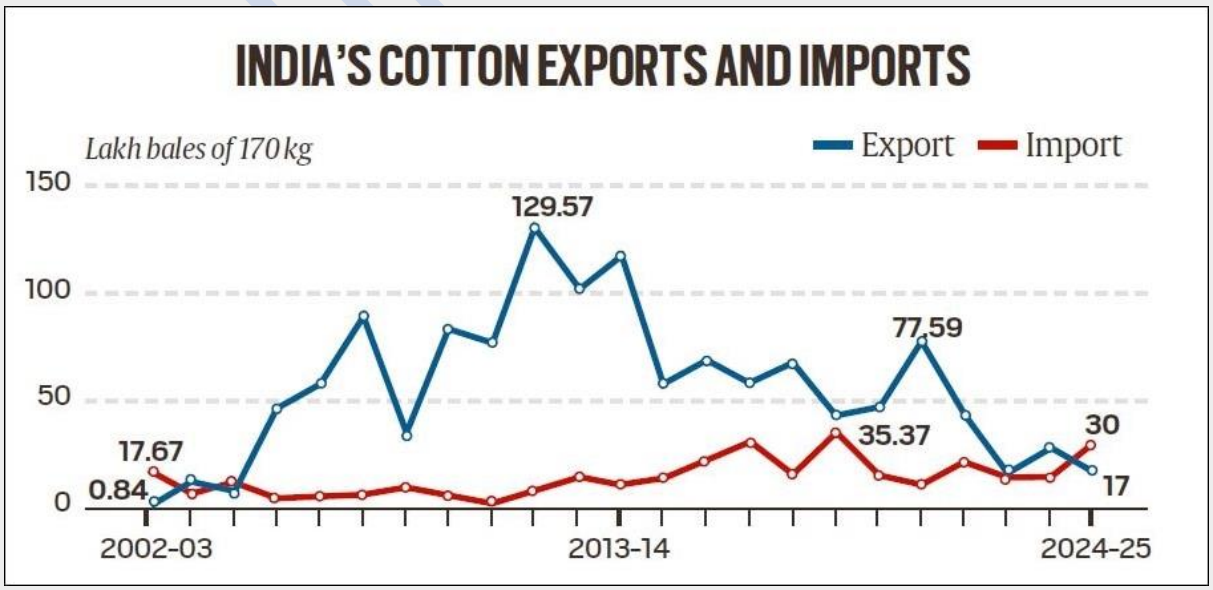
## 1. Cotton production steep decline in India

**Why in News?**

India's cotton economy isn't in great shape. The cause for concern is production. India's cotton output in the 2024-25 marketing year (October-September) is projected at just over 294 lakh bales (lb; 1 lb=170 kg), the lowest since the 290 lb of 2008-09. Production has been on a declining path since the peak of 398 lb in 2013-14. A fall from almost 400 lb to under 300 lb can even be termed catastrophic.


With fall in production, exports have dipped even as imports have risen.



**Why Production increased earlier?**
The cultivation of genetically modified (GM) cotton hybrids – incorporating alien genes isolated from a soil bacterium, Bacillus thuringiensis or Bt – had led to not only a near-trebling of production (from 136 lb to 398 lb) between 2002-03 and 2013-14.

**Pink bollworm**
The above production slide, and India turning from a large cotton exporter to a net importer, is mainly courtesy of the pink bollworm (PBW). This is an insect pest, whose larvae bore into the bolls (fruits) of the cotton plant. The bolls contain seeds from which the white fluffy cotton fibres or lint grow. The PBW caterpillars feed on the developing seeds and the lint, causing yield loss as well as lint discolouration.

The GM cotton now grown in India have two Bt genes, 'cry1Ac' and 'cry2Ab', coding for proteins toxic to the American bollworm, spotted bollworm and cotton leafworm pests. The double-gene hybrids initially provided some protection against the PBW too, but that effectiveness has dissipated over time.

**Monophagous pest**
The reason for it is that the PBW is a monophagous pest, which feeds exclusively on cotton. This is unlike the other three pests that are polyphagous and survive on multiple host crops: The American bollworm larvae infest even maize, jowar (sorghum), tomato, bhindi (okra), chana (chickpea) and lobia (cowpea).

Being monophagous enabled the PBW larvae to gradually build resistance to the toxins from the existing Bt cotton hybrids. The PBW population that became resistant from continuously feeding on these plants eventually overtook and replaced the ones that were susceptible. The pest's short life cycle (25-35 days from egg laying to adult moth stage), allowing it to complete at least 3-4 generations in a single crop season of 180-270 days, further accelerated the resistance breakdown process.

**What now?**
Leading Indian seed companies have developed GM cotton hybrids deploying new genes from Bt, which they claim confer resistance to PBW. However, these hybrids are yet to pass field trials.

Relevance: GS Prelims & Mains Paper III; Science & Technology
Source: Indian Express

## 2. ESA's satellite to monitor forests: Everything you need to know about the upcoming Biomass mission

**Why in News?**
The European Space Agency's (ESA's) new mission, which will map the world's forests, will launch later this month. Known as the Biomass mission, it will provide information about the state of the planet's forests and how they are changing, which will help expand the knowledge about the role forests play in the carbon cycle.

The mission will launched by end of April. It will be placed in a sun-synchronous orbit (SSO) — a type of orbit in which satellites are in sync with the Sun — at an altitude of around 666 km. The Biomass is ESA's seventh Earth Explorer mission. Under the Earth Explorer programme, the space agency has launched satellites to observe different aspects of the planet's system.

**What will the Biomass mission do?**

Forests are an essential part of the world's carbon cycle as they store huge amounts of carbon. Scientists estimate that forests absorb around 16 billion metric tonnes of carbon dioxide (CO2) per year, and currently hold 861 gigatonnes of carbon in their branches, leaves, roots, and soils.

However, there is a lack of forest above-ground biomass — the total mass of living organisms located above the forest vegetation — and forest height data on a wide geographical scale. As a result, there is a limited understanding of the state of the forests, their contribution and impact on the carbon cycle and climate. The primary aim of the Biomass mission will be to tackle this knowledge gap.

**How will the Biomass mission monitor forests?**

To fulfil its objectives, the mission will use a synthetic aperture radar (SAR) — a satellite imaging technique which uses radar waves to map the Earth's surface. This SAR sensor will operate in the long-wave P-band frequency range, with a wavelength of 70 cm. Therefore, unlike other shorter-wave SAR sensors, the P-band SAR will be able to peer down through forest canopies to assess how much carbon is stored on the floor and branches of the trees in the world's forests and to assess how levels are changing. The sensor will also estimate the amount of forest biomass.

Notably, Biomass is the first satellite in the world to host a P-band SAR. The satellite is fitted with a huge 12 m antenna which will be deployed as it begins its sweep over the Earth.

**Synthetic-Aperture Radar (SAR)**

Synthetic-Aperture Radar (SAR) is a form of radar that uses the movement of radar antenna to create a higher resolution images of objects. Such images may be either two-dimensional or three-dimensional. SAR uses the motion of the radar antenna over a target region to provide a higher resolution than conventional beam-scanning radars.

SAR is typically mounted on a moving platform, such as a satellite or an aircraft. This movement of SAR device creates a large synthetic antenna aperture (the size of the antenna).

Typically, the larger the aperture, the higher the image resolution will be, regardless of whether the aperture is physical (a large antenna)

or synthetic (a moving antenna) – this allows SAR to create high-resolution images with comparatively small physical antennas.

**What is the Earth Explore programme?**
The satellites launched under this programme are meant to provide essential information about Earth's interior, cryosphere (frozen parts), hydrosphere, atmosphere, ionosphere (home to all the charged particles in the atmosphere) and land surface.

The first spacecraft — the gravity field and steady-state Ocean Circulation Explorer (GOCE) mission — took off in 2009 and worked till 2013. The mission helped further research in areas of ocean circulation, physics of Earth's interior, etc.

The most recent one was the Earth Cloud Aerosol and Radiation Explorer (EarthCARE) mission, which was launched in May 2024. It contributes to a better understanding of Earth's radiative balance in climate, among other things.

Relevance: GS Prelims & Mains Paper III; Science & Technology
Source: Indian Express

## 3. Palna Scheme

**Why in News?**
Lack of proper day-care services is, often, a deterrent for women to go out and work. To address these difficulties faced by the working mothers in giving due child care and protection to their children, day-care crèche facilities are being provided through Palna Scheme. Crèche services formalise the child care responsibilities hitherto considered as part of domestic work.


**Erstwhile National Creche Scheme**
In 2022, erstwhile National Creche Scheme was reorganized and renamed as Palna Scheme under the sub scheme 'Samarthya' of 'Mission Shakti'. Palna is a Centrally Sponsored Scheme ensuring the participation of State/ UT government to ensure better day-to-day monitoring and proper implementation of scheme, and is implemented with a funding ratio of 60:40 between Centre and State Governments and UTs with legislature except North East & Special Category States where ratio is 90:10. For UTs without legislature, 100% funding is provided by the central government.

**Objectives of the Palna Scheme**
The objective of the Palna scheme is to provide quality crèche facility in safe and secure environment for children (from ages 6 months – 6 years), nutritional support, health and

cognitive development of children, growth monitoring & immunization. Crèche facilities under Palna are provided to all mothers, irrespective of their employment status.

Relevance: GS Prelims; Governance
Source: PIB