

**UN/AUSTRIA SYMPOSIUM "SPACE  
APPLICATIONS FOR FOOD SYSTEMS"  
7<sup>TH</sup> - 9<sup>TH</sup> SEPTEMBER, 2021**

**Precision Agriculture for optimum Agri  
Output : Uttarakhand State, India  
September 7, 2021**

**Prof V Madhava Rao,  
Research Professor, School of Engineering & Technology,  
GIET University, Odisha, India**

# Presentation Outline

- ❖ Introduction
- ❖ Objectives
- ❖ Parameters Studied
- ❖ Analysis & Mapping
- ❖ Mapping of Dominant Crop Types
- ❖ Soil Suitability Mapping
- ❖ Concluding Remarks

# INTRODUCTION

- ❖ Precision Agriculture based APIB (Agro Climatic Planning and Information Bank) is a single window Knowledge base for Agricultural and allied Sector.
- ❖ Help farmers, agri sector, Government to make decisions for improving agriculture productivity.
- ❖ Large Scale mapping at 1:10,000 Scale integrated with all relational information, both spatial and non spatial.
- ❖ Effective Management of Agricultural Resources and Planning for Sustainable Development.
- ❖ Timely & Reliable Information on Agricultural Resources with respect to their Nature, Extent, Magnitude and Spatial Distribution.

## **COVERAGE**

- ❖ Capturing all Agriculture Spatial and Non Spatial Database, analyse and map information at 1:10,000 scale;
- ❖ Integration of agro-climatic and agro-ecological data, Agricultural Practices, Seeds, Fertilizers, Plant Protection, Agricultural Implements, Agricultural Credits, Insurance Schemes, Subsidy, Agriculture Market Infrastructure, Weather Information, Socio-economic Infrastructure etc,
- ❖ Decision Support on Precision Agriculture application for optimum Agri Output production.

## **BENEFITS**

- ❖ Single window access of information in Agricultural Sector
- ❖ Information on Agro-climatic farming system.
- ❖ Information on Land use/ Land cover and shift pattern
- ❖ Redefining land use pattern based on land suitability
- ❖ Provide scientific information on High yield varieties/Hybrid seeds, Tissue culture seedlings, Improved package of practices and Efficient irrigation schemes.

- ❖ Market related information
- ❖ Encouragement for contract farming
- ❖ Information on production of export-oriented commodities
- ❖ Help to conserve precious top soil and natural resources to arrest soil erosion, avoid silting of Dams & rivers and production of fertile agriculture land
- ❖ Suitability of land for alternative use-agriculture, horticulture, Afforestation, pasture development, recreation sites and wildlife habitat development.
- ❖ Real time monitoring of crops.
- ❖ Interlinkages with Existing Databases(NIC (DISNIC), NBSS & LUP, NNRMS, etc).
- ❖ Act as sectoral node for Ministries, State Govt, District Admn, Agrl Dept, KVK, Research Organisations, etc.
- ❖ Crop Acreage Estimation
- ❖ Crop Condition Forecasting
- ❖ Crop Yield Forecasting
- ❖ Soil Mapping

## **Monitoring**

- ❖ Crop Production Monitoring
- ❖ Land use Monitoring
- ❖ Salt Affected Soil Monitoring
- ❖ Wasteland Monitoring
- ❖ Drought Monitoring

## **Management**

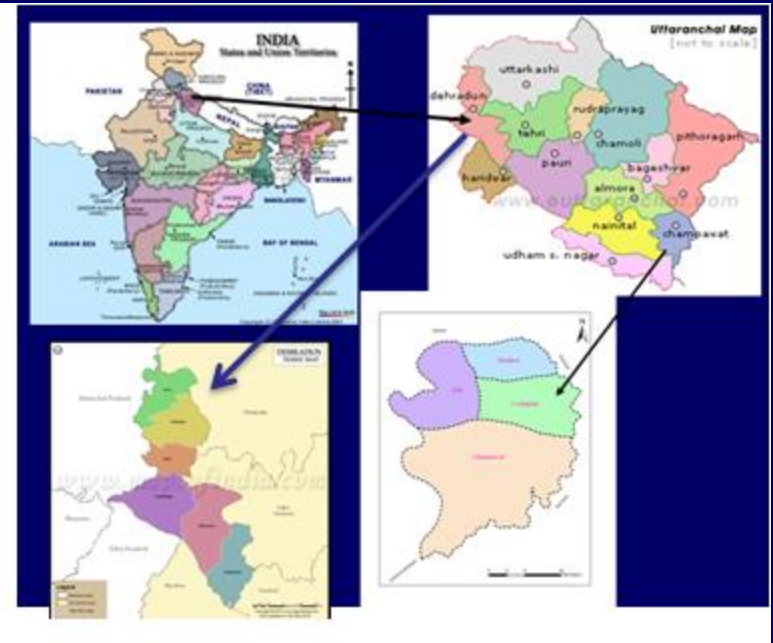
- ❖ Irrigation Management
- ❖ Cropping System Analysis
- ❖ Contract Farming
- ❖ Precision Farming

## **Spatial Decision Support System (SDSS)**

- ❖ Analytical Modelling Capabilities
- ❖ Database Management System
- ❖ Graphical Display Capabilities
- ❖ Tabular Reporting Capabilities
- ❖ Expert Knowledge

# Study Area

- ❖ The study area comprise of two Districts namely Dehradun and Champawat districts of Uttarakhand State, India.



# THEMATIC LAYERS

- ❖ Cultural Features ( Roads, Settlements, Canals etc.)
- ❖ Terrain Characteristics ( Digital Elevation Model )
- ❖ Slope
- ❖ Aspect (Direction of Slope)
- ❖ Drainage Characteristics (Delineation of Micro Watershed Boundaries)
- ❖ Land Use Land Cover
- ❖ Irrigated / Unirrigated Land Area
- ❖ Geomorphology (Land Forms Characteristics)
- ❖ Soil Map (Type of Soil & Detail Characteristics)
- ❖ Hydrological Soil Characteristics (water and soil-moisture content)
- ❖ Extent of Soil Loss
- ❖ Land Degradation
- ❖ Land Irrigability
- ❖ Land Capability
- ❖ Land Productivity
- ❖ Crop Suitability
- ❖ Dominant Crop Types- A few selected crops
- ❖ Ground Water Potential
- ❖ Soil Mapping
- ❖ Soil Physico-Chemical Properties

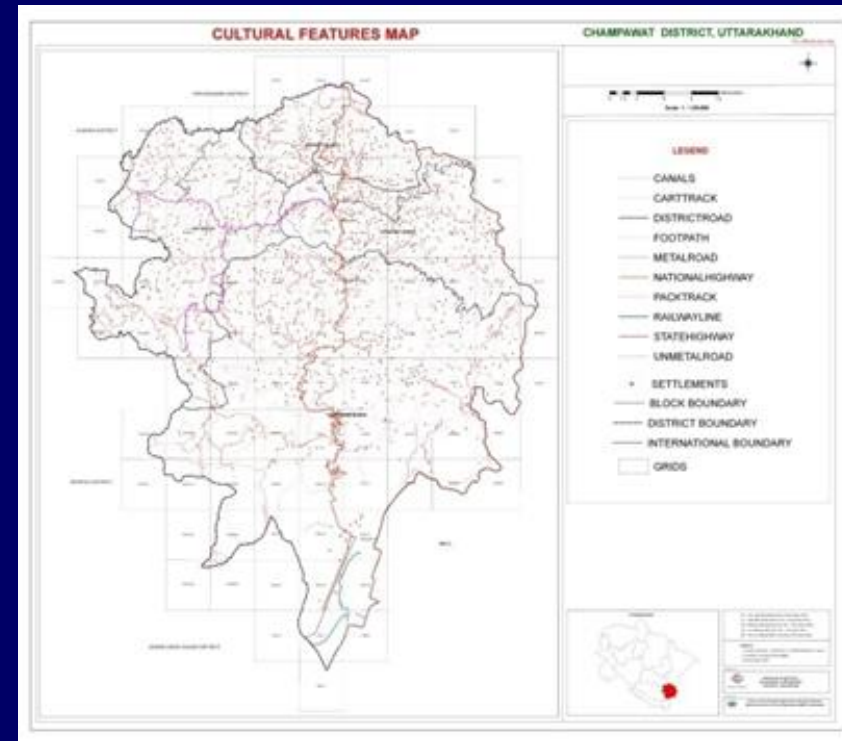


## DATA INPUTS

- ❖ Cartosat – 1 Satellite Images (2.5 mt Resolution)
- ❖ Resourcesat IRS P6 LISS – IV Images (5.8 mt Resolution)
- ❖ Survey of India Topo sheets 1:25,000 scale
- ❖ Soil Survey, Sampling & Analysis
- ❖ GPS / DGPS Data
- ❖ Census Data
- ❖ Meteorological Data
- ❖ Agronomy Practices

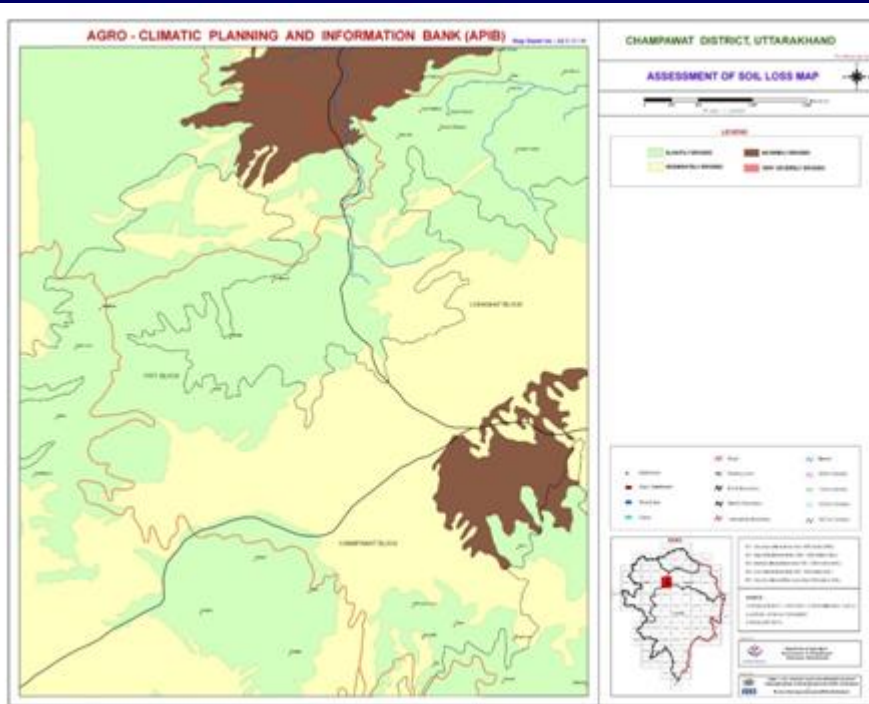
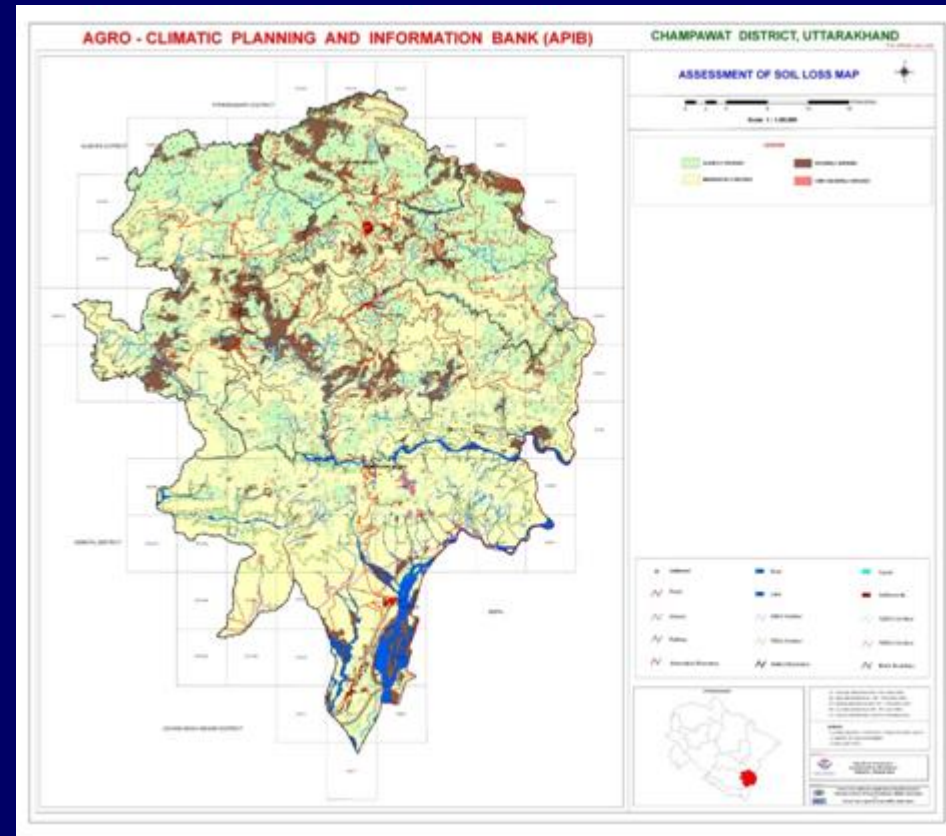
## CULTURAL FEATURES MAP

- ❖ Cultural Features maps (roads, canals, villages, towns etc)



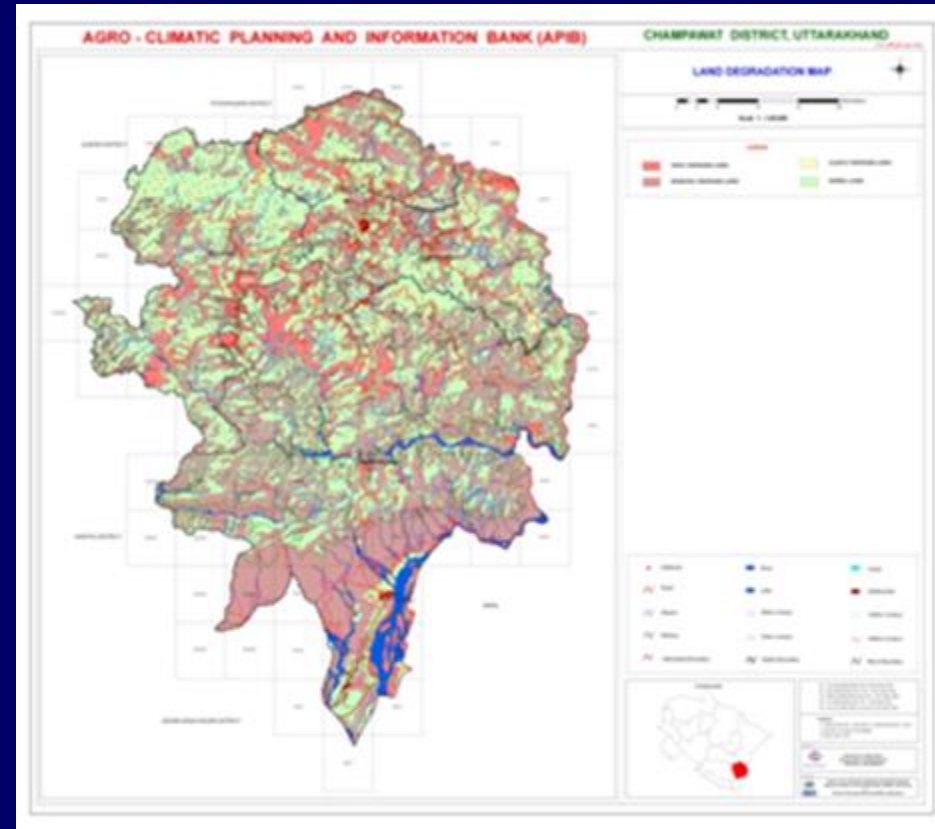
# ASSESSMENT OF SOIL LOSS MAP

- Soil loss is directly related to soil erosion so the map indicates erosion status of the area. Three categories of erosion is shown on the map
- Slightly eroded
- Moderately eroded
- Severely eroded



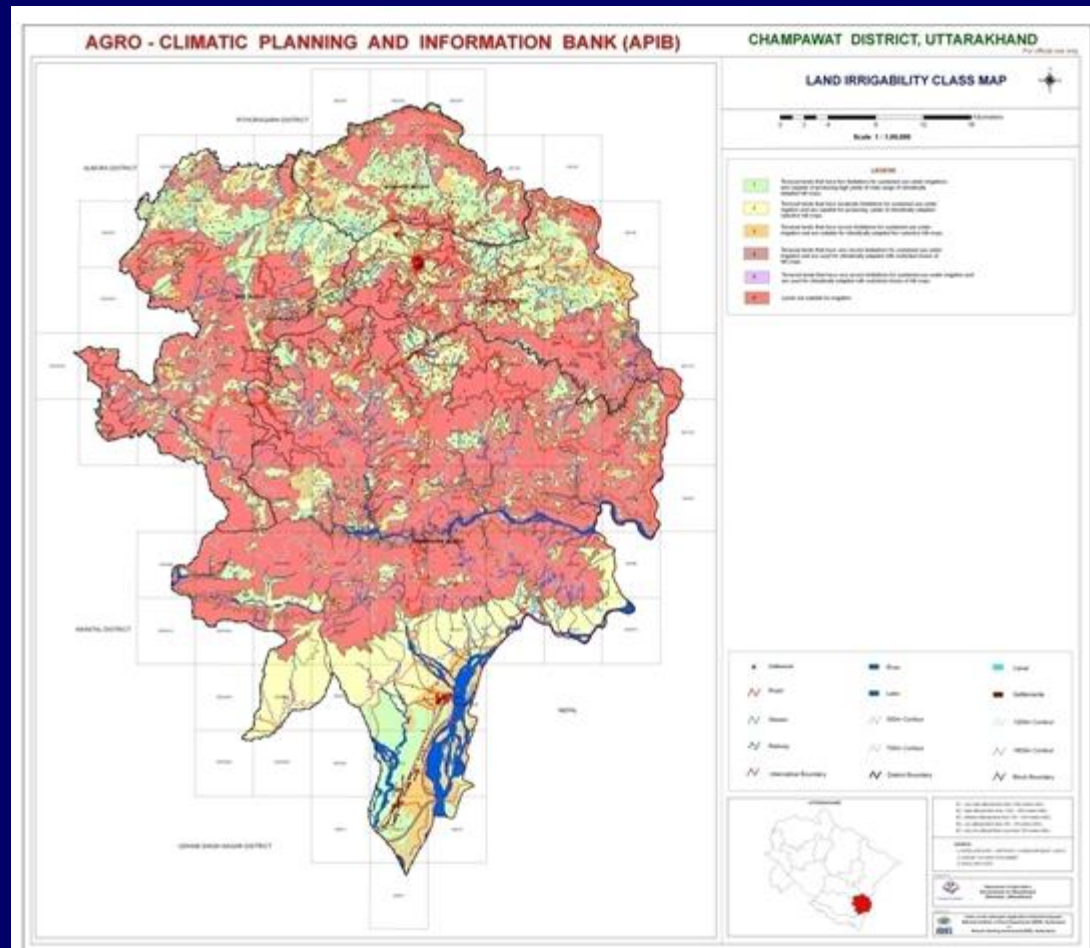
# LAND DEGRADATION MAP

- Land degradation due to erosion, salinity and sodicity.
- Map shows highly degraded, moderately degraded, slightly degraded and normal lands.
- Degradation in hilly areas due to the loss of top fertile layer.
- Terraced land protected and classed as slightly degraded lands.
- In plain cultivated areas the degradation is slight to moderate, while open forest areas have moderate to severe degradation.



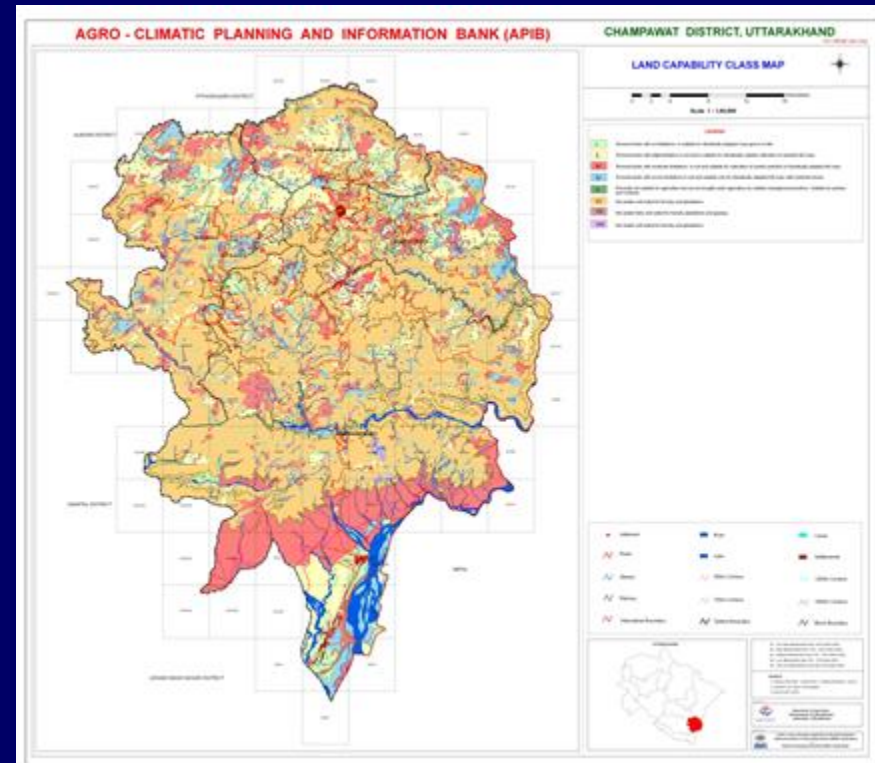
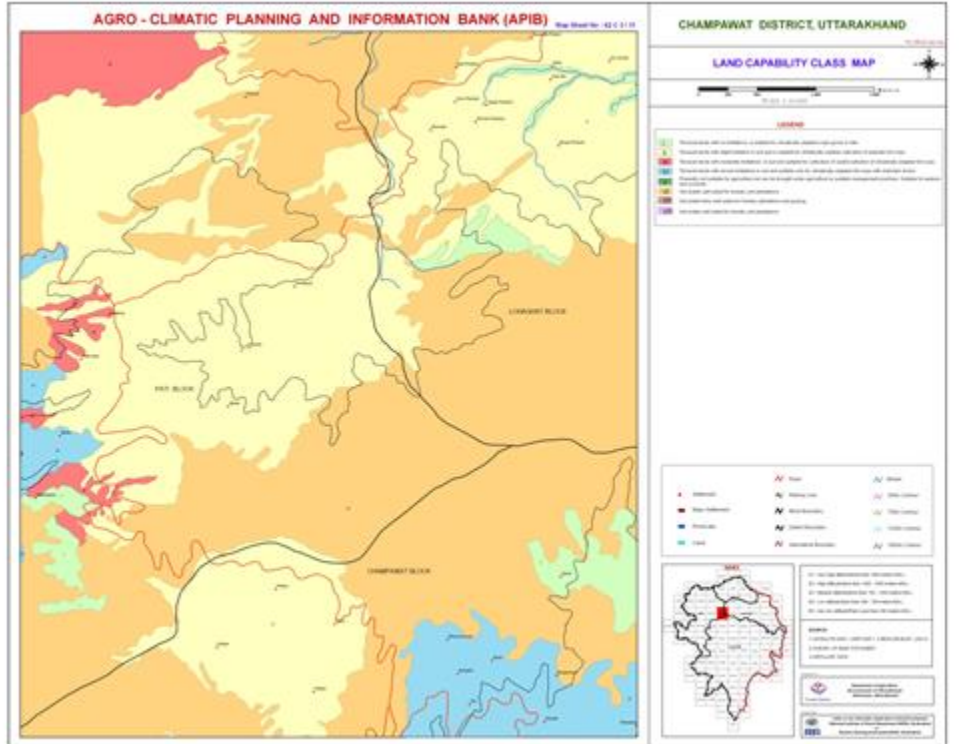
# LAND IRRIGABILITY MAP

- Land irrigability map shows total 6 classes.
- Land Class I to 4 are irrigable
- Land Class 5 is presently not suitable for irrigation
- Land Class 6 is non irrigable due to severe limitations of soil and topography



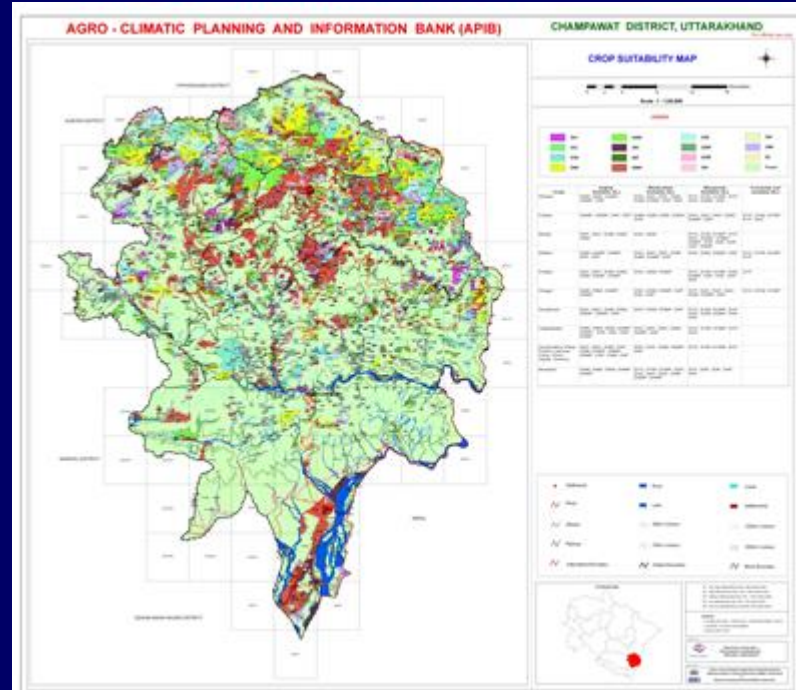
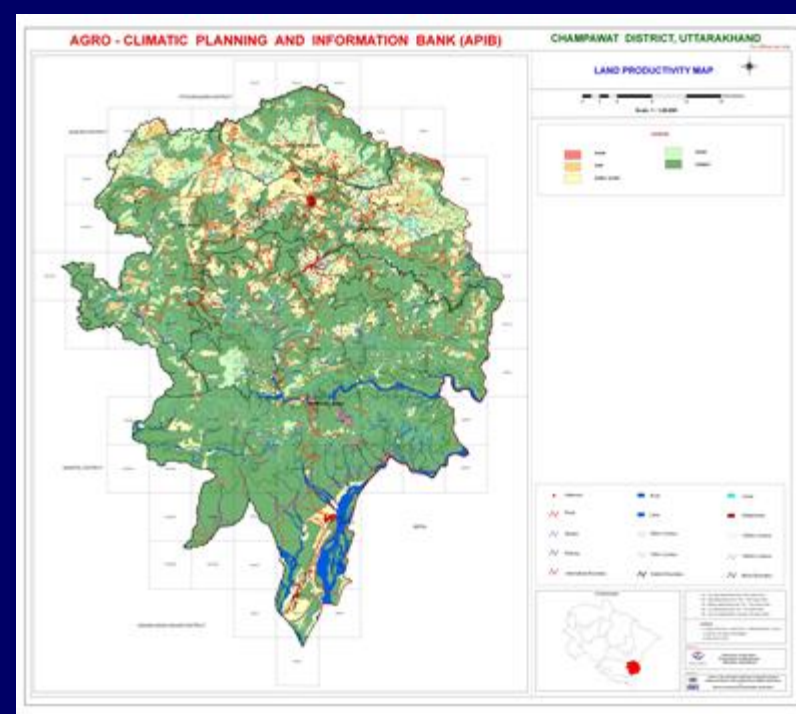
# LAND CAPABILITY MAP

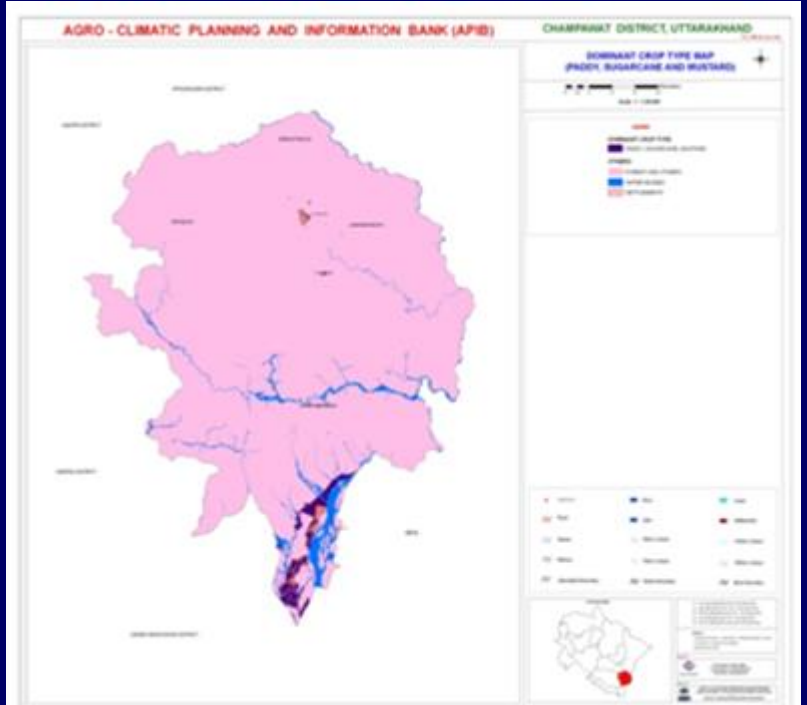
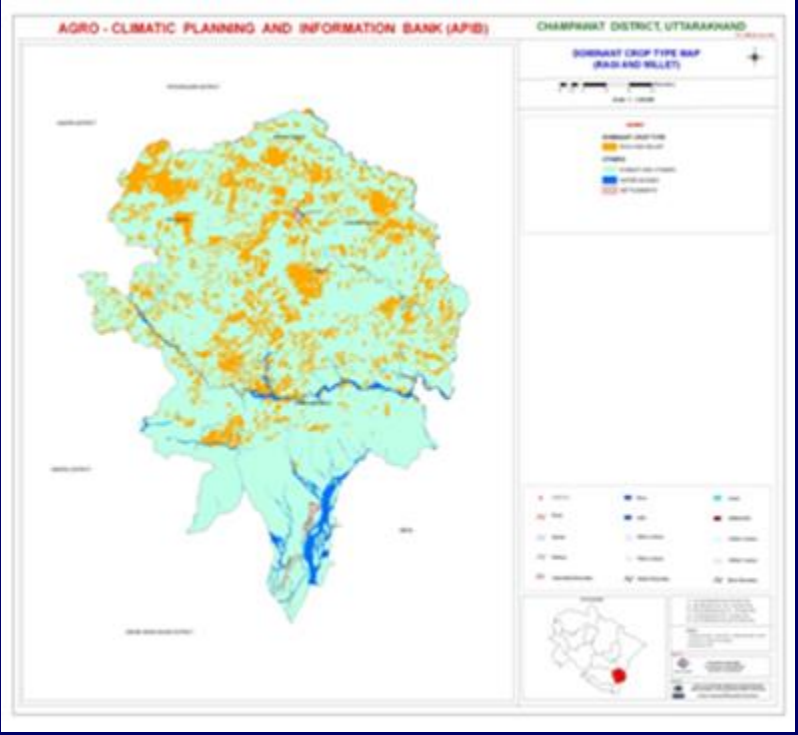
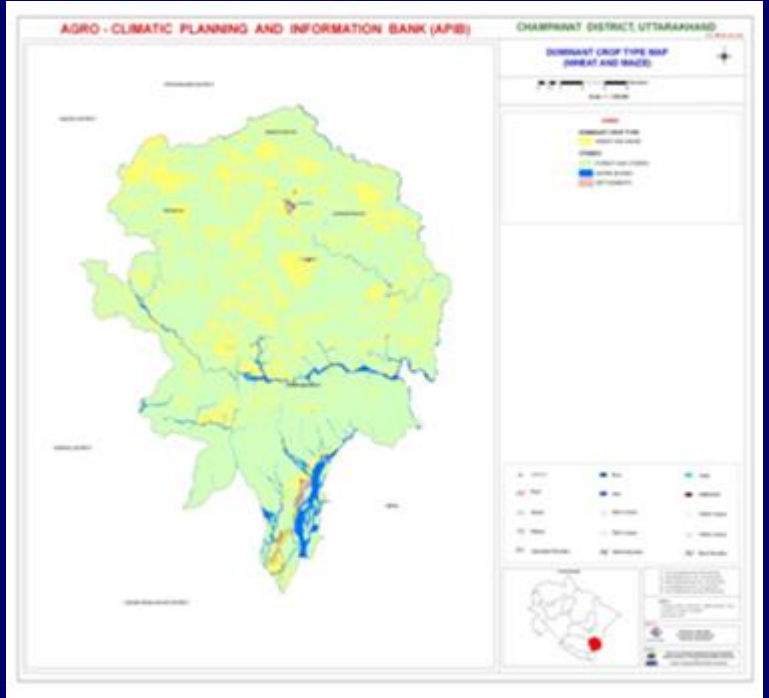
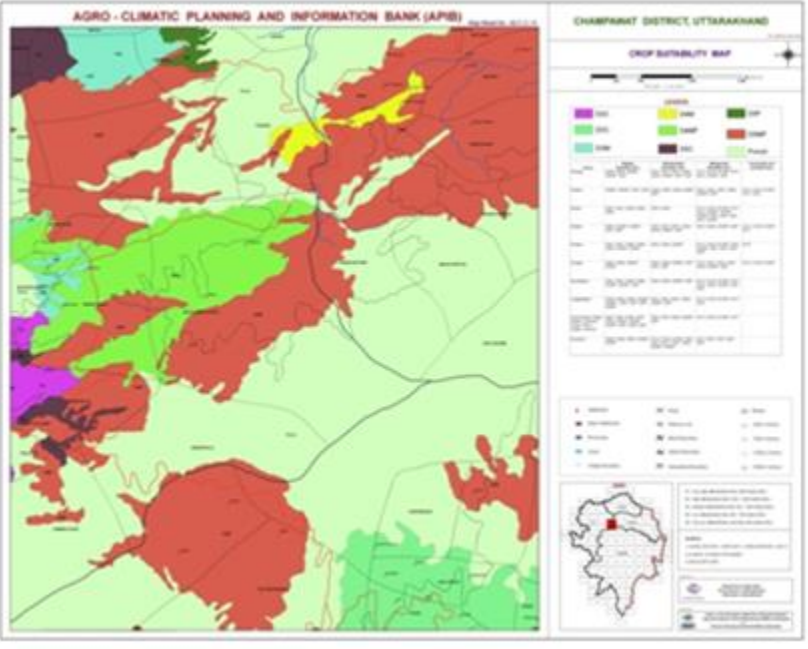
- Classes I-IV are arable.
- Class V to VIII is non-arable.
- Class VI is mostly suitable for forestry and pasture.
- Class VII is suitable for wildlife.
- Class VIII is suitable for recreation.



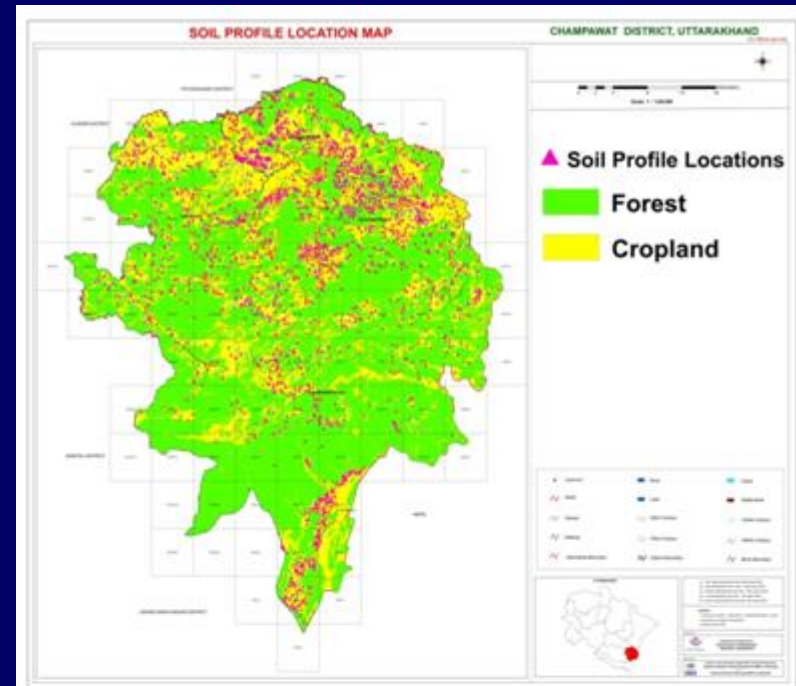
# LAND PRODUCTIVITY MAP

- Land productivity of cultivated areas is productivity based on the average rainfall, location, slope, soil texture, soil depth, macronutrients.
- The map shows the productivity rating based on Storie Index 1964.
- District has mostly fair to fairly good land productivity rating.

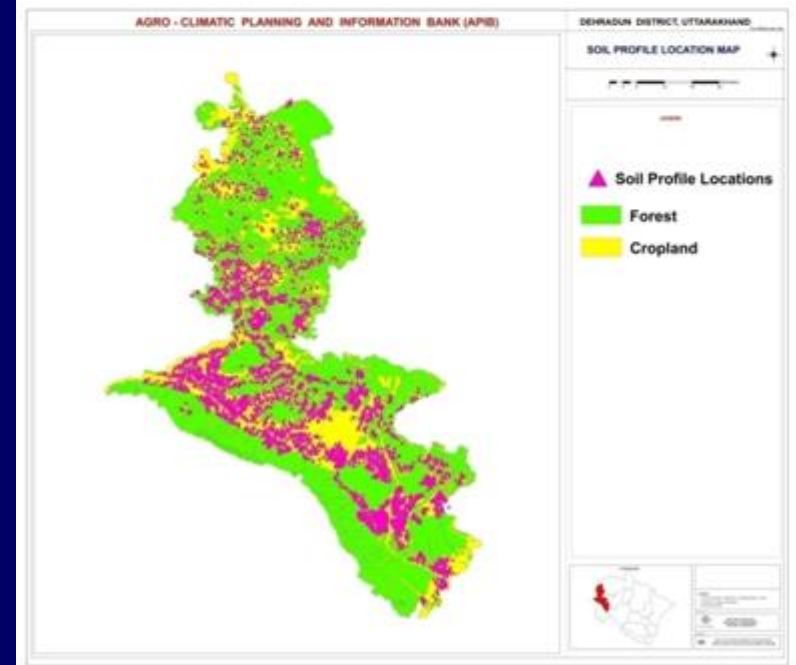




Total Number of Profiles  
2027



Total Number of Profiles  
4424



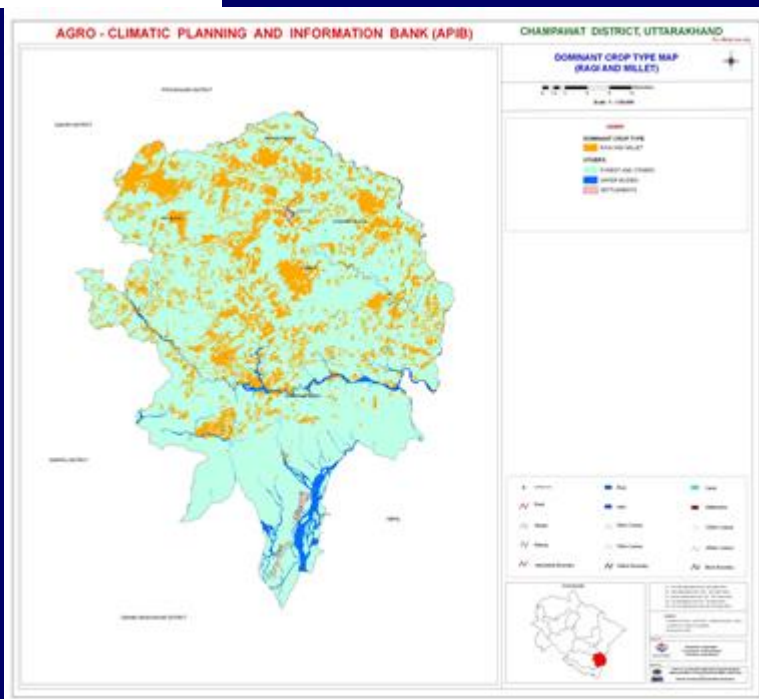
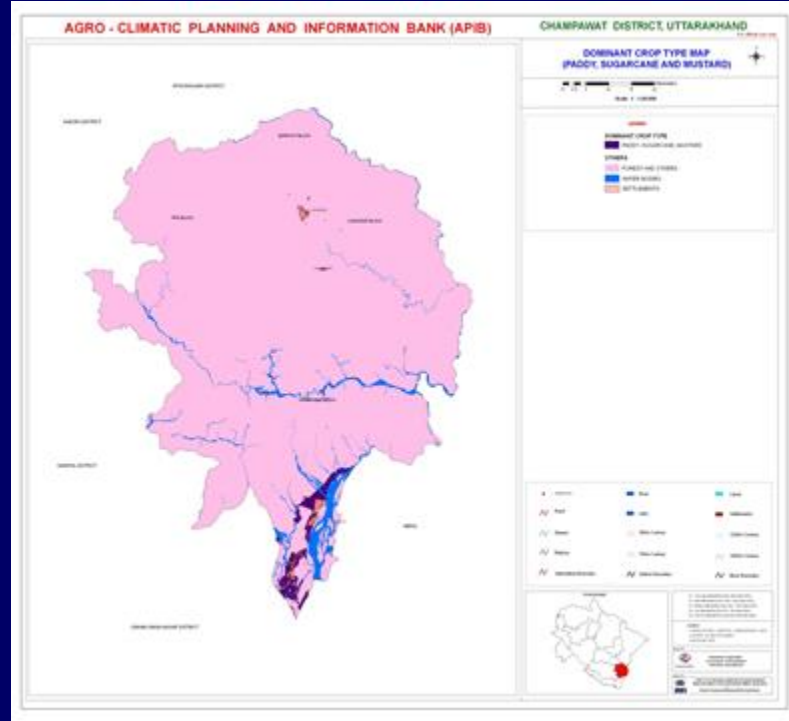
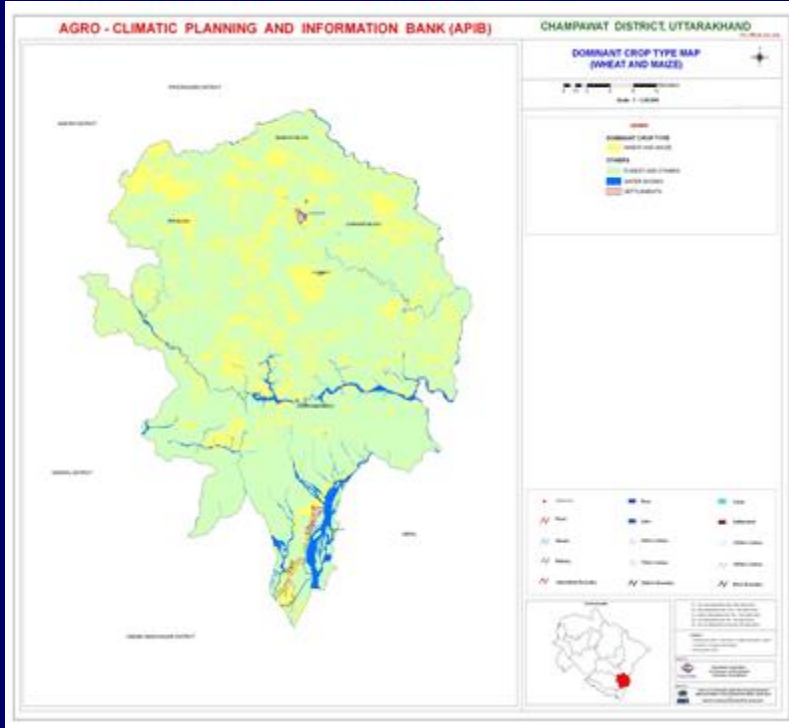


Soil Profile at Tilone  
Village, Champawat Block



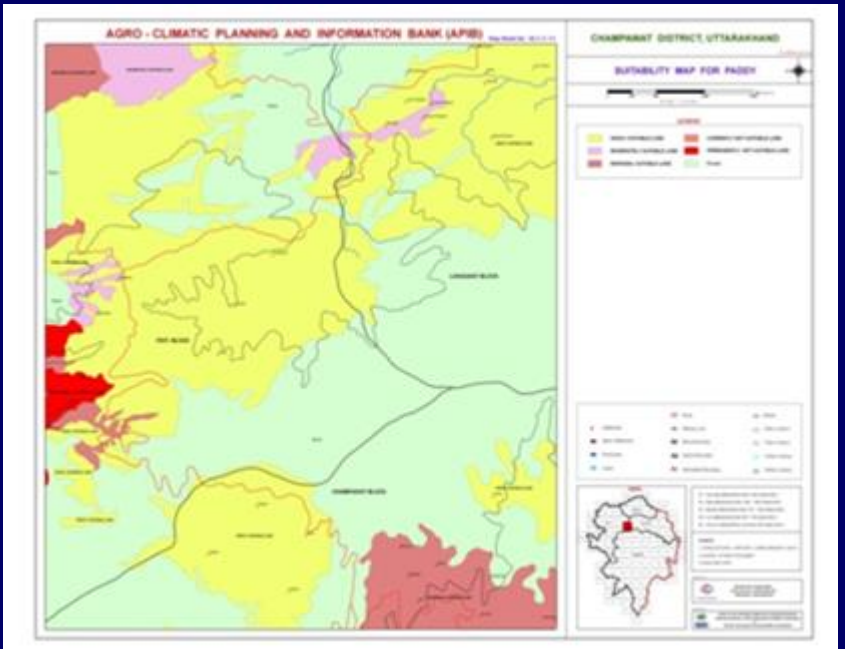
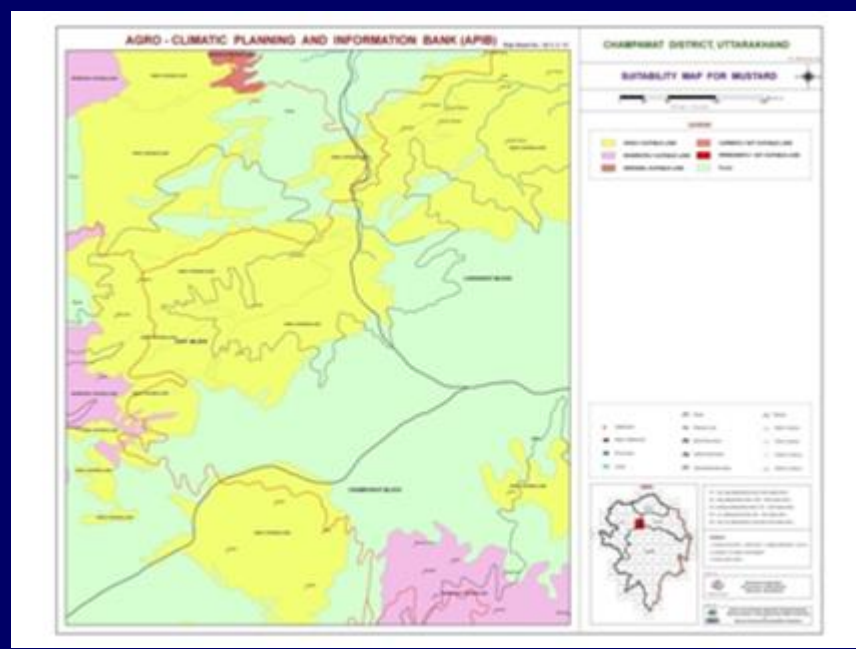
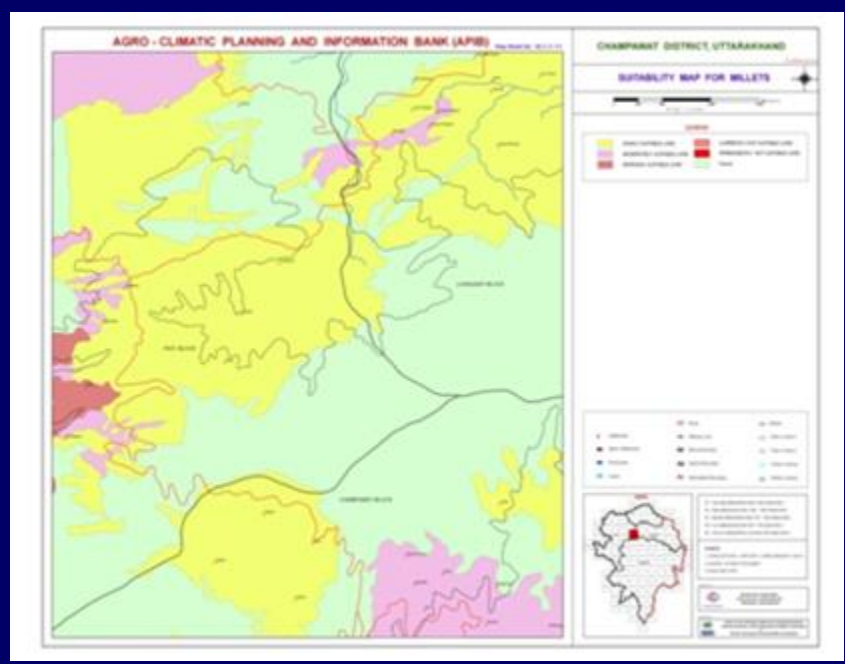
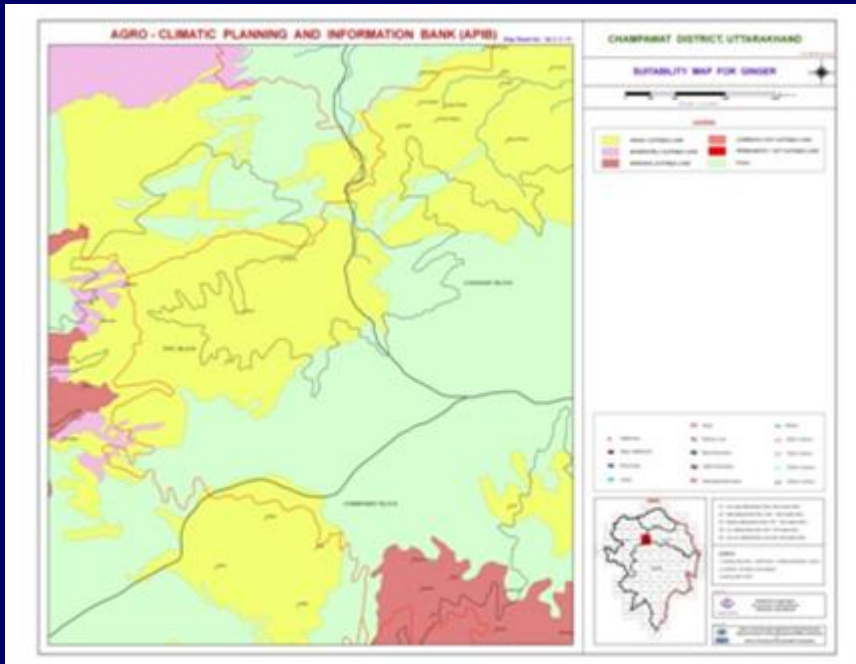
Soil Profile at Koti  
Khanasar Village in  
Chakrata Block

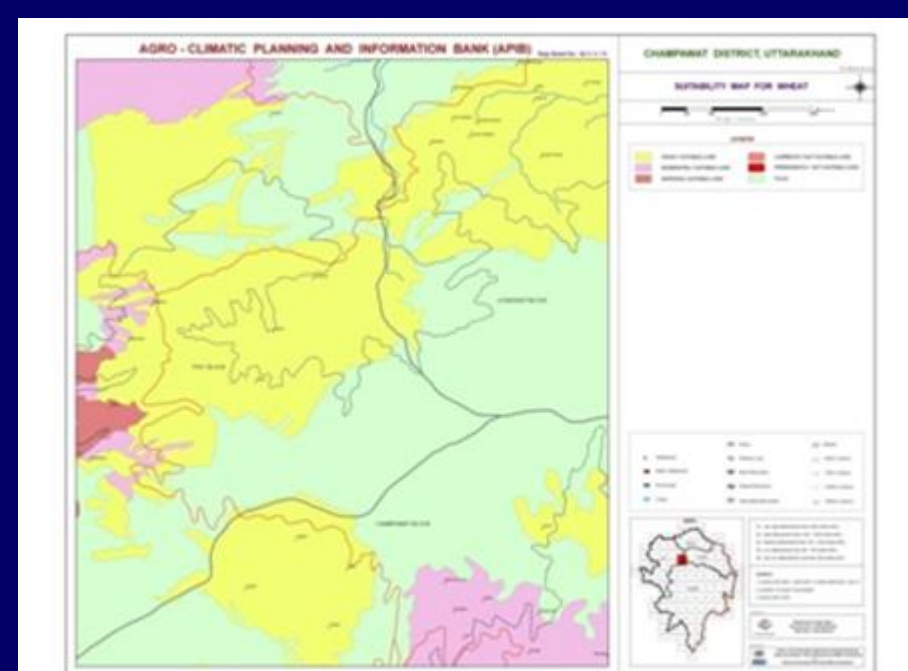
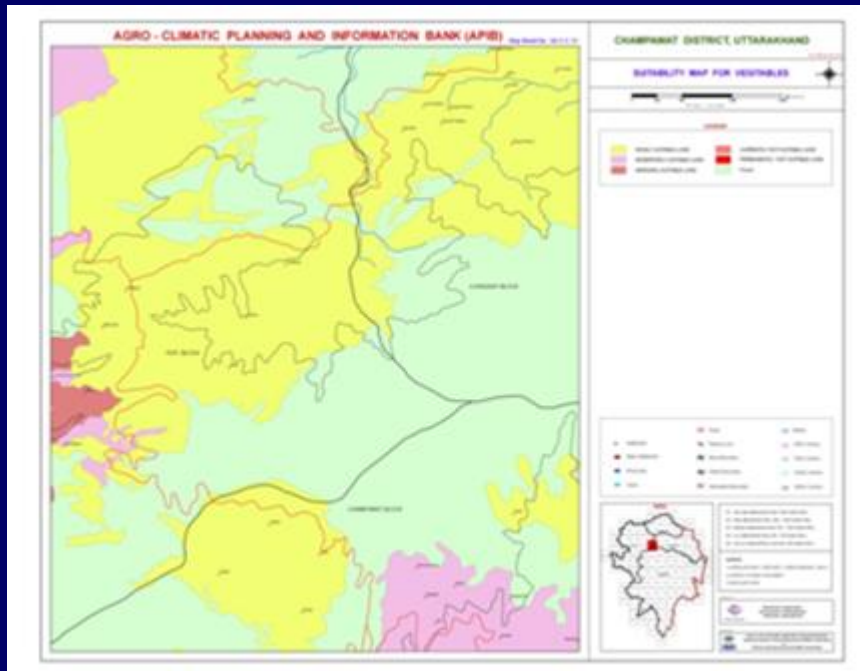
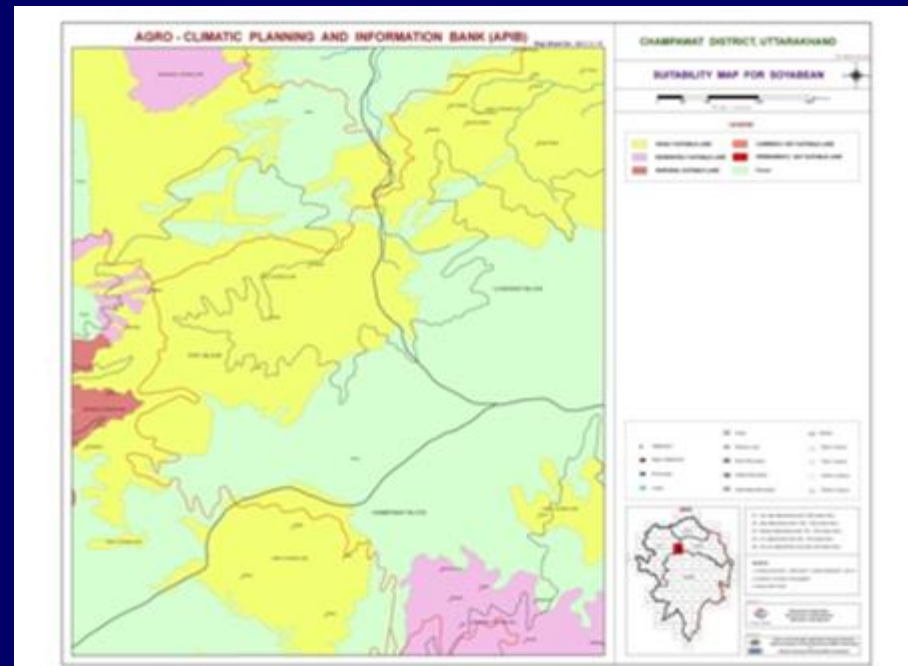
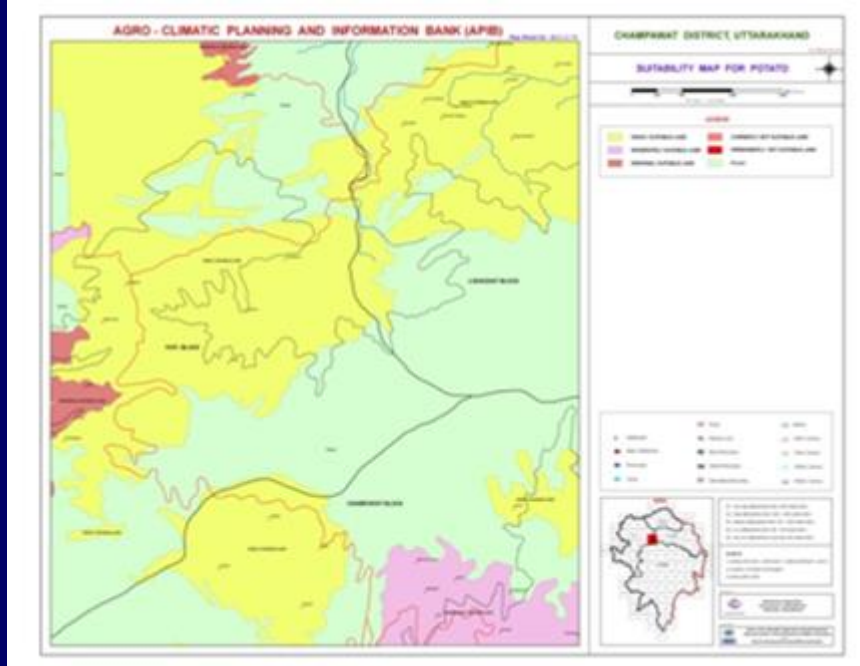




**DOMINANT  
CROP  
TYPES**

# CROP SUITABILITY MAP





### SUITABILITY MAP FOR HORTICULTURE

CHAMPAWAT DISTRICT, UTTARAKHAND



**LEGEND**

<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	HIGHLY SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightcoral;"></span>	MODERATELY SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightcoral;"></span>	MARGINAL SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:red;"></span>	CURRENTLY NOT SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightgreen;"></span>	PERMANENTLY NOT SUITABLE
<span style="display:inline-block; width:15px; height:15px; background-color:lightgreen;"></span>	Forest


**Map Information**

**Scale:** 1:1,00,000

**Projection:** UTM

**Zone:** 45 N

**Datum:** Everest

**Units:** Meter

**Author:** [Organization Name]

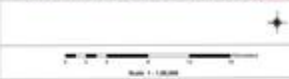
**Year:** [Year]

**Version:** [Version]

**Disclaimer:** This map is for general information only and should not be used for any specific purpose without the approval of the concerned authorities.

### SUITABILITY MAP FOR APPLE

CHAMPAWAT DISTRICT, UTTARAKHAND



**LEGEND**

<span style="display:inline-block; width:15px; height:15px; background-color:darkgreen;"></span>	HIGHLY SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:blue;"></span>	MODERATELY SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightcoral;"></span>	MARGINAL SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightcoral;"></span>	CURRENTLY NOT SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span>	PERMANENTLY NOT SUITABLE LAND
<span style="display:inline-block; width:15px; height:15px; background-color:lightgreen;"></span>	FOREST


**Map Information**

**Scale:** 1:1,00,000

**Projection:** UTM

**Zone:** 45 N

**Datum:** Everest

**Units:** Meter

**Author:** [Organization Name]

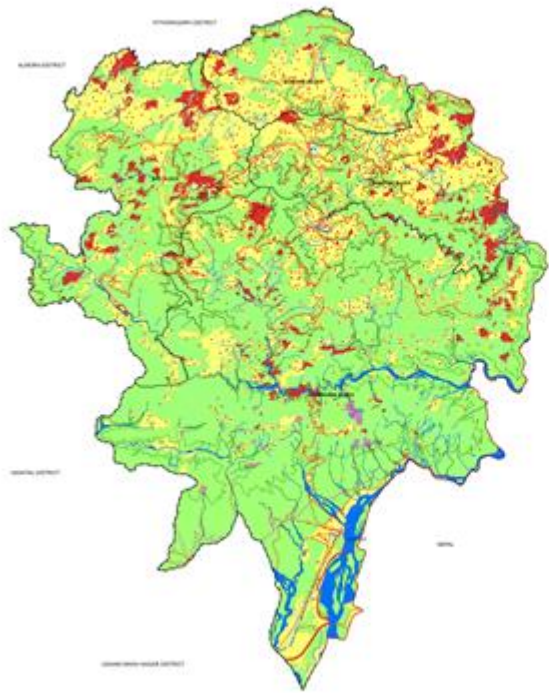
**Year:** [Year]

**Version:** [Version]

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### SUITABILITY MAP FOR APRICOT

### CHAMPAWAT DISTRICT, UTTARAKHAND



**LEGEND**

<span style="color: yellow;">■</span>	HIGHLY SUITABLE LAND
<span style="color: red;">■</span>	MODERATELY SUITABLE LAND
<span style="color: lightgreen;">■</span>	MARGINAL SUITABLE LAND
<span style="color: brown;">■</span>	CURRENTLY NOT SUITABLE LAND
<span style="color: pink;">■</span>	PERMANENTLY NOT SUITABLE LAND
<span style="color: darkgreen;">■</span>	Forest

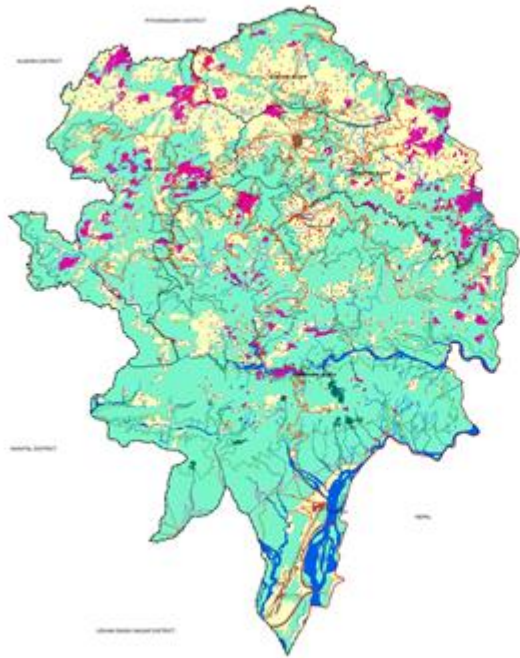

**ACKNOWLEDGEMENT**

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- Department of Agriculture, Government of Uttarakhand
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- Department of Water Resources, Government of Uttarakhand
- Department of Land Use, Government of Uttarakhand
- Department of Soil Conservation, Government of Uttarakhand
- Department of Horticulture, Government of Uttarakhand
- Department of Animal Husbandry, Government of Uttarakhand
- Department of Fisheries, Government of Uttarakhand
- Department of Poultry, Government of Uttarakhand
- Department of Beekeeping, Government of Uttarakhand
- Department of Apiculture, Government of Uttarakhand
- Department of Sericulture, Government of Uttarakhand
- Department of Silk, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand

### SUITABILITY MAP FOR CITRUS

### CHAMPAWAT DISTRICT, UTTARAKHAND



**LEGEND**

<span style="color: yellow;">■</span>	HIGHLY SUITABLE LAND
<span style="color: magenta;">■</span>	MODERATELY SUITABLE LAND
<span style="color: brown;">■</span>	MARGINAL SUITABLE LAND
<span style="color: darkgreen;">■</span>	CURRENTLY NOT SUITABLE LAND
<span style="color: pink;">■</span>	PERMANENTLY NOT SUITABLE LAND
<span style="color: lightgreen;">■</span>	Forest


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- Department of Apiculture, Government of Uttarakhand
- Department of Sericulture, Government of Uttarakhand
- Department of Silk, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand
- Department of Handloom, Government of Uttarakhand

### SUITABILITY MAP FOR GUAVA

CHAMPAWAT DISTRICT, UTTARAKHAND



- LEGEND**
- HIGHLY SUITABLE LAND
  - MODERATELY SUITABLE LAND
  - MARGINAL SUITABLE LAND
  - CURRENTLY NOT SUITABLE LAND
  - PERMANENTLY NOT SUITABLE LAND
  - Forest

- |   |             |   |              |   |              |
|---|-------------|---|--------------|---|--------------|
| • | Settlement  | • | Canal        | • | Contour      |
| ~ | Well        | • | Can          | • | Watercourse  |
| ~ | Stream      | ~ | Water Course | ~ | Water Course |
| ~ | Stream      | ~ | Water Course | ~ | Water Course |
| ~ | Watercourse | ~ | Water Course | ~ | Water Course |

**Scale**  
1:1,00,000

**North Arrow**

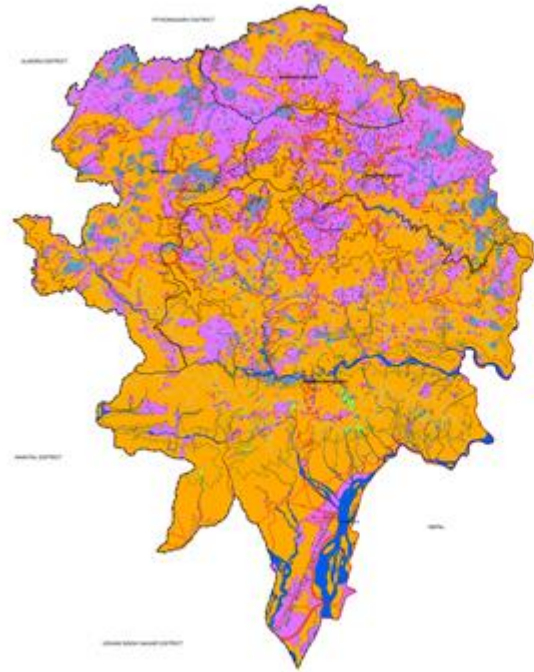
**Inset Map**  
Location of ChamPAWAT District in Uttarakhand

**Prepared by**  
[Institution Name]

**Date**  
[Date]

### SUITABILITY MAP FOR PEACH

CHAMPAWAT DISTRICT, UTTARAKHAND



- LEGEND**
- HIGHLY SUITABLE LAND
  - MODERATELY SUITABLE LAND
  - MARGINAL SUITABLE LAND
  - CURRENTLY NOT SUITABLE LAND
  - PERMANENTLY NOT SUITABLE LAND
  - Forest

- |   |             |   |              |   |              |
|---|-------------|---|--------------|---|--------------|
| • | Settlement  | • | Canal        | • | Contour      |
| ~ | Well        | • | Can          | • | Watercourse  |
| ~ | Stream      | ~ | Water Course | ~ | Water Course |
| ~ | Stream      | ~ | Water Course | ~ | Water Course |
| ~ | Watercourse | ~ | Water Course | ~ | Water Course |

**Scale**  
1:1,00,000

**North Arrow**

**Inset Map**  
Location of ChamPAWAT District in Uttarakhand

**Prepared by**  
[Institution Name]

**Date**  
[Date]

### SUITABILITY MAP FOR PEAR

CHAMPAWAT DISTRICT, UTTARAKHAND



Scale 1:1,00,000

**LEGEND**

- HIGHLY SUITABLE LAND
- MODERATELY SUITABLE LAND
- MARGINAL SUITABLE LAND
- CURRENTLY NOT SUITABLE LAND
- PERMANENTLY NOT SUITABLE LAND
- Forest

● Settlement	● Dam	● Canal
▲ Peak	● Well	● Watercourse
▽ Mine	○ Barrage	○ Check Dam
△ Pipeline	○ Head Channel	○ Sub Channel
▽ Irrigation Boundary	○ Drain Boundary	○ Road Boundary

**Notes:**

- This map is prepared using GIS software.
- The map is prepared using the latest available data.
- The map is prepared using the latest available data.
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**Scale:** 1:1,00,000

**Projection:** UTM

**Units:** Meter

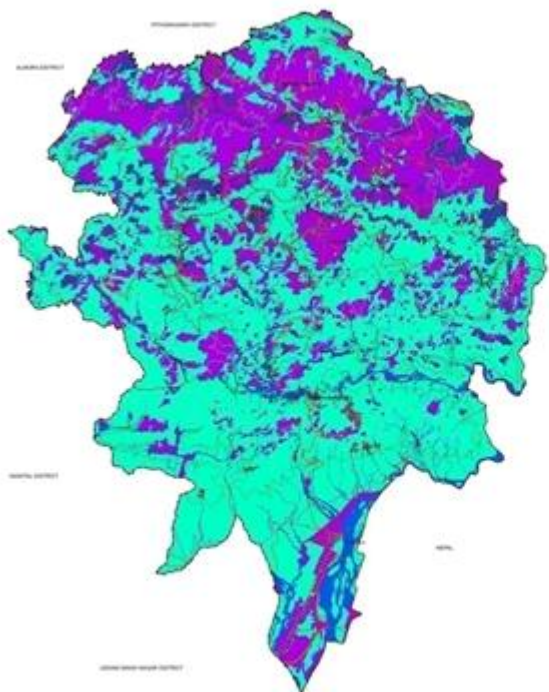
**Author:** [Name]

**Date:** [Date]

**Organization:** [Organization]

### SUITABILITY MAP FOR PLUM

CHAMPAWAT DISTRICT, UTTARAKHAND



Scale 1:1,00,000

**LEGEND**

- HIGHLY SUITABLE LAND
- MODERATELY SUITABLE LAND
- MARGINAL SUITABLE LAND
- CURRENTLY NOT SUITABLE LAND
- PERMANENTLY NOT SUITABLE LAND
- Forest

● Settlement	● Dam	● Canal
▲ Peak	● Well	● Watercourse
▽ Mine	○ Barrage	○ Check Dam
△ Pipeline	○ Head Channel	○ Sub Channel
▽ Irrigation Boundary	○ Drain Boundary	○ Road Boundary

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**Units:** Meter

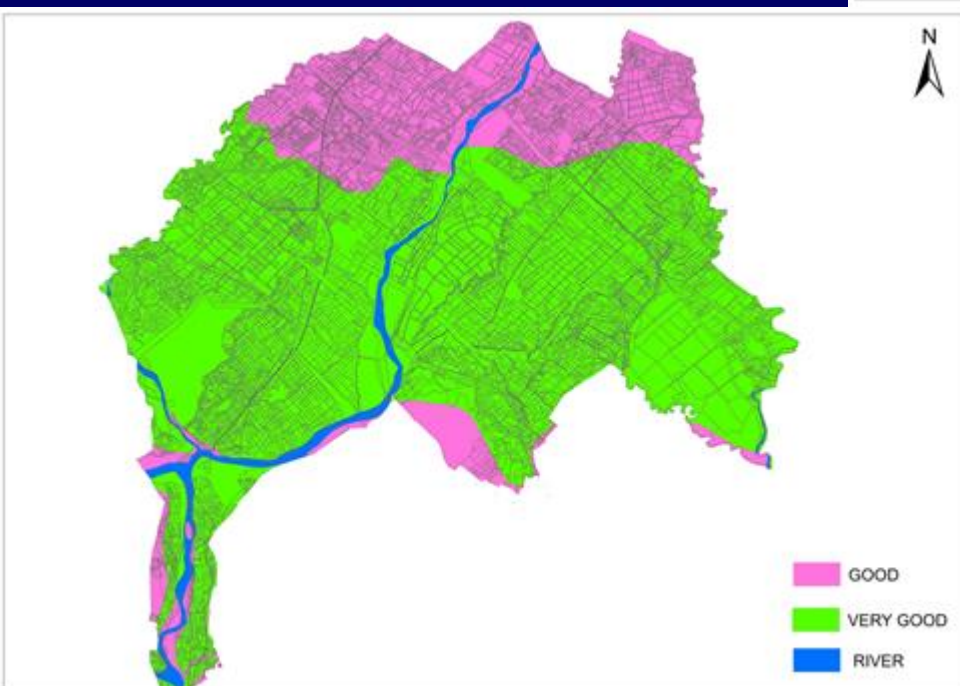
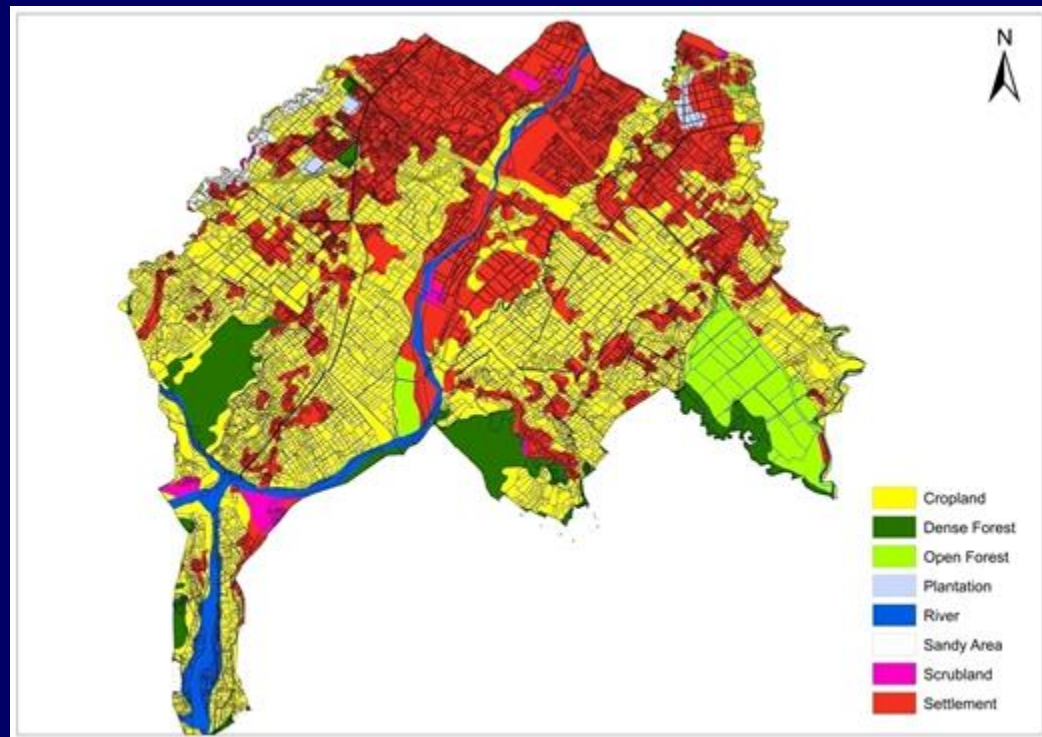
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**Date:** [Date]

**Organization:** [Organization]

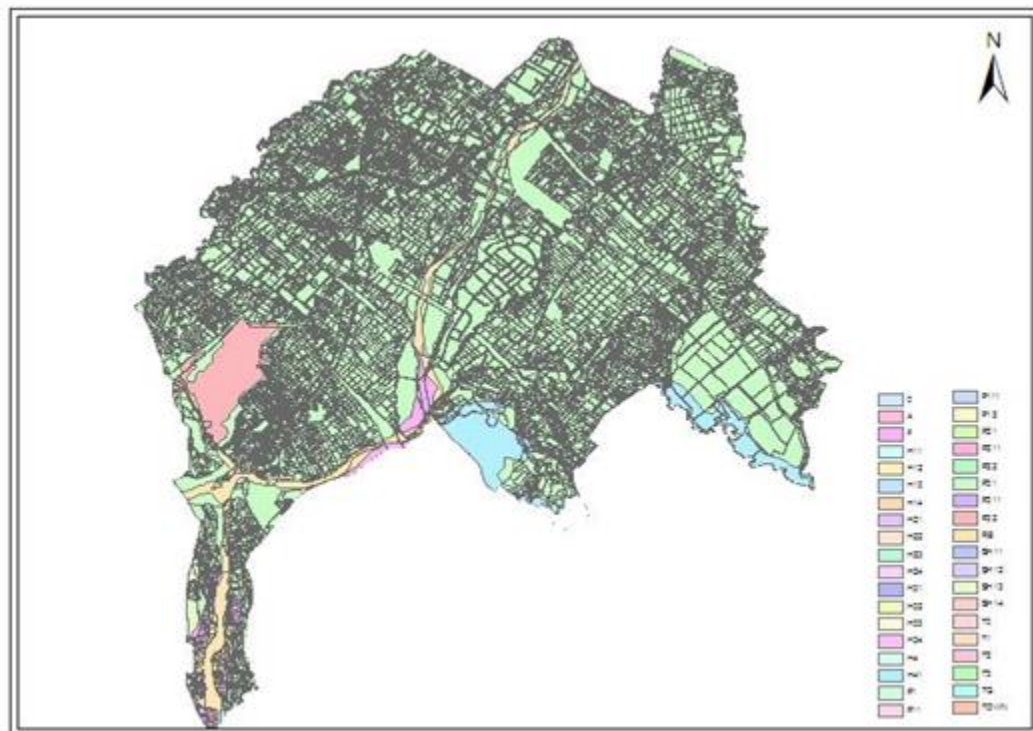
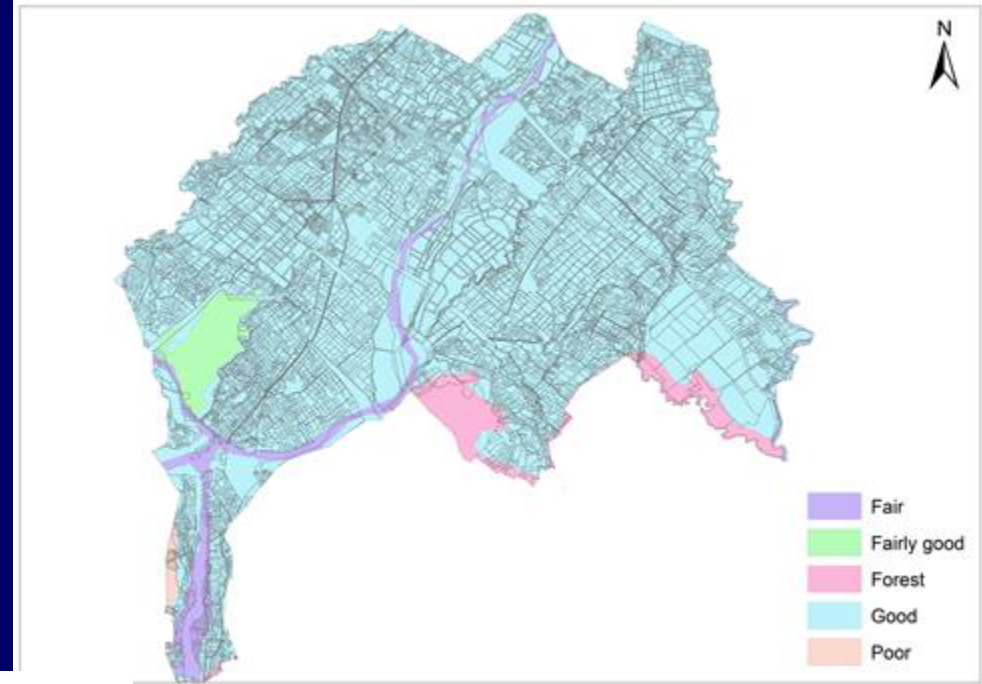


# Cadastral LULC Map



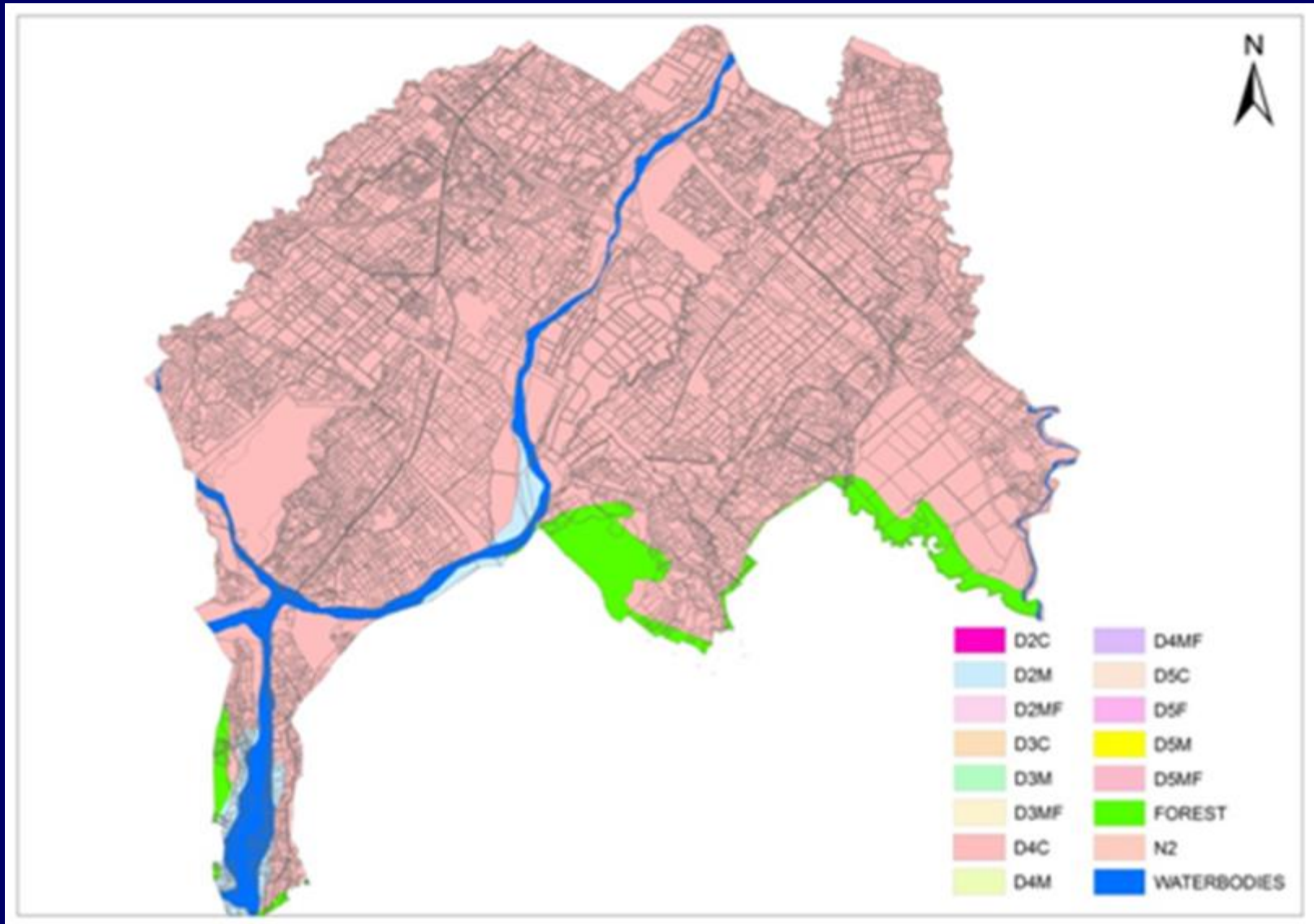
# Cadastral Ground Water Potential Map

# Cadastral Land Productivity Map



# Cadastral Soil Map

# Cadastral Crop Suitability Map



## CONCLUDING REMARKS

- Natural Resources Data Bank generated for the 18 themes at 1:10,000 scale.(i.e., Cadastre level)
- Data Bank contains both Spatial and Non-Spatial Data
- APIB is a single window Knowledge base for Agricultural and allied Sector.
- Helps Government and empowers Farmers to take decisions for improving productivity of their crops.
- Farmers use Smart Mobiles to access data and take decisions, on Farming related activities.
- Farmers take soil suitable, agro metrology compatible, demand based, export oriented, income generating, optimum input cost based, food crops, horticulture, medicinal & Aromatics, spices, pulses, oil seed, etc, and derive greater economic benefits.
- Agro Farming Start Ups, Agro Industry, Retail & Wholesale Business, Banks, NGOs, CBOs, Agro Federations are taking interest for Agri Development and Business Promotion.

A futuristic space station is shown orbiting Earth. The station features a large, multi-faceted satellite dish antenna with a glowing yellow and orange dome on top. Below the dish is a complex structure of white and grey modules. A prominent feature is a large, ring-shaped structure that curves around the station. The Earth's surface is visible in the lower-left corner, showing a mix of green and brown terrain. The background is a vast expanse of space filled with stars, a colorful nebula, and a bright, glowing galaxy. The text "THANK YOU Namaskar" is overlaid in the center of the image in a bright cyan color.

**THANK YOU  
Namaskar**