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ECOSYSTEMS AND LIFE: *On Land*



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Letter from the Editor-in-Chief

The Roots of Life



By: Maissa Azab

Over the course of the past two years, we were completely besieged and inundated with the life-changing global experience that has been the COVID-19 pandemic. In reality, we are not completely in the clear yet; however, life has returned to normal in most ways, which is good news on several fronts, but unfortunately very bad on many others.

Indeed, it is great to be able to go out and about, and have the opportunity to mingle and travel; yet, should we go back to our oblivious ways of disregarding anything that does not belong to or impact us directly? Are we going back to our old ways of not paying attention to the bigger picture? Will we again forget about other species sharing our planet? Will we continue invading territories that are not only the habitats of other creatures, but are actually the lungs, heart, brain, and every other vital organ of our planet, our one and only home?

Pandemic, fear, lockdown, social distancing, and all the fallout from all this have had an impact on each one of us; physically, psychologically, socially, and economically. Many of us who had been previously completely immersed in the daily churn of modern life have seen the fault in our ways, but maybe not enough people. To be honest, I was hoping that more people, businesses, organizations, and governments would come out of the COVID-19 tunnel with a renewed respect to nature, wildlife, and the health of our planet as a united being. From what I see, it looks

like most are rushing back to the old, familiar paths, which have been leading us to major environmental calamities that have been devastating many regions of the world and will eventually have an irreversible print on the whole planet.

With that in mind, *SCiplanet* Team believes it is a good time to pause and reflect on the bigger picture; the greater canvas of life. Let us remember the glory of our intricate planet with its mesmerizing tapestry of incalculable ecosystems and lifeforms on land and under water. We dedicate the two special issues of 2022 to this overarching theme, which is truly at the core of everything. We marvel at the wonders of life, explore some of the impact mankind has had on nature, and look into possible ways of redeeming ourselves.

As always, we wish you an enjoyable and hopefully inspiring reading experience. Please also do not forget to visit our online magazine at www.bibalex.org/sciplanet, and follow us on Facebook, Instagram, and Twitter.

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ANIMAL AND PLANT LIFE

Humans are an integral part of nature; our fate is tightly linked with biodiversity: the huge variety of animals and plants, the places they live, and their surrounding environments, worldwide. We rely on this rich diversity for the provision of essentials we simply cannot live without.



Restoring Degraded Land Ecosystems: A Feasible Miracle!

By: Marwa Gaber
Head, Events Unit,
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Land is a complex and dynamic bio-physical system that maintains essential planetary functions and vital ecosystem services, including biodiversity maintenance, water and nutrient cycling, climate regulation, food, fiber, and fuel production, as well as providing space for human habitation and other development activities.

Today, 25% of the total land area across the globe is degraded due to various direct and indirect drivers—industrialization, rapid urbanization, intensive agricultural activities, climate change, etc. While 3.2 billion people are directly affected by land degradation, especially smallholder farmers and rural communities, millions more are affected by food insecurity, higher food prices, climate change, environmental hazards, and the loss of biodiversity and ecosystem services. Scientists have warned that 24 billion tons of fertile soil is lost each year, largely due to unsustainable agricultural practices. If this trend continues, 95% of the Earth's land areas could become degraded by 2050 (*Global Environment Facility*, 2019).

The international community has been trying to combat land degradation and desertification for decades, but

challenges remain. Restoring and protecting land requires involving many different stakeholders to co-design solutions that are socially, economically, and environmentally sustainable. In this article, success stories from all over the world will be shared to inspire more people and communities with possible ways of land restoration.

The Center for International Forestry Research (CIFOR) is a non-profit, scientific institution that conducts research on the most pressing challenges of forest and landscape management around the world. CIFOR envisions a more equitable world where forestry and landscapes enhance the environment and well-being. It has worked in several countries in different parts of Africa to shine a light on the efforts of communities, some of them decades-long, in restoring degraded forests and landscapes.

In South Korea, a reforestation program nearly doubled the country's tree cover, improving air and water quality, and providing habitat for wildlife. These benefits are worth an estimate of over 92 billion dollars, which is equivalent to 10% of the gross domestic product (World Resources Institute, 2014).

Such a tremendous change happened through launching a strong forest protection policy by the South Korean Government that, among other things, declared illegal logging a serious crime.

The policy also included an increased use of coal, which further contributed to forest recovery efforts by reducing the demand for firewood. Moreover, economic growth and urbanization further contributed to reforestation efforts. The migration of rural populations into cities resulted in a drop in firewood consumption and an increase in the volume of growing forest stock. Finally, local governments encouraged villagers to build tree nurseries and sell seedlings for the reforestation program.

Planting a variety of tree species during the Program laid a foundation for changes in biodiversity. Several tree species were planted for erosion control; they also provided habitat for forest species. Studies have proven that, as forests developed, the density of mammal, microorganism, insect, and bird species has shown a constant increase, indicating an increase in forest biodiversity in general.

In Niger, an agroforestry practice restored over five million hectares of degraded farmlands when farmers allowed trees to regenerate alongside their crops. The addition of 200 million trees to their landscape mosaic has increased farm yields and household incomes; it also benefited the climate and biodiversity (World Resources Institute, 2014). The use of such practice, which entails integrating forest trees into agriculturally-productive landscapes, has succeeded; the trees act as a natural fertilizer, fixing atmospheric nitrogen in the soil through its roots, and helping the crop yields to increase.

In Central Uganda, some districts that were once forested landscapes have been degraded by farming and illegal logging. Planting projects were implemented in the Central Forest Reserve, which lies adjacent to the villages. Through the project, more than 50,000 trees have been planted on 33 hectares of degraded forest reserve, with high seedling survival rates, at around 80%. These forests offer a natural habitat for natural wildlife, enrich the soil, save and filter water, and help mitigate the greenhouse effect by acting as a carbon sink.



Tree planting in Uganda.
Credit: en.freejpg.com.ar

In the Sahel region of Burkina Faso, degradation and desertification are quite serious issues, where around 470,000 hectares of land are degraded each year, through a combination of natural and human factors. Trees are felled for firewood, which provides around 80% of the country's domestic energy needs, and to make space for agriculture. As desertification increases, many farmers let their cattle roam freely to enable them to find sufficient food, which retards regeneration further.



Women drying their beans. Credit: Thomson Reuters Foundation/Christopher Bendana

As the climate changes, droughts are becoming more prolonged and the weather more unpredictable; formerly arable farmlands are transforming into desert, with devastating human and environmental consequences. Activists in the region, boosted by support from civil society and the government, have constructed stone bunds, which helped reduce the risks of run-off and erosion, and contribute to effective rainwater harvesting. Such practices have resulted in around 200 hectares of total restoration in the area.



A family grows millet in northern Burkina Faso. Credit: © Marco Simoncelli, Davide Lemmi

In southern Senegal, a coastal village once covered in lush mangrove forests, had turned into a desert, completely bereft of vegetation. Communities living in such village struggled to grow food crops, because erosion from forest loss had caused the salt content in their rice fields to rise. This is a common story for villages in the region; as a result, around 40% of all cultivable land in the area was suffering from salinization, making villagers' food supplies and livelihoods more precarious.

A local NGO has succeeded in educating the villagers on the need to urgently restore the mangroves in order to regain the productivity of their rice fields. They managed to collect

around 65,000 seeds for the villagers to plant; they also planted about 700,000 *Avicennia* and *Rhizophora* mangrove cuttings in the area. As the project grew, it gained increasing attention, including from the private sector, where several companies have funded the planting of millions of mangrove trees in the region.



Local women working on the mangrove forest restoration program. Source: livelihoods.eu

As a result of the reforestation work, 100% of the rice fields in the region have been restored from salinization, and fish stocks have been boosted by up to 18,000 tons per year. Around 300,000 people across 350 communities have participated in the reforestation efforts so far—most of them women—who particularly benefit from the economic boost. So far, 15,000 hectares have been replanted under the program, and the work continues: it is the largest mangrove replanting effort in the world.

At the end, looking over all the success stories shared, we can conclude that leadership, social capital, cooperation, and supportive governance are important for successful community-based restoration. In order to scale land restoration efforts further, there is a need to develop successful models, and to share knowledge and resources across the whole world.

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KEYSTONE SPECIES

AND THEIR ROLE IN ECOSYSTEMS

By: Ahmed Adel

Keystone species are those that help maintain the balance and survival of an ecosystem; without them, the ecosystem would drastically change, or it would completely disappear. As the name implies, these species are the keystone the ecosystem is based on; they are particularly important because, if they disappear, no other species can replace them. Keystone species are usually predators, but they might also include fungi and plants.

The term “keystone species” was first coined by the American biologist Robert Paine in 1966. In one of his studies, he noticed that excluding the starfish from an aquatic ecosystem caused imbalance. In the absence of starfish, mussels and other species prevailed, and then benthic algae, which support many species, declined. One year later, it was noticed that biodiversity deteriorated in the area.

Grey wolves in Yellowstone, USA, are another example of the significant role that keystone species play. These wolves partially control the populations of elk, bison, rabbits, and birds species in the Yellowstone ecosystem. The feeding behavior of these preys and the places they choose for their nests and holes are largely affected by the wolves behavior.

In the late nineteenth century, the American Government designated an area for the Yellowstone National Park, where wolves mainly fed on elk and bison. The Government feared wolves would negatively affect these local herds, so it opted for the elimination of wolves on the State level; the last cub in Yellowstone was killed in 1924. As a result of eliminating the keystone predator at Yellowstone Park, elk

reproduced in great numbers, and herds competed for food, which led to the deterioration of grass and plant growth. The overgrazing caused by elk negatively influenced other species, including fish and songbirds, since they depend on plants and their products for survival.

Additionally, the natural geography of the ecosystem was influenced by the absence of wolves and the subsequent overgrazing. The river banks eroded due to the failure of wetland plants in consolidating the soil. Also, the temperature of lakes and rivers arose due to the failure of trees and shrubs to provide shade. With the beginning of the 1990s, the American Government started to reintroduce wolves to the Yellowstone ecosystem; the outcomes were noticeable. Elk numbers shrank, willow plants grew taller, and the numbers of beavers and songbirds increased.

In addition to predators, there are other types of keystone species that are essential for their ecosystems; they are known as ecosystem engineers. These are species that construct, destruct, or maintain natural habitats; the home or environment of a given animal or plant. Ecosystem engineers create unique conditions that provide benefits to other species, such as a suitable habitat or a food source. Although the activities of some ecosystem engineers might cause damage to the environment, the vast majority of them are supportive to the survival of other species. Example of ecosystem engineers include elephants. Being herbivores that mainly feed on grass and shrubs, they limit their growing areas to make it possible for the growth of other plants that support grazing animals, such as antelopes and zebras.

Another example of keystone predators that preserve their ecosystems is otters; they sustain the population of sea urchins that feed on seaweeds and algae. Otters keep sea urchin numbers under control, which allows for the sustainable growth of seaweeds; as such, the system remains balanced and able to host a diverse set of marine species. Back to terrestrial settings, fire ants are key predators of arthropods that could damage agricultural crops.

It is worth-mentioning that there is another interaction that is particularly important to maintaining ecological balance; namely symbiotism or mutual benefit. In this interaction, the change that occurs to a specific keystone species would not only affect other species, but also the ecosystem as a whole. In South America, there is symbiotic interaction between a species of hummingbirds and local plants. The birds pollinate the plants and the plants provide them with sugar nectar, which is the main food source of hummingbirds.

There are no species that pollinate these local plants other than these hummingbirds; so, if they are not there, the plants would be critically endangered.

In conclusion, keystone species are particularly important to sustain the structure and function of their ecosystems on the long term.

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 Banner Image: abadonian/Getty





ANIMALS AND BIRDS LOST DUE TO OVERHUNTING

The world is governed by precise measures that make it perfectly balanced. Wild beasts feed on smaller herbivores, and plants make their own food with the help of sunlight, the world's eternal source of energy. However, humans have interfered with the innate nature of the life cycle in many ways and for different purposes, causing an evident environmental imbalance. Hunting has always been a main human activity since the beginning of time. It has been a source of food and clothing, and a means to protect some animals and plants from wild predators. It has also provided mankind with expensive furs, ivory tusks, and other precious animal products.

Yet, overhunting of specific species has not only led to a drastic decrease in their numbers, but also to their extinction. This has been particularly true in past centuries when overhunting or hunting of specific species was not banned by law. Now, let us go through some examples of animals that have gone extinct due to overhunting.

The Tasmanian Tiger

The Tasmanian tiger, also known as the Tasmanian wolf, was a carnivorous mammal with a unique shape. Its head was similar to that of a dog or wolf, while its body was striped like cats; it also had a pouch like kangaroos. Before overhunting led to the extinction of the species, the Tasmanian tiger lived only in Australia and nearby islands. Farmers used to kill Tasmanian tigers to protect cattle against their attacks. They were also an important source of fur, on which some companies directly depended for manufacturing fabrics. The last Tasmanian tiger died in Hobart Zoo, Australia, in 1936.

The Dodo

The bird known as the dodo became extinct in the mid-seventeenth century; only one century after it was first discovered. It was endemic to the Island of Mauritius, East of

Madagascar. Mauritius was never inhabited by predators, so the dodo neither developed defensive skills nor went through any kind of evolution when it was discovered by the Dutch in the sixteenth century. As a result, the explorers and the animals they brought to the Island found the dodos an easily obtained source of food.

Passenger Pigeons

Can you believe that passenger or wild pigeons used to make up more than one-quarter of all birds in the USA? Nevertheless, they went extinct in the early twentieth century. It was possible to observe flocks of billions of them; however, due to this abundance, USA residents depended on it to feed the slaves and the poor. Passenger pigeons were hunted in huge numbers that they shrank to a very limited population by the beginning of the nineteenth century. The last passenger pigeon died in Cincinnati Zoo, Ohio, in 1914.

Steller's Sea Cows

The Steller's Sea Cow is a huge mammal that looks like a seal. It was only a few years after the discovery of this species that it went extinct. As soon as a Russian expedition had discovered these sea cows in the Bering Sea

(part of the Pacific Ocean) in 1741, its exploitation and hunting rates doubled seven times. Demand for their high-fat meat was so high that hunters killed them with arrows and let their bodies drift to the beach. Consequently, the species went extinct in 1768.

The Bubal Hartebeest

The bubal hartebeest is a vertebrate that looks like an antelope; it used to live in the semi-arid regions of North and Central Africa. The bubal hartebeest was a popular catch for European hunters in the early nineteenth century, and was also sent to zoos in America and Europe. As a result of overhunting, the last bubal hartebeest died in a Parisian zoo in 1923. There is also an embalmed bubal hartebeest carcass in Philadelphia, USA.

God designed the world to run according to a balanced system. Yes, hunting is allowed, but within acceptable limits. Exceeding the limits has driven some species into extinction, causing imbalance to the whole system. Despite the efforts exerted around the world to minimize overhunting and secure endangered species, many areas still suffer from hunters who do not realize or ignore the harm they are causing the environment.

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Invasive Species:

Unwelcomed Intruders

By: Jailane Salem

Our planet is made up of a wide variety of different ecosystems; all with their own unique structures and biodiversity. Many different parts make up an ecosystem, including biotic and abiotic factors; the biotic factors are the living parts and the abiotic factors are the nonliving parts. Animals, plants, and other living organisms are biotic, while weather and rocks are abiotic factors; all factors in a particular ecosystem are crucial for its survival. Whether that connection is direct or indirect, they are all pieces of a puzzle that fit together to create the picture and if one piece is removed or lost it affects the whole. So, what happens if a non-indigenous biotic factor is introduced into an ecosystem? How much of a danger can it really pose? Can a non-indigenous ant wreak havoc over an ecosystem? The answer is a resounding YES!

Such invasive non-native or non-indigenous species are known as Invasive Alien Species (IAS); any non-native species that becomes established in an ecosystem and then becomes invasive can negatively impact its biodiversity. In the past, before human movement was possible, species developed separated by natural barriers; however, with the advances in human development, as movement became easier and easier, many IAS have either hitchhiked along human companions to far-away places, or were introduced intentionally by humans to new ecosystems. Various factors can play a role in IAS flourishing; if the new habitat is similar to its original one or if the new habitat lacks a natural predator that can keep its numbers in check, this allows it to not only survive but also thrive at the cost of indigenous species, which translates to loss of species and biodiversity. Once an IAS is established in a new ecosystem it is difficult, sometimes near impossible, to eradicate.

The issue of IAS is on the rise globally; a study in the journal of *Nature Communications* has found that more than one-third of IAS occurrences in the past 200 years has taken place after 1970. This is no surprise, since that parallels the rapid explosion in global movement, of both people and goods. The more roads and routes that connect different parts of the world together, the more occurrences of IAS, which is unfortunate because IAS are one of the main causes of species extinction, as well as loss of unique biodiversity around the world.

Marine IAS are especially a huge concern. Marine life such as crabs, algae, barnacles, and mussels can easily hitchhike around the world by attaching themselves to ship hulls, a process known as biofouling. If they survive the journey, then it can spell trouble to other parts of the world where these species are not indigenous. This is why the global shipping industry poses

a great risk to marine life. However, it is not only big cargo ships that can fuel the spread of IAS; it has recently come to light that non-trading vessels, fishing vessels, and recreational vessels could pose a greater risk of introducing IAS to marine ecosystems around the world. This is because they stay stationary for longer periods of times, which allows organisms to attach themselves better; they reach more areas and spend more time in coastal waters.



A recent study tracking vessels that visit Antarctica highlighted that ships from around 1500 ports around the globe visit the area. Arlie McCarthy who was the lead researcher explains why this is of concern: "It means that almost anywhere could be a potential source for invasive species... They can create entirely new habitats that would make it harder for those amazing Antarctic animals to find their own place to live... This is the last place in the world where we do not have marine invasive species... So, we [still] have an opportunity to protect it".

As native species have been isolated for millions of years, the threat of IAS is much greater. If they find their way to the waters of Antarctica, the biodiversity there might lose many completely unique species. This is why the British Antarctic Survey is calling for an improvement in "biosecurity protocols", as well as stepping up environmental protection measures in order to protect the biodiversity of Antarctic waters. This is key given that climate change is affecting water temperatures, which might make the Antarctic waters more habitable for IAS. It becomes absolutely necessary to inspect ship hulls and clean them frequently and thoroughly as a preventive measure.

While the threat of IAS finding their way to the Antarctic waters is something being studied to prevent it, there are many examples where IAS did reach destinations where they adversely affected the biodiversity. Remember the havoc wreaking ant? Well, that was not hypothetical; it is aptly named the "crazy ant", also known as *Anoplolepis gracilipes*. This species of ants has created incredible damage to the ecosystems it has invaded in tropical places such as Seychelles, Zanzibar, the Christmas Island and Hawai'i. On Christmas Island, crazy ants have been able to form super colonies and are able to forage in all types of habitats.

These yellow crazy ants are believed to have been introduced accidentally to Christmas Island by a visiting ship in the early 20th century. What makes the presence of yellow crazy ants so alarming? How can such a small organism destabilize a whole ecosystem? Well, they have a lot of attributes that make them one of the worst IAS around; they are

very aggressive and are known to out-compete others to dominate food resources. They defend themselves by spraying formic acid, which can kill other species. They are able to establish super colonies that have billions of them; without a natural predator to keep their numbers in check, they have run rampant on many parts of the Island.

A victim of yellow crazy ants is a type of crab known as the red land crab, which is important to Christmas Island's ecosystem. These crabs help maintain the rainforests health by eating leaf litter and then returning vital nutrients back to the soil. Without its help in breaking down the litter, and helping in forest composition, the health of the rainforests can greatly suffer, which in turn causes other species to lose their natural habitat.

Since the early 1990s, after the explosion in yellow crazy ant numbers, around 40 million red crabs have been killed by them. The crabs have an annual mass migration that sees them pass through crazy ant super colonies where they are overwhelmed by the huge numbers of ants. The ants spray formic acid into the crabs' eyes and then into their joints to paralyze them and eventually kill them. At the rate in which they were dying, it was feared that the red crab could face extinction in the wild, which was why authorities decided to intervene to try and fight against this insidious IAS.

One of the ways to fight against IAS is through biocontrol, where another non-native species that is a natural predator to the IAS or one that competes for its resources is introduced to try and control the spread of the IAS.

This method has backfired in some cases where the introduced biocontrol species became themselves an IAS. However, in this instance, researchers have said that there were more checks and balances in their project to prevent that from happening. Their project entailed the introduction of a small wasp that feeds on scale insects, which is the food source that fueled the yellow crazy ants' establishment. Researchers from La Trobe University and Parks Australia have bred the wasps and slowly introduced them to different sites across Christmas Island. So far, early signs have shown positive indicators that the numbers of yellow crazy ants are waning; however, until the number of red crabs on the Island stabilizes and shows signs of flourishing, the project cannot claim victory over the crazy ants just yet.

As shown above, the impact of IAS can be quite drastic; they can affect not only other species and their habitats, but also human health by introducing diseases, as well as people's livelihoods and food security by destroying crops and the economy. IAS cost money, not only to prevent their spread but also to manage their damage; it is estimated that they cost the world economy billions of US dollars annually.

One of the most cost-effective measures to address IAS is prevention, like what the researchers are trying to do in Antarctica. This can be achieved by creating well-resourced biosecurity measures, early warning systems, and raising awareness around the dangers of IAS so that the public too can take part in prevention. Where prevention is no longer an option, there needs to be concerted efforts in curbing the effects of IAS, like what the researchers are trying to accomplish in protecting the red crabs of Christmas Island. IAS is an issue of global concern and will therefore need a global multi-sectoral effort to address.



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GALAPAGOS ISLANDS

By: Sara Khattab

If you are an adventurer and a nature lover, you have to add the Galapagos Islands to your bucket list. In addition to the lack of natural predators and friendly wildlife, these Islands are teeming with a diverse array of endemic plants and animals. This means that they are not found elsewhere in the world, thanks to the geographical isolation of the Islands from other places.

Located 1000 km off the Ecuadorian Coast in the Pacific Ocean, the Galapagos Archipelago is made up of 13 major Islands, seven smaller and about 125 islets. These Islands are considered one of the most volcanically active areas in the world. Repeated seismic and volcanic activity helped form the rugged mountain landscape of the Galapagos Islands. There are still active volcanoes across the Islands, which affect the Islands and make them in a state of change with new Islands emerging or sinking.

According to UNESCO, the Galapagos Archipelago is considered one of the most unique, scientifically important, and biologically outstanding areas on Earth. Galapagos is so biodiverse thanks to the different habitat zones that are found on the Islands. Environmental conditions helped form this unique ecosystem, and the climate affected the animals and plants.

There are many theories on the nature of the animals and plants on the Galapagos Islands. The most popular belief is that the original species that evolved to this unique ecosystem arrived to these Islands from the surrounding Islands on flotation rafts of vegetation and other wastes, or via wind, storms, and sea currents. It was easier for birds to reach the Islands than reptiles or mammals, which can take days or even months at Sea, and many of them did not survive.

Endemic Species of the Galapagos

Land Iguana



One of the famous endemic species on the Galapagos Islands is the “Galapagos Land Iguana”, which is considered one of the largest lizards in the world. It can grow up to 1.5 meters in length and can weigh up to 13 kg, depending on the Island it is living on. It is yellowish in color with black, white, and brown splotches; it has a short head and powerful hind legs, with sharp claws on their toes. Even though it

may look scary, they are herbivores that feed on pear leaves and fruit. They can be seen all the year round on the Islands and have a symbiotic relationship with the birds, which remove parasites and ticks from the Iguana's body, providing food for the birds. The main threat facing the Galapagos land iguana is volcanic eruptions or periodic droughts.

Flightless Cormorant



Another endemic species is the “Flightless Cormorant”, also known as the Galapagos Cormorant, which is most famous for not flying. It is the only species out of 29 cormorant species that cannot fly; its stunted wings are one-third the size of the wings required to fly. The keel on the breastbone, where birds attach the large muscles needed for flight, is also greatly reduced. The flightless cormorants still use its wings for balance while jumping from one rock to another. They range 90–100 cm in length and can weigh up to 5 kilograms,

making them the heaviest cormorants in the world. The flightless cormorants tuck in their wings and dive into the ocean to get food, such as octopus, eel, and rockfish.

The Laboratory of Evolution

For more than 180 years, scientists have studied this rich ecosystem and its species. Among all the scientists, the Galapagos Islands were of great importance to Charles Darwin; it was the place that gave him the main idea of evolution by natural selection. In 1835, Charles Darwin visited the Islands to study the rocks and volcanoes. While collecting geological and biological specimens, he moved from one Island to another.

Meanwhile, he noticed that some species, such as the finches, mockingbirds, and tortoises, differ on each Island. He started to take notes about these species that later contributed to his groundbreaking *Theory of Evolution* by natural selection. Darwin studied the pattern of evolution of some species due to their adaptation to the different environmental features of each Island. Since his trip was short, Darwin had to take back with him some species to study them extensively back home.

Darwin's Finches



The Galapagos finches, also known as “Darwin’s Finches”, had a great influence on Darwin’s *Theory of Evolution* as they have been able to adapt to the different environments on the Islands. These finches make up the largest population group on the Islands. Darwin noticed that their beak types, shape, body size, and feeding behavior are different from one Island to another. They evolved to have different beaks according to the type of food available on the Island they lived on. For example, the Finches that

ate large nuts had strong beaks to be able to crack them, while the finches that ate fruits had parrot-like beaks.

Giant Tortoises



Darwin also found that there are different shapes of the Galapagos giant tortoises depending on the Island they lived on. Each kind of tortoise adapted for different feeding habits needed on low arid Islands and high lush Islands. On the dry Islands, Darwin found that the tortoises are saddle-backed with longer necks and limbs. This made it easier for them to lift their heads high to reach higher vegetation, such as the cactus. While on the Islands where there is plenty of vegetation and water, Darwin found that the tortoises are dome-shaped; their shells are more rounded and their necks and limbs are shorter. They do not need extra height due to the abundance of grass close to the ground so they do not raise their heads to eat.

Threats and Conservation Efforts

Over thousands of years, wildlife—plants and animals—formed their own unique ecosystems without any influence of outside forces until the Islands underwent many changes, especially since the arrival of humans to the Islands. With the increase of the population, the demand for food also increased, causing an increase in fishing, poaching, hunting, in addition to an increase in the use of wood. Moreover, more land was used for people to build homes. Even though the Galapagos Islands depend mainly on tourism, however, tourism should be managed carefully.

In the past, some animals came with the tourists during their visits to the Islands; immigrants also brought animals for agricultural purposes. That was a

threat to the native species on the Island. Before the increase of human activity on the Islands, it was estimated that around 250,000 giant tortoises had lived on Galapagos Islands; now, there are only 15,000–20,000 tortoises alive. The tortoises are protected by the Ecuadorian law and the Ecuadorian Government created the Galapagos National Park to protect all the species habitats on the Islands.

Many actions have been taken to control and eliminate the risk of any invasive species entering the Islands. Currently, a species of parasitic fly named *Philornis downsi* is posing a big threat to the Galapagos wildlife. The adult form of the fly has no dangerous impact; however, the larvae of this fly feeds on the eggs and hatchlings of many species of Galapagos land birds. This has also led to a decrease in the population of many Darwin Finches. There are many initiatives and projects that aim at studying the biology of this fly, to effectively control and minimize its impact on the Galapagos birds.

Preserving and protecting the Galapagos Islands is an ongoing battle. Since Galapagos Islands are so biodiverse, any small effort in the conservation process makes a big difference.

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How Does Light Pollution Affect Biodiversity?

By: Zahraa Abo-Eleneen

Electric light is regarded, without doubt, as one of the greatest human inventions for its significance in our lives, especially at night. Yet, like other inventions that people overuse, human health and the environment, including the behavior of wildlife, have been affected negatively.

If you look at pictures of Earth from space, you will see remarkable light pollution. Areas such as America, Asia, Europe, and the Middle East, are glowing with light at night, while remote regions, such as the Amazon and the Sahara, are in complete darkness. The distribution of light on the map shows that densely populated urban areas are more light-polluted because of electric lights, outdoor advertising, cars, factories, and buildings.

Residents of these areas live after sunset as much as they live in broad daylight thanks to artificial lights. It is normal for the body to produce melatonin when it gets dark; yet, the presence of artificial lights inhibits melatonin production and decreases its percentages. This leads to sleep deprivation, fatigue, headaches, stress, and other health issues.

Artificial Light and Animal Behavior

As much as artificial light ruins the human circadian biological clock, it also ruins the natural body rhythms in animals. At night, animals are annoyed by incandescent light that confuses their biological clock; because animals are active during daylight hours, they do not get enough rest at night.

Studies show that light pollution is impacting animals' migration patterns, and causing their death too. For example, birds guided by moonlight during migration get confused, lose their way, hit buildings and lighted towers, and die. During their migration, birds rely on seasonal signals that are disoriented by light pollution; as a result, migratory birds miss out on weather-related adequate living conditions and finding food supplies.



Sea turtles also die as a result of light pollution. They lay their eggs on the shore and they hatch at night. These newly born turtles are supposed to recognize the bright horizon; however, they are drawn by artificial night lighting away from the ocean and definitely die. On the other side, insects are drawn

to artificial light and are instantly killed upon contacting light sources. Shortage in the numbers of insects, which are a food source for birds or other creature pollinators, affects the food chain.

Light Pollution and Natural Animal Habitats

Light pollution affects animal habitats formation. Moreover, some animals on roadsides can be temporarily blinded due to their exposure to car lights. This may hinder them from seeing their prey; thus, losing their ability to chase them and obtain food. Some animals may be afraid of light, hide, and do not try to find their food; resulting in an imbalance between prey and predators.

Nocturnal animals are supposed to sleep during the day and be active at night, but light pollution alters their nighttime environment by turning night into day. This is most evident in frogs, whose croaking at night is part of the breeding ritual, which is disrupted by artificial night lights.

Artificial light has several general effects on wildlife; it attracts some living creatures affecting their location, predation, or reproduction, and causing their death.

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Birders

By: Seham Elsherif

Three persons pursue the winner's title for spotting the highest number of birds in North America during one year. This is the plot of the American film *The Big Year*. The film tackles birders, or people who are so obsessed with birds that they move from one place to another to spot them, either through identifying their shapes or sounds.

There are different types of Big Year competitions; some are held at the USA level, some on the North American level, and some on the world level. In 2016, Dutch birder Arjan Dwarshuis broke the world record in birding by spotting 6852 bird species around the world; almost two-thirds of the known species. The idea of Big Year competitions goes back to ornithologist Frank Chapman. He reflected on the American habit to compete on hunting the largest number of birds in Christmas days, and suggested spotting the largest number of birds instead. This is a case in point on how scientists can influence human behavior positively.

Birders are different regarding how far they would go. Some simply love birds and enjoy watching them in natural parks, some equip themselves for birdwatching and spotting and take notes to increase their knowledge, while some would literally go far beyond in search for birds in distant places. Birding is a hobby that promotes one's communication with nature, a practice that relieves stress and raises environmental awareness; as such, it is an environmentally-proactive hobby.

Amateurs play a role in the conservation of nature; they assist scientists, researchers, and environmental

specialists by participating in birding events, a practice known as citizen science.

In February, the USA witnesses a backyard-bird-spotting event that continues for some days, held under the supervision of the National Audubon Society and Cornell Lab of Ornithology. The event takes place in February to study bird congregations before the migration season starts in March. People participate by spotting birds from their backyards or any other place of their choice for 15 minutes or more; they then submit their observations through the Internet. Scientists analyze the submitted data, which enables them to find answer to questions, such as what impact does climate change have on bird congregations and where do some species go when they disappear during the winter? They can also compare migration timings between one year and another, and how bird diseases impact migration. Moreover, scientists get insights into the differences between bird populations in urban, rural, and wild settings.

To start practicing birding as a hobby, you need binoculars, a telescope, and a field guide. The guide can be a set of flash cards carrying the most important birds, or a mobile application, such as *eBird*. In

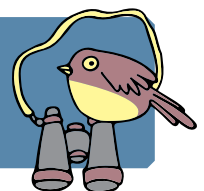
the beginning, try understating the birds you are familiar with, by identifying their sounds, shapes, and how they move and eat. Then, move to other birds, observing their colors, sizes, beak shapes, and tail lengths; use the guide to identify them.

Choose a suitable spot, such as areas with water bodies, where birds are likely to exist. It is also important to choose a suitable time, which would vary according to the target bird; worm-eating birds would appear in the early morning, while owls would appear at night. As for the season, it is determined by migration patterns; some birds show up in summer only, others in winter only, while some only in autumn or spring. Try always to take notes of the place and time you spotted a given bird; this would help you gradually acquire knowledge about birds.

Safeguarding birds is a priority, and hence, there are some rules and ethics birders have to abide by. Wild birds are protected by law: hunting, killing, harassing, and collecting them is prohibited; trading nests, eggs, or chicks is also prohibited. Birds must not be exposed to danger; hence, you must not take dogs along, since they put nests and chicks at risk. You must also respect the bird's privacy; keep an appropriate distance from it and its territory. Keep quiet; a bird's sense of hearing is stronger than a human's, so a bird might fly away if it senses any noise. You must also be acquainted with the signs of birds anxiety so as to avoid them. Last but not least, contact the relevant authorities if you witness any violations. If you spot a lost or an injured chick, do not take it home; also contact the relevant authorities.

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Oh, If I Could fly

By: Hend Fathy

Now that I am in my mid-thirties, I still remember and often sing a poem I studied in my third year of primary education, entitled *Āhy lāw konto ātir* (Oh, If I Could Fly). The lyrics went on like this:

*Oh, if like a little bird I could fly
I'd go so high, heading towards the sky
I'd embrace the serenity of trees and waters
And move about freely, under the Lord's eye.*

Perfect as the life of birds might seem, many in fact are facing serious threats. According to *BirdLife International*—a leading long-established international organization in the field of bird conservation—there are more than 11,000 species of birds out there. However, the numbers of birds are declining at a shocking rate. One in eight species is threatened with extinction, with 223 species classified by the International Union for Conservation of Nature (IUCN) as Critically Endangered.

Birds are of crucial importance to their ecosystems, and hence to life on Earth as a whole. Since birds are usually located on the high end of food chains, they are very useful in assessing the status of biodiversity in their habitats. Changes in bird populations in a specific region would indicate broad environmental changes in it.

Moreover, birds play a critical role in controlling the populations of insects in natural systems. Many serve as scavengers of the bodies of dead animals; they clean up wastes and turn them into nutrients that are essential to maintain life. This also prevents the spread of deadly diseases. Birds also spread seeds and pollinate around 5% of the plants that humans use for food or medicine.

The protection of habitats is a well-known measure in the conservation of wildlife in general, and birds are no exception. However, unlike most animals, birds are on the move as annual migration is an integral part of the avian life cycle. Birds regularly fly tens of thousands of kilometers in search for more

convenient ecological conditions, safer habitats, food, and mating grounds. They migrate, in Spring and Autumn, through established flyways, mostly from North to South and back, to take advantage of the booming insect populations and budding plants as the weather warms.

As their migration journeys cross borders, birds have made it possible to foster conservation efforts between governments, NGOs, and experts on the international level. As such, they have long cooperated to determine the areas or habitats that require protection, also known as Important Bird Areas, or IBAs.

Important Bird Areas (IBAs)

Important Bird Areas (IBAs) are sites identified as being of global importance for the conservation of bird populations on the basis of an internationally agreed set of criteria. The Program carrying the same name was launched in Europe in 1979, as a cooperation between the International Council for Bird Preservation (now *BirdLife International*) and another wildlife conservation organization. A working group was established to develop criteria of selection for such sites, and its first output was identifying 694 IBAs in Europe.

Very few years later, the IBA concept went beyond Europe when the Program began to identify priority sites for the conservation of European migrant birds on their wintering grounds in Africa. It then extended to many other parts of the world, as BirdLife International launched the standardized global criteria for determining IBAs. To qualify as an IBA, the site must comply to one of the four categories of the global IBA criteria (A criteria): the presence of globally threatened species (Criterion A1), range-restricted species (Criterion A2), biome-restricted species (Criterion A3), and large congregations (Criterion A4).

Subsequent regional and local inventories of IBAs were then developed around the world by Birdlife Partners and other



organizations. These inventories were compiled and curated in a central database maintained by BirdLife International. The databases helped in developing and guiding the conservation strategies of IBAs around the world. Local governments and NGOs in different countries started focusing their conservation activities on their identified IBAs, and efforts were mobilized to help protect, monitor, and manage them.

IBAs of Egypt

According to *BirdLife Data Zone*, the total number of bird species in Egypt are 378. Of them, 91% (346 species) are classified as Least Concern by the IUCN, meaning they are plentiful in the wild, 15 species are classified as Near Threatened, 12 as Vulnerable, and five as Endangered. The five endangered species are the Egyptian Vulture, the Bateleur, the Lappet-faced Vulture, the Steppe Eagle, and the Saker Falcon.

The majority of Egypt's bird species—297 out of 378—are migratory birds. Egypt is situated on internationally important migration routes for birds traveling between their breeding grounds in Eurasia and their wintering sites in Africa. It is the only land bridge between Eurasia and Africa. Hundreds of millions of birds pass through the country—northwards or southwards—in Spring and Autumn. Many of these birds spend Winters in Egyptian wetlands, making them internationally important wintering grounds for water birds.

There are 34 IBAs in Egypt, covering a total area of 36,174 square kilometers; 21 areas host globally threatened species (Criterion A1), nine areas host biome-restricted species (Criterion A3), and 24 areas host congregatory species (Criterion A4). Some of Egypt's IBAs are luckily within natural protectorates, such as Ras Muhammad, Nabaq Wadi Elrayan, Gebel Elba, and Zaranik. Other IBAs include fresh water bodies, such as the Aswan reservoir, Lake Bardawil, Lake Manzalla, Lake Burullus, Lake Idku, Lake Maryut, and Lake Qarun.

Threats and Conservation Efforts

IBAs in Egypt are facing a variety of threats, such as habitat destruction, pollution, and over exploitation of resources. Habitat destruction occurs mainly due to unregulated development, leading to losing the birds' natural habitats to land reclamation, overgrazing, among others. Pollution can occur due to uncontrolled solid waste dumping, as well as oil spillage accidents, which pose serious threats to seabirds. The over exploitation of resources can be exemplified by overhunting. According to the Egyptian Ministry of Environment, one million to two million birds are netted, trapped, and shot every Autumn along the Egyptian Mediterranean coast.

The Egyptian Government is currently developing the IBAs Conservation Program, aiming to monitor, conserve, and sustainably manage IBAs. The measures include increasing public awareness and promoting the involvement of local people, NGOs, and businesses in the conservation and management of IBAs.

One leading NGO in the field, which works hand-in-hand with the Egyptian Government, and is also a BirdLife Partner, is Nature Conservation Egypt (NCE). The Organization is carrying out promising programs, including "The Egyptian Vulture New Life: Securing the Egyptian Vulture Flyway", which addresses the conservation of one of Egypt's five endangered bird species.

The IBAs Conservation Program also aims at encouraging environmentally friendly economic activities, such as nature-based tourism, at the IBAs. According to the Ministry, nature-based tourism—such as birdwatching tourism—has been a flourishing economic activity in Egypt during the last few years, taking place in IBAs such as Zaranik and Saint Catherine in Sinai, as well as some Red Sea islands.



Birds, as diverse, pleasant, and vibrant as they seem, are truly impressive and they add an undeniable touch of beauty to our world. Perhaps you and I need to further explore the realm of birds and learn more about the amazing species around the globe, such as the Houbara bustard, the cassowary, the Victoria crowned pigeon, the green aracari... It is an endless list.

As a child, when the sky view was much wider from the balconies of our city, I always loved watching the patterns of flying bird flocks. Now, I still bless the precious morning encounters with pigeons resting on my ledge, and enjoy their soothing cooing. I wish, one day, I could have more of these pleasant neighbors.

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ANIMALS, TOO, HAVE SENTIMENTS!

By: Shahenda Ayman

“We have known for a long time, but scientists have just recently acknowledged that animals other than humans have emotions. Everyone who has a pet knows this, but scientists were afraid for many years of being accused of being anthropomorphic, of falsely attributing human characteristics to animals. Now the evidence is overwhelming that animals have emotions” from the book *Emotional Awareness: Overcoming the Obstacles to Psychological Balance and Compassion* by Paul Ekman, American Psychologist and Professor Emeritus at the University of California, San Francisco.

Have you ever wondered what a dog feels when beaten? Does it feel pain? Does it cry? Is wagging its tail really a sign of happiness or is it just a gesture that dogs do? Do animals really have feelings and show emotions like humans? The answer is: Yes; they do have feelings and they can experience emotions from simple ones, such as happiness and sadness, to more complex ones, such as empathy, jealousy, and grief.

Animals' life is very similar to ours; we both try to stay alive, have food and shelter, and raise our offspring. They know who their friends are and who their enemies are. Their lives follow the arc of a career like we do; they compete and have ambitions for higher status.

According to the dictionary, emotions are “feelings such as happiness, love,

fear, anger, or hatred, which can be caused by the situation that you are in or the people you are with”. In simple words, these are the feelings that we show in response to the different situations we face in life. For example, when you cuddle a baby, you feel happy, but if you have a fight with a loved one, you feel sad or angry.

Emotions produce a physiological response in us; you smile to show gratitude, your heart beats faster when you are afraid or excited, and you cry when you feel sad. These responses show others what we really feel. Long ago, Pythagoras (490 BCE), an ancient philosopher and mathematician, believed that animals possessed the full range of human emotions. Today, current research supports the idea that at least some animals experience a

variety of emotions, including fear, joy, happiness, shame, rage, compassion, respect, and more.

To meet the scientific standard for sentience, an organism must show itself capable of judging an experience as either positive or negative, and of retaining felt emotions. These are defined as measurable physiological or neural states that guide an organism toward adaptive behavior.

Researchers found that animal and human nervous systems react in similar ways in fearful situations. This indicates that many emotions in animals physiologically mirror those in humans. Also, when observing the hormonal activity in both animals and humans, they found that they respond in the same way when facing the same situations.

For example, in stressful situations, the adrenaline hormone immediately increases reducing the blood supply to all organs that are not absolutely needed in an emergency. At the same time, the blood flow is increased to important organs such as the brain, heart, and lungs. The hormone Noradrenaline provides increased alertness, and cortisol provides the energy to deal with stressful situations. Other hormones, such as dopamine, serotonin, and

oxytocin, play important roles in joy, enthusiasm, and social bonding.

Many people think that empathy is a special emotion in humans only. Nevertheless, many animals express empathy for each other. Empathy in animals spans species and continents. They show empathy toward humans and to other animals in a multitude of ways, including comforting, grieving, and even rescuing each other from harm at their own expense.

There are many stories about elephants finding lost people. One of which is about an old woman who could not see well and got lost; she was found the next day with elephants guarding her. They had encased her in sort of a cage of branches to protect her from hyenas. That behavior may seem extraordinary to us but it comes naturally to elephants.

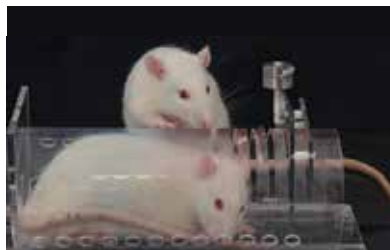


Lawrence Anthony, a conservationist who founded the Thula Thula Reserve with African elephants, gained a reputation for being able to comfort elephants when they arrive at the reserve. In his book *The Elephant Whisperer: My Life with the Herd in the African Wild*, he stated that he learned how to communicate with the elephants by observing how they communicated with each other. When he died of a heart attack, elephants traveled to his home seemingly to pay their respect. His son said that since his father's death, the herd has come to his house on the edge of their reserve every night.

Another example is humpback whales who help seals from being hunted by killer whales. There is a documented account of a humpback sweeping a seal on its back out of the water to protect it from the killer whales. These things seem new to us because we have only documented these incidents recently; however, they have probably been doing these kinds of things for millions of years.



Rats join the empathy team even if many do not picture them when they think of empathy, but a recent study proves that rats empathize with their friends. The experiment showed that when one rat was soaked in water, another rat quickly learned how to operate a lever that would allow the rat to escape to a dry area. What is more impressive about this experiment is that the rats gave up a treat that would have dropped if they did not pull the lever to help their fellow rat. This suggests the well-being of their friend was more valuable to them than food for themselves. If the suffering rat was not present, the other rat accepted the treat.



When you think about emotions in other creatures, you may be astonished to know that bees appear in the list. In 2016, scientists discovered that bees are happy when given a treat through testing their reaction after being given a sugary treat. They first trained the bees to associate particular areas and colors with sugary water or plain water. Then, they gave some bees sugary water, some plain water, and opened up a new space with a new color. Bees given the sugar visited the new area quicker than those that were only given normal water, suggesting that they were more optimistic about the possibility of getting a sugary treat. Both those given plain and sugary water took the same amount of time to visit the known areas. After a treat, bees also recovered quicker and started feeding sooner after a simulated predator attack.

Long ago, research strongly suggested that fish behavior is guided by emotion; when observed, researchers found that it avoided dangerous locations based on previous experiences in which it faced negative stimuli. Its behavior proved that it neurologically processes the negative feelings of previous experiences rather than making decisions based solely on immediate stimuli—what feels good or bad in the present moment. Now, most scientists consider fish sentient with similar research piling up for invertebrates like crabs, bees, and octopuses.

Such findings could drive changes in how we treat the animals in our care. For instance, a broad scientific review published in November 2021 by the London School of Economics and Political Science concluded that certain invertebrates such as crabs, lobsters, and octopuses should be considered sentient. They are capable of subjective experiences such as pain and suffering. The conclusions suggest that protection afforded by animal welfare laws should extend to these creatures. One possible outcome is the updates to the United Kingdom animal welfare legislation which may make it illegal to boil lobsters alive, requiring swifter, less painful methods to kill the animals.

Emotions are fascinating, and interest is not the only reason to study them in animals though. Understanding how animals feel and react to different situations can help us improve the lives of those in our care and those around us. We share the same land and the same feelings as well.



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wildfires

By: Seham Elsherif

Wildfires are enormous fires that occur in forests and areas with plant cover, and are very difficult to control. The past few years have witnessed an increase in the severity of wildfires. In 2021, fires took over around 7.7 million acres in the USA alone. Although this is a smaller area than the area that burnt out in 2020 (10.12 million acres), it was more difficult to control the fast-spreading flames.

Fire Triangle

Wildfires occur due to a combination of three elements: heat, fuel, and oxygen. Heat from the Sun, thunderbolts, or lighted matches; trees, dry leaves, and weeds serve as fuel; while oxygen keeps the flames raging, and the wind carries them around.

Why Do Wildfires Happen?

There are natural causes that help ignite wildfires, such as drought, climate change, high temperature, thunderstorm, wind, and lava. However, statistics indicate that humans are the main cause behind them; according to the U.S. Department of the Interior, 90% of wildfires are human-made. Careless human behavior in situations such as waste burning, making camp fires, or lighting fireworks in vegetation areas can have damaging effects. Car accidents and acts of vandalism, such as burning trees and buildings, can also start fires.

Types of Wildfires

There are three types of wildfires: (1) *Crown Fires*: they hit the trees at the canopy level, and are the most serious and damaging type; (2) *Crawling Fires*: they are surface fires that burn weeds, grass, and falling leaves; they are the least dangerous type and the easiest

to control; (3) *Ground Fires*: they burn under the ground, and are the slowest spreading type of wildfires.

The Effect of Wildfires

A direct negative impact of wildfires is losing vast vegetation areas, such as rainforests, which take a long time to flourish again. These fires also take the lives of thousands of animals, whereas some survive by hiding under the ground or escaping to safe areas. Additionally, wildfires produce thick smoke that negatively affects air quality and consequently human lungs; not to mention the huge CO₂ and methane emissions, which raise the temperature. Water resources also suffer and the quality of water decreases, which damages animal habitats.

However, wildfires also play a positive role to maintain the ecosystem balance. They eliminate weeds, shrubs, unhealthy trees, and the remnants of dead animal bodies, all of which serve as fuel to enormous fires. As a result, healthier trees receive more sunlight, new plants grow, and soil species get nutrients. Moreover, the fertility of the soil increases as it absorbs the nutrients resulting from burning organic matter. Last but not least, the seeds of some plants would not grow in the absence of fire.

Technological Solutions

The challenge with wildfires is about spotting them once they occur and before they spread; here is where technology comes in. Using satellites and software, forests can be monitored to spot hot areas with visible smoke in their images, or areas that shift infrared radiation. Once the area is detected, a text message with its latitude and longitude is sent to the fire control department. In Australia, Fireball International Company uses satellites to detect fires. They managed to detect a wildfire after only 66 seconds, and verified it within 3 minutes using cameras and sensors.

In case we want to predict fires, a team from the University of California has managed to develop an AI-platform to map areas at risk of wildfires, known as FireMap. The platform creates a deep learning model that uses different data, such as weather, topography, and vegetation dryness. Satellites, cameras, and sensors compile these data to figure out the location, direction, and spreading speed of the fire for six hours. As such, FireMap can be used to display environmental data in real time, predict and model fire behavior, and perform the analysis needed to deal with potential fires.

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MATHEMATICS WILL SAVE PLANET EARTH



By: Nada Emad

Although we study mathematics from kindergarten to high school or college, many do not feel it is of much importance in our everyday life, if important at all. They are definitely not aware that mathematics is much more than a set of problems we need to solve in order to obtain high marks. It is one of the pillars on which the universe and all sciences are based; environmental balance is also based on some mathematical grounds. The role of mathematics in maintaining environmental balance is worthy of our attention, especially in light of the growing climate change crisis and the harsh—maybe the harshest—Winter Egypt has witnessed this year.

Environmental Chaos is the Basis of Its Order

An ecosystem might seem chaotic at first glance; living and non-living organisms interact and predate one another. Humans are exploiting everything so heavily that one might assume these organisms and resources will inevitably perish from overuse. Well, this assumption might turn true if the environmental balance is upset. However, the ecosystem is not chaotic at all; on the contrary, it is balanced by nature, and so are all its species and resources. For example, the percentage of oxygen is always 21% regardless of the continuing photosynthesis and breathing processes; here comes mathematics.

Have you heard of mathematical applications in ecology or mathematical ecology?

In ecology, mathematicians set models and laws that express how ecosystems work and the percentages within them. They aim to solve the problems of ecosystems, predict their development and growth, understand their behavior, and decipher the relations between different food chains. Hence, we can predict what should be done to preserve the environment.

For example, we all consume fish and might worry they may shrink in number, or even go extinct. Therefore, governments define marine protected areas where fishing is banned to conserve marine life. Moreover, a mathematician from Oregon State University has developed an equation that determines which marine protectorates can tolerate fishing. His work establishes a balance between the conservation of fish and supplying our demands. The mathematician hopes all the world governments use his equation to maintain environmental balance.

Our Attempts to Own Planet Earth Endangers Us

The conservation of all species around us is at the heart of maintaining environmental balance. Humans need biodiversity on Earth to go on. Since we do not own the Planet but share it with many other species, any disorder we cause would harm these species. Similarly, any wrong exploitation of non-living resources upsets the environmental balance. Problems associated with environmental imbalance puts human life at risk; the most prominent example is climate change.

In weather forecasts, we see colored maps that express the weather, mostly in red and yellow. These meteorological maps and models are based on mathematical statistics used in daily weather forecasts. Computer-assisted mathematical equations are used to make long-term predictions of climate changes. This allows time for governments to take the decisions needed to mitigate catastrophic climate events. As such, research in mathematics is essential for nations to face climate change. Scientific research develops mathematical tools and technologies, which help find rapid solutions to climate change and other environmental problems.

Mathematics helps us conserve species and the climate, and thus conserve environmental balance and Planet Earth as a whole. Therefore, we should seriously encourage students to study mathematics, instead of avoiding it. Mathematics should be related to our everyday life and problems, and research in the field must be developed.

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By: Esraa Ali

Legends Of Coffee and Chocolate: From Cup to Cope

Imagine going to the coffee shop and ordering your favorite drink and being told: "This beverage is not available anymore". A nightmare is to know that the cup of your joy is going extinct, right? Everyone has a favorite drink with a special taste. They are from significant plants that have lots of stories to tell. In recent years, climate change, due to global warming and pests, has created a perfect storm that threatens their existence, and it is time to ask ourselves: Can we cope with a future without a cup of coffee or chocolate?



The Coffee Tree

According to popular legend, a goat in the Ethiopian city "Kaffa" found a tree full of berry-like fruits. For its nice taste, it ate a lot of it then started to behave differently. The goat-herder, named "Kaldi", noticed an unprecedented wide-awake feeling in one of his goats. He followed his curiosity and the goat, until he found the magical tree. He chewed on the berries himself and became alert, too. To find out its secret, he took some berries and went to the nearest place of worship.

Immediately, the berries were ordered to be put on fire to move that devilish effect away. Surprisingly, an aromatic smell that could not be overlooked filled the place, so orders were issued to save the rest of the berries from the fire and pour hot water on it to save that sensual smell. Upon tasting the mixture, the attendees experienced a calming sensation. From there, the energetic berries power spread as wildfire with various recipes worldwide known today as "Coffee".

There are about as many different legends about the discovery of the coffee tree as there are varieties of coffee. The coffee plants are small trees or shrubs, with oval and dark glossy green leaves. They produce a fruit, commonly referred to as a berry, with two seeds. Global coffee trade relies on two species; the brown and black beans from the coffee tree or *Coffea arabica* (arabica) that represents 60%–80% of the world's coffee production, and the *Coffea canephora* (robusta) that grows in warm and tropical climates worldwide.

In more than 50 countries, coffee is grown on largely smallholder farms. Specific temperature, light, and humidity levels are among the required criteria of coffee crops to grow properly. However, changing climate conditions is impacting coffee's taste and aroma in farms at higher

altitudes, and too much light exposure is linked to a decrease in its quality. In fact, this has to be of least concern compared to coffee's sustainability.

Sri Lanka, for example, used to be a world coffee power but everything changed in 1869, when a disease that causes coffee leaf rust and ruins coffee plantations, known as the *Hemileia vastatrix* fungus, spread across the Island. After 20 years, it killed Sri Lanka's coffee industry and began to expand around the world. In 1970, it appeared in Brazil, then spread to Central America and Colombia.

During 2012/2013, the rising temperatures led to a major coffee rust crisis in Central America, and more than half of the planted areas were destroyed. Although rust has no cure, it can be prevented; yet, with the increasing global temperature, it is getting harder to control the increase of plant diseases in coffee farms and the decrease in the quality and production of coffee worldwide.

You might have noticed recently that several coffee brands are increasing their prices; this is highly correlated with climate change. Though it can be hard to be precise about the consequences in an era of accelerated climate change, it is generally accepted that coffee output is at

risk. Today, there are 124 coffee species known to science, and researchers expect at least 75 coffee species (60%) are at the risk of extinction worldwide! The threats include deforestation, plant diseases, and most importantly, temperature change that influences coffee plant's survivability.

By 2050, 50% of the land used for growing coffee plants will not be suitable for farming, as estimated by experts. More plant diseases and damage of crops will result from intense rainfall and related pests that can survive more easily. Nevertheless, the risks of coffee extinction will not affect your morning only; it will affect several species that support our lives and livelihood, such as birds and bees, which will face threats of habitat destruction and loss, as per a recent study.

However, not all hope is to be lost! As the area suitable for growing coffee will reduce due to the rising temperatures, some other unideal areas will become hospitable to the crop. Researchers also study many other new solutions to slow down the extinction and help coffee farmers combat climate change. They hope to create diverse range of coffee beans that are resistant to climate changes through plant breeding, to recreate rust-resistant varieties of coffee.



The Cocoa Bean

The legend dates back to more than 5000 years ago, when ancient people used to think that money really did grow on trees! The "Toltecs", related to the Aztecs, worked hard to find food, but they did not know how to grow it properly, so they remained poor and hungry. The gods sympathized with them and descended to earth to teach them about harvest and food, and they became expert farmers.

"Quetzalcoatl", one of the gods, wanted to give the Toltecs a gift. It was a special tree with small leaves growing from its branches, discovered by the gods in the mountains. Once the tree fruited, "Quetzalcoatl" taught the Toltecs how to collect its pods and smash the seeds in it, and they enjoyed it for many years. Being so precious, the beans were prepared as a beverage among nobles, and were used as a currency too. The special drink spread to neighboring countries with various recipes, and the *Theobroma cacao* tree became the source of our beloved cocoa and "Chocolate".



Originating in the Amazon rainforest, the cacao plant has been grown for thousands of years in tropical areas and spread northwards; yet, it never grew in the mountains! With its various products, cocoa is often viewed as one of the greatest gifts of ancient civilizations to the world. Humans consumed cocoa as a beverage for most of its history, then appeared the term "chocolate", which is relatively new; the technology in the mid-1800s made it possible to produce solid chocolate.

Back to the plant, the cacao trees thrive in rainforests. They take about 5 years to bear the pods—a cucumber-shaped fruit that workers cut after they ripe and remove the seeds that are then dried. The trees can prosper under certain conditions, including nitrogen-rich soil, high humidity, abundant rain, uniform temperatures, and protection from the wind. They grow within 10°–20° North and South of the Equator. Leading producers of cocoa are Côte d'Ivoire and Ghana; together they produce over 50% of the world's cocoa. In both countries, cocoa has played a key role in the conservation of their forests and biodiversity.

Over the next decades, these places would be less suitable for cacao cultivation as they would grow warmer and drier; recent research has shown that progressive climate change will affect cacao plants. Like coffee, cocoa has a major importance in several countries for smallholder livelihoods and

ecosystems. The threats are different; having no substitute, cacao plants will not be affected by rising temperatures alone as coffee plants. The danger is from an increase in evapotranspiration; as higher temperatures squeeze water out of the soil and plants, it is unlikely for rainfall to increase or substitute that moisture loss.

Predicting the future of cacao farming is not simple, but if we carry on as before, we will see the end of our favorite treat soon. In a report on climate change, a team of researchers expected that by 2050, the rising temperatures will push the cacao cultivation areas uphill. The areas that show improved cultivation conditions are often hilly terrain, to pose another question: Which is more important? Meeting global demands or preserving natural habitats? That is why other solutions are on the table.

Some of the adaptation strategies are providing cacao farmers with drought resistant seeds; the cultivation approach also has to be monitored. The *Cabruca* in Brazil is an example of a successful approach that provides the trees with shade, for example, and could help decrease both temperature and evapotranspiration. That is all about cacao farmers, who can plan for the future and keep producing our favorite treat; what about you?

Where would you be without these precious trees? I will tell you, still in bed. The choices we make everyday affects our lives; even if we do not see that impact. We sometimes take things for granted, but we need to contemplate our world's various species. They face threats of climate change and habitat destruction as we do; nevertheless, we are the main culprit. Outreach and education are important components of the response; we must learn how to help conserve and protect these species that we have been depending on for decades before they cease just in a few decades.

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Biodiversity and Human Wellbeing

By: Maissa Azab

Biodiversity makes the Earth habitable. Biodiverse ecosystems provide nature-based solutions that buffer us from natural disasters, filter our water, and regenerate our soils. Ecosystem functions and services are shaped by their biodiversity; it is, thus, intuitive that Human Wellbeing (HWB) and biodiversity should be linked. As we strive towards more sustainable development pathways, it is important to properly conceptualize the link between biodiversity and human wellbeing.

Natural Needs

Human wellbeing is a broad concept that means different things to different people; it includes both subjective (how happy you feel) and objective measures (access to resources). A simple definition from the *Oxford English Dictionary* describes wellbeing as “The state of being comfortable, healthy, or happy”. The World Health Organization (WHO) describes human health as “A state of complete physical, mental, and social wellbeing, and not merely the absence of disease or infirmity”. A more complex assessment considers the numerous aspects of health as well as the environment in which humans live;

for example, the Millennium Ecosystem Assessment identifies five basic elements of human wellbeing as:

1. an adequate supply of basic materials for livelihood (as food, shelter, clothing, energy),
2. physical health,
3. security,
4. good social relations, and
5. personal freedoms.

This outlines the interdependence between human health and wellbeing and a healthy and stable ecosystem. Numerous studies found that daily contact with nature is connected to better health through reductions in obesity, stress levels, and improved concentration. Although the effects of “green space” are increasingly well understood, little is known about the importance of variation in the quality of green space, in particular differences in biodiversity, for benefits to human wellbeing.

Laboratory and mobile technologies that enable us to measure brain activity have vastly widened the scope of studies of mental health and nature. Researchers are able, for example, to analyze responses to images of urban streetscapes versus forests. Research shows us biodiverse nature has particular positive benefit for mental wellbeing. Multi-sensory elements such as bird or frog sounds, or wildflower smells, have well-documented beneficial effects on

mental restoration, calm, and creativity. Other senses—such as our sense of ourselves in space, our balance, and equilibrium and temperature—can also contribute to us feeling restored by nature.

Beyond brain imaging of experiences in nature, there is growing and compelling evidence that contact with diverse microbiomes in the soil, and air has a profound effect on depression and anxiety. Increasing our interaction with natural elements through touch is both psychologically therapeutic and neurologically nourishing. We also have increasing evidence that air, noise, and soil pollution increase risk of mental health disorders in cities.

Healthy Nature, Healthy Humans

Biodiversity fortifies global nutrition and food security. Millions of species work together to provide us with a large array of fruits, vegetables, and animal products essential to a healthy, balanced diet; unfortunately, they are increasingly under threat.

Every country has indigenous produce, which have adapted to local conditions, making them more resilient to pests and extreme weather. In the past, this produce provided much-needed micronutrients for local populations. The

simplification of diets, processed foods, and poor access to food have led to poor-quality diets. As a result, one-third of the world suffers from micronutrient deficiencies.

Moreover, plants are essential for medicines; 25% of drugs used in modern medicine are derived from rainforest plants, while 70% of cancer drugs are natural or synthetic products inspired by nature. This means that every time a species goes extinct, we miss out on a potential new medicine.

Biodiversity due to protected natural areas has been linked to lower instances of disease such as Lyme disease and malaria. While the exact origin of the virus causing COVID-19 is still unknown, 60% of infectious diseases originate from animals and 70% of emerging infectious diseases originate from wildlife. As human activities encroach upon the natural world, through deforestation and urbanization, we reduce the size and number of ecosystems. As a result, animals live in closer quarters with one another and with humans, creating ideal conditions for the spread of zoonotic diseases.

Furthermore, the clearance of over 35% of the world's mangroves for human activities has increasingly put people and their homes at risk from floods and

sea-level rise. If today's mangroves were lost, 18 million more people would be flooded every year (an increase of 39%) and annual damages to property would increase by 16% (USD 82 billion). Protecting and restoring natural ecosystems is vital to fighting climate change. Nature-based solutions could provide 37% of the cost-effective CO₂ mitigation needed by 2030 to maintain global warming within 2°C.

Human or economic development, in which capital stocks are marketed to produce flows of desired economic outputs, comes at the price of biodiversity loss. Indeed, processes directly and indirectly associated with declines in biological diversity have largely driven human colonization and development of civilizations on all continents since the Early- to Mid-Holocene about 5000–7000 years ago. These processes include conversion of natural habitats to agriculture, unsustainable exploitation of living resources, alteration of biogeochemical cycles, substitution of native and wild by exotic and domesticated species, freshwater appropriation and impoundment, human appropriation of primary production and other human activities that generally lead to biodiversity loss.

The link between biodiversity and human wellbeing became a focus of public discourse and scientific research in the early 1990s following the Brundtland Report, and the United Nations (UN) Conference on Environment and Development held in Rio de Janeiro in 1992. The latter event also marked the launch of the UN Framework Convention on Climate Change and the UN Conventions on Biological Diversity and to Combat Desertification, all seen as landmarks in the rise of sustainable development as a societal paradigm.



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Capturing Wildlife: Adventure Techniques

By: Hossam Ragab



Wildlife is teeming with beauty, originality, and splendor; many photographers from all over the world try to convey this fabulous life by capturing special images of the animals in the forests. Although it is not that easy to take these shots, it is never impossible; wildlife photography is very similar to sports photography and trying to capture athletes in motion.

While capturing animals in the wild or birds flying at far distances, you will need a “telephoto” lens to zoom at them, or a lens specialized for extra zoom such as 400 mm or more because you will not be able to approach any animal except in rare cases and in different forms of disguise. If you are going to shoot in a public park, maybe a 70–200 mm lens will do the trick. One of the most important points is that you will not be able to use lighting tools when capturing animals. That is why you will need to use the largest aperture possible in case of low light or if you want to isolate the background of the animal.

When capturing animals, we look for the right angle to get the best results. Since the movement of animals is unpredictable, which can also be very far from the photographer, s/he has to take many shots and try to capture the

wonderful moments by waiting and watching. Examples of these shots include the scene of an animal or bird attacking a fish, or a lion attacking a herd of deer.

Here are some of the **BEST TIPS** for wildlife photography:

- The photographer should make sure that the eyes of the animal are visible in the shot because they add soul to the picture.
- Sunlight must be focused on the face of the animal or bird, but in a professional proportion, so that the photo will not be burnt.
- The lighting of the background should not be brighter than the animal's lighting, because this can cause many black and dark areas to appear in the image, so the results are completely unprofessional.

- We always recommend using optical zoom to exclude unwanted elements, such as trees, plants, etc., from the picture and limit the shot to the intended subject.
- Do not forget to apply the rules of composition, such as the principle of space, the rule of triangulation, or filling the shot as much as possible, because the more you abide by the rules, the better the results are.
 - As for the principle of space, it is important to leave space in front of the moving object while capturing, so that the picture will be balanced and logical.
 - As for the rule of triangulation, it depends on dividing the image into three parts, through two longitudinal parallel lines and two horizontal parallel lines, all of which intersect at four points; for a perfectly balanced photo.



- The rule of filling the frame means filling the frame with the entire target object without showing the background; this rule is applied when capturing animal faces or flowers.

One of the most important notes is that if you are capturing animals that move a lot like birds, you should use the “Shutter Speed” feature on the camera because you will not find time to switch settings often. So, if your goal is to capture a bird flying away in the sky or a fish swimming in a river, use the speed of 1/1000 and above. You also have to set the control type by focusing on the “Motion Mode” because you will not be able to select the focus point manually as usual. Also, set the “Shutter” to continuous mode by using the “JPEG” image type to be able to take as many photos as possible, to reach the required expressions on the faces of the animals. However, if you want to capture a bird on a tree branch or an animal sitting on the grass that does not move a lot, you will need to use “Portrait Mode”; in this case, you will need to use “Aperture” and a relatively narrow “Depth of Field”.

When processing begins, put the images in the light editing program “Light Room” and sort them looking for special shots. Make sure to pick out pictures that show the eyes of the creatures, and the images that are properly lit and do not have dark areas. Adjust the “Image Brightness” to suit the shooting mode, remove lens errors, and then set the “Image Composition” according to one of the rules of composition known in professional photography through the cropping tool and adjusting the horizon in the program.

One of the best examples of the photographers of the wild is the world-renowned photographer Joachim Munter, who escaped into the woods and dedicated his life to capturing animals, according to the *Bored Panda* website. The website also includes a set of images captured by Munter, which amazed their viewers with the sincere feelings they contain. Joachim Munter decided to stay in the forests to see wild animals and capture images of them at different times and seasons of the year. He was able to be part of the forests of Finland through his camera to capture wildlife and its creatures; to make you

feel that you are in his place watching the creatures, and sometimes even feel what they feel.



In an interview with Munter, he said: “From the first look at these wild animals in the forest, you feel as if they are trained on everything! They do not move randomly; they know what they do and where they will go, and why exactly;” he added: “Capturing wildlife is nothing more than gaining the trust of the creature you are capturing! The most important thing is that you do not chase animals in any way; it just needs great patience, like hunting, and to reassure the animals that you do not want to harm them or to infringe on their safety area”. He continued: “My photo sessions can extend for long hours to a whole day, sometimes for weeks and months. What is interesting about capturing wildlife and forests is that it is hard to predict when and what is going to happen; you do not know what is going to happen in a few seconds. Sometimes, I can spend long weeks there without taking a good picture, and sometimes it just takes hours to take a picture that will amaze everyone. The whole thing is not measurable”.



In conclusion, we say that part of the nature of humans is the difference in their interests; so this thing that may seem strange to you can be the life of another person. This is the most wonderful thing; capturing wildlife is never a normal thing. It is—even if it is not one of your interests—one of the most wonderful things that allow us to observe the creatures and their behavior, and the splendor and greatness of the Creator in his creation. Also, wildlife photography is an explicit call to preserve the environment and its balance with its non-human creatures.

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and Coexistence with Nature

For artists, nature has always been the primary source of creativity and artistic inspiration. It inspires both the scenes and the raw materials that are the first influential variable. The artist has dealt with his surrounding nature since the dawn of humanity; artistic expression has been a direct language to portray daily events. Many cave drawings discovered in Europe and Africa are the best evidence of this eternal connection with nature. Cave artists used the available natural materials, such as natural oxides from stones and the blood of hunted animals. With evolution, humans began depicting their daily scenes, but the surfaces and materials differed; with the passing of time, they moved away from using natural materials to manufactured ones.

By the last quarter of the 20th century, with the emergence of the Ozone hole and other huge pollution issues worldwide and the spread of global calls to save the environment, artists reattempted to find solutions together with the community, to preserve the environment. As such, new types of art have emerged, such as art using scrap and recycled materials, followed by a tendency to use natural

materials in their environment to preserve the ecological balance. This has directed artists to environmental and land arts.

At first glance, the titles may seem strange, but they are absolutely expressive of these modern art types that are originally ancient.



Stonehenge

Land Art

It is an art created and developed from nature, using natural materials found on-site; the introduction of new elements is extremely limited. This art

By: Mahmoud Hagra

Head, Temporary Exhibitions Unit
BA Art Exhibitions and Collections Department

has let us reconsider nature and all available materials, and think of using methods that preserve the elements identities and integration with nature. It also has contributed to increasing our appreciation of nature and its changes.

The oldest environmentally-related artwork is Stonehenge in the United Kingdom (UK); built in the late Neolithic period. It is considered the most famous archaeological site in Europe. It is a stone circle monument; each block weighing around 25 tons. This magnificent landmark is stable to this day, and no one knows yet how and why it was built.

Numerous artists excelled in this new art field; pictures of their artworks are widely spread across the Internet and on art sites; their artworks also appear at several modern art museums worldwide. Perhaps the most famous



Wall Drawing, Massachusetts

artist of the kind is Andy Goldsworthy from the UK—an artist, photographer, sculptor, ecologist, and environmental artist. He started his career as a Professor of Applied Mathematics, then studied art and specialized in sculpture. This enabled him to create pieces of art in nature, based on natural mathematics theories. Goldsworthy has used and merged the contrast of the colors of tree leaves, stones, and woods, to create beautiful art scenes.

In the “Wall Drawing” picture, we find a wall made of stones, twisted up and down, in the Massachusetts forest. The stones are held together without any adhesives, such as cement or clay, but rely on the theories of friction and gravity. It was carried out in 2014 and is inspired by the ancient history of the region and the collapsed ancient walls.



Spiral Jetty

The second work is Spiral Jetty by Robert Smithson; constructed in Ohio, USA, in 1970, it is considered the most famous land art sculpture. It is inspired by snake movements and expresses the period before Columbus discovered America. The spiral sculpture is made

of basalt and clay, and is colored with salt crystals from the Great Salt Lake, which sometimes flood it; Smithsonian calls it “abstract geology”.

Seven Magic Mountains in Nevada

The next artwork is the Seven Magical Mountains by Swiss artist Ugo Rondinone, constructed in the Nevada Desert, in 2016. It is made of seven columns from stacked cheerful fluorescent-colored rocks that reflect the spirit of nearby Las Vegas. The height of the columns is about 9,144 m; it is located in an easily accessible location, so it receives around 1,000 visitors per day.



Seven Magical Mountains



The last artwork is by the American artist Andres Amador, who is best known for his large-scale geometric and organic drawings on sandy beaches. He grew up in San Francisco and obtained a bachelor's degree in environmental science. He started his career as a computer technician and then became an environmental or land art pioneer, carrying out huge artworks that depend on photography.



In the end, this is just a glimpse of modern and aspiring arts that preserve the environment and direct people's eyes to its beauty and diverse resources. Some people may agree or disagree, but they are clean arts that do not cause any pollution; they use diverse materials that are highly integrated with their surrounding environment. The most significant drawback is being an ephemeral art; the artworks cannot be preserved as lasting objects, which has been the first and supreme goal of arts since the dawn of time.

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PARK RANGERS



The Planetarium Science Center (PSC), affiliated to the Bibliotheca Alexandrina (BA) Cultural Outreach Sector, in cooperation with the Hanns-Seidel Foundation, organized a tour of Egyptian Governorates under the “Park Rangers” Campaign. The tour was part of the PSC celebration of the “World Environment Day” that was held for the fourteenth consecutive year at the BA, in November 2021.

The Campaign targeted students aged 8–14 years old in three Governorates: Asyut, Cairo, and Luxor. It started out in Cairo with 105 students, from the fourth to the sixth primary grades, as well as from the first and second preparatory grades. It was held in coordination with the BA Khadija Palace in Helwan and the BA Sinnari House in Cairo, together with the Directorates of Education in each governorate.

The PSC team delivered a lecture on geology and workshops on sedimentary rocks at “Wadi Degla” protectorate in Maadi and the “Petrified Forest” reserve in the Fifth Settlement. Afterward, they headed to “El-Hassana Dome” protectorate on the Cairo–Alexandria Desert Road. While the team was in Asyut, they gave a scientific demonstration to students in “Wadi Al-Asyuty” reserve, in addition to an introductory lecture on the reserve, its nature, fossils, and some extinct animals and birds. The tour ended with a visit to the “Dababiya” reserve in Luxor.

At the end of the Park Rangers Campaign tour, the “World Environment Day” celebration—one of the most important annual BA events—was organized at the BA. It lays a foundation for sound environmental principles for young people to be better citizens in the future; trying to make this world a better place for future generations.

By: Nadine Elsarrag
Marketing Specialist,
BA Planetarium Science Center



Banner image: commons.wikimedia.org



Available Planetarium Shows

Seven Wonders; 30 min.

Kaluoka'hina: The Enchanted Reef; 33 min.

Great Barrier Reef; 42 min.

To Space and Back; 25 min.

Stars of the Pharaohs; 35 min.

Oasis in Space; 25 min.

Alexandria the Cradle of Astronomy; 22 min.

The Secrets of Gravity; 45 min.

The Future by Airbus; 27 min.

The Life of Trees; 33 min.

Phantom of the Universe; 25 min.

Space Flight (Live Show); 45 min.

Enlightened Mind; 19 min.

ALEXploratorium

Discovery Zone

Opening Hours and Guided Tours Schedule

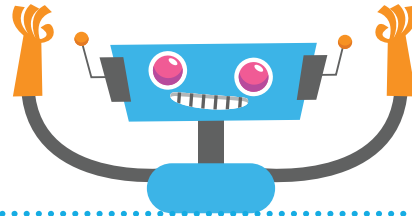
Sunday to Thursday (except Tuesday):
10:30, 12:30, and 14:30

Tuesday: 10:30

Entry Fees: EGP 10.- (EGP 5.- for students)

Listen and Discover

12D Shows Fees: EGP 20.-



The Planetarium operates from Sunday to Thursday, and offers five shows per day. For schedule and fees, please visit the PSC website.

The Bibliotheca Alexandrina Planetarium Science Center (PSC) invites its visitors to spend a day of fun learning, where they can enjoy amazing scientific shows that cover a diverse variety of scientific fields and are suitable for a wide range of groups at the **Planetarium Theater**.

Visitors can also enjoy tours of the **History of Science Museum**, which highlights scientific discoveries throughout three eras: Pharaonic Egypt, Hellenistic Alexandria, and the Golden Age of Islam.

Moreover, visitors can enjoy a collection of interactive exhibits that targets children and adults, workshops, **DVD** and **3D** shows at the **ALEXploratorium**, as well as shows at the **12D Theater**.



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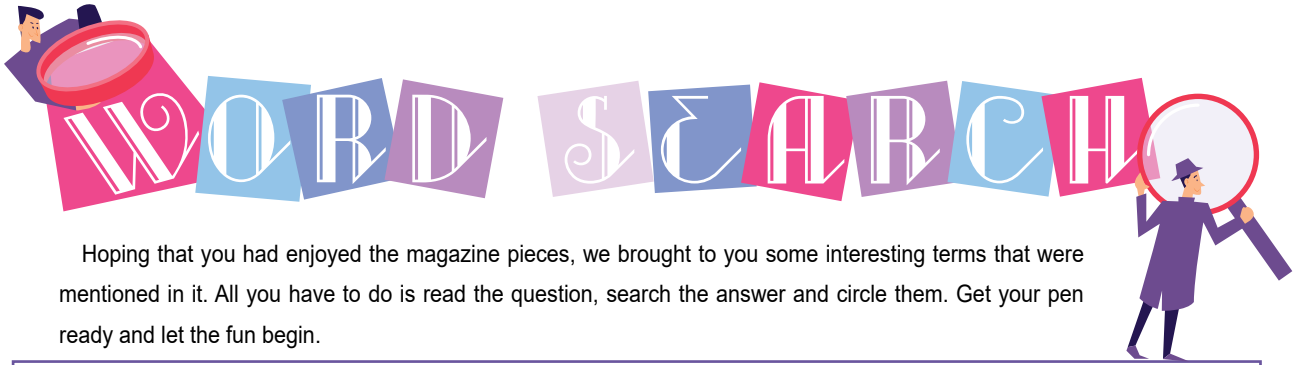
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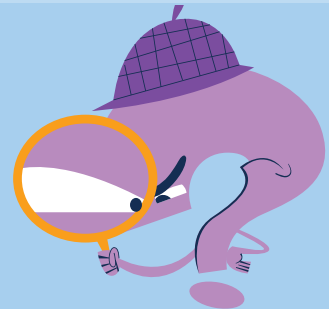


Hoping that you had enjoyed the magazine pieces, we brought to you some interesting terms that were mentioned in it. All you have to do is read the question, search the answer and circle them. Get your pen ready and let the fun begin.

L M V G K M M K W S Q H M K W H Z U Q C D K U
 A W W I O I B T Z R Z L P P G L W O A C W R J
 M Z O G P S V A S N Q B E X R S F A H G N L G
 R Y I S R Q U D V C Q C F R U E F P V C V M M
 E Q Y S R E S O P M O C E D P S D X X I J N K
 T G S E I C E P S E N O T S Y E K A R V O P W
 N S B N U U U G M Z R J T H R E M I T K J X O
 U D R V Z B V W J F X K X H A R K B E O A Y S
 M K I Z Y C O S B B S O D N M B K H X U R R B
 M M O A N U A F G D C E C V B W I F J X O S A
 I R Y V F L C C X U Y K L L I M K T Q V P J E
 H I R K I S R E D R I B E L F Q K I A P K Y O
 C F O V X I F Y N W X P H I X X C N D T U Q L
 A G R E E N I G N E M E T S Y S O C E S T P U
 O V W N O I T C N I T X E E Y A M C P K Y K F
 J A M O X T S R O T C A F C I T O I B P S T S

CLUES

1. People who are so obsessed with watching birds.
2. Species that help maintain the balance and survival of an ecosystem.
3. Living parts in the ecosystem.
4. Species that creates, significantly modifies, maintains or destroys a habitat.
5. World-renowned photographer of the wild.
6. An animal that naturally preys on others.
7. The termination of a kind of organism or of a group of kinds, usually a species.
8. Organisms that break down dead or decaying organisms.
9. The natural home or environment of an animal, plant, or other organism.
10. The animals of a particular region, habitat, or geological period.



ANSWERS REVERSED

- 1. Birds
- 2. Keystone Species
- 3. Biotic factors
- 4. Ecosystem Engineer
- 5. Joachim Munier
- 6. Predators
- 7. Extinction
- 8. Decomposers
- 9. Habitat
- 10. Fauna



Do It Yourself ECOSYSTEM IN A JAR

Most people love adding a little slice of nature to bring a bit of greenery inside their homes to spruce up their space. In this activity, we will help you create your own plant ecosystem which requires very little maintenance to keep it green and healthy. Let's start!

To begin with, you need a good jar, a container with a wide opening will make it easier to work inside it. Make sure that the container can be properly sealed.

Then, you have to find the appropriate plants; any plant will work but try to choose plants that need the same amount of water otherwise you will need to put each plant in a separate jar.

Other materials needed are soil, pebbles, charcoal, stones, and water.

STEPS

1. Fill the bottom of the jar with pebbles until they form a layer so that the water will collect at the bottom and your plants do not drown in water.
2. Cover the pebbles layer with a layer of charcoal. This step is very important because charcoal will filter out the impurities in your ecosystem making it clean and healthy.
3. Cover the pebbles and the charcoal with a layer of soil. Make sure that the soil has compost and you have added enough amount of soil so the plant roots have room to grow.
4. Add any type of small plant in the soil by digging a small hole in the soil and place the roots in the hole.
5. Add some stones on the soil to decorate your terrarium.
6. Add some water to the soil and place the jar somewhere that is exposed to sunlight.
7. Observe your ecosystem to make sure that your ecosystem is healthy. If it looks pale, open the lid to let some damp out. If it looks dry add some water.



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It is a matter of Perspective

