REVISION OF ECOSYSTEMS AND FOREST TYPES OF NEPAL

Terms of Reference for Remote Sensing and Geographic Information System (RS/GIS) Specialist

1. Background

In 2019, the Government of Nepal- Ministry of Forests and Environment (MoFE) initiated Ecosystem and Forest Type Mapping as a priority program and assigned the Forest Research and Training Centre (FRTC) to manage this. The program’s overarching goal is to enhance the sustainable management and conservation of Nepal’s ecosystems and thus support local as well as national economies. The program also supports a timely response to the Aichi Targets # 14 of the Convention on Biological Diversity’s (CBD) ensuring international commitments of ground action and reporting. This target primarily focuses on the restoration and protection of ecosystems by 2020 that provide essential services that contribute to the health, livelihood and well-being of women, and indigenous and vulnerable people.

To date, the vegetation maps drawn by Dobremez and his colleagues in the 1980s have been used as the basis of knowledge and classification of Nepal’s ecosystems and vegetation types. They identified 198 vegetation communities in seven ecological maps covering the entire area of Nepal. In 1995, the Biodiversity Profile Project (BPP 1995) digitized these maps and synthesized 118 unique ecosystem types by merging the vegetation types into one class despite their difference in the structures or conditions. Since the Nepalese Government commissioned the BPP and accepted the report, 118 ecosystem types were officially recognized for Nepal.

A comprehensive and systematic study of ecosystem and forest types of Nepal is long overdue, as the existing classifications made before the 1980s were based on limited expeditions, field studies and ground verification. Hence, the MoFE’s present initiative is a significant milestone, which aims to deliver a national-level ecosystem mapping effort using the standardized
methodology developed by the Global Earth Observation System of Systems (GEOSS) under the global ecosystem mapping initiative.

The standardized methodology for ecosystem mapping entails the integration of vegetation types and the creation of a composite map of environmental parameters. The macroclimate, lithology and landforms are the commonly used spatial parameters for the vegetation type. The vegetation type is considered to be a proxy for a specific biological community. The homogeneity of the environmental parameters with relatively stable condition delineates the iso-potential zone with a unique habitat and represents an ecological facet. Each ecological facet is considered as a distinct ecosystem type.

A national-level classification of forest, rangeland, agriculture and wetland ecosystem types will apply medium resolution satellite images in combination with extensive field data to validate the resulting map. Assessment threats and vulnerabilities to individual ecosystems and forest types will also be assessed using standard methods. Hence, the Ecosystem Mapping Program will contribute to devising national-level policies and strategies to protect and manage these life-supporting systems.

This ToR is developed and shared to seek a Remote Sensing and GIS Specialist to carry out ecosystem mapping in Nepal.

2. **Objectives**

The objectives of the Ecosystem Mapping Program are as follows:

- To review the existing knowledge and database relevant to the terrestrial and aquatic ecosystems of Nepal.
- To reclassify and delineate forest, rangeland, agriculture and wetland ecosystem types by applying a standardized methodology and generate appropriate maps.
- To assess critical threats and vulnerabilities to the ecosystems and provide management prescription.
- To improve institutional capacity for future monitoring and updating ecosystems of Nepal.

3. **Roles and responsibilities:**

The Remote Sensing and Geographic Information System (RS/GIS) Specialist will work under
the supervision and direction of the Technical Advisor (TA), Ecosystem Mapping Coordinator and the FRCT management. He/she will work together with the Ecosystem Mapping Team on Mapping of Forest, Rangeland, Agriculture and Wetland Types and Ecosystems of Nepal and generate these maps applying the standardized methodology and good practice.

**Specific tasks**

**A. Desktop**
- Work closely with Remote Sensing and GIS Programmer to develop specific RS/GIS applications for reclassification, integration and mapping of ecosystems.
- Download the cloud-free LANDSAT imagery for Nepal for the appropriate timeframe for land use and land cover classification for Ecosystems Mapping of Nepal using Google Earth Engine Platform.
- Collate land cover layer, digital elevation model and environmental parameters and check the metadata for ensuring the credibility of the data sources.
- Together with the TA and thematic specialists, prepare an efficient field visit plan for collecting field data and information at the point of interests.
- Prepare a Standard Operating Procedure on the satellite imagery classification and the methods describing the process for locating the new forest types training points and validation points.

**B. Other tasks**
- Perform radiometric correction (including atmospheric correction) of the downloaded satellite imageries to enhance the quality of the representations with the accurate reflectance value of the pixels due to land use and land cover the earth surface.
- Apply the training data points for forest types derived from FRA data, Community Forests, Dobremez Ecology Map of ICIMOD, and the potential vegetation distribution map of TISC (2002) to reclassify the satellite imagery using pixel-based classification at the physiographic or eco-regions (Eastern, Central and Western eco-regions).
- Work with TA to identify additional training data points for the forest types with a limited number of the training data points and validation points ensuring the sufficient sample points in each physiographic and eco-regions to assess the accuracy of the map.
- Provide the relevant LRMP maps, Google Earth Maps or Rapid Eye Maps and travel itinerary for the duration of the field trip and explain to each field team.
● Work with Rangeland, Agro-ecologist and Wetland Specialist to digitize the location data or geographic coordinates of the known Rangeland, Agriculture and Wetland to use as training data points for reclassifying the imagery.

● Apply the training data points for agriculture types and Wetland types to reclassify the relevant satellite imagery at the physiographic or eco-regions (Eastern, Central and Western eco-regions) using pixel-based classification.

● Work with TA, and the thematic specialists decide on the appropriate design for capturing all physiographic and eco-regions with sufficient training and validation data points for field data and information collection.

● Use the field data and information to reclassify the imageries to generate the Forest Types, Agriculture Types and Wetland Types Maps and finalize these maps after the Expert panel’s consensus on the classifications.

● Work with TA and thematic specialists to derive independent significant physical environmental parameters for forest, agriculture and Wetland, and generate an individual map for each parameter.

● Work with TA and thematic specialists to integrate the environmental maps and the respective maps of Forest Types, Agriculture Types and Wetland Types, and generate the maps with ecological facets representing unique Forest Ecosystems, Agro-ecosystems and Wetland Ecosystems of Nepal.

● Prepare and share the ecological facets for Forest Ecosystems with the Expert Panel and facilitate the evaluation and consensus decision on the classification of the Forest Ecosystems of Nepal.

● Work with TA and the thematic specialists to apply the recommendations of the Expert Panel on ecosystems classification and finalize the maps of Forests Ecosystems, Agro-ecosystems and Wetland Ecosystems of Nepal.

● Apply the map legends and coding endorsed by the relevant authorities of the government of Nepal.

● Join the field crew and other members of the Ecosystem Mapping Team for validation of the field data and information.

● Assist the thematic specialist (Agro-ecologist and Wetland Specialist) to interpret the imagery during the reclassification and validation.

● Together with the TA and the thematic specialists, generate threat and vulnerability maps of Forest Ecosystems, Agro-ecosystems and Wetland Ecosystems.
• Design and provide capacity building training to FRTC staff and other stakeholders on the application of RS/GIS in Ecosystem and Forest Types Mapping.
• Assist Ecosystem Mapping Coordinator in developing RS/GIS database at the FRTC and submitting all datasets with metadata including the products (maps) to the database.

4. **Duration of contract:**
It is a full time job for a period of 24 Months. The Duty Station is Kathmandu, Nepal with 10% field visits of the total duration.

5. **Required Skills and Experience:**
• Master degree in Forestry or Forest Ecology or Natural Resource Management or Geoinformatics.
• A minimum five years of professional experience in Remote Sensing and Geographic Information Systems (RS/GIS) focusing on the land use and land cover classification of LANDSAT imagery using pixel-based classification, Principle Component Analysis and image interpretation and analysis.
• A good understanding of Agro-ecosystem and Wetland Ecosystem and the relevant environmental parameters, biotic and abiotic factors.
• Excellent interpersonal skill with the ability to effectively interact with all team members and stakeholders.
• A demonstrated experience in working with a multidisciplinary team in different settings and environment and deliver outputs within the timeframe.

6. **Reporting Requirements**

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<tr>
<th>S.N.</th>
<th>Output and deliverables</th>
<th>Delivery date</th>
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<tbody>
<tr>
<td>1</td>
<td>Inception report</td>
<td>July 2020</td>
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<tr>
<td>2</td>
<td>Prepare a field visit plan for each field crew with the point of interest on the maps and travel itinerary.</td>
<td>July/Aug 2020</td>
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<td></td>
<td>Task Description</td>
<td>Date</td>
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<td>3</td>
<td>Produce the maps of Forest Types, Rangeland Types, Agriculture Types and Wetland Types by reclassifying the LANDSAT imageries.</td>
<td>Aug/Sept 2020</td>
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<td>3</td>
<td>Compile the field data and information collection point with geographic coordinate and archive in a database system.</td>
<td>Aug 2020 – July 2021</td>
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<td>5</td>
<td>Together with the TA and the thematic specialists, validate and finalize maps of Forest Ecosystems, Agro-ecosystems and Wetland Ecosystems</td>
<td>December 2021</td>
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<td>6</td>
<td>Generate threat and vulnerability maps of Forest Ecosystems, Rangeland Ecosystems, Agro-ecosystems and Wetland Ecosystems</td>
<td>January 2022</td>
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<td>7</td>
<td>Finalize maps of Forest Ecosystems, Agro-ecosystems and Wetland Ecosystems after addressing all the comments</td>
<td>March 2022</td>
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<td>8</td>
<td>Finalize threat and vulnerability maps of Forest Ecosystems, Rangeland Ecosystems, Agro-ecosystems and Wetland Ecosystems after addressing all the comments</td>
<td>April 2022</td>
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