

Daily Mains Practice Answer 28-07-2026

Q. Discuss the role of Artificial Intelligence, geospatial technologies, and digital soil mapping in transforming soil resource management in India. (150 words, 10 marks)

Direction: Intro----Role of AI, geospatial technologies & digital soil mapping + Significance + Challenges-----Conclusion.

Introduction:

Describe soil (or) Soil with respect to India (or) general terms about soil.

Soil is a strategic national resource vital for agricultural productivity, food security, and rural livelihoods. India is adopting AI, geospatial technologies, and digital platforms to enable scientific, data-driven, and climate-resilient soil management.

Main Body

Role of Artificial Intelligence

- AI-based soil diagnostics use satellite images and remote sensing data to identify nutrient deficiency, soil stress and support timely corrective action.
- AI-enabled precision farming - Supports site-specific application of water and fertilisers.
- AI-driven advisory systems - Help farmers with crop selection, sowing time, and nutrient management.
- Advances in agri-robotics & technologies, including autonomous tractors, use GPS, cameras, and AI for greater precision.

Role of geospatial technologies

- Uses GIS, Remote Sensing, and GPS for real-time monitoring of soil resources (Nationwide Soil Resource Mapping project).
- Maps soil moisture, erosion-prone areas, and land degradation.
- Facilitates watershed planning and land-use optimisation.
- Assists in climate-smart agriculture through satellite-based monitoring.

Role of digital soil mapping

- Digital technologies are transforming agricultural decision-making through integrated data systems and targeted advisory services.

- Digital Agriculture Mission – Build a unified data framework by linking soil information with land and crop datasets.
- AgriStack – Enabling the integration of farmer, land, and soil data to support targeted advisory services.

Significance

- Improves agricultural productivity.
- Supports food security.
- Improves soil health & reduces pollution & balanced fertiliser use.
- Promotes climate-resilient and sustainable agriculture.
- Enables precision agriculture through integrated digital public infrastructure.

Challenges

- Limited availability of high-quality soil databases.
- High cost of advanced technology infrastructure.
- Lack of digital literacy among small farmers.
- Data privacy and standardisation concerns.

Conclusion:

Give a balanced way forward-based conclusion.

Soil remains one of India's most valuable natural resources, sustaining agriculture, livelihoods, and food security. The integration of the above technologies is transforming India's soil resource management from reactive and generalised practices to predictive, precision-based, and location-specific management.