National Land Use Zoning (NLUZ) Technical Guidelines 2021 (NLUZ TG-2021)

National Land Commission is working together with partners to secure High Conservation Values in south-western Bhutan

‘This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag.’

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Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

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Acronym and Abbreviation

AHP	:	Analytical Hierarchy Process
AOI	:	Area of Interest
BOA	:	Bottom-Of-Atmosphere
CDP	:	Comprehensive Development Plan
CR	:	Consistency Ratio
CGISC	:	Center for GIS Coordination
GIS	:	Geographic Information System
LULC	:	Land Use Land Cover
NLUZ	:	National Land Use Zoning
MSI	:	Multi-Spectral Instrument
MCDA	:	Multi-criteria decision analysis
OBIA	:	Object based Image Analysis
RF	:	Random Forest
RI	:	Random Index
SNAP	:	Sentinel Application Platform
TOA	:	Top-Of-Atmosphere
TWG	:	Technical Working Group
WLC	:	Weighted Linear Combination

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1. BACKGROUND

National Land Use Zoning (NLUZ) aims to provide a scientific basis for the realization of sustainable land use and management in the country. As such, it is one of the major expected key result areas of the NLCS for the 12 FYP. It is envisaged that the project will be implemented in collaboration with all relevant stakeholders.

Two documents namely National Land Use Zoning - Implementation Guidelines 2018 (NLUZ-IG 2018) and National Land Use Zoning- Technical Framework 2019 (NLUZ-TF 2019) have been prepared for project implementation.

However, during implementation, limitations in the technical framework and guideline were encountered. The major challenges include zone specific parameterization by concerned authorities and lack of reliable spatial data. This necessitated the revision of the existing technical framework (NLUZ-TF 2019) and the preparation of a new strategic technical framework (NLUZ-TF 2021).

This National Land Use Zoning Technical Guidelines-2021 (NLTG-2021) is formulated based on NLUZ-TF 2021 for pragmatic and robust implementation of the project. It is strategically structured with three component-based outcomes and provides technical details and methods.

The guidelines define purpose, scope, and component-based implementation modalities with activities. Each detailed and itinerated activity includes defined objectives, a clear methodology, quality assurance/ control, and a specific schedule.

2. PURPOSE

- Serve as a technical basis for NLUZ implementation
- Provide a clear technical process and methodologies to achieve each component of NLUZ.
- Provide a practical approach in context of existing technical problems and issues

3. SCOPE AND LIMITATIONS

The guideline shall serve as the detailed procedures for implementation of the project and realize the three components of the NLUZ framework. However, it may not be treated as an exhaustive and immutable document. Appropriate changes or revision shall be incorporated as deemed necessary during the course of implementation.

4. IMPLEMENTATION MODALITIES/PROCEDURES

The execution of the NLUZ project is organized into three result-oriented components. The guidelines shall facilitate in achieving the three components as follows:

5. RESULT BASED FRAMEWORK

Based on the NLUZ-TF 2021, the following three outcomes are to be achieved after the execution of this guideline

1. Land Use Land Cover (LULC) map
2. Alienable land map
3. National Land Use Zone (NLUZ) map.

A. COMPONENT 1 – LAND USE LAND COVER MAP

	ACTIVITY	METHODOLOGY	OUTPUT
1	Acquisition/Downloading of satellite images	Copernicus Open Access Hub	Downloaded satellite images
2	Pre-processing of the satellite images	Sen2Cor	Pre-processed images
3	Defining of land use land cover classes	Consultation	Final land cover classes
4	Sampling	Stratified sampling	Sample data
5	Image segmentation	Multi-resolution	Segmented image
6	Image classification	Random Forest	Classified image
7	Validation	Confusion matrix	Validation report
8	Analysis	Comparison	Final results and report

Figure 1: Technical framework for conducting Land Use Land Cover (LULC) Mapping

Activity 1: Acquisition/Downloading of satellite images

1. Create a User Account and register with the Copernicus Open Access Hub to download the sentinel 2 image products. (https://scihub.copernicus.eu).
2. Select the area of interest (AOI) on the map.
3. Choose Satellite Platform S2A and Product type S2MSI1C.

    a. S2A platform and S2MSI1C product type are used since the atmospheric corrected data under S2MSI2A product type is not covered for the entire country.

    b. Choose the images with minimum cloud coverage for all the tiles.

Activity 2: Pre-processing of the satellite data

1. Once the images are downloaded, initiate pre-processing for carrying out the classification. Sen2Cor plugin shall be used in the Sentinel Application Platform (SNAP). Sen2Cor is a processor for Sentinel-2 level 2A production generation and formatting; it performs the atmospheric, terrain and cirrus correction of Top-Of-Atmosphere level 1C input data.
2. Convert the S2MSI1C images (Top-of-Atmospheric) reflectance to the S2MSI2A (Bottom-up-Atmospheric), surface reflectance.
3. Carry out the layer stacking of individual spatial resolution (10m & 20M) to create a single ortho-image of the entire Area of Interest (AOI).
4. Mosaic the stacked images into a seamless image
5. Define the image projection system to our national coordinate system (DrukRef03).
6. Subset the image using the Area of Interest (AOI) boundary.

Activity 3: Defining LULC classes

1. Identify Land cover classes to be used in the classification system.
2. LULC 2016 and finalized zones shall be the basis to derive the final land cover classes.
3. Define each land cover class clearly.

Activity 4: Sampling

1. Determine the appropriate sampling techniques to be used
2. Collect the sample/reference data for training the classification algorithm
3. Determine the sample size based on the number of LULC classes defined.
4. Perform sample validation based on the high satellite imagery and ancillary data.

Activity 5: Image segmentation

1. Image segmentation is a technique in digital image processing and analysis to partition an image into multiple parts or regions, often based on the characteristics of the pixels in the image. Efficient image segmentation is one of the most critical tasks in automatic image classification.
2. Use multi-resolution image segmentation technique to segment the image objects.
3. Use training sample data to train in Random Forest (RF) algorithm.
4. Convert training samples to sample statics to be used for the image classification.

Activity 6: Image segmentation

1. Develop a ruleset for the classification.
2. Apply Random Forest algorithm to perform classification

Activity 7: Validation and Accuracy assessment

1. Accuracy assessment is an important part of any classification process. It compares the classified image to another data source that is considered to be accurate or ground truth/reference data.
2. Generate classification assessment report using the validation samples
3. Construct error matrix for accuracy assessment.
4. Compute all the accuracy reports (User's, Procedure's, Overall, Kappa statics)

Activity 8: Results and analysis

1. Generate statistical reports
2. Perform statistical comparison with LULC2016
3. Perform accuracy analysis

Activity 9: Publication of the LULC technical report

1. Prepare/design statistical report
2. Finalize and publish final LULC map and reports

B. COMPONENT 2 – ALIENABLE LAND

	ACTIVITY/PROCESS	METHODOLOGY	OUTPUT
1	Identification of criteria	Expert knowledge and references	Factors and constraints
2	Data collection and preparation	GIS processing	Cleaned spatial input data
3	Criteria mapping	Reclassification	Standardized factors and constraints
4	Criteria weighting	Analytical Hierarchy Process(AHP)	Weighted factors
5	Aggregating criterion maps	Weighted Linear Combination (WLC)	Provisional alienable land
6	Evaluating registered land	Overlay and exclusion analysis	Alienable land
7	Verification and validation	Field and desktop verification	Final alienable land
8	Reporting and publication	GIS and statistical analysis	Reports and zone maps published

Figure 1: Framework for identifying alienable land

Activity 1: Identification of criteria

1. Criteria can be either factor or constraint. A factor is a criterion that increases or decreases the suitability of the alternative under consideration. And constraint is a criterion that imposes a restriction (by legal or natural land capability) on the consideration of alternatives.
2. The criteria shall be comprehensive and fulfilled to meet the objective of identifying the alienable land.
3. The identification of criteria shall be determined by the availability and quality of the data that shall be used as input parameters for the analysis.
4. Following relevant policies, acts, rules and regulations shall be the basis while selecting the criteria:
    - National Rehabilitation Project guidelines (2016)
    - National Environment Protection Act of Bhutan (2007)
    - Forest and Nature Conservation Act of Bhutan (1995)
    - Forest and Nature Conservation rules and Regulations of Bhutan, 2017F
    - Operation and Maintenance Manual for Transmission Lines
    - Road Act of Bhutan 2013
    - Land Act of Bhutan 2007
    - Cultural Heritage Bill of Bhutan 2016
    - Other relevant documents
5. Experts from sectors and agencies shall be consulted in the event of ambiguity.
6. The listed criteria shall be reviewed, assessed, finalized and endorsed by TWG member/PSC.
7. Factors and constraints identified and listed separately shall be the outcome of this activity.

Activity 2: Data collection and preparation

1. Once the criteria are identified, the spatial data representing it shall be collected.
2. Following data shall be considered for collection from the concerned agencies and use as the input source for criteria preparation:
    - Topographic (NLCS)
    - Cadastral (NLCS)
    - Administrative (NLCS)
    - Environmental (MoA)
    - Social (NSB, NLCS,MoWHS..)
    - Economic (MoEA, NSB,CNDP.)
    - Disaster, etc.(NLCS, DoDM,

3. Develop structured spatial geodatabase and store all the spatial files.
4. Extract all the required data and segregate into factors and constraints.
5. Ensure data quality through quality control check (QCC) (accuracy, completeness, reliability, consistency, compatibility and integrity)
6. All the spatial data shall be projected into National Coordinate system (DrukRef03)
7. Wherever possible, if need be, effort shall be made to improve the data quality through appropriate means (conversion, transformation, integration, segregation, standardization, enrichment, digitization, field survey, etc).
8. It is commonly observed that the actual land use of cadastral is not as per the land types recorded in the Thrams. For example, many chuzhing (land type in Thram) are reported being used for other land type use such as orchards (Oranges, cardamom, etc). The current Thram data do not have this data and information. Given the importance of preserving and protecting the existing potential chuzhing for food self-sufficiency, it has become necessary to make field verification and take appropriate measures. The use of drone technology to capture data and process a high-res image using machine learning algorithms deemed to be only the viable and sustainable option. Given the highest probable case in Samtse Dzongkhag, the pilot study shall be conducted in the Dzongkhag. If found efficient and cost-effective, the same shall be replicated in other Dzongkhags.
9. The data format shall be either vector or raster.
10. The output of this activity is to have the cleaned spatial data for factors and constraints.

Activity 3: Criteria mapping

1. After establishing a set of criteria, every criterion should be represented as a map layer in GIS. The map layer representing the criteria is known as criterion map.
2. Generate criterion maps by standardization and reclassification.
3. Any proximity or distance factor shall be represented with linear decreasing or increasing (may use Euclidean distance tool) distance values.
4. Standardize and reclassify all factors into four suitability classes viz High, Medium, Low and Not suitable.
5. The suitability value for each class shall be based on the expert knowledge or standard literature review where appropriate.
6. Ensure that the value for each suitability class is realistic for implementation.
7. The suitability values shall be reviewed and endorsed by TWG members.
8. The constraints shall have maps representing the binary values (0 for not suitable and 1 for suitable).
9. Raster with 10-meter resolution shall be the format for representing the criterion maps.
10. Generate standardized map for all the factors and constraints

Activity 4: Criteria weighting

1. Assign the weights to each factor. The weight is the relative importance of each factor. .
2. Analytical Hierarchy Process (AHP) method can be used to derive the criterion weights as follows.
   - *Step 1:* Construct pairwise comparison matrices for criteria/parameters and alternatives.

     Step 2: Calculate the sum of each pair-wise comparison matrix column.

     Step 3: Normalization of rated values- by dividing each element in the pairwise comparison matrix by its column totals.

     Step 4: Computation of the average of elements in each row of the normalized matrix and obtain the final weights.
3. After deriving the weights, it is important to test the consistency of the pairwise comparison matrix to ensure that the expert's judgements are consistent. This can be done by calculating the consistency index (CI) as follows:
   i. Each value in the first column of the pairwise comparison matrix shall be multiplied by the weights of the first item considered.
   ii. The same procedure is applied for other items.
   iii. Sum of the values across the rows are labelled as 'weighted sum'.
   iv. Divide the elements of the 'weighted sum' by the corresponding weights.
   v. Compute the average of the values computed in sl.no. iv and the average is denoted as λ_max The consistency index (CI) is computed with the following formula (1) and the consistency ratio (CR) is computed with the formula (2).

   CI= (λ_max-n)/(n-1) .....(1)

   Where n is the number of items being compared.

   CR= CI/RI .....(2)

   Where RI is the random index, which is the consistency index of a randomly generated pair-wise comparison matrix. It can be shown that RI depends on the number of elements being compared and takes on the following values.

n	1	2	3	4	5	6	7	8	9	10	11	12
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48

Source: (Saaty, 1980)

4. The consistency index CI for the pairwise comparison must be less than 10 percent.
5. If the CI value is greater than 10 percent, the experts shall re-do the pairwise comparison.
6. Derive the relative weights of importance for all the factors.

Activity 5: Aggregating criterion maps

1. Weighted Linear Combination (WLC) method shall be used for aggregating the criterion maps to produce composite maps of alienable land.
2. The WLC method operates by multiplying each standardized factor map by its factor weight and then sums the results. This output is then multiplied by the constraint inputs (if any) to exclude the undesirable areas.
3. The mathematical formula for this method can be expressed as.

$$s = \sum w_i x_i * \prod c_j$$

Where:

s – the composite suitability score

w_i - weights assigned to each factor

x_i – factor scores (pixel value)

c_j – constraints (Boolean factors)

$\sum$ - sum of weighted factors

$\prod$ - product of constraints (1- suitable, 0 unsuitable)

4. Process the criteria aggregation by using a Raster calculator or WLC tool in ArcGIS.
5. The output of the activity will be the composite map of alienable land

Activity 6: Evaluating the registered lands

1. The main objective of this activity is to evaluate the existing registered land against the alienable criteria and segregate accordingly.
2. This can be done in the following steps:
    i. Collect or obtain cadastral data (Map and Thram)
    ii. Extract/segregate registered cadastral plots with land type attributes
    iii. Overlay the output of (ii) with the provisional alienable land and extract registered land that intersects with alienable land.
    iv. Subtract the provisional alienable land by output (iii) to generate the alienable land.
3. The output of the activity will be alienable land maps

Activity 7: Verification and validation

1. The alienable land produced by GIS-MCDA method shall be validated in field as well as desktop validation performed using the satellite images where appropriate.
2. Appropriate system/technique shall be developed for verification and validation
3. Select validation sites randomly through the GIS processing system.
4. If necessary Dzongkhag/Dungkhag shall collaborate with the Technical teams.
5. Any issues detected shall be reported and find appropriate measures to rectify the issues.
6. The output of this activity will be the verification and validation reports.

Activity 8: Reporting and publication

1. Consolidate/integrate entire alienable land maps
2. Perform zonal-statistical analysis and generate statistics
3. Apply standard cartographic design and styles on zone maps
4. Generate detail reports
5. The output of this activity will be publishing report and maps of alienable land

C. COMPONENT 3 – NLUZ

	ACTIVITY	METHODOLOGY	OUTPUT
1	Identify and classify zones	Consultation	Classified zones and subzones
2	Defining of zone and sub-zones	Literature review	Zones and sub-zones defined
3	Classify and segregate land use	GIS- segregation	Produced Provisional Zones
4	Aggregate provisional zones and alienable land	GIS - aggregation	Generated Zones data
5	Verification and validation	Field and desktop verification	Final Land Use Zones
6	Reporting and publication	GIS and statistical analysis	Reports and zone maps published

Figure 2: Framework for mapping National Land Use Zones

Activity 1: Identification and classification of zones

1. Identify and classify zones and sub-zones must be through the sector consultation process
2. Enlist all the relevant sectors and agencies for the consultation and representation.
3. As an alternative, zones and sub-zones identified by the technical team may be submitted to the TWG for review and endorsement.
4. The output of the activity is identified and classified zones and subzones.

Activity 2: Defining zones and subzones

1. Define the zones and subzones clearly.
2. Literature review of all the relevant and existing laws, rules, regulations, scientific paper, etc, shall be the basis of definitions

Activity 3: Classification and segregation of land use

1. Collect existing spatial data of Cadastral, cultural, and environmental data.
2. Classify and segregate the data as per the classified zones and sub-zones (based on Activity 2).
3. Verify the classified data to conform the current land use on the ground.
4. Drone technology may be used for field verification. Any mismatch shall be reported and accordingly incorporate the changes.
5. Provisional zones based on the land use segregation will be the output of this activity.

Activity 4: Aggregate provisional zones and alienable land

1. Aggregate the alienable land adjacent to the provisional zones.
2. The aggregation shall be based on the principal of its nearest proximity.
3. The aggregated alienable zones with respective provisional zones shall be final zones.
4. National Land Use Zone maps will be the output of this activity.
5. Upon completion of HCV areas identification by the relevant sectors, it shall be integrated into the output from step 4 where the final Zone map inclusive of HCV zone shall be the final output.

   The following two points shall be considered for this final component:

   a. Step 5 shall be realized only after identification of the HCV areas which might be completed after the NLUZ project period (12 FYP) and

   b. In cases where HCV overlaps with other Land use zones, HCV shall prevail.

Activity 5: Verification and validation

1. Validate the result in the field as well as perform desktop validation using the satellite images where appropriate.
2. Develop an appropriate system/technique for verification and validation
3. Select validation sites randomly through the GIS processing system.
4. Dzongkhag/Dungkhag if necessary shall collaborate with the Technical teams for verification.
5. Any issues detected shall be reported and find appropriate measures to rectify the issues.
6. The output of this activity will be the verification and validation reports.

Activity 6: Reporting and publication

1. Consolidate/integrate entire land use zone maps
2. Perform zonal-statistical analysis and generate statistics
3. Apply standard cartographic design and styles on zone maps
4. Generate detail reports
5. The output of this activity will be publishing reports and maps of National Land Use Zoning.

6. CODE OF CONDUCT AND ETHICS

Professionalism in the performance of tasks and teamwork are the main principles of the Code of Conduct and Ethics and apply to all staff during the execution of project work. CGISC and TWG members, as well as NLUZ liaisons across sectors and agencies, must exercise due diligence in ensuring their collective efforts and deliveries to deliver NLUZ exercises on time and with the expected quality.

Officials and stakeholders within the NLUZ implementation landscape must adhere to the following specific code of conduct and ethics:

6.1 SOCIAL ASPECTS

i. Promote/ support procedures that protect community effervescence and principles of GNH and relevant social SDG goals;

ii. Respect and protect NLUZ social objectives diligently;

iii. Consider short and long-term relevance through NLUZ;

iv. Represent your organizations in a socially responsible manner; and

v. Respect the privacy of others.

6.2 PROFESSIONAL INTEGRITY

i. The assigned officials/ members/ focal persons shall be diligent about the completion of his or her duties, and do so in such a way that it reflects well on the sector/agency/ individual responsibilities and profession;

ii. Follow all prevailing laws on disclosure, transparency and accountability;

iii. Be open and transparent about the limitations and uncertainty in data and information provided;

iv. Avoid misleading data presentation and interpretations;

v. Avoid conflict of interests in all decision making process; and

vi. Acknowledge other's contributions.

6.3 COMPETENCY AND PROFESSIONAL DEVELOPMENT

i. Accept and provide appropriate employee review;

ii. Consult/ provide, when necessary, with colleagues in their areas of expertise;

iii. Maintain professional knowledge: seek information about current laws, accepted practices and relevant standards pertaining to professional work/ duties; and

iv. Continue to develop professional skills that supplement technical skills.

6.4 PROFESSIONAL RELATIONS

i. Encourage others to adhere to this code of conduct and ethics;

ii. Review the work of others in an objective, candid, and properly documented way;

iii. Respect and seek, when necessary, professional review and opinions from colleagues in their areas of competence;

iv. Give a fair hearing to the opinion, concerns, or complaints of a colleague;

v. Assist colleagues in professional development; and

vi. Take appropriate action if one discovers a colleague engaging in unethical behavior.

6.5 PROFESSIONAL RESPONSIBILITY

i. Work towards the best possible data quality, standard and integrity;

ii. Assure accountability;

iii. Advocate correct use of data and information;

iv. Adhere to the Individual Work Plans (IWPs) and mandates assigned officially;

v. Adhere to appropriate data security procedures; and

vi. Acknowledge any sources of data that are used in any field of tasks;

7. MONITORING & EVALUATION

The planned activities with end results and schedule described for each component under this Technical Guideline may serve as the basis for monitoring and evaluation.

8. DEFINITION

AHP: Method for ranking decision alternatives and selecting the best one from the multiple parameters, or criteria.

Criteria/parameter: It is a factor that determines the suitability and constraints of land uses.

Digital Elevation Model: It is a digital model or three-dimensional (3D) representation of a terrain's surface created from elevation data.

Image classification: It is the process of extracting information classes from multiband raster images.

Image pre-processing: It is a technique of enhancing data images prior to computational processing.

Image Mosaicking: It is a combination or merge of two or more images.

Image Segmentation: It is a technique of dividing an image into objects with meaningful representation of an image that is easier to analyze.

Land Cover (LC): Land cover refers to the type of material present on the landscape (e.g., water, sand, crops, forest, wetland, human-made materials such as asphalt).

Land Use (LU): Land use refers to what people do on the land surface (e.g., agriculture, commerce, settlement). The land type/s reflected in the ownership certificate/s shall fall under this definition.

Multi-resolution image segmentation: Multi-resolution image segmentation is one of the popular image segmentation algorithms in OBIA to convert the image into objects or image object primitives.

Object based image analysis: It is an image classification based on the object-oriented paradigm where an object can be defined as a grouping of pixels of similar spectral and spatial properties.

Rated values: Value assigned based on the AHP preference scale (from 1-9).

Random Forest: Random Forest is an ensemble learning supervised algorithm based which is operated by constructing a multitude of decision trees at training datasets.

Sample: A sample is a subset of the elements taken from a population used to make inferences about certain characteristics of the population.

Sentinel-2: Sentinel-2 is an Earth observation mission from the EU Copernicus Programme that systematically acquires optical imagery at high spatial resolution (10 m to 60 m) over land and coastal waters. The mission is a constellation with two twin satellites (Sentinel-2A and Sentinel-2B).

S**urface Reflectance:** The ratio of the energy within a wavelength band radiated by a nit area per solid angle (Steradian) of measurement (Wm-2 sr-1 μm-1) with the incoming energy.

Training Data: It is a set of sample data for training the satellite image into different LULC classes.

Validation Data: It is the sample data for validating the classification.

Weight: Is the average of normalized rated values of individual criteria/parameters obtained after AHP pair-wise comparison method.

Zone map: It is a map produced from weights of defined criteria/parameters and ranking of associated alternatives depicting suitability and constraints for different land uses.

Image accuracy: Accuracy assessment is the general term used for comparing the land cover classification results of the reference data that are assumed to be true.

9. WORK ACTIVITIES AND TIMELINE

COMPONENT 1: LAND USE LAND COVER PUBLISHED												
OUTPUTS	ACTIVITIES	TIMELINE (2021-2022)										
		Sept'21	Oct'21	Nov'21	Dec'21	Jan'22	Feb'22	Mar'22	Apr'22	May'22	Jun'22	Jun'22
Output 1.1. Downloaded satellite images	1.1. Acquisition/Downloading of satellite images											
Output 1.2. Pre-processed images	1.2. Pre-processing of the satellite images											
Output 1.3. LULC classes defined	1.3. Finalized land cover classes											
Output 1.4. Carried out sampling	1.4. Collected sample data											
Output 1.5. Carried out image segmentation	1.5. Produce segemented image											
Output 1.6. Carrried out image calssification	1.6. Produce classified image											
Output 1.7. Carried out validation	1.7. Validation reports											
Output 1.8. Carried out analysis	1.8. Final reports											

COMPONENT 2: ALIEANBLE LAND MAP PRODUCED																							
OUTPUTS	ACTIVITIES	TIMELINE (2021-2022)											TIMELINE (2022-2023)										
		Sept'21	Oct'21	Nov'21	Dec'21	Jan'22	Feb'22	Mar'22	Apr'22	May'22	Jun'22	Jun'22	Jul'22	Aug'22	Sep'22	Oct'22	Nov'22	Dec'22	Jan'23	Feb'23	Mar'23	Apr'23	May'23	Jun'23
Output 2.1. Factors and constraints identified	2.1. Identify criteria/parameters																						
Output 2.2. Cleaned spatial input data	2.2. Data collection and preparation.																						
Output 2.3. Standardized factors and constraints	2.3. Criteria mapping																						
Output 2.4. Derived factor weights	2.4. Criteria weighting																						
Output 2.5. Provisional alienable land.	2.5. Aggregate criterion maps																						
Output 2.6. Alienable land data generated	2.6. Evaluate registered land																						
Output 2.7. Final alienable land data generated	2.7. Verification and validation																						
Output 2.8. Reports and alienable land maps published	2.8. Reporting and publication																						

COMPONENT 3: NATIONAL LAND USE ZONE MAP PUBLISHED																							
OUTPUTS	ACTIVITIES	TIMELINE (2021-2022)											TIMELINE (2022-2023)										
		Sept'21	Oct'21	Nov'21	Dec'21	Jan'22	Feb'22	Mar'22	Apr'22	May'22	Jun'22	Jun'22	Jul'22	Aug'22	Sep'22	Oct'22	Nov'22	Dec'22	Jan'23	Feb'23	Mar'23	Apr'23	May'23	Jun'23
Output 3.1. Classified zones and subzones	3.1. Identify and classify zones.																						
Output 3.2. Zones and sub-zones defined.	3.2. Defining of zone and sub-zones.																						
Output 2.3. Produced Provisional Zones	3.3. Classify and segregate land use																						
Output 3.4. Zones data generated	3.4. Aggregate provisional zones and alienable land																						
Output 3.5. Final Land Use Zones.	3.5. Verification and validation.																						
Output 3.6. Reports and zone maps published	3.6. Reporting and publication.																						

Note: The development of web mapping for National Land Use Planning and related activities shall be carried out after 2023 only.

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