# Harnessing Biomass Cultivation on Degraded Land

**For Prelims:** Principal Scientific Adviser, **National Green Hydrogen Mission**, National Biomass Atlas, Bhuvan portal**,** Indian Space Research Organisation

**For Mains:** Significance of biomass cultivation, Bioenergy generation, Government initiatives for Renewable Energy

**Source: PIB**

## Why in News?

The **Principal Scientific Adviser (PSA)** to the Government of India recently convened the first meeting to discuss biomass **cultivation on degraded land for** green biohydrogen **production and** bioenergy generation.

- This significant meeting gathered key stakeholders, and research institutes, to explore the potential of utilising degraded, barren, and uncultivated lands for biomass cultivation.

## Note

The Government of India established the **Office of the Principal Scientific Adviser (PSA)** in November 1999.

- The PSA's office aims **to provide pragmatic and objective advice to the Prime Minister** and the cabinet in matters of Science and Technology.
- The Office of **PSA was placed under the Cabinet Secretariat** in August 2018.

## What are the Key Highlights of the Meeting?

- **Biomass Cultivation Prospects:**
  - **Seaweed Cultivation**: Highlighted prospects for **seaweed cultivation** as biomass for bioenergy production and fostering a marine biomanufacturing start-up ecosystem.
  - **Plant-Based Biomass:** Discussed biomass production using various plants, including **algae, molasses, and sugarcane.**
- **Government Programs and Data Utilisation:**
  - Highlighted one of the objectives of the **National Green Hydrogen Mission** is to initiate focused pilots for biomass-based green biohydrogen production.
  - The **Ministry of New & Renewable Energy (MNRE)** highlighted the various programs at the Ministry for Bioenergy and also talked about the **National Biomass Atlas for agri-residue surplus data.**
- **Economic and Strategic Frameworks:**

- **Data on Biomass:** The **National Remote Sensing Centre (NRSC)**, and **Indian Space Research Organisation (ISRO)**, presented the **Bhuvan portal** for biomass availability from agri-residue and degraded Land Mapping and emphasised the need for data on the characterisation of biomass for understanding the potential of biomass.

## Note:

- The **National Biomass Atlas of India** is a tool that helps people understand the **country's biomass availability.**
  - The Biomass and Energy Management Division of the Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE) under the Ministry of New and Renewable Energy (MNRE) developed the atlas.
- The atlas shows **state-wise and crop-wise fractions** of different residues available per crop, as well as images of different crops and their crop residue ratios.

## What is Biomass Cultivation on Degraded Land?

- **About:** Biomass cultivation on degraded land refers to the **practice of growing organic matter,** such as crops or trees, on land that has been rendered unsuitable for conventional agriculture due to factors like soil erosion**, salinisation, or** deforestation**.**
  - **Biomass is renewable organic material** that comes from plants and animals. Biomass contains stored chemical energy from the sun that is produced by plants through photosynthesis.
- **Benefits:**
  - **Soil Restoration and Erosion Prevention:**
    - The cultivation of energy crops helps rebuild the soil on degraded land and helps improve soil quality, fertility, and structure.
    - It **prevents soil erosion** and creates a habitat for native plant species.
    - This restoration process **improves overall biodiversity** and provides additional carbon sinks, aiding in the fight against climate change.
  - **Carbon Sequestration:** Biomass plants absorb carbon dioxide from the atmosphere during photosynthesis, contributing to **climate change** mitigation.
  - **Sustainable Biohydrogen Production**: Biomass can be used as a **feedstock for green biohydrogen production** through a process called **thermochemical or biochemical conversion.**
    - Green biohydrogen is a clean-burning fuel that produces water vapour as its only emission.
  - **Bioenergy Generation:** By growing specific bioenergy crops on previously degraded or barren land, we can harness their biomass for energy production.
    - These crops include **fast-growing trees, grasses,** and other plants that have high energy content.
    - The biomass can be converted into various forms of energy, such as **biofuels, biogas, or solid biomass.**
  - **Enhancing Food Security:** By focusing biomass cultivation on degraded or marginal lands, it avoids using fertile agricultural land, which is better suited for food crops.
    - This approach helps prevent the diversion of food grains and improves **food security while also promoting agri-export.**

## India Biomass Energy Potential

- India has a **strong agricultural and allied sector** that contributes significantly to the country's **Gross Domestic Product (GDP)** (~20%) and is also the largest source of livelihood (>50% of the population).
  - This presents a large and **widespread biomass availability to the country.**
- Biomass offers several benefits as it is **renewable, carbon-neutral and has the potential to provide significant livelihood generation opportunities.**

- A recent study by the Ministry of New and Renewable Energy (MNRE), indicated estimated **surplus biomass** availability of about **230 million metric tonnes per annum** (2017-18) from agricultural residues and a **biomass power potential of about 28 GW for the country.**
- **Biomass Production Potential:** India is a tropical country and thus offers an ideal environment for Biomass production.
    - Further, the vast agricultural potential, also makes available huge **agro-residues to meet the energy needs.**
        - With an estimated production of about **460 million tonnes of agricultural waste every year, Biomass is capable of supplementing the coal to the tune of about 260 million tonnes.**
    - This can result in a saving of about Rs 250 billion, every year.

## What are the Challenges in Biomass Cultivation on Degraded Land?

- **Soil Quality:** Degraded land often **lacks essential nutrients and organic matter.** Rehabilitating soil quality is crucial for successful biomass cultivation.
- **Species Selection and Adaptation:** Selecting appropriate biomass crops that can thrive in harsh conditions is challenging. Research is needed to identify resilient species and improve their adaptability.
    - Degraded land may experience extreme temperatures, droughts**, or** floods.
- **Water Availability and Management:** Degraded land often lacks **adequate water resources**. Developing efficient irrigation methods for biomass crops is essential.
    - Exploring **rainwater harvesting** techniques can enhance water availability.
- **Economic Viability and Market Demand:** Initial investments in land preparation, seedlings, and infrastructure can be high.
    - **Biomass crops must align with market demand for bioenergy** or other products.
    - Governments can encourage farmers through financial incentives. Ensuring economic viability while rehabilitating land is complex.
- **Biodiversity and Ecological Impact:** Introducing biomass crops may affect local ecosystems and biodiversity. Some biomass **crops may become invasive** and disrupt native flora and fauna.
    - Implementing cultivation methods that minimise ecological impact is essential.

## Way Forward

- **Cultivation Techniques:** Implement strategies to improve degraded soil fertility. This could involve **incorporating organic matter** like compost, and biochar, or using techniques like **bioflocculation (harnessing microbial processes**) to improve soil health.
- **Biomass Cultivation with Agroforestry:** Implement a multi-tiered cropping system on degraded land, integrating fast-growing tree species with native grasses and legumes.
    - Trees like ***Pongamia pinnata (Karanj)*** can fix nitrogen in the soil, improving fertility for companion crops like drought-resistant grasses **suitable for biofuel production.**
    - This strategy not only helps in biofuel production but also creates a habitat for native fauna, promoting biodiversity.
- **Drones for Degraded Land Diagnostics**: Use drones with multispectral sensors to quickly assess large areas of degraded land, map soil composition, identify potential biomass cultivation areas, and evaluate existing biodiversity.
- **Market Development:** Develop markets for biomass and its by-products to ensure economic viability and create a value chain that supports rural livelihoods.

***Drishti Mains Question:***

Q. Assess the biomass energy potential of India and the opportunities it presents for the country's transition towards a sustainable energy mix. Discuss the policy frameworks required to harness this potential effectively.

## UPSC Civil Services Examination, Previous Year Question

### ***Prelims***

**Q. With reference to the usefulness of the by-products of sugar industry, which of the following statements is/are correct? (2013)**

1. Bagasse can be used as biomass fuel for the generation of energy.
2. Molasses can be used as one of the feedstocks for the production of synthetic chemical fertilizers.
3. Molasses can be used for the production of ethanol.

**Select the correct answer using the codes given below:**

**(a)** 1 only
**(b)** 2 and 3 only
**(c)** 1 and 3 only
**(d)** 1, 2 and 3

**Ans: (c)**