



USE OF INNOVATIVE TECHNOLOGIES IN SUSTAINABLE FOREST MANAGEMENT IN BHUTAN

DEPARTMENT OF FOREST AND PARK SERVICES

INNOVATIVE TECHNOLOGIES IN SUSTAINABLE FOREST MANAGEMENT IN BHUTAN

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Forest Information and Database

2

Forest and Wildlife Resources Assessment

3

Remote Sensing and GIS

4

Timber Extraction

5

Timber Processing



Forest Information and Data Base Needs



Strong Information online Databases on Forest and Wildlife Resources for informed decision making and for National Forest Monitoring system



Information and Communication for timely and accurate information



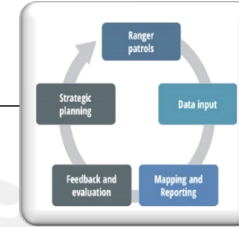
ICT Technologies for development of online information system.



Forest Information and Data Base systems

SDSS (Spatial Decision Support System)

- Management Regimes
- Forest Functions
- Ecosystems



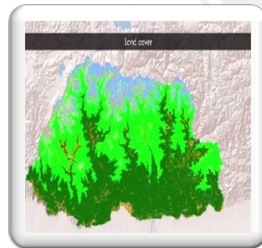
SMART (Spatial Monitoring and Reporting Tool)

FIRMS (Forest Information Reporting and Management System

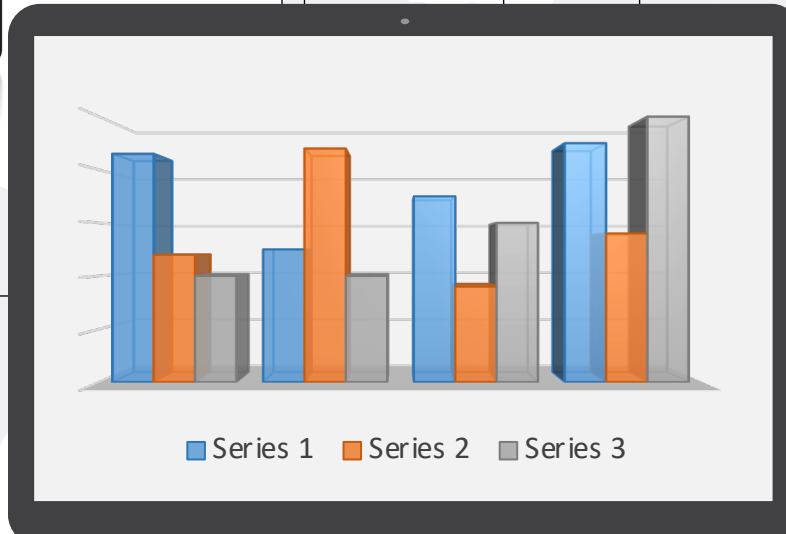
- Central Forest information database



Geospatial portal



National Forest Monitoring Systems



NFI (National Forest Inventory)

- Growing Stock
- Carbon Stock
- Biomass
- FRL and Emissions



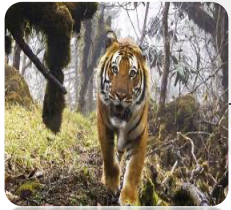
National Wildlife Survey

- Population
- Density
- Habitat
- Diversity

Existing Technologies in Use for Forest and Wildlife Resource Assessment

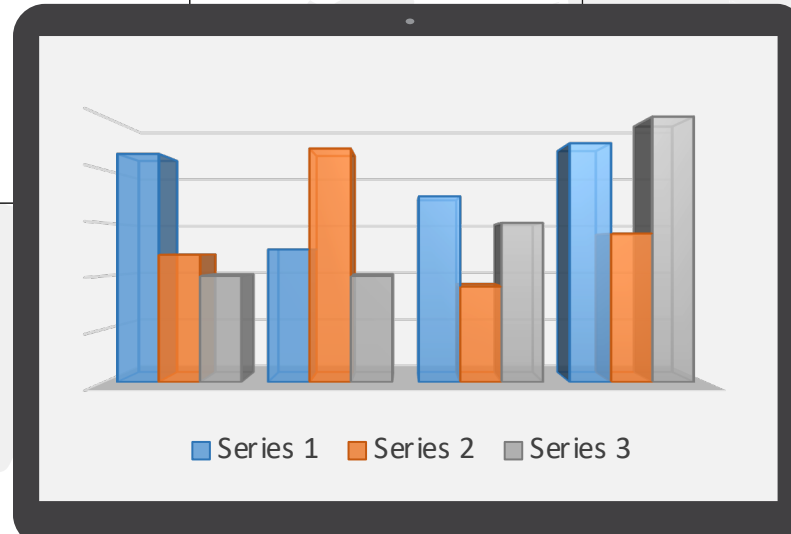
Forest Resource Potential Assessment

- Satellite Images (Landsat, Sentinels....)
- GIS
- Remote sensing



National Wildlife Survey

- Camera Traps
- Radio telemetry
- Non-invasive genetic sampling



Land Use and Land Cover

- Satellite Images (Landsat, Sentinels....)
- GIS
- e-Cognition software



NFI (National Forest Inventory)

- Open Forest Collect tool
- Collect Mobile
- Calc (R-Statistical Package)
- Laser Hypsometer
- Trimble GPS with inbuilt survey design

Remote Sensing and GIS technology Opportunities for SFM in Bhutan

Un-Manned
Aerial Vehicles
(Drones)



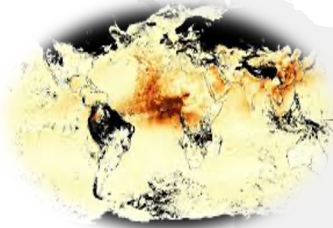
RaDaR (Radio
Detection and
Ranging)



LiDAR (Light
Detection and
Ranging)



Online Sensors
and Detectors
(AVHRR (1 km
pixel) and
MODIS (250 m
to 1 km pixel)



Satellite Imageries
(Landsat, Sentinels)



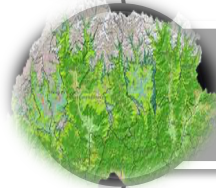
Remote Sensing and GIS technologies (Area of opportunities)



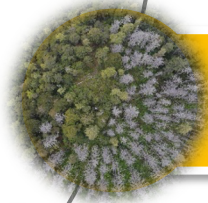
Forest Fire Detections



National Forest Inventory and Wildlife Survey



Mapping land use change and land use categories (LULC)



Mapping outbreak of pest and diseases

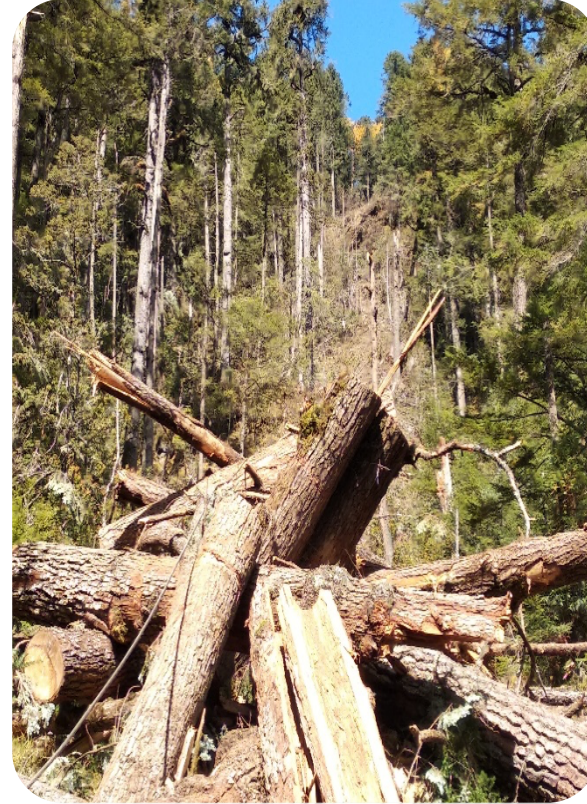


Mapping forest and studying species shift forest dynamics.

Timber Extraction and Transportation Technologies in Use



Low Impact Logging using cable cranes (1500 m coverage)



Extraction of timber from cable lines using cable cranes



Low Impact Logging using K-500 machine (500m coverage)



Swing Yarder



Telly Logger



Trucks



Timber Extraction

Penz Log Loader



Tractor Mounted mini
cable cranes for extraction



Penz Loader and Trucks

Challenges in Timber Extraction



Fragile Mountain Ecosystem

Rugged terrain with poor accessibility

Depleting Conifer Timber and high value broadleaved timber Resources.

Only about 16% of the total forest area feasible for commercial harvesting.

Scattered Timber Resources with high extraction cost.

Lack of competitive marketing (price, quality and quantity).

Sawmilling Technologies in Use



Indian band sawmill



Lucas sawmill



Timberking sawmill



Wood-Mizer sawmill

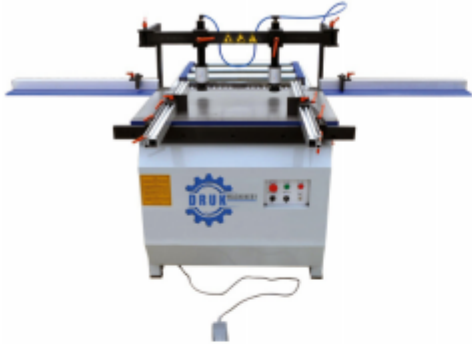


Norwood sawmill



Mebor sawmill

Wood Processing Technologies in Use



Drilling machine



Table saw



Moulder machine



CNC Router



Vertical band saw



Wood panelling machine



Surface planer



HF vacuum drying machine

Wood Processing Technologies in need



More efficient processing technologies delinking end-use products from raw wood characteristics (Less preferred species like Oak and other Broadleaved timber)



Technologies allowing more efficient processing, less waste and more recycling.



Integrated Wood Based Technologies with Improved Sawmills, Wood processing machines with office automations to minimize wastage and for production of value added products for export and Import substitution (Engineered Wood Products)



Challenges in Wood Processing & Utilization



Preferential demand for conifer timber over broadleaved timber

High timber wastage due to inefficient logging, conversion and timber processing skills and technologies.

Low investment in improved technologies due to resource constraints

Lack of competitive marketing (price, quality and quantity).

Poor seasoning and wood treatment.

Thank You