as integrated in ProGRES would provide a basis for a full land administration system.

The tool is intuitive to use and manage. Local people and other stakeholders easily understood the application of Google image/ satellite images/ Aerial Photographs to identify their location and participate in the IVR process thereby. They can see the documents they submitted in support of their claim attached electronically with the sketch of plot/parcel.

Community confirms (or does not confirm) the one's claim. The community itself explains how long one or one's family has been staying there, how they get the piece of land, how they have been using it, what is their relationship with the land and whether the claim is legitimate or not. They further produce some formal/informal proof that can show the government or local body's endorsement in one way or another. Such proofs may be bill of water supply, electricity supply, telephone line, subsidy to build biogas plant or toilets from local authorities etc.



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



Current cadastre only contains the record of the land with formal tenure. The land with informal tenure has not been mapped in large scale. The large-scale maps/sketches and records of such sites captured in STDM can be helpful for planning and implementation of various development and construction activities, evaluation of land for compensation and preparing land acquisition plan as well.

Government has estimated around 900,000 landless and informally settled family seeking land and formal tenure in the land they hold (Giri, 2016). The Government of Nepal has expressed its commitment to solve the issue of informal settlements and remove encroachments on government land through its policy statement in the parliament in 2016. However, the government doesn't have any appropriate information and means to verify the claim. The government can be benefitted by making use of STDM in identifying, verifying and recording their claims. Application of STDM can be a good tool to solve this long-standing problem of landlessness and informal settlements.

The government needs to recognize various land tenure system in the country. It is responsible for addressing problems in inclusive, democratic and rational way. Many poor and marginalized people still do not have access to land and secured tenure right on the land they hold. They demand for the title and formal land right over the land which cannot be fulfilled right now under the current legal system of Nepal. In this situation, this tool can be useful for recognizing each kind of tenure rights on land enjoyed by those people.

Nepal has mapped only about 28% of land for large scale cadaster. This is mostly cultivated land with formal land tenure. Nonetheless, the country needs a detailed cadaster for efficient and effective land administration and management of whole country. The remaining land need to be mapped in large scale as soon as possible. It is very difficult to map this remaining land with the state of the art technology in short time period and with limited financial resources. In this situation, fit for purpose land administration model can be adopted to acquire the land related data and prepare well-functioning database of the remaining land. ProGResS can support as effective system for creating fit for purpose land information system of the remaining land.

## **5 Conclusion and Outlook**

The study shows that the ProGResS is a useful tool to manage both (Spatial and Attribute) kind of land related data efficiently and effectively. The newly developed data acquisition, data analysis and data dissemination modules are capable to integrate existing data to the newly acquired pro-poor and gender responsive socio-economic data. Further, it can also be integrated with the database of informal land tenure through STDM. Finally, as it is customized on top of free and open source system, it is affordable and hence as per the concept of fit-for-purpose.



# Responsible Land Governance: Towards an Evidence Based Approach

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 20-24, 2017



There are some issues still to be studied. It is recommended to develop an automated workflow for integrating existing cadastral data to newly acquired pro-poor and gender responsive socio-economic data. It was done manually for this study mainly because of inconsistencies in citizenship numbers of the land owners or in some cases such information was unavailable in the existing LAS. Further study for integrating STDM with the ProGResS is still necessary. Both systems were run separately within one platform in this study. In future, both systems can be integrated to keep all land related data in one database and provide all facilities from the integrated system. Additional study on the issue of integrating large volume data from different sources and locations is also felt necessary. For the purpose of this study, validations and test are run in a comparatively smaller data set.

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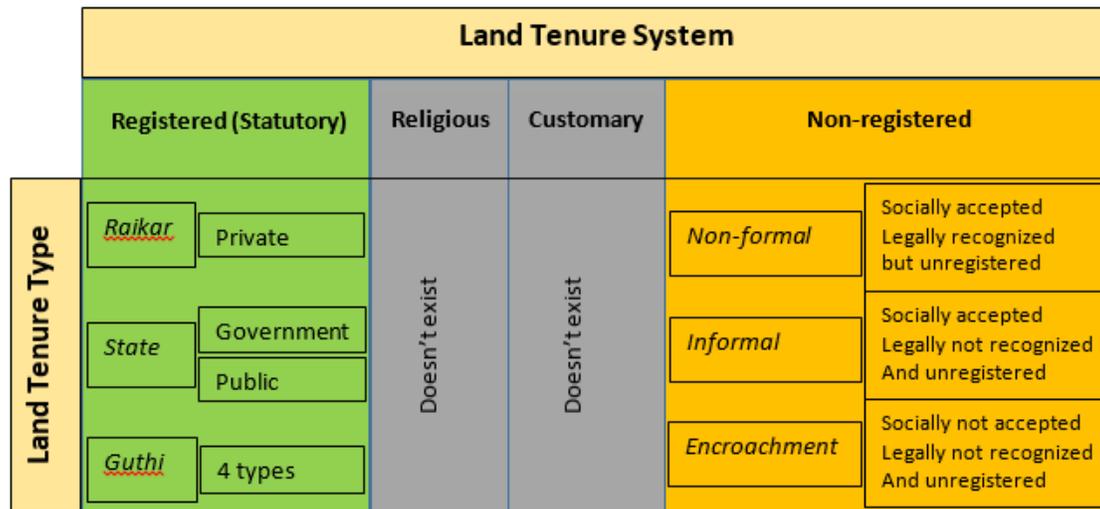


Figure 1 Nepalese modern land tenure types

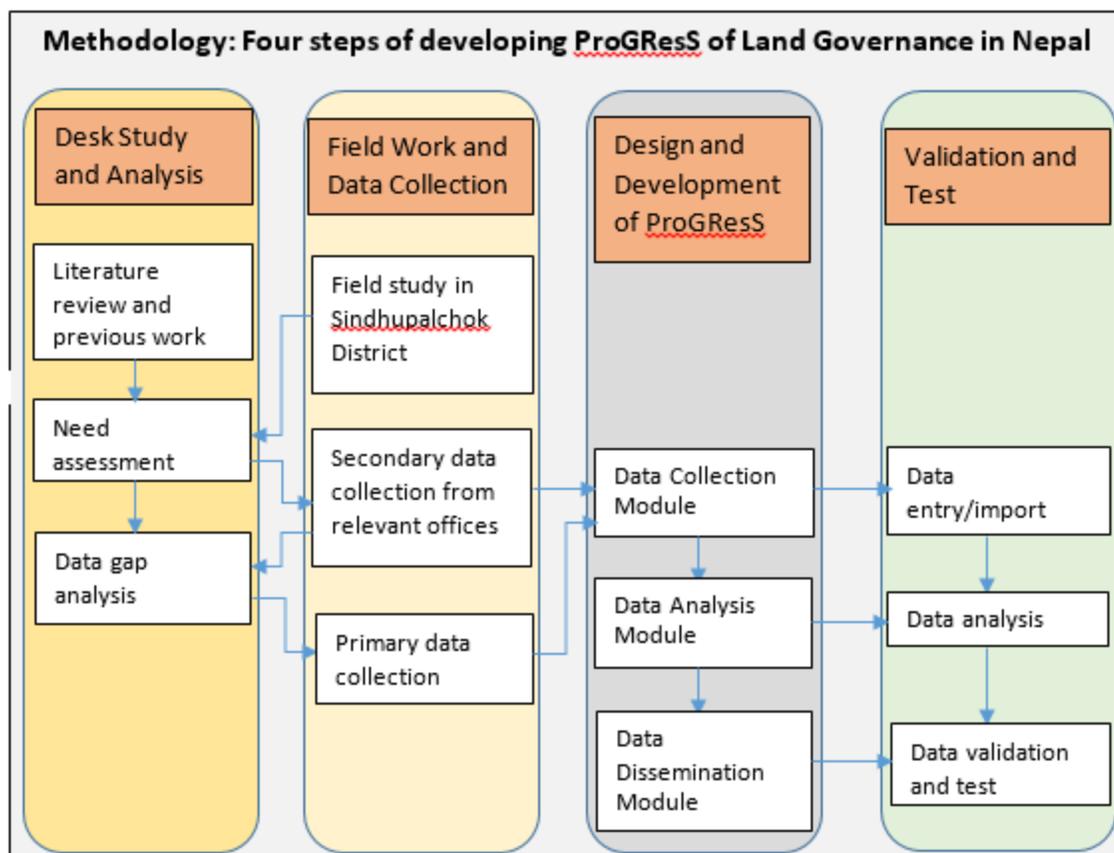


Figure 2 Methodological workflow of the study



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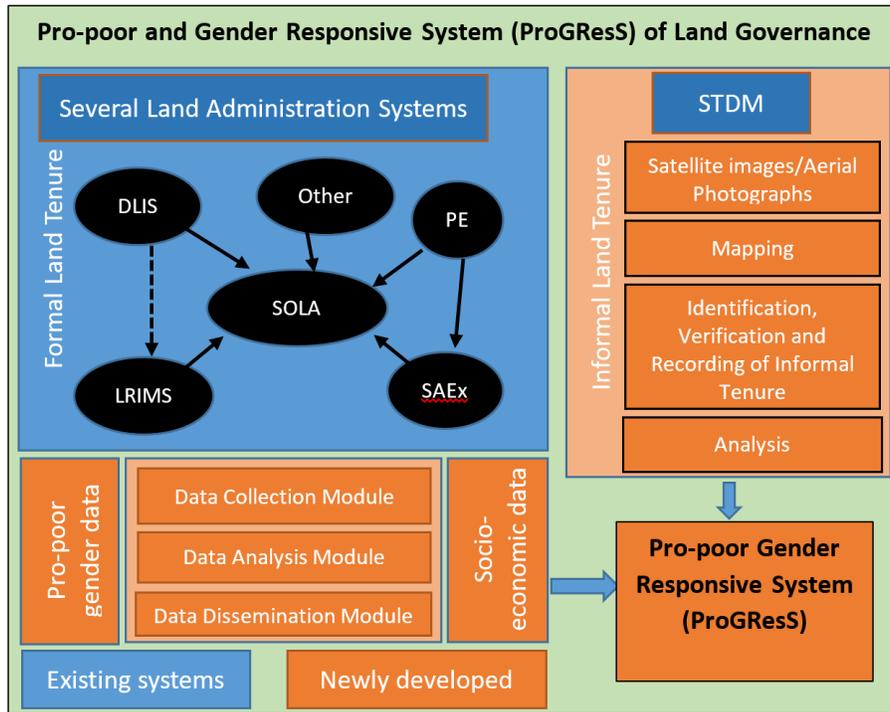


Figure 3 System design