De-Extinction

Mains Syllabus: GS I - Changes in flora and fauna and the effects of such changes; GS III – Conservation, Science and Technology- developments and their applications.

Why in News?

Recently in April, Colossal Biosciences ,a biotechnology company in Texas, U.S. announced that it had “resurrected” a dire wolf, a large predator that went extinct more than 12,000 years ago.

How was the extinct dire wolve brought back?

- **De-extinction** – Also known as resurrection biology or species revivalism, it is the process of reviving extinct species using biotechnology.

Scientists have estimated that 99.9% of all species that ever lived on the earth are now extinct.

- **Genetic Reconstruction** - It involves reconstructing the genetic material of an extinct species and using it to create a similar or identical organism.
- It is often done by modifying the DNA of a closely related living species through techniques like gene editing(like CRISPR), cloning or back-breeding.

Back-breeding involves selective breeding of closely related living species to reintroduce traits lost in the extinct species.

- **Dire wolves (Aenocyon dirus)-** They were large canines that dominated southern Canada and the US . they went extinct at the end of the last ice age about 13,000 years ago.
- A dire wolf could be 3.5 feet tall, more than 6 feet in length, and weigh up to 68 kg.
- **Dire wolf extinction** - When many of the prey species became extinct, the dire wolf may have also gone extinct.
- **Wolf Genome** – It consists of 2.447 billion base pairs which means there are 2.447 billion positions in the DNA filled by one of the four nucleotides: adenine, thymine, cytosine, and guanine.
- The order in which these four nucleotides appear determines the genetic identity of an

organism.

- **Close relative** - They resembled the grey/ gray wolves (Canis lupus) of today, but were larger, with white coats.
- The genomes of the gray wolf (Canis lupus) and the dire wolf (Aenocyon dirus) are 99.94% identical, meaning 2.445 billion of the 2.447 billion base pairs were in the same places in the two genomes.

Humans and chimpanzees share about 98.77% of their DNA, yet no one would mistake one for the other.

- **Gene editing** - To create these 'dire wolf' pups, Colossal scientists edited the genome of a gray wolf and implanted embryos with the modified genome into surrogate dog mothers.

What are the advantages of de-extinction?

- **Restoration of Ecosystems** - Bringing back extinct species can help restore ecosystems that have been disrupted by their absence.
- **Environmental Balance** - Revived species can help stabilize ecosystems by reintroducing natural predators or prey.

Revival of Woolly Mammoth & Climate Change Control
• **Wolly Mammoth** - Woolly mammoth, a distant ancestor of the elephant, roamed lush grasslands across the tundra during the Pleistocene Ice Ages. • **Arctic Tundra -** Until its extinction around 5,000 years ago, the Arctic tundra also supported large populations of bison, wolves, cave lions, and giant deer. • **Climate Change** - As the climate warmed, these species disappeared, and the grasslands gave way to shrubbery and sheets of snow. • **GHG Emission** - As temperatures rise, permafrost begins to disappear, resulting in high emissions of methane, a more potent greenhouse gas than carbon dioxide. • To prevent this, some scientists at a Siberian park have been transporting large animals that are resistant to cold to see if their foraging can restore the grasslands. • Grass absorbs less heat than the tall trees in a shrub forest — the dominant species — and therefore decelerates warming, but it cannot stop warming.

- **Biodiversity Enhancement** - De-extinction can increase biodiversity, potentially improving ecological resilience against climate change and habitat loss.
- **Scientific Discovery** - Reviving species provides opportunities to study evolution, genetics, and ecological interactions.
- **Ethical Responsibility** - Some proponents argue that humans have a moral obligation to revive species that were driven to extinction due to human activities.

What are the issues with de-extinction process?

- **Ecological risk** - Bringing back animals that lived thousands of years ago, like the dire wolf or woolly mammoth, carries significant ecological risks.

- Reintroducing extinct species may be potentially disrupting current ecosystems rather than restoring ancient ones.
- **Competition for ecological niche** - Reintroduced species may compete for resources such as food and habitat with native organisms, potentially leading to declines in local populations.

An ecological niche refers to the specific role and position an organism or species has in its environment.

- **Unsuitable contemporary environment** - The environmental conditions, plant communities, prey species, and climate that once supported these animals no longer exist.
- **Not a true de-extinction** – Some studies suggest that despite genetic similarities, dire wolves may not be true wolves at all, but grey wolves, with genes modified to produce an animal that resembles a dire wolf.
- **Biological risk** – Their revival may bring back the ancient deadly microbes or the revived species may not be resistant to the current deadly infectious diseases.
- **Affects conservation** – The de-extinction process may slow down the current conservation efforts.
- **Ethical Concerns** - The moral consequences of resurrecting species, questioning whether humans have the right to intervene in natural processes.

What lies ahead?

- The idea of reviving extinct animals is certainly captivating but it seems more prudent to apply this technology to protect and strengthen existing ecosystems.

Reference

The Hindu | Is the once-extinct dire wolf back?