UPSC Syllabus Topic : GS GS Paper 3 Science & Technology – Developments and their applications and effects in everyday life.

Growth of Land Management With Technology in India

Introduction: Land, a vital factor of production, plays a crucial role in India's economic growth, necessitating efficient land management practices. This article explores the issues in traditional land management, highlights the benefits of adopting tech-based Geographic Information System (GIS), and outlines the steps taken to harness technology for effective land management in India.

Concerns in Land Management in India:

1. **Untapped Economic Potential:**
   - The economic potential of land in India remains largely untapped, hindering optimal utilization.
2. **Lack of Accessibility to GIS:**
   - Until 2021, GIS was restricted by regulations, relying on platforms like Google Maps due to the regressive Map Policy of 2005.
3. **Lack of Centralised Database:**
   - Government entities held vast land expanses without a centralised database until recently.
4. **Lack of Land Surveys:**
   - Major land-owning ministries, like the Ministry of Defence, lacked comprehensive land surveys until recently.

Steps Taken in Land Management in India:

1. **National Centre of Geo-informatics (NCoG):**
   - Formed in 2015, NCoG has seamlessly incorporated GIS into e-governance applications nationwide.
2. **Liberalisation of Geospatial Sector:**
   - In 2021, reforms deregulated the geospatial sector, fostering innovation and accessibility.
3. **Use of Drones for Mapping:**
   - Drone Rules 2021 sanctioned drone surveys for mapping, enhancing accuracy and efficiency.
4. **Government Land Information System:**
   - Initiated in 2015, it contains details on 95,742 parcels of land measuring 384,000 acres.

Benefits of Utilising Tech-based GIS:

1. **Land Titling (SVAMITVA scheme):**
   - Utilising drone surveys to provide accurate records of land rights in villages.
2. **Connectivity and Logistics (PM Gati Shakti):**
   - A GIS-based national masterplan for multimodal connectivity to enhance infrastructure and connectivity projects.
3. **Applications in Defence:**
   - Technologies like LIDAR enable the creation of 3D GIS maps for remote borders, enhancing security measures.

The Way Forward Regarding Utilising Technology in Land Management:

1. **Using AI:**
   - AI-based image analysis technology can identify land-use based on satellite or drone imagery, aiding in comprehensive planning.
2. **Role of State Governments:**
   - State governments, responsible for managing various land resources, should embrace technology for effective governance.

3. **Rationalising New Acquisitions:**
    - Geospatial technology can intelligently identify available government land before new acquisitions, ensuring informed decision-making.
4. **Preventing Encroachments:**
    - An AI-based system, leveraging satellite imagery and longitudinal analysis, can detect encroachments and unauthorized constructions in a timely manner.

In conclusion, the integration of technology, particularly GIS and AI, into land management practices is essential for unlocking economic potential, ensuring transparency, and contributing to the vision of a developed India.

UPSC Syllabus Topic : GS paper 3- Science and Technology- Awareness in the fields of Space.

How INSAT Analysis Weather

Introduction: India's Indian National Satellite (INSAT) system, featuring advanced satellites like INSAT 3D and 3DR, plays a pivotal role in weather forecasting. This article delves into how these satellites use different wavelengths to analyse clouds, snow, and other weather phenomena, contributing to accurate and timely weather predictions.

How INSAT System Aids Weather Analysis:

1. **Advanced Imaging (RGB Imagers):**
    - INSAT 3D and 3DR employ red-green-blue (RGB) imagers, facilitating the identification of various weather phenomena by analysing solar reflectance and brightness temperature at different wavelengths.
2. **Strategic Geostationary Orbits:**
    - Positioned strategically in geostationary orbits, such as 82 degrees and 74 degrees east longitudes, INSAT satellites ensure consistent monitoring over India, crucial for real-time weather analysis.
3. **Day and Night Monitoring:**
    - Components like 'day microphysics' and 'night microphysics' enable effective tracking of weather changes during both day and night, providing comprehensive monitoring capabilities.
4. **Snow and Cloud Differentiation:**
    - The satellites differentiate between snow and clouds based on their reflectance in different parts of the spectrum, a crucial factor for accurate weather predictions.
5. **Enhanced Weather Predictions:**
    - By combining day and night data, scientists can track cyclone formation and predict thunderstorms more accurately, contributing to improved early warning systems.
6. **Advanced Radiometers:**
    - Upgraded radiometers on satellites like INSAT 3DR offer enhanced spatial resolution and functionality, surpassing earlier models like Kalpana 1 and INSAT 3A.
7. **Atmospheric Sounders:**
    - These instruments measure temperature, humidity, and water vapor, providing detailed atmospheric profiles essential for comprehensive weather analysis.
8. **Continual Technological Improvement:**
    - Each new satellite iteration in the INSAT series introduces improved technology, such as INSAT 3DR's upgraded VHRR, sounder, and additional transponders, enhancing India's weather monitoring capabilities.

Colour and Snow Analysis:

- **Colour Determination:**
    - Satellites like INSAT 3D employ RGB imaging, where colours are determined by solar reflectance and brightness temperature. Different signals in visible, shortwave

infrared, and thermal infrared bands dictate the amounts of green, red, and blue colours.

- **Snow Tracking:**
  - Snow exhibits a unique signature, reflecting similarly to clouds in the visible spectrum but strongly absorbing shortwave infrared radiation. This absorption weakens the red component in the RGB scheme, enabling satellites to differentiate snow from clouds.

Types of Weather Satellites in India:

1. **Kalpana 1 (2002-2017):**
   - Positioned in geostationary orbit, equipped with an early version of the Very High-Resolution Radiometer (VHRR) and a data-relay transponder.
2. **INSAT 3A (2003):**
   - Carried a three-channel VHRR for meteorological observations, with different resolutions for visible, thermal infrared, and water vapor bands.
3. **INSAT 3D and 3DR:**
   - Positioned in geostationary orbits at 82 degrees and 74 degrees east longitudes respectively. Equipped with upgraded VHRRs for improved spatial resolution and functionality. They also carry atmospheric sounders for measuring temperature, humidity, and water vapor.
4. **Upcoming INSAT 3DS (Scheduled for February 2024):**
   - The third iteration following the INSAT 3D and 3DR series, signifying continual advancements in India's weather monitoring capabilities.

In conclusion, India's INSAT satellites, with their advanced technology and strategic positioning, are integral to the nation's weather forecasting efforts, contributing significantly to accurate predictions and timely warnings. The upcoming INSAT 3DS further signifies the nation's commitment to continually advancing its capabilities in meteorological observation.