

Land Use Zoning towards the Fulfillment of the 2030 Agenda for Sustainable Development

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Key Words: Land Use Zoning, Land resources maps, Sustainable Development Goals,

ABSTRACTS:

Land Use Zoning of Municipality/ Rural Municipality (VDC, the lower administrative unit consisting each of 9 wards) commenced after decision of Land Use Policy 2012 and completed 21 districts out of 77 districts of Nepal. It involves preparation of land resources data base (administrative, geology, land utilization, soil, land system, land capability, land use zoning and superimposition of cadastral data with land utilisation and land use zoning) at the scale of 1: 10,000 and Municipality/ Rural Municipality profile. It is prepared after field and desk study of 0.5m resolution satellite imagery, spatial and other data and documents and field verification.

The main aim of the study is to assign most optimal use of land resources, the land use zones and to assign land use zone to each cadastral parcel. During the study, new agricultural, socio economic data are also collected by questionnaires completed from experts and stakeholders and Focus Group Discussions (FGD) methods. A Municipality/ Rural Municipality Profile is prepared for each Municipality/ Rural Municipality incorporating land resources, administrative and socio economic data and shows the present development status of the Municipality/ Rural Municipality. It may need to improve the questionnaires to address all the 17 Sustainable Development Goals for Nepal.

In this article, It is briefly described the land Use Zoning systems, status of data related to Sustainable Development Goals(SDG) 2030 and suggestions related to improvement of questionnaires and spatial data to be useful to Sustainable Development Goals(SDG) 2030.

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1. BACKGROUND

Land is one of the important and precious natural resources of the earth surface. The demands for arable land, grazing, forestry, wild-life, tourism and urban development are greater than the land resources available. Hence, land-use planning for making the best use of the limited land resources is inevitable. Land-use planning is the systematic assessment of land and water potential, alternatives for land use and economic and social conditions in order to select and adopt the best land-use options (FAO, 1993). Except sporadic attempts for the urban areas (GoN, 2002), Nepal has not practiced land-use planning for the country as a whole, although attempts were made for balanced use of country's existing natural resources in the past through different policies and national planning efforts.

Land-use planning is in Nepal applied at three broad levels: national, district/now province and local. Local level planning is about getting things done on particular areas of land - what shall be done, where and when, and who will be responsible. It requires detail basic information about the land, the people and services at local level. However, Nepal has only regional level data base on land use, land system /soil, land capability which were produced at the scale of 1:50,000 and geology at the scale of 1:125,000 by Land Resource Mapping Project (LRMP,1980-86). Realizing this fact, the Ministry of Land Reform and Management of Government of Nepal established the National Land Use Project (NLUP) in 2000/01 fiscal year to generate the necessary data bases on the land resources of the country.

In the first phase, the National Land Use Project of Nepal had initiated several projects at district level and updated/prepared Land Resource Maps and Database at the scale of 1:50,000 for the whole Nepal. It had also prepared same kinds of maps and database for some municipalities at the scale of 1:10,000. Finally, NLUP was mandated to prepare land resource maps of rural municipalities (Village Development Committees or VDCs) of Nepal for local level planning through outsourcing modality. Up to fiscal year 2016/17, NLUP had completed preparation of land resource maps and database for 1404 Former VDC/ municipality of 20 districts of terai region and some VDCs/ Municipalities of Kathmandu, Lalitpur, Palpa and Syangja District. These digital database includes VDC/Municipalities level present land use, soil, land capability, land use zoning, cadastral layers and profile with bio-physical and socio-economic information.

The Government of Nepal has approved the National Land Use Policy, 2069 on April 2012. It has intended to manage land use according to land use policy of the government of Nepal and had outlined six zones such as Agricultural area, Residential area, Commercial area, Industrial area, Forest area and Public use area. The policy has defined the respective zones

as per the land characteristics, capability and requirement of the lands. Further, for the effective implementation of land use zones in the country, the National Land Use Policy, 2012 had clearly directed for an institutional set up of Land Use Council at the top, District Council to the District level and rural municipal level at the bottom. It has added further importance to the NLUP projects on preparation of rural municipality/ municipality level maps and database. However, based on the scenario developed after the major earthquake of April 25, 2015, Government of Nepal has re-directed for possible amendment on the existing Land Use Policy, 2069 which possibly may also emphasize the safe and secure settlement along with the environmental protection and ensuring of food security. Moreover, the Land Act 2021 (Sixth amendment) has land use classes. Some of which obviously differs from mandated for designation of more than six land what exist in the National land use policy, 2069. NLUP at present endeavours on the same to maintain the essence of the proposed amendment on the National Land Use Policy and as mandated by the Land act 2021 (Sixth Amendment) at the same time with the strategy of completion of land use mapping within 5 years to come as directed by the parliamentary committee in 2014. Land Use classification should be carried on the basis of Land Use policy, 2072 revised in 2015.

The sustainable development agenda has been under global discussion over the past three decades. The SDGs were first formally discussed at the United Nations (UN) Conference on Sustainable Development in Rio de Janeiro in June 2012 (Rio+20), and then in the UN General Assembly (UNGA) in September 2014.

As the SDG goals and targets are being negotiated and agreed in the UNGA in September 2015, their indicators and implementation strategy are worked out by ECOSOC at its 70th session in June 2016.

Nepal is planning to meet SDG 17 goals and targets. It studied and published the Nepal's Sustainable Development Goals, Base line Report on June 2017 by National Planning Commission, Nepal. This national report delves into the current status of the proposed SDGs and their targets in Nepal, the enabling policy environment and existing institutions for their operationalization.

2. SUSTAINABLE DEVELOPMENT GOALS (SDG) 2030

Nepal has following status and targets to fulfill the sustainable development following 17 goals:

SDG 1 proposes ending poverty in all its forms everywhere. Using the international benchmark for extreme poverty of an income of US\$ 1.25 per day, less than 25 percent of the population are living below this line. The poverty gap ratio has narrowed to 5.6 percent, while per capita GNI stands at US\$ 772 in 2015. Poverty has fallen not just nationally but across all of its major dimensions. Poverty (as defined nationally) is targeted to decline from 23.8 percent to 5 percent by 2030.

SDG 2 proposes ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture. In Nepal, still 30 percent of children aged 6–59 months are underweight; while stunting persists in 37.4 percent of fewer than five year old children and wasting in 11.3 percent of the same age group. The proposed target is to reduce the prevalence of stunting in children under five years, of underweight children (aged 6-59 months), and anaemia among women of reproductive age and children to less than one percent.

SDG 3 aspires to ensure healthy lives and promote well-being for all people of all ages. The progress in the health sector has been encouraging.

The SDG 3 targets for Nepal for 2030 are to reduce maternal mortality ratio (MMR) to less than 70 per 100,000 live births, to reduce preventable deaths to less than 1 percent of newborns and children, and to eliminate the prevalence of the human immunodeficiency virus (HIV), TB, malaria, other tropical diseases and water borne diseases. The targets also include reducing non-communicable diseases (NCD) by one-third and raising the proportion of births attended by skilled birth attendants (SBA) to 90 percent.

SDG 4 aspires to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. Nepal has made good progress in primary education with the NER now standing at 96.2 percent and the literacy rate of 15–24 year olds at 88.6 percent. Some of the proposed targets for 2030 include almost 100 percent enrolment and the completion of primary Sustainable Development Goals, 2016-2030

National (Preliminary) Report ix education, 95 percent of students being enrolled in grade one to reach grade eight, and 90 percent of children attending pre-primary education.

SDG 5 is about achieving gender equality and empowering all women and girls. Nepal has made substantial progress in ensuring equal access to education, with gender parity in primary and secondary level school enrolment. But discrimination and violence against women and girls remains despite significant improvements.

The proposed targets for 2030 include eliminating gender disparity in all levels of education, wage discrimination at similar work, physical and sexual violence, and all harmful practices,

and raising the presence of women in the national parliament and public service decision-making positions.

SDG 6 is about ensuring the availability and sustainable management of water and sanitation for all. Basic water supply coverage in Nepal was 83.6 percent in 2014, while sanitation had reached 70.3 percent of the population. Two-thirds of the Nepali population now use latrines and 30 percent of urban households are connected to sewerage systems. The proposed targets for 2030 include 95 percent of households having access to piped water supplies and improved sanitation, all communities being free of open defecation, and all urban households being connected to a sewerage system.

SDG 7 aspires to access to affordable, reliable, sustainable and modern energy for all. Currently, nearly three-quarters of households use solid fuels as their primary energy source for cooking while more than a quarter use liquid petroleum gas (LPG). Nearly three-quarters of households have access to electricity in their dwellings. The proposed targets for 2030 include 99 percent of households with access to electricity, only 10 percent of households using to firewood for cooking, the generation of at least 10 thousand megawatts of electricity, and decreasing energy intensity by 0.8 percent per annum.

SDG 8 aspires for sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. The target for LDCs is at least seven percent per annum growth in per capita gross domestic product (GDP), which Nepal is targeted to achieve by 2030. Other proposed targets to meet this goal are growth of labour intensive sectors like agriculture and construction by 5 and 10 percent respectively.

SDG 9 aims for resilient infrastructure, inclusive and sustainable industrialization, and innovation. So far, 12,500 km of the country's strategic road network and about 53,000 km of the local road network have been built. The share of industry in the country's total output is only 15 percent. The targets and indicators for 2030 are to increase road density from the current 0.44 km/km² to 5 km/km², grow access to telecommunications (tele-density) to 100 percent, and raise the share of industry in total output to 25 percent.

SDG 10 is about reducing inequality within and among countries. In Nepal, consumption inequality (as measured by the Gini coefficient) inequality 2014 was estimated at 0.33, and the share of the bottom 40 percent population in total income was about 12 percent. The proposed targets for 2030 are reducing consumption inequality from 0.33 percent to 0.16 percent, increasing the share of national income of the bottom 40 percent of the population from 12 percent to 18 percent, and increasing social, economic, and political empowerment indices to 0.70.

SDG 11 aspires to make cities and human settlements inclusive, safe, resilient and sustainable.

It is estimated that 7 percent of Nepal's urban population lives in squatter settlements and only 30 percent of houses are safe to live in. The proposed targets for 2030 include reducing multidimensional poverty, doubling the proportion of households living in safe houses,

increasing the road density to five km/km², making 50 percent of roads safe (for driving) by international standards, and creating at least 50 new satellite cities.

SDG 12 intends to ensure sustainable consumption and production patterns. In Nepal, only 10 percent of water resources have been used and fossil fuels comprise only 12.5 percent of energy consumption. The proposed targets for 2030 include limiting fossil fuel consumption to 15 percent of energy consumption and improving Sustainable Development Goals, 2016-2030

National (Preliminary) Report x the soil organic matter from 1 percent in 2014 to 4 percent in 2030.

SDG 13 calls for urgent action to combat climate change and its impacts. In Nepal, the total emission of carbon dioxide (CO₂), at 0.10 metric tons per capita, is negligible and the consumption of ozone depleting substances (ODS) is only 0.88 ODS tones. The proposed targets for 2030 include halving the emission of CO₂, OD and greenhouse gases from agricultural, transportation, industrial and commercial sectors.

SDG 14 is about conserving and sustainably using the oceans, seas and marine resources for sustainable development, and so is not relevant for Nepal. But as mountain resources are so crucial for Nepal's fresh water resources, hydropower, livelihood, agriculture, adventure tourism and environment protection, some specific targets can be set and indicators developed for this goal.

SDG 15 calls for protecting, restoring and promoting the sustainable use of terrestrial ecosystems, sustainably managing forests and halting biodiversity loss. Nepal's current forest cover including bushes and grassland is 39.6 percent.

Protected areas cover 23.2 percent of the country's land area. The proposed specific targets for 2030 are to increase forest cover to 45 percent and protected areas to 25 percent.

SDG 16 calls for promoting peaceful and inclusive societies for sustainable development among others. Nepal scores only 3 out of 6 for transparency, accountability and corruption in public life. Violence against children and women is common. The specific targets for 2030 include ending deaths from violent conflict, violence against women and violence against children, and improving the transparency and accountability score to 5, and the score on the good governance scale to 2.

SDG 17 is about strengthening the means of implementation and revitalizing the global partnership for sustainable development. SDG 17 has 19 targets, although its further elaboration through measurable indicators has yet to be done.

3. LAND USE ZONING

3.1 Objective

The main objective of the study is:

to prepare the municipality/rural municipality level land resource maps (present land use map, soil map, land capability map, land use zoning map, municipal level profile for land use zoning and superimpose of cadastral layers) database and reports.

3.2 Scope of Work

In order to achieve the above mentioned objective, the study team carries out the following activities following the updated National Level specification for the Preparation of Municipal Level Land Resource Maps, Database and Reports, 2015 for details.

- Collect all the basic and foundational information from various sources
- Perform DGPS surveying to collect acceptable number of GCP required for the geometric rectification of satellite images with spatial resolution of 0.5 m panchromatic and 2 m MSS.
- Perform necessary rectification of the given satellite images
- Perform field work to collected relevant land use, soil, risk factor, socio economic data and other information.
- Populate the given database with the extracted features.
- Maintain the database as per the specification.
- Prepare land resources maps as per the specified hierarchical levels
- Discuss the accuracy, reliability and consistencies of data.
- Prepare reports describing methodology, existing land resources data and model of GIS data base.

3.3 Methodology of Land Use Zoning

Brief methodology is as following:

- i) To review all the relevant maps of the project area including LRMP maps, Topographical map sheets and documents prepared by the Survey Department of Nepal as well as relevant products prepared by other agencies,
- ii) The municipal level land resources maps are prepared from rectified enhanced high resolution satellite images and the field collected data, sample and laboratory analyzed data.

- iii) Ortho-rectification of satellite images be performed in standard software generating Digital Elevation Model (DEM) and using Ground Control Points (GCP) collected through Differential Global Positioning System (DGPS). Location of GCPs be represent the range of elevation and the Root Mean Square Error (RMSE) should not exceed the value of two pixel size of the satellite image.
- iv) The level 1 categories of data be such as Agricultural, Residential, Commercial, Industrial, Forest, Public Use, Riverine and Lake, Cultural and Archaeological, Mines and Minerals, Excavation Area and other area (as per NLUP specification and data model. The fundamental classes should be as per Land Act 2021 (sixth amendment). However, sub levels should be populated as per requirement of the data model and ground truth.
- v) The interpretation and feature extraction in terms of different units be validated through enough ground truths collected from extensive fieldwork as well as through accuracy assessment matrix. The accuracy of each class as well as overall accuracy should not be less than ninety percent.
- vi) The map layout and legends be as according to the map/ data model supplied by NLUP.
- vii) The land resources map must contain Hazard Risk Information as a separate layer.
- viii) The reports on each of the land resources information be cover details of the methodology adopted in preparation of the maps of the selected municipality. It should cover tables, maps and charts showing the categories of the land resources and their properties. It should be in the format provided by the NLUP.
- ix) The output maps must be based on Modified Universal Transverse Mercator Projection System of Nepal and at the scale of 1:10,000. The database, images and maps be provided as per the data model and specification provided by the NLUP office.

4. SOCIO ECONOMIC DATA

Municipal Profile has to be prepared by analyzing primary and secondary information and maps necessary for formulating land Use zones for the municipality. The primary data that are generated are land utilization, soil and land system, land capability, risk prone areas, land use zones data and maps and location of infrastructures, buildings, names and other data. The secondary data are topographical and cadastral maps, climatic data, census data, and details of infrastructures.

The following contents with the necessary data and information are mandatory for each municipal profile:

- 1 Naming and origin of the municipality
- 2 Location
- 3 Settlements and administrative units
- 4 Physiography

- 5 Geology/geomorphology
- 6 Drainage/hydrology
- 7 Terrain
- 8 Climate
- 9 Forest and Biodiversity
- 10 Natural hazard and overall environment
- 11 Land systems, soils, land capability and other land characters
- 12 Present land use and land use zoning
- 13 Cadastral data
- 14 Agriculture and food production
- 15 Vegetable farming/fruit production
- 16 Poultry farming/fishing etc.
- 17 Livestock
- 18 Access to infrastructure and services
- 19 Industry
- 20 Social condition
- 21 Population characteristics
- 22 Economic condition
- 23 Heritage and Culture
- 24 Tourism
- 25 Hazard and Risk

While preparing profile, the units in the map of geology, soil types, land capability, land use etc. should be analyzed and data about each area be made available and chart, diagram and graphs have to be presented. Digital or analogue data collected by other institutions is utilized if necessary quoting the data sources along with the presented data.

5. USE OF LAND USE ZONING DATA FOR EVALUATION OF SDG

Land resources mapping was carried out to determine the carrying capacity of the area by studying the climate, geology, land utilization, land system and soil, land capability, risk features, socio-economic data, land use zoning and preparation of profile for land use zoning. The spatial data is prepared by interpretation of panchromatic / MSS aerial or satellite imagery of high or very high resolution along with field data collection.

The present land resources are useful to calculate the production of the area on the basis of productivity of the land resources, area covered and technology used. It will be useful to estimate of the status of sustainable development goals in the following way:

SDG 1 proposes ending poverty in all its forms everywhere. In the tarai and hills areas, landless people are generally in the extreme poverty and mountain area people having less than 1 ha productive land and without other employment are extreme poverty. It can be

estimated that the people or person without land ownership or squatters are in cycle of poverty. It can be estimated from cadastral data superimpose on present land use data as well as socio-economic data.

SDG 2 proposes ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture. The land capability data and cadastral data will allow estimating the area of hunger/ food secured area along with the population data. The food use habit also affects ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture in Nepal.

SDG 3 aspires to ensure healthy lives and promote well-being for all people of all ages. The progress in the health sector has been encouraging. The infrastructure data, present land use, environment and data related to diseases will indicate the situation.

SDG 4 aspires to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. The infrastructure data, and data related to education will indicate the situation.

SDG 5 is about achieving gender equality and empowering all women and girls. Nepal has made substantial progress in ensuring equal access to education, with gender parity in primary and secondary level school enrolment. But discrimination and violence against women and girls remains despite significant improvements. The census data use in profile will be useful to indicate status of girl or woman education. It may add to major crime situation in the profile.

SDG 6 is about ensuring the availability and sustainable management of water and sanitation for all. Basic water supply coverage, sanitation and use of latrines and connected to sewerage and garbage disposal system in urban areas are recorded in the profile. The assessment on employment situation is briefly described in the profile.

SDG 7 aspires to access to affordable, reliable, sustainable and modern energy for all. Electricity supply, petrol pumps, LPG depot etc. are shown as infrastructure and mapped, and use of energy is briefly assessed in the profile.

SDG 8 aspires for sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. The factory, modern agriculture practice, plantation, farm etc are mapped and data recorded on the profile.

SDG 9 aims for resilient infrastructure, inclusive and sustainable industrialization, and innovation. The industry, communication towers, optical fiber route, road and railway network are shown and mapped.

SDG 10 is about reducing inequality within and among countries. In Nepal, consumption and sale inequality (as measured by the Gini coefficient) could be recorded in the profile.

SDG 11 aspires to make cities and human settlements inclusive, safe, resilient and sustainable. The open space, park, forest are shown on present land use map. The squatter settlement may be classified separately.

SDG 12 intends to ensure sustainable consumption and production patterns. In Nepal, water resource, power house, brick kiln and factory are mapped and other infrastructure is also shown on the present land use and infrastructure maps.

SDG 13 calls for urgent action to combat climate change and its impacts. In Nepal, the total emission of carbon dioxide (CO₂), and consumption of ozone depleting substances (ODS is negligible. The forest coverage is improving and water body is also increasing for hydropower, recreation and fish farming. It is contributing on carbon sink.

SDG 14 is about conserving and sustainably using the oceans, seas and marine resources for sustainable development, and so is not relevant for Nepal. But as mountain resources are so crucial for Nepal's fresh water resources, hydropower, livelihood, agriculture, adventure tourism and environment protection, some specific targets can be set and indicators developed for this goal.

SDG 15 calls for protecting, restoring and promoting the sustainable use of terrestrial ecosystems, sustainably managing forests and halting biodiversity loss. Nepal's current forest cover including bushes and grassland is 39.6 percent. Protected areas cover 23.2 percent of the country's land area. The present land use will indicate forest cover and classify as forest, community forest or national parks/sanctuary.

SDG 16 calls for promoting peaceful and inclusive societies for sustainable development among others. Nepal scores only 3 out of 6 for transparency, accountability and corruption in public life.

SDG 17 is about strengthening the means of implementation and revitalizing the global partnership for sustainable development. SDG 17 has 9 targets, although its further elaboration through measurable indicators has yet to be done. It is require generating local resources for SDG and getting international assistance to sustain the SDG.

6. CONCLUSION AND RECOMMENDATION

The National Land Use Project completed large scale land use zoning works for sustainable development and most productive use of land of tarai, about 25% territory of Nepal using present specification. It has more emphasis on present land use and soil mapping and later stage on risk mapping. It may also need to give priority to infrastructure mapping as well as socio economic data collection so that it will also reflect the situation of sustainable development goals.

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