Integrating AI and Spatio-Temporal Data- National Forest Monitoring System (NFMS) for Enhanced SDG Monitoring for Pakistan

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SDGs in Pakistan
National Standing and Priority

SDG 15: Life Above Land
National Initiatives

Project Overview
Project Technical Details

Way-Forward
Implementation
Other Relevant Project Initiatives

Q&A
Discussion
SDGs: NATIONAL PERSPECTIVE

ECONOMIC IMBALANCE

24% of the population lives below the national poverty line

SOCIAL INJUSTICE

Women earn 34% less wages than men

22.7 million Pakistani children aged five to 16 are out of school

54.3% of population doesn’t have internet access

100 million of Pakistanis financially excluded
SDG NATIONAL PERSPECTIVE

SDGs Index: 128 in 2023

**NATIONAL COMMITMENT**
1. Pakistan one of the initial signatories of SDGs (2015)

**1ST PARLIAMENT IN THE WORLD**
2. Est. Secretariat in Parliament House for SDGs

**FEDERAL SDGS SUPPORT UNIT**
3. Est. by Ministry of Planning, Dev, SI (MoPDSI), to monitor/coordinate on SDGs nationally

**NATIONAL INITIATIVE FOR SDGS 2030 AGENDA**
4. A 5-yrs joint project of Ministry of Planning, Dev, and Reform (MoPDSI), with the support of UNDP

**IMF PROGRAMME**
5. IMF Bailout puts tremendous pressure on Pakistan to achieve UN SDGs
<table>
<thead>
<tr>
<th>PRIORITY SDGs</th>
<th>2nd PRIORITY SDGs</th>
<th>3rd PRIORITY SDGs</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDG 2</td>
<td>SDG 1</td>
<td>SDG 12</td>
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<td>SDG 3</td>
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<td>SDG 7</td>
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<td>SDG 8</td>
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<td>SDG 16</td>
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Initiatives by Govt. in 2023

1. **IPAS BUDGET TAGGING**
   PSDP portfolio mapped with the SDGs goals and targets

2. **PROGRESS MONITORING THROUGH GEO-SPATIAL DATA**
   PC and SUPARCO launched initiative to use geo-spatial data for monitoring of progress on infrastructure project and pledged to make it open source

3. **DECISION SUPPORT SYSTEM USING GEO-SPATIAL DATA**
   In pilot-phase: DSS for public sector development investments for primary, secondary and tertiary health facilities
Project Overview

- Ministry of Climate Change and Environmental Coordination in Pakistan has established National Forest Monitoring System (NFMS) under REDD+ Readiness Project

- Harnessing AI, Remote Sensing, and GIS for Refined Forest Monitoring in Support of SDG 15

- These technologies can strengthen forest monitoring efforts, combat land degradation, and address deforestation challenges
<table>
<thead>
<tr>
<th>Indicator Description</th>
<th>Baseline Value</th>
<th>Year</th>
<th>Last Value</th>
<th>Year</th>
<th>Latest Value</th>
<th>Year</th>
<th>Data Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.1.1 Forest area as a proportion of total land area</td>
<td>5.01%</td>
<td>2012</td>
<td>4.56%</td>
<td>2016</td>
<td>4.68%</td>
<td>2020</td>
<td>Ministry of Climate Change and Environmental Coordination</td>
<td>6%</td>
</tr>
<tr>
<td>15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type</td>
<td>12.3</td>
<td>2012</td>
<td>13</td>
<td>2018</td>
<td>17.85</td>
<td>2023</td>
<td>Provincial wildlife notifications</td>
<td>0.15</td>
</tr>
<tr>
<td>15.2.1 Progress towards sustainable forest management</td>
<td>65.3 tonnes / ha Above Ground Biomass</td>
<td>2010</td>
<td>65.3 tonnes / ha Above Ground Biomass</td>
<td>2015</td>
<td>73.49 tonnes / ha AGB</td>
<td>2023</td>
<td>Forest Resources Assessment (FRA) 2025</td>
<td>NA</td>
</tr>
</tbody>
</table>
## SDG 15: LIFE ON LAND

### PAKISTAN STANDING

<table>
<thead>
<tr>
<th>Indicator Description</th>
<th>Baseline Value</th>
<th>Year</th>
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<th>Year</th>
<th>Data Source</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.3.1 Proportion of land that is degraded over total land area</td>
<td>5%</td>
<td>2015</td>
<td>0.04%</td>
<td>2019</td>
<td></td>
<td></td>
<td>Ministry of National Food Security &amp; Research</td>
<td>3</td>
</tr>
<tr>
<td>15.4.1 Coverage by protected areas of important sites for mountain biodiversity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>85% of the total PAs come in the domain of Mountain PAs area of 0.12 million Sq. Km</td>
<td>2023</td>
<td>Provincial wildlife departments</td>
<td>NA</td>
</tr>
<tr>
<td>15.4.2 Mountain Green Cover Index</td>
<td>86.29%</td>
<td>2000</td>
<td>87.60%</td>
<td>2015</td>
<td>89.72%</td>
<td>2018</td>
<td>FAOSTAT</td>
<td>NA</td>
</tr>
</tbody>
</table>
**SDG 15: LIFE ON LAND**

**NATIONAL INITIATIVES**

### SLMP

**1.** Sustainable Land Management Program (SLMP) aim to address land degradation and desertification through sustainable land management practices.

### SLCP

**2.** Snow Leopard Conservation Project and the Markhor Conservation Program, focus on protecting endangered species and their habitats.

### BILLION TREE TSUNAMI

**3.** According to the Food and Agriculture Organization (FAO), Pakistan's forest area increased from 4.9% of total land area in 1990 to 5.1% in 2020. The Billion Tree Tsunami Afforestation Project, launched in Khyber Pakhtunkhwa province, aims to plant one billion trees to combat deforestation and climate change.

### BIODIVERSITY CONSERVATION

**4.** Pakistan has established protected areas and national parks to conserve biodiversity, including the Deosai National Park, Khunjerab National Park, and Hingol National Park.
UNFCCC and National Forest Monitoring System

A National Forest Monitoring System (NFMS) is one of the elements to be developed by developing country Parties implementing REDD+ activities as recommended in paragraph 71 of Decision 1/CP.16 (UNFCCC 2015). NFMS is a methodological framework and institutional arrangements in a country to monitor forests in the context of REDD+ and in accordance with guidance from the COP.
Geospatial Data Availability

• Available Datasets include:
  • Forest Masks
  • Land Use Land Cover
  • NFI Sample Plots
  • Deforestation Hotspots
  • Linear Plantation
  • Forest Stratification
  • Administrative Boundaries
  • Activity Data
  • Satellite Imagery (province wise)

• Area of Interest
  • KPK or Punjab Province
• Digital Trees Library
  • Total 183 species added into the system
    o Tree Name
    o Family Name
    o English Name
    o Description
    o Distribution
    o Uses of that tree
    o Pictures
**Prunus fasciculata**

**Family:** Rosaceae  

**English Name:** Wild almond  

**Local Name:** Jungli Akhroot

**Description:**

This plant is a spiny and woody shrub that grows up to 2 to 2.5 m high. The bark of the plant is grey. The branches are smooth and grey. The leaves are 5 to 20 mm long. The flowers are small and white with 3 mm. Petals occur either solitary or in fascicle. Flowers are usually bisexual, solitary or in racemes, sometimes precocious. Male flowers have 16 to 15 stamens, female flowers have one or more pistils. The drupe is about 1 cm long; gray to red brown in color and hairy with thin flesh.

**Distribution:**

It is native to the deserts of Arizona, California, Baja California, Nevada and Utah. It is distributed in the areas that usually below 2,100 m elevation as it prefers sandy or rocky soil on dry slopes and washes. It was also introduced in Indian subcontinent including Pakistan and India.

**Uses:**

The plant is not edible. It has very limited range uses. It has traditional ways of using it: the Cahuilla prepared the drupe as a delicacy. The wild almonds were considered a delicacy by Native Americans. The Kawaiisu found the tough twigs useful as drills in starting fires and as the front portion of arrow shafts.

(Wiesenborn, 2015)
**Acacia Senegal (L.) Willd**

**Family:** Leguminosae  
**English Name:** Senegal, Gum Arabic  
**Local Name:** Khumbat  
**Description:**

Commonly a small, thorny deciduous shrub that will take tree form with a height up to 8 m. The thorns typically occur in threes, with the central ones curved. The leaves are compound 2 to 5 cm long the bark is smooth, Pale greenish grey and peels off in flake patches. The flowers are fragrant, white to pale yellow growing in bunches and occur between August and December depending on geographic location. The pods are 5 to 7 mm long and mature between January and March. It can be reproduced both from seed and by vegetative means. It is best reproduced from seed or planted seedlings. Pretreatment of seed with an overnight soak in water will increase germination. It is relatively slow growing, with a life span of 25 to 30 years. Yields of 1 to 4 m³/ha/yr at 25 years of age, depending on the site, have been recorded. This tree is adapted to a variety of arid sites and soils. It is aggressive and is easily established. It coppices readily and under certain conditions it can become a serious problem because it is difficult to eradicate. In South Africa and Australia, it is considered a "noxious weed" and policies have been established to eradicate it and prevent its further introduction. Sapwood yellowish white and heartwood is black having coarse texture. The wood is heavy and very strong, with a calorific value of 3200 kcal/kg.

**Distribution:**

This tree is native to Pakistan and is found in Jowar Sindh and Balochistan. It has been planted extensively throughout Africa, Central and South America, the Subcontinent, and other parts of the world. An intolerant, drought resistant tree that grows on a variety of very harsh sites, usually below 1700 m in elevation. It will not tolerate water logging and requires precipitation between 200 to 800 mm/yr. It prefers an arid to semi-arid, hot sub-tropical, maritime climate with a temperature range of -4 to 48°C. It can tolerate periods of drought up to 8 to 10 months. Mature trees are susceptible to termite attack during periods of stress.

**Uses:**

It is a good nitrogen fixer and has potential as an erosion control tree on very harsh sites. With care this could be a useful farm forestry tree. Young trees need protection from grazing. fodder, fuel, gum (food, beverages), land stabilization, nitrogen fixing, poles, and agricultural implements.
To meet the essential criteria for international reporting, especially under Enhanced Transparency Framework and Biennial Transparency Report (from 2024 onward), it is imperative for Pakistan to regularly update the existing data.

In order to achieve this, mapping AI and Spatio-temporal data is highly desired for this project.

Beside this, AI and ML can be used to process and analyze large datasets derived from RS, automating the identification of forest cover changes, illegal logging activities, and potential areas of degradation.
Proposed Objectives

- Improved Accuracy in Monitoring Changes in Forest Cover
- Early Warning System for Illegal Logging and Land-Use Changes
- Reliable Data for International Reporting and Compliance with SDG 15
- Decision Support Tools for Policy Makers

Use of AI and ML
Stakeholder Engagement and Capacity Building

- Ministry of Climate Change and Environmental Coordination
- Ministry of Planning Development & Special Initiatives
- Provincial Forest Departments
- Academia

Stakeholders workshop + Collaborative Opportunities + Knowledge Sharing
Way Forward

- Implementation of proposed project as a working prototype
- Testing and pilot at national level
- Mapping results with SDG 15
- Preparation for Enhanced Transparency Framework and Biennial Transparency Report
- Stakeholder’s capacity building and knowledge sharing
- Impact assessment
ONGOING PROJECTS- SDG MAPPING
PROBLEMS

- Lack of national gender data
- No identification of gaps and challenges related to gender development
- Non-existence of policies and strategies for achieving gender equality

SOLUTION

Development of National Gender Data Portal

Collaborating partners
NATIONAL GENDER DATA PORTAL

- First of its kind in Pakistan
- Centralized and interactive information portal
- Portray gender disaggregated data and statistics
- Gender analysis on the situation of women
- Use of gender statistics for policy action
THEMES

1. Demographics
2. Education
3. Health
4. Economic Empowerment
5. Violence Against Women
6. Access to Justice
7. Elections and Political Participation
8. Disabilities
9. Poverty & Social Protection
10. Response to Emergencies
QUANTITATIVE & QUALITATIVE INDICATORS

1. Demography
   - Sub-themes: 4
   - Qualitative Indicators: 18
   - Quantitative Indicators: 14

2. Education
   - Sub-themes: 6
   - Qualitative Indicators: 44
   - Quantitative Indicators: 22

3. Health
   - Sub-themes: 7
   - Qualitative Indicators: 45
   - Quantitative Indicators: 22

4. Economic Empowerment
   - Sub-themes: 8
   - Qualitative Indicators: 65
   - Quantitative Indicators: 38

5. Violence Against Women
   - Sub-themes: 7
   - Qualitative Indicators: 31
   - Quantitative Indicators: 10
QUANTITATIVE & QUALITATIVE INDICATORS

6. Access to Justice
- Sub-themes: 4
- Qualitative Indicators: 21
- Quantitative Indicators: 7

7. Elections & Political Participation
- Sub-themes: 2
- Qualitative Indicators: 6
- Quantitative Indicators: 8

8. Disabilities
- Sub-themes: 6
- Qualitative Indicators: 6
- Quantitative Indicators: 7

9. Poverty & Social Protection
- Sub-themes: 4
- Qualitative Indicators: 25
- Quantitative Indicators: 10

10. Response to Emergencies
- Sub-themes: 3
- Qualitative Indicators: 8
- Quantitative Indicators: 6
CONCEPTUAL FRAMEWORK FOR QUANTITATIVE INDICATORS

FRAMEWORK HEADLINES

- Themes & Sub-themes
- Description of Quantitative Indicators
- Level of Disaggregation
- Linkage with SDGs and Beijing +25
- Time Duration
- Source of Data

Level of Disaggregation

General Disaggregation:
- Age
- Sex
- Location
- Residence

Specific Disaggregation:
- Education
- Wealth Quintile
- Disabilities
QUALITATIVE INDICATORS

Constitutional and Legal Provisions

Policy and Institutional Arrangements
**KNOWLEDGE HUB: THEMES**

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<td>7. Public and Political Participation</td>
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<tr>
<td>8. Girl/Child Rights</td>
</tr>
<tr>
<td>9. Access to Knowledge and ICT</td>
</tr>
<tr>
<td>10. Women in Peace and Conflict</td>
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- Reports and Books
- Articles and Perspectives
- Data Sets
- Visuals and Infographics
- Training Material
- Booklets
- Pamphlets
- Posters/Leaflets
KNOWLEDGE HUB: THEMES

11. Portrayal in the Media
12. Poverty and Social Protection
13. Women and Sustainable Development
14. Women in Emergencies/Disasters
15. Human Rights of Women
16. Gender Mainstreaming
17. National Commitments of Pakistan
18. Women and Agriculture
19. Home-based Workers and Economy
20. Women and Environmental Protection

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PAKAGDP is a web based Portal to access spatial data related to Agriculture and Food Security.

Key datasets in the portal include:

- land cover maps,
- crop area maps,
- mapping of indicators related to
- food price monitoring,
- food security (availability, accessibility, utilization etc.), soil fertility and agro-ecological zones mapping.

Pakistan Agriculture Geospatial Data Portal (PAKAGDP)
The Pakistan Agriculture Geospatial Data portal has brought together data from multiple domains, from Agriculture, Food Security and Nutrition to Pests/Animal Health to Trade and integrating data on Soil, Land, Water, Climate, Fisheries, Livestock, Crops, Forestry, Trade, Social and Economics, etc.

Currently, the portal reflects more than 172 geospatial data layers categorized into 12 themes of Food Security, Water, Land, Agriculture, Forest, Climate, Trade & Production, Live-Stock, Fisheries, Socio-Economic, Demographics etc.
- Ministry of National Food Security and Research
- Food Security and Nutrition Information System (FSNIS)
- Hand In Hand (HIH)
- FAOSTAT
Thank You

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