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THE GREEN ARCHIVE

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THE UNENDING FOREST FIRES OF U-KHAND

Photo: India TV

Yashika Prem
B.Sc. Forestry II Year

The state of Uttarakhand has been witnessing ravaging forest fires for the past 6 months. Wildfires have engulfed a total of 1793.48 hectares forest area reporting around 1288 incidents this year in Uttarakhand.

This, however, is unfortunately becoming a common phenomenon in the state of Uttarakhand. The scanty and erratic rainfalls, the rise in temperatures, global warming are primarily the reasons that have been cited for this calamity. The depletion in the groundwater is causing the spread of the forest fire. Another major reason for these forest fires is the massive expansion of the Chir pine trees (*Pinus roxburghii*) as these pine needles are contributing in the spread of the wildfires. Around 2.3 tonnes of pine needles are generated annually. The pine trees result in the depletion of the ground water as their roots penetrate deep into the soil. It also restricts the water recharge and hampers the growth of plants underneath it. The repercussions of climate change and Chir pine expansion is massive in Uttarakhand.

There have been vast consequences due to the forest fires, affecting both human and the wildlife. The animals have lost their homes. It is one of the major reasons for the loss of biodiversity and the degradation of the environment. Large stretches of forest land have burnt to ashes. Another effect has been on the quality of air, the fire has rendered air lethal. Levels of black carbon or soot have shot up 6 times while the levels of ozone has severely trebled. It has caused serious complications like chest pain, coughing and its prolonged exposure might lead to the damage of the lungs as well as the heart. As per the data, Uttarakhand Forest fires have emitted nearly 0.2 tonnes of carbon in the past one month.

The Uttarakhand government has also sanctioned a budget of 16 crore to fight the raging forest fires. Also, the Chief Minister of Uttarakhand is pushing for helicopters for managing the forest fires. Continuous efforts are being made to control the spread of these forest fires.

Editor's Desk

Here we are, towards the end of the first half of the year, oblivious to the pace at which staring at screens for education and walking on terrace for having "a day out" have become the new normal for us.

The time when one could speak of the act of attending classes without having to add the online/offline suffix seems to be a distant memory now. Even the stagnant heat, the suffocating humidity of June 2019 during which we constantly implored the college authorities for an air-conditioned class has become a time which I personally miss today, despite the unpleasant nature of the actual moment. This longing of mine, however, stands nothing when compared against the agitation of the fresher year students, who have spent nearly half of their college lives in high anticipation of getting an in-person glimpse of the campus itself, while getting deprived of the very practical experience their course has to offer. The situation makes it normal for one to feel out of sight, out of purpose and in strong pursuit of sense. But well, as it is put by Neil deGrasse Tyson, "The Universe is under no obligation to make sense to you."

In the flow of this non-sensical voyage, the students still did not back down from putting in any less effort in extracurricular activities. On the 22nd of May, the students organised a webinar for the International Day of Biodiversity, following this year's theme- "We're part of the solution.". In the spotlight was Dr. Kaushik Banerjee, a well renowned scientist from NTCA (National Tiger Conservation Authority). The event started off with the perspicacious Principal, Dr. I. J. Gulati, followed by a deeply insightful presentation on the science and politics behind lion reintroduction in India, making us well aware of the unnoticed and growing imbalance in the prey-predator relationship, and how a lion reintroduction might save lives of thousands of species in the ecological pyramid.

The Department also organised a poster-making competition for the World Environment Day on the 5th of June, giving the students an opportunity to exercise their creativity. The Thursday activities attempted to resuscitate the college nostalgia too, by conducting photo and video competitions which highlight the life in DBS.

With each passing day, we reach a little closer to the light at the end of the tunnel. But instead of waiting idly in hope for far-flung happiness, it would be a more important and challenging task to find the happiness that already surrounds us. Happiness cannot be chased, but only realised in the things we were overlooking all along.

Manas Shukla
Editor-In-Chief

The Mysteries behind Whale's Poop

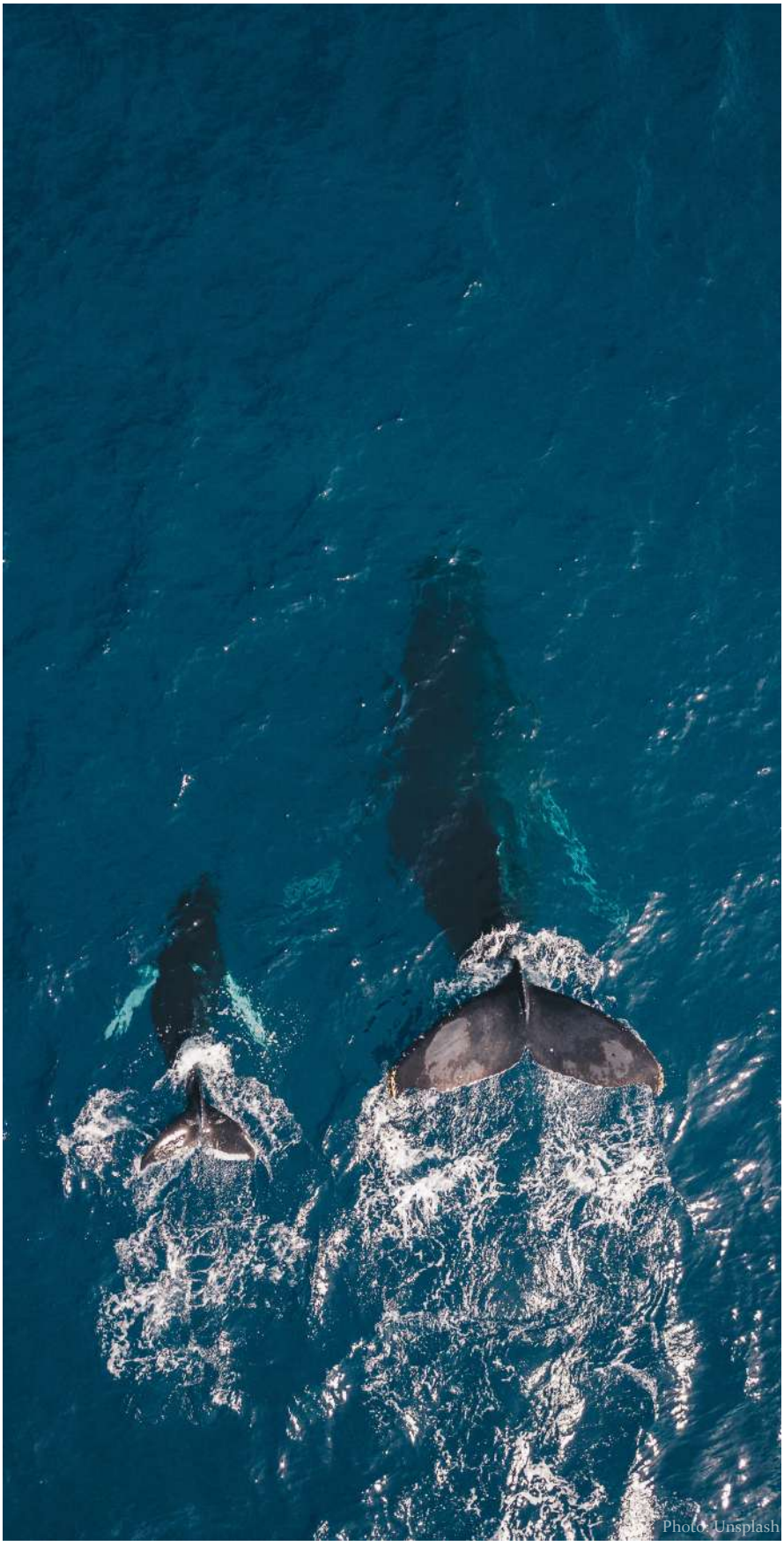


Photo: Unsplash

Sneha Singh
B.Sc. Forestry III Year

Whale poop? Well that certainly sounds like a no discussion topic but we should be rethinking about it before making poop a matter of disgust. Not all poop in the world is waste, we have been imbued with 'Scoop the poop' as the only way to deal with any waste but in our ecosystem, there are some creatures which are helping to make this world a better place through their poop.

Blue whales are the largest animal that have ever lived on the planet, weighing up to 200 tons. Whales are the oceans most unappreciated gardener; they nourish the whole marine ecosystem with their poop. Well, it might sound strange but the whale poop is worth its weight in gold.

By simply eating and pooping, whales are creating a healthy ecosystem, providing us air to breathe, and also combating climate change.

Here's how whales could turn out to be our "saviour":

- Whales like to feed on Krills, which are nutrient rich crustaceans. When they eat this nutrient rich diet, they also excrete nutrient rich feces. Since whales are such massive mammals, they excrete in enormous amounts, providing a lot of nutrients to the top surface of ocean.
- Although whales feed in the deep ocean but due to having some trouble in pooping at extreme pressure below, whales usually come to the surface when it's time to go and they drop a load of essential nutrients onto the top surface of ocean.
- The whale poop consists of crucial nutrients which are

adamental to the health of ecosystem, the global nutrient cycle, and the carbon cycle.

- Unlike the fish, whale poop floats which are later consumed by the Phytoplankton. The phytoplankton are the plant like, microscopic organisms which are the basis of entire ocean food chain.
- Phytoplankton thrives on whale poop; they get their essential nutrients from the poop which helps them to grow. That means more whale poop leads to more phytoplankton and healthy phytoplankton serves a healthy nutrition rich diet for many marine creatures, helping them to survive.
- The best way to combat climate change is to reduce the carbon amount from the atmosphere, and the phytoplankton absorbs as much carbon dioxide as trees. Therefore, the ocean alone holds about 50 times more carbon than our atmosphere does.
- When these phytoplankton die, they fall to the bottom of the ocean where they store carbon for thousands of years, locking away the major culprit of climate change. They also release 50-70% of oxygen in atmosphere that we inhale every day.
- This concludes that even a slight disturbance in phytoplankton growth can lead to increase the carbon level in atmosphere.
- Since the phytoplankton growth is directly related to the whale's poop, we could assume what the commercial whaling at present time is leading us towards.

So, the next time when you go out for swimming, fishing or surfing, or even if you take a breath of air then take out a moment and thank the whales for helping to keep the ocean alive and the air full of oxygen.

CRISPR/Cas9-based Gene Drive in Plants

Photo: DrugTargetReview

Mayuri
B.Sc. Agriculture II Year

Breaking the rules in plant breeding, scientists of University of California San Diego have developed the first CRISPR-Cas9 based gene drive in plants.

The new technology which allows scientists to cut and copy genetic elements in *Arabidopsis* plants.

CRISPR-Cas9 system is a genome editing techniques that allows to alter the genetic code of any given organism.

This new research steps outside the conventional rules of inheritance by using CRISPR-Cas9 editing to transmit particularly targeted traits from a single parent in subsequent generations. Such genetic engineering could be used in agriculture to help plants defend against diseases and help fortify plants against the impact of climate change.

At the present moment, the CRISPR/Cas9 system has proven to be successfully applicable in various plant species which includes not only model plants used for testing, such as *Arabidopsis*,

but also agricultural crops, such as rice, tobacco, sorghum, wheat, maize, soybean, tomato, potato, poplar, apple and banana.

According to Qi lab, this new CRISPR-Cas9 technology will play an important role in food security, nutrition, and safety. The traditional process of developing superior crops through genetic inheritance can take a heavy toll on the financial aspects, and cannot be a time efficient process. This is due to the complicated and lengthy process of passing of genes through multiple generations. However, the researchers claim that by the use of new active genetics technology based on CRISPR-Cas9, such genetic bias can be achieved much timelier basis. Aside from its benefits in the field of agriculture, the CRISPR/Cas9 system has proved its useful abilities in the arena of fungal pathology as well.

This advance is also believed to revolutionize plant and crop breeding and help address the global food security problem.

The Environmental Effects of Covid-19

Abantika Das
B.Sc. Agriculture II Year

The coronavirus outbreak is still ravaging after a year, and is continuing to affect millions of lives on a global scale. The virus which first emerged from a city in China has put a halt in the everyday lives of people. But this does not mean we are only going to look at the negative aspects. Mother earth has been significantly affected as well. Such as shutdown of many activities to put the situation in control has had many positive effects.

These positive effects mean the air quality has been improved in a lot of cities such as Delhi. Also, there are records stating that has been a huge drop in the emission of greenhouse gases and other gases such as nitrogen dioxide leading to acid rain. This change has come about solely due to the closing down of industries, companies and transportation. Transportation plays a key factor as it is assumed vehicles contribute a lot to the emission mentioned before. Therefore, less transportation means needing less fuel and less fuel very importantly means two things- stepping towards climate changed and reduced climate consumption. It has been found that during the lockdown period major river basins such has ganga and Yamuna had reached a remarkable level of purity thanks to no industrial wastes. Prior to the Kumbh mela, there had been a significant improvement of water quality along with reduction of sewage at Haridwar and Rishikesh as there were no visitors.

In conclusion, when then entire world is battling against the virus by planning and implementing various strategies, nature got a chance to heal itself and restore the ecosystem and the environment. But now the most important thing to do will be to take measures to maintain the pollution reduction and its effect on the environment. Otherwise, it will be very irresponsible of us to let that sink in once all the lockdown norms are lifted.

How Agro-waste can be used as a Construction Material

Wanishree Jha
B.Sc. Agriculture II Year

Crop residue burning has serious environmental consequences, including greenhouse gas emissions that cause global warming, elevated particulate matter and pollution that pose a health risk, and biodiversity loss.

Crop residue burning considerably raises air pollution levels such as carbon dioxide, carbon monoxide, ammonia, nitrogen oxides, sulphur, volatile organic compounds, and particulate matter (PM). According to studies, if existing systems continue, emissions may rise by 45 percent by 2050.

To this date, most government initiatives have mostly concentrated on agricultural residual energy generation, notably biogas production. However, bio-composites made from agricultural wastes such as rice husks, wheat stalks, and coconut fibres are gaining popularity.

Natural fibre-reinforced composites have gotten a lot of attention in recent years because they are superior to synthetic fibres in several ways as they are lighter, have a better surface finish on composite components, are inexpensive, disposable, and have high mechanical characteristics.

Cellulose, hemicellulose, and lignin make up the majority of organic matter, with pectin, amino trace elements, polysaccharides, and other extracts accounting for

the remainder. Cellulose is the biomolecule that gives the bio-composite its mechanical stability.

On a trial scale, the CSIR-Advanced Materials and Processes Research Institute (AMPRI) in Bhopal has created a methodology for large-scale recycling of paddy straw/stubble and wheat straw for the development of transgenic green composite particle/fibreboards.

They improved the process parameters and knowledge of the process. The technological bundle is ready for mass production on a commercial scale.

Architectural cladding panels, partition walls, doors, and furniture may be made from the new composite materials, which are superior alternatives to particleboard, MDF board (medium-density fibreboards), and wood.

Agro-waste bio-composites are long-lasting, cost-effective, and termite and corrosion-resistant. They come in a variety of colours, textures, and surface finishes, and are of higher quality than particleboard. These materials aid in carbon sequestration, air pollution management, and global warming reduction.

In comparison to thermoplastic polymeric materials supplemented with inorganic fillers, agricultural wastes are favourable to the economy and environment due to their low density, low manufacturing energy consumption, low Carbon dioxide emissions, and high biodegradability. It can help with the Make in India, Clean India, and Skill India initiatives.

However, it is important to note that unless any legislative framework encourages and develops agricultural waste-based construction materials, there would be insufficient trust in their long-term viability. At the policy level, the usage of agricultural waste-based construction products will have to be considered necessary.

To improve the use of these goods, the building sector has to be trained. To establish the market for green building goods, a targeted mission-mode strategy is required.

This must be done by government entities with the authority to do so. Many similar experiments have been carried out successfully in the industrialized world, demonstrating the feasibility of market formation and demand-supply equations.

Food Processing: The Vital Link between Agriculture and the Industry

Mrinal Singh
B.Sc. Agriculture III Year

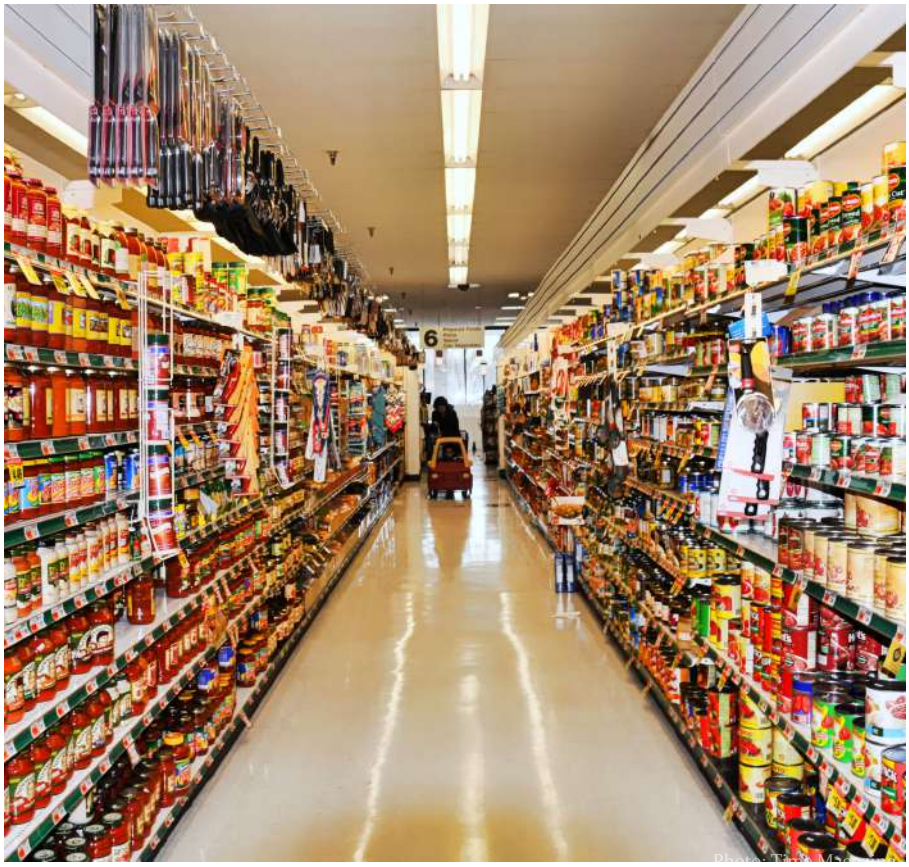
What are the processing constraints of food processing in India? Does the packaging affects composition of food? From nutritional point of view, processed and ultra-processed foods have altered nutritional profile as compared to the raw materials. The effect on nutritional composition depends on the temperature, light exposure, humidity, pH, addition of food additives, time of processing, presence of oxygen, suitable packaging and the condition during shelf life.

According to Dr. Sridevi Annapurna Singh, the Director of CSIR-Central Food Technological Research Institute, Mysore, some beneficial effects on nutrition quality are:

- Proteins undergo denaturation (changes in structure leading to aggregation or unfolding or hydrolysis) that make them more digestible and readily absorbable.
- Carbohydrates – starch, the abundant carbohydrate in plants, gets gelatinized during heating or cooking and this makes its more digestible.
- Reduction or inactivation of antinutrients that make the food more digestible and increase bioavailability of minerals like iron, calcium, zinc and phosphorus.
- Proteolysis of proteins, either by enzymatic, acidic, alkali, fermentation or ageing can produce bioactive peptides that have one or more activities like antioxidant, antimicrobial, anti-hypertensive, immuno-modulatory, hyper cholesterolemic, prebiotic or opioid activities.

But at the same time, there are some undesirable changes during food processing as well:

- Vitamin B- complex and vitamin C are most labile. Folic acid, thiamine and vitamin C are most unstable, while vitamin D, niacin, vitamin K, biotin and pantothenic acid are stable to most processing conditions.
- At high temperatures, protein (lysine residues) reacts with reducing sugars to form Schiff's bases that undergo amadori rearrangement and the products polymerize to form melanoidins through non-enzymatic browning (Maillard reaction e.g., Baked goods).
- Cutting or mincing or pulverizing leads to disruption of cell walls that allow the enzymes like polyphenolase, peroxidase, lipoxygenase to come in contact with their substrates to form undesirable products which affect the nutritional quality of fats (rancidity, e.g., Soybean oil) or cause undesirable colour (enzymatic browning e.g., Apple juice).
- Frying, roasting or baking of foods at very high temperatures causes formation of acrylamide through reaction of asparagine with sugars like in potato fries.
- Proteins treated at alkaline pH may cause reaction of lysine with dehydroalanine to form lysin alanine, which is toxic (e.g., Protein isolation at pH greater than 9.5)
- During smoking of meat, formation of polycyclic aromatic hydrocarbons is of concern (e.g. Ham, bacon). Similarly, generation of heterocyclic aromatic amines in grilling/ heating conditions can be hazardous to health.
- Fats, especially unsaturated fats, get oxidized during heating. They also help solubilize fat soluble vitamins and aid their absorption.



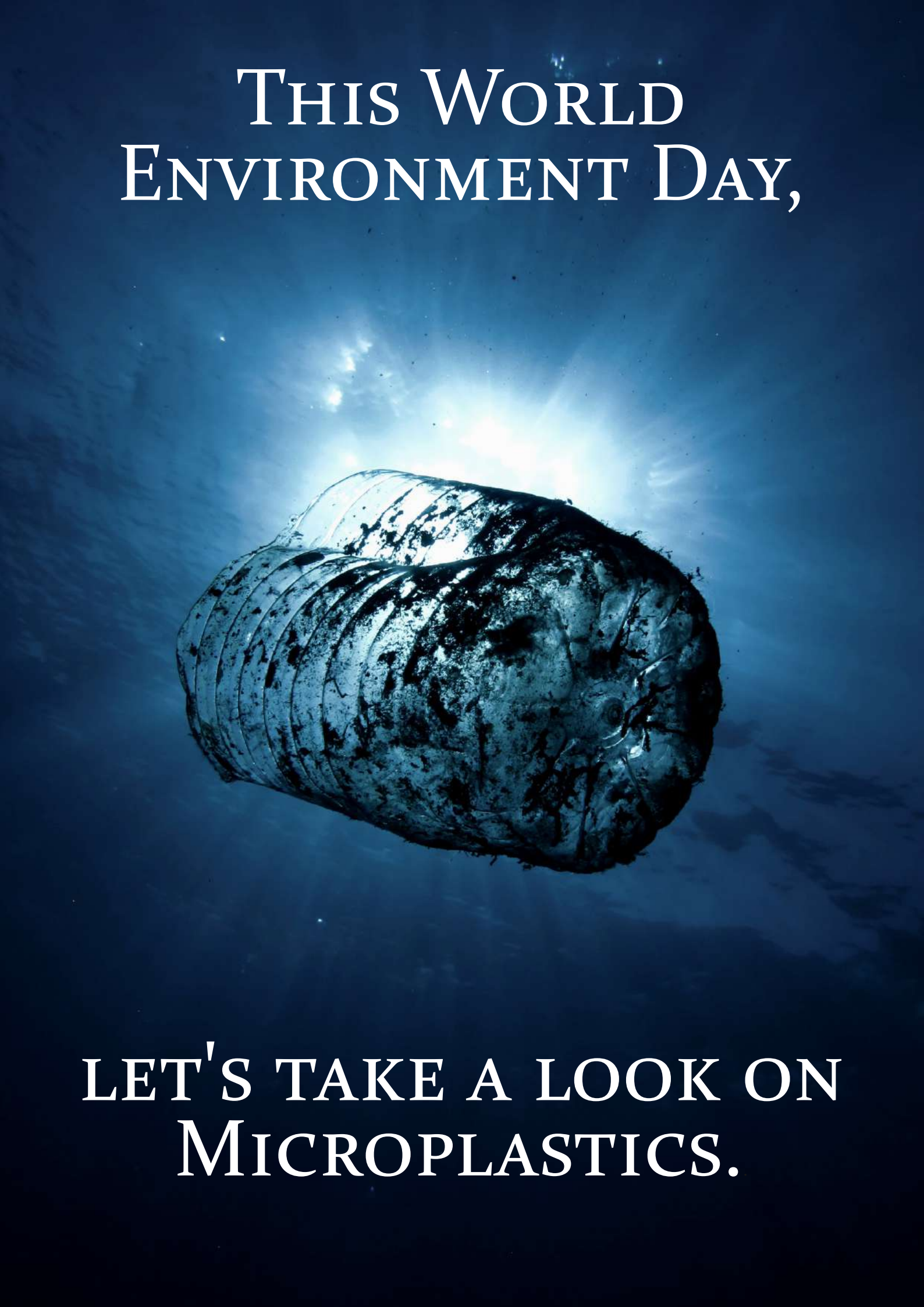
Oxidation reactions of lipids and proteins are required for flavour and texture but can be of concern for food safety (eg. Reheated frying oils with high PUFA contents).

- Several food additives are used for preservation, colour, flavour, emulsification and so on to retain the natural quality of food. Many of these additives are known to have a deleterious effect on the health of the consumer. Addition of phosphates that enhance texture, taste and shelf-life ¬cause weak bones, kidney damage, ageing problems and compromised immunity.

Moisture, temperature, pH and oxygen are the factors that affect the chemical reactions, microbial contamination, sensory attributes and ultimately, the shelf-life of foods. Controlling these factors help in preserve freshness and nutritional quality of the food product, even at ambient temperatures. Optimal packaging helps to preserve food quality through preventing water vapour or oxygen transfer.

Fresh fruits and vegetables are coated with waxes or dipped in specific solutions to reduce respiration and transpiration and increase shelf-life. All packaged foods in every country, including India, declare nutritional information on the product labels. Nutritional labelling enables consumers to make informed choices during purchase. Packaging too is of great importance in prevention of product deterioration during its shelf life. This knowledge of processed and packaged food becomes crucial as their market keeps on increasing, and one should know how their food is affecting their body.

This World Environment Day,



let's take a look on Microplastics.

The Omnipresent Microplastics

Sonakshee
B.Sc. Agriculture II Year

As the name itself suggests, microplastics are small fragments of plastics generally having a length of 5mm or less.

Though not very easily noticeable, recent studies express concern about the increasing ubiquitousness of this imperceptible pollutant. A new study also revealed the presence of high concentration of microplastics in mangroves and seagrasses at many places along the coast of water bodies throughout the world. These forests, also called *blue forests*, are home to many organisms who end up ingesting plastic specs while they seek food, and it harms them in various ways and may even lead to their death. Exposure to microplastics is not just limited to plants or animals, according to the environmental scientist **Albert Koelmans**, few limited studies about microplastics' presence in the environment suggests that humans might be ingesting around dozens to thousands of plastic specs in a single day. Right from the packed water or the veggies that we buy from the supermarket, to the dusty air that we sometimes inhale, microplastics have been found everywhere.

There are limited studies on effect of microplastics in aquatic animals, which show reduced reproductive ability and some physical damage, but this can never be accurate owing to the vast range of size and composition in which the microplastics exist. There aren't enough studies yet to suggest what affect it might be having on humans, but it's clear that a non-biodegradable foreign particle definitely isn't going to do any good.

There have also been instances of plastic specs raining down along with water in the remotest of the regions, full of mountains and snow which don't even have any settlements nearby, this shows the extent of omnipresence of microplastics.

Around **400 million** tonnes of plastic are produced every year, suggesting that this problem is only going to increase by each passing year, and even we somehow manage to reduce plastic production significantly, we'll still have enough plastic in our landfills, degrading, breaking and getting ready to contaminate air, water and soil for the decades to come. If things aren't controlled while we still have time this may lead to a grim situation and we won't be able to stop Earth from becoming ***the plastic planet***.

Life in the Rife of Microplastics

Aadhya Chekoti
B.Sc. Forestry I Year

Microplastics as we all know is the pressing issue all around the world for its adverse effects not only on marine life but also on our human bodies. Microplastics are generally smaller than 5mm in size that originate from various sources as bigger plastics break down with the action of wind, sun or ocean waves just like the process of weathering.

Microplastics are everywhere! Starting from the aquatic animals to the human fetus as well. Microbeads in cosmetics too are microplastics which are used to give a slippery, soft feel in primers and foundations and also act as a bulking agent in various other cosmetic products. Apart from external application and effects of microplastics, the most appalling fact is that they've managed to enter even the human placenta through air and water!!! This affects the foetal health and development drastically affecting several cellular regulating pathways including the infant's immunity. "We are what we eat" is something we all know.


Photo: Unsplash

But have you ever imagined we would soon be a product of the plastics we consume? Food like apples too have the highest microplastic count. Approximately, 195000 microplastics per gram. Nanoplastics are being absorbed even by plant roots making our food so toxic. These parlous plastic wastes enter the food chain as soon as plankton organisms and mollusks consume them that sooner or later get carried higher through the food chain gradually collapsing the whole ecosystem with its perilous effects.

The question now arises, *how do we prevent microplastics from escalating any further?* The answer lies in our daily routine. We can avoid microplastics to a great extent when we stop using disposable items right away and switching to organic food. Also, being selective of the products we choose must be sustainable and eco-friendly. It indeed is the worst of times but is also the best of times because we still have a chance.

Contact us at:
Department of Forestry,
DBS School of Agriculture and Allied Sciences,
Doon Business School Group.
Address: Mi-122, Behind Pharma City, Selaqui
Dehradun, Uttarakhand-248001
E-mail: *thegreenarchive@doonbusinessschool.com*