WordPress English 2023

Illustration 1 - Baroque's Standard

Science News #016

In Today's Science News, we will learn about the key reason why loss of smell occurs in long-Covid, what may cause the Fermi bubbles and the scale of fungal disease in India.
All three articles were rather short, that's why the entry is short as well. Lastly, from now on I'll also link directly to the studies and mention whether they are open access or not.

Illustration 2 - Microscope from Pixabay (AdrianoKF)

Article 1: Scientists find key reason why loss of smell occurs in long COVID-19

SD-Date: 21st December, 2022
Et-Date: 4th January, 2023
ScienceDaily-Summary: *"The reason some people fail to recover their sense of smell after COVID-19 is linked to an ongoing immune assault on olfactory nerve cells and an associated decline in the number of those cells, scientists report."*
Status: Open Access
https://www.science.org/doi/10.1126/scitranslmed.add0484

Method of Research

The study was conducted by Bradley Goldstein, M.D., Ph.D., and his colleagues at Duke, Harvard and University of California-San Diego.

They analyzed olfactory epithelial samples collected from 24 biopsies, 9 of whom were from patients who suffered from long-term smell loss following Covid-19.

Biopsy (source: NHS)
A biopsy is useful when you want to investigate abnormalities. It is done by taking a tissue sample anywhere on or in your body - from the skin to organs and other structures. These abnormalities can be **functional** (such as kidney or liver problems) or **structural** (such as swellings in a particular organ). Information gained from this procedure can play a very important role in the decision-making progress (i.e. the appropriate treatment and how well a person responds to a particular treatment). For instance, a clinical examination alone usually cannot tell when a lump or growth on your skin or inside your body is cancerous (**malignant**) or non-cancerous (**benign**). Then a biopsy is required to make this determination.

In collaboration with Sandeep Datta, M.D., Ph.D., at Harvard University, the research team used a sophisticated single-cell analyses in this biopsy-based approach.

Findings

- There was a *"widespread infiltration of T-cells engaged in an inflammatory response in the olfactory epithelium*"*, this inflammatory response persisted despite the absence of detectable SARS-CoV-2 levels,
- in addition to this unique inflammation process, the amount of olfactory sensory neurons were diminished, the ongoing inflammation may be the reason since it damages the sensitive tissue.

*the smell nerves are located in the tissue of the olfactory epithelium, the latter is located on the "roof" of the nasal cavity (which is divided by the nasal septum).

(see picture below)

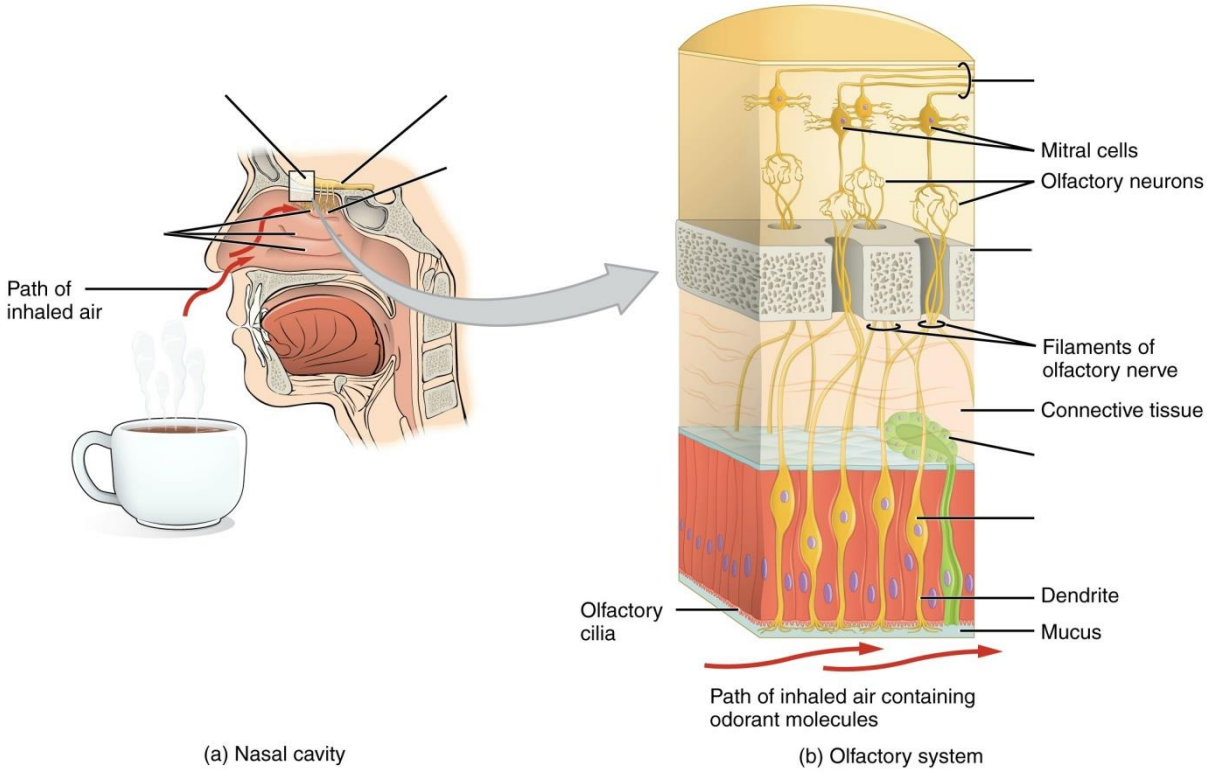


Illustration 3 - The nasal cavity and the olfactory system
(source: pressbooks)

Moreover, the researchers were encouraged by the fact that the neurons appeared to still have maintained some ability to repair themselves even after the long-term exposure.

"We are hopeful that modulating the abnormal immune response or repair processes within the nose of these patients could help to at least partially restore a sense of smell," Goldstein said, noting this work is currently underway in his lab.

Source

https://www.sciencedaily.com/releases/2022/12/221221154434.htm

Article 2: Mysterious gamma-ray emitting bubbles around the center of the Milky Way explained

Phys-Date: 3rd January, 2023
Et-Date: 4th January, 2023
Phys-Summary: *"A scientist from Tokyo Metropolitan University has shown that large gamma-ray-emitting bubbles around the center of the Milky Way were produced by fast, outward-blowing winds and an associated "reverse shock."*
Status: Not Open Access
https://academic.oup.com/mnras/article-abstract/518/3/4551/6825459?redirectedFrom=fulltext&login=false#no-access-message

Method of Research

For this study, Professor Yutaka Fujita from Tokyo Metropolitan University used the state-of-the-art X-ray observations from the Suzaku satellite and compared it to the results of numerical simulations. On this methodology he based his theoretical evidence.

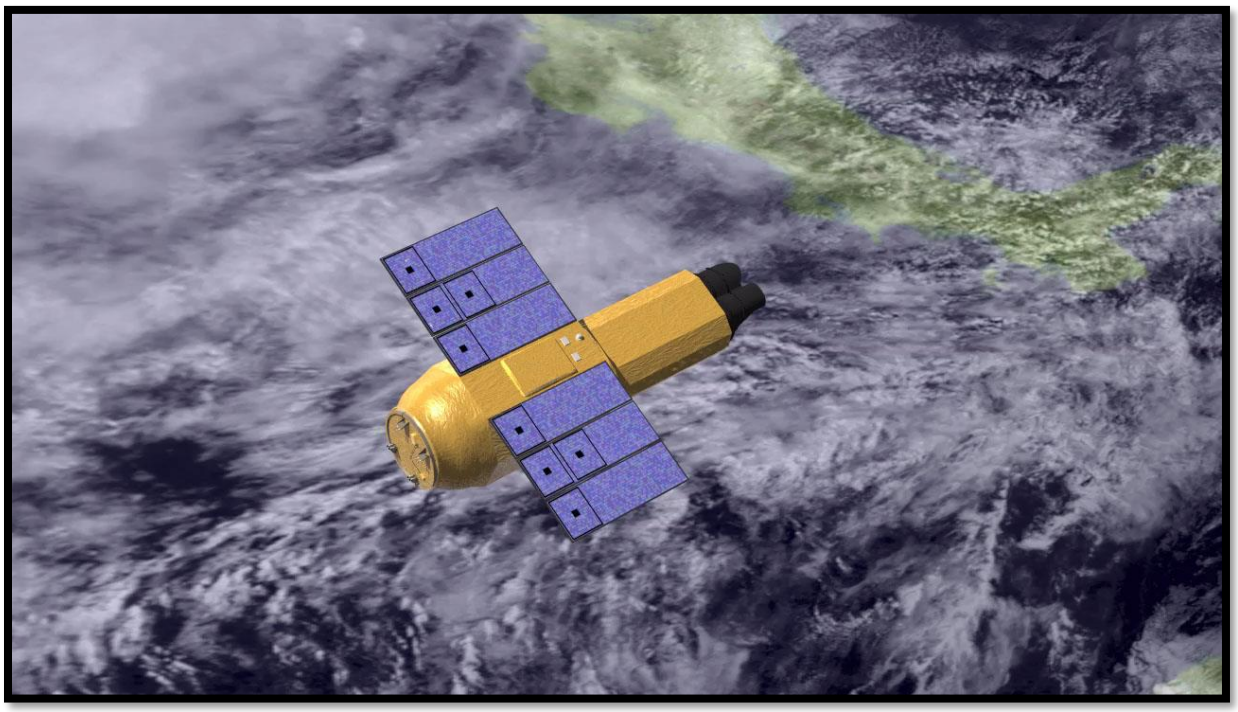


Illustration 4 - Artist's concept of Suzaku satellite in low-Earth orbit.
(source: NASA)

Suzaku Mission Overview (source: NASA)

Launched: July 10, 2005
Development: It was developed by the Japanese Institute of Space and Astronautical Science (which is part of the Japan Aerospace Exploration Agency) in collaboration with Japanese and U.S. institutions, including NASA.
Equipment: The Suzaku satellite was equipped with a new type of X-ray spectrometer (XRS) that makes for the first time high-resolution and high-throughput possible.
Mission: Observation of *"extremely energetic objects like neutron stars, active and merging galaxies, black holes and supernovae"* to gather information on these events in the X-ray energy range.
Difficulties: Just 19 days after the launch, the loss of a cryogen (coolant) made it no longer possible for the XRS to provide the planned science. However, the X-ray Imaging Spectrometer and the Hard X-ray Detector were not affected by the loss of the coolant.

Findings

Professor Fujita's simulation considered *"fast outflowing winds from the black hole injecting the necessary energy into the gas surrounding the center of the galaxy"*.
When compared with the measured profiles, they found that the Fermi bubbles were likely produced by the fast **outflowing winds*** which are blowing at 1,000 km per second over 10 million years. As they travel outward, they interact with the surrounding halo gas which causes a reverse shock that *"creates a characteristic temperature peak"*.

Another reason why the Fermi bubbles are likely caused by these winds, is that the simulations showed that explosions at the center were unable to reproduce the profiles measured by the telescope. Lastly, the author noted that what had been observed is similar to what we already observed in other galaxies.

"The correspondence suggests the same kinds of massive outflows seen in other parts of the universe were present in our own galaxy until fairly recently." (Phys.org)

***They are not winds as we experience them on Earth. Here, they mean with **outflowing winds** highly charged particles at high speeds which propagate through space.

(images on the next page)

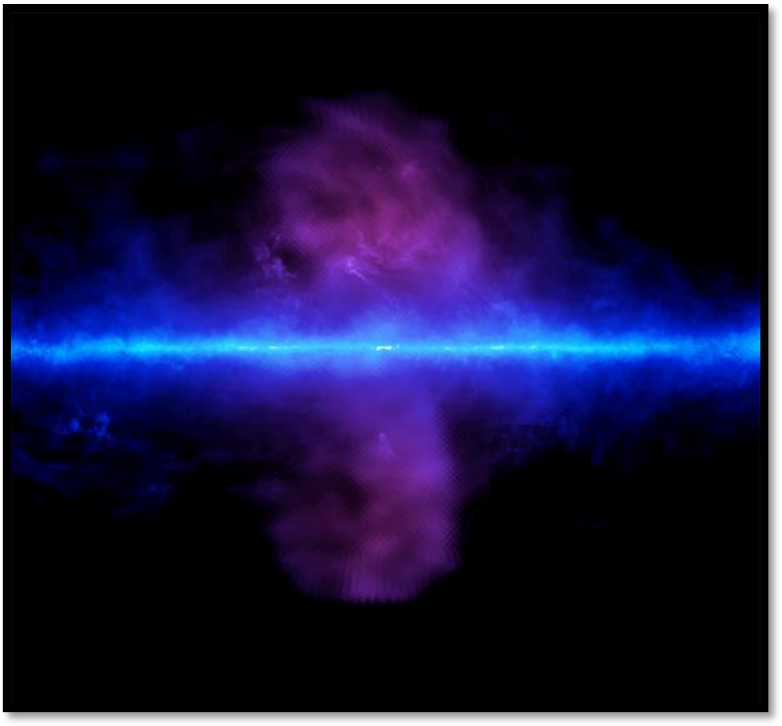


Illustration 5 - The Fermi bubbles were discovered by the Fermi Gamma-ray Space Telescope in 2010 (source: NASA)

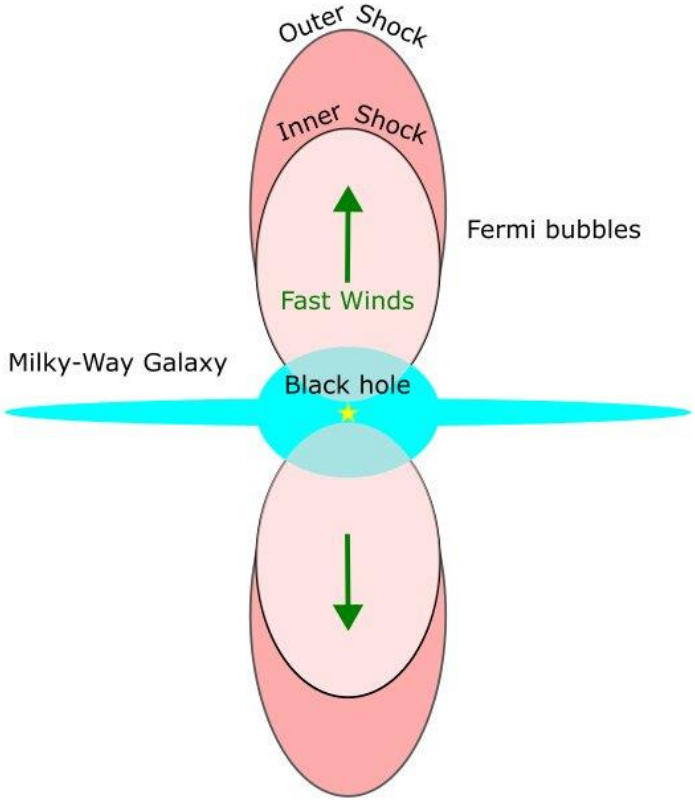


Illustration 6 - How the Fermi bubbles may have been formed (source: Tokyo Metropolitan University)

Source

https://phys.org/news/2023-01-mysterious-gamma-ray-emitting-center-milky.html

Article 3: Study reveals huge extent of fungal disease in India

MedXPress-Date: 3rd January, 2023
Et-Date: 4th January, 2023
MedixalXPress-Summary: *"Researchers from India and Manchester have shown that over fifty million Indians are affected by serious fungal disease, 10% of which are from potentially dangerous mold infections."*
Status: Open Acess
https://academic.oup.com/ofid/article/9/12/ofac603/6960896?login=false

Method of Research

In this study, experts from three Indian hospitals were involved - AIIMS, New Delhi, AIIMS Kalyani, West Bengal and PGIMER, Chandigarh - and The University of Manchester. This comprehensive review was achieved by analysing the data of 400 published academic articles and the databases of PubMed, Embase, and Web of Science (WOS) used. In addition, deterministic modeling was used to determine "annual incidence and prevalence estimates for multiple life- and sight-threatening infections with significant morbidity".

(image on next page)

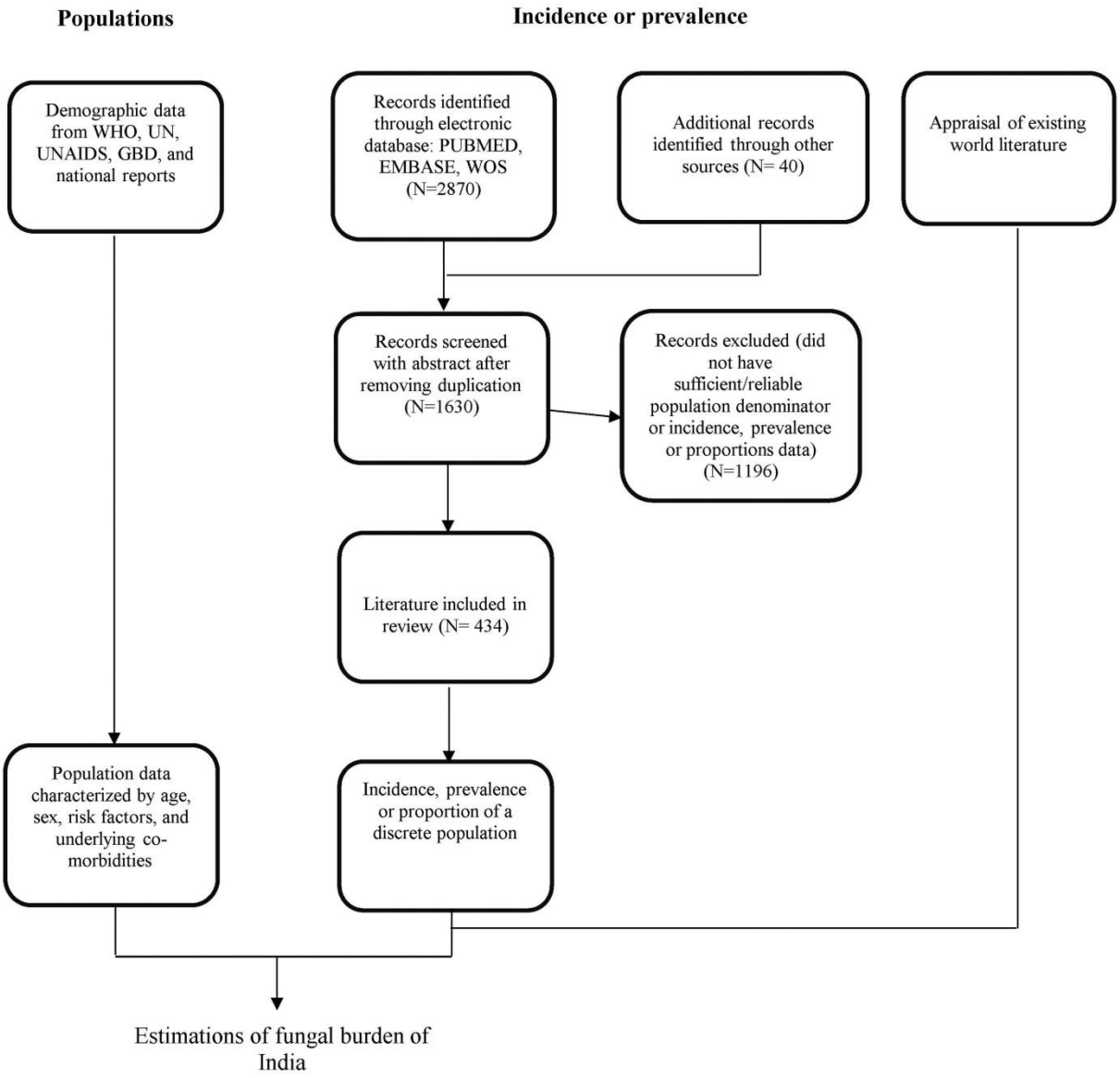


Illustration 7 - Overview of the Methodology
(source: Burden of Serious Fungal Infections in India, IDSA)

Findings/Results

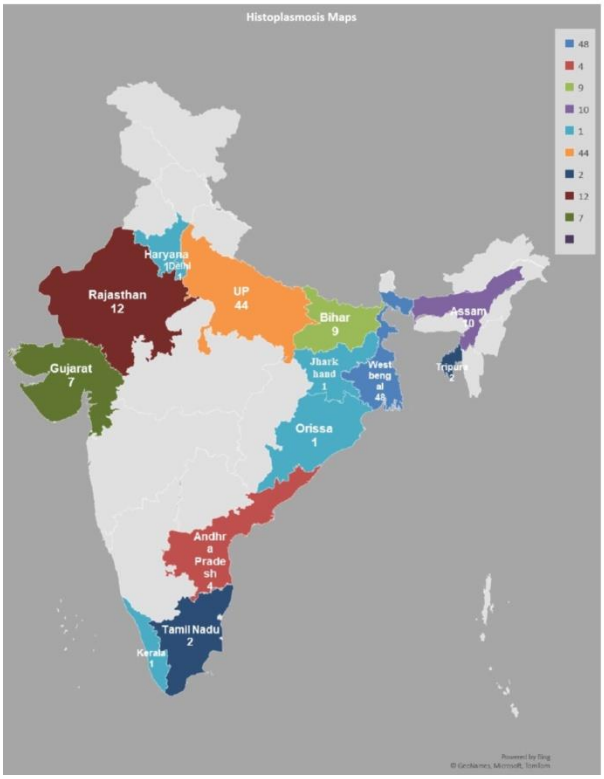
It is estimated that around 57,251,328 from 1,393,400,000 Indians (4.1%) suffer from serious fungal disease. The table below (next page) shows the amount of people affected:

Table 1 - (source: Burden of Serious Fungal Infections in India, IDSA)

Fungal Infection	Number of Affected
Vulvovaginal candidiasis	24,300,000
Allergic bronchopulmonary aspergillosis	2,000,000
Tinea capitis (in school-aged children)	25,000,000
Severe asthma with fungal sensitization	1,360,000
Chronic pulmonary aspergillosis	1,740,000
Chronic fungal rhinosinusitis	1,520,000
Pneumocystis pneumonia	58,400
Invasive aspergillosis	250,900
Mucormycosis	195,000
Esophageal candidiasis in HIV	266,600
Candidemia	188,000
Fungal keratitis	1,017,100
Cryptococcal meningitis	11,500
Note: The study says that histoplasmosis, talaromycosis, mycetoma, and chromoblastomycosis were less frequent.	

Finally, the lead author of the study, Dr. Animesh Ray of AIIMS in Delhi, shall have the last word on this topic: *"The total burden due to fungal diseases is huge but underappreciated. While tuberculosis affects less than 3 million people in a year in India, the number of Indians affected by fungal disease are several times higher."*

A Epidemiology Maps for Histoplasmosis According to Statehood of Patients



B Epidemiology Maps for Histoplasmosis According to Statehood of Authors

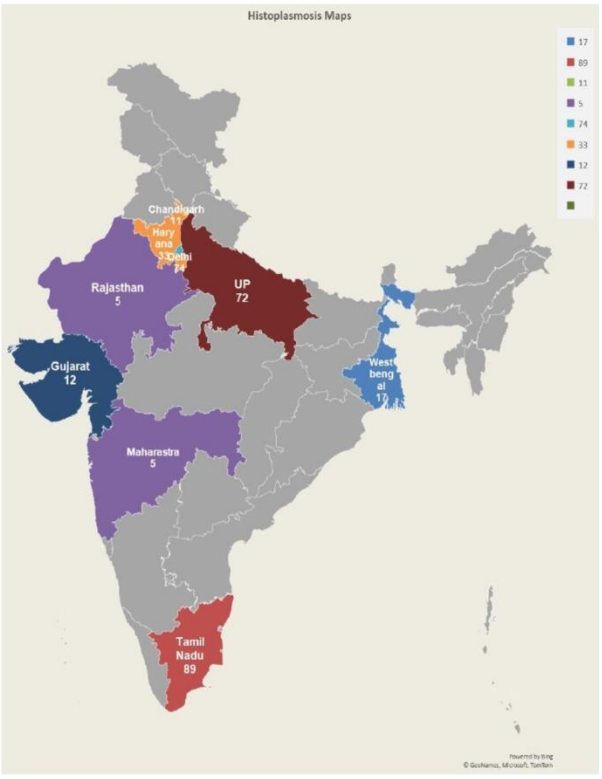


Illustration 8 - The map above shows the areas of higher incidence of histoplasmosis, although the total incidence cannot be calculated with the current data (source: Burden of Serious Fungal Infections in India, IDSA)

Source

https://medicalxpress.com/news/2023-01-reveals-huge-extent-fungal-disease.html

(Released: 4th January 2023, 7:05 pm/19:05 Uhr)

Tabellarius #003: Ukraine, Turkey / Syria and Togo

In Today's Tabellarius we cover the ongoing war in Ukraine, the devastating earthquake which hit Turkey-Syria and the mismanagement of Covid-19 funds in Togo.

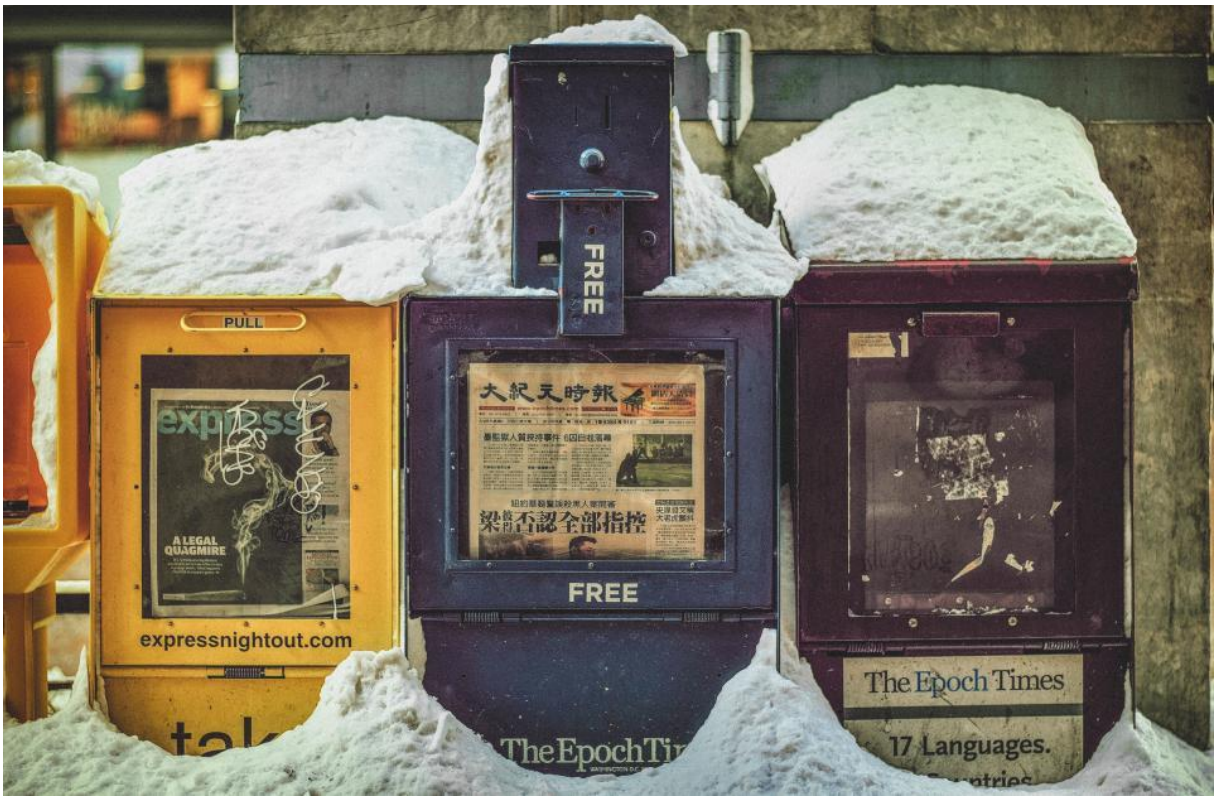


Illustration 9 - Image from stocksnap

Ukraine

It's been almost a year since Russia started its war of aggression against Ukraine. Thousands of Ukrainians - civilians and soldiers alike - already died or were injured and millions of Ukrainians had to flee within Ukraine (internally displaced persons) or flee to other countries. Consequently, we begin with the civilian casualties as of February 5, 2023 (last time I wrote about it was on September 29, 2022, for reference):

a total of 7,155 killed (2,853 men, 1,927 women, 180 girls, and 226 boys, as well as 32 children and 1,937 adults whose sex is not yet known)
Increase: +1,159 killed (+519 men, +322 women, 23 girls, and +36 boys, as well as the 32 children and 1,937 adults whose sex is not yet known)
- a total of 11,662 injured (2,576 men, 1,833 women, 248 girls, and 339 boys, as well as 264 children and 6,402 adults whose sex is not yet known)
Increase: +2,814 injuries (+726 men, +477 women, 57 girls, and 75 boys, as well as 264 children and 6,402 adults whose sex is not yet known)
o In Donetsk and Luhansk regions: 10,092 casualties (4,172 killed and 5,920 injured)

- On Government-controlled territory: 7,888 casualties (3,665 killed and 4,223 injured)
- On territory controlled by Russian armed forces and affiliated armed groups: 2,204 casualties (507 killed and 1,697 injured)
Increase: +1,710 casualties in Donetsk and Luhansk (+518 killed and +1,129 injured)
On territory controlled by the government +1,231 casualties and on Russian-controlled territory +479 casualties.
o In other regions of Ukraine (the city of Kyiv, and Cherkasy, Chernihiv, Ivano-Frankivsk, Kharkiv, Kherson, Kirovohrad, Kyiv, Mykolaiv, Odesa, Sumy, Zaporizhzhia, Dnipropetrovsk, Khmelnytskyi, Poltava, Rivne, Lviv, Ternopil, Vinnytsia, Volyn, and Zhytomyr regions), which were under Government control when casualties occurred: 8,725 casualties (2,983 killed and 5,742 injured)
Increase: +2,263 casualties (+578 killed and +1,685 injured)

"Most of the civilian casualties recorded were caused by the use of explosive weapons with wide area effects, including shelling from heavy artillery, multiple launch rocket systems, missiles and air strikes.

OHCHR believes that the actual figures are considerably higher, as the receipt of information from some locations where intense hostilities have been going on has been delayed and many reports are still pending corroboration. This concerns, for example, Mariupol (Donetsk region), Lysychansk, Popasna, and Sievierodonetsk (Luhansk region), where there are allegations of numerous civilian casualties." (OCHA relief web)

Across Europe, there are currently 8,054,407 recorded refugees (as of February 7, 2023), which means since September 27, 2022 **520,564** more Ukrainians fled their home country. That's nearly as many people that live in Dresden, Germany (with 567,375 inhabitants).

It goes without saying that behind each number is a human with their own story; hopes and dreams that have been destroyed with the beginning of the Russian invasion and the painful decision of leaving (the photos I show below are from the Red Cross, all the way back in March 2022). So, here are some of the faces and names, along with a Polish helper.

(next page)

Illustration 10 - Tanja with her four children, before they arrived in Poland they fled for 30 hours.

Illustration 11 - Pendura and her family who were headed to Spain at the time.

Illustration 12 - After heavy bombing, Alina and her daughter fled from their neighbourhood.

Illustration 13 - When the conflict started, the two students Francis and Frank left Ukraine.

Illustration 14 - Viktoria and her mother were headed for their relatives in Poland.

Illustration 15 - Magdalena Michutka Kuras is a paramedic who volunteered at the health station at the Przemysl train station in Poland. She distributed toys to Ukrainian children: *"It is nice to see how happy they are when they are given a toy."*

Russian War Crimes

According to Prosecutor General Andriy Kostin, Russia committed more than 65,000 war crimes in Ukraine since Moscow started the war on February 24, 2022. It ranges from indiscriminate shelling of civilians, willful killing, torture, conflict-related sexual violence, looting and forced displacement on a massive scale. Moreover, he says that they documented the abduction of more than 14,000 Ukrainian children and who were forced into adoption in Russia. About 75,000 buildings have already been destroyed, including homes, schools and hospitals. Then there's the weaponization of the winter season, as it is elaborated by Kostin: *"Russia resorts to prohibited methods of warfare like weaponizing winter and aiming to starve, freeze and terrorize the civilian population in the whole territory of Ukraine."* Due to Russia's shelling, approximately half of Ukraine's energy sector has been destroyed. The US's top military officer, Joint Chiefs of Staff Gen. Mark Milley, called Russia's deliberate targeting of energy structure in Ukraine a war crime.

However, establishing a special tribunal to proescute these war crimes is another question. The International Criminal Court cannot prosecute them, because war crimes cross a range of jurisdictions. Neither can they prosecute heads of states like Vladimir Putin.
The United Nations could endorse a special tribunal, but this is also unlikely to happen since Russia is still able to veto all measures put forth by the 15-member group.
In light of this, the US is considering a proposal that would name an interim prosecutor, he'd then start to record evidence of potential war crimes. Kostin said that European countries like France and the UK have agreed to create a special tribunal.

Author's Note

Whether we will able to prosecute the war criminals right after the war remains in the open, but for now the main focus is on ensuring a victory for Ukraine and help them in gaining back their entirey territory including occupied Crimea. This can only be achieved by maintaining military and humanitarian aid. Recording the war crimes remains a priority as well, because even if it takes us decades to finally get them in front of a court, we will be able to confront Russia with it and show other authoritarian countries that their disregard for human lives won't be ignored. They may blind their own people with chauvinistic propaganda and disinformation, but their crimes remain transparent and clearly visible to the world. We remain determined to hold them accountable one day!

Sources

Ukraine: Civilian casualties as of 24:00, 5 February 2023 [EN/RU/UK]
https://reliefweb.int/report/ukraine/ukraine-civilian-casualties-2400-5-february-2023-enruuk

Population Dresden
https://www.dresden.de/en/city/statistics/Population.php

Voices of Ukraine: Refugees Tell Their Stories
https://www.redcross.org/about-us/news-and-events/news/2022/voices-of-ukraine-refugees-tell-their-stories.html

Russia has committed more than 65,000 war crimes in Ukraine, prosecutor general says
https://www.cnbc.com/2023/02/01/ukraine-russia-war-65000-war-crimes-committed-prosecutor-general-says.html

Turkey-Syria

On February 5, 2023, a magnitude 7.8 earthquake struck Turkey and Syria. The epicentre was located 26 km east of the Turkish city of Nurdagi at a depth of about 18 km on the East Anatolian Fault. For comparison: the earthquake that hit Italy in 2016 measured 6.2 on the Richter scale, the one that hit Turkey and Syria released 250 times as much energy.
In Italy some 300 people died as a result, in this quake died at least 42,000 people.

Just eleven minutes after the initial earthquake, the region was hit by a 6.7-magnitude after shock. A 7.5-magnitude quake occurred hours later, followed by a 6.0 spasm in the afternoon. In 1822, when approximately 20,000 people died after a 7.0 earthquake hit the region, the aftershocks lasted into the following year as well.

And while the late-20th century was rather calm - only three earthquakes registering above 6.0 on the Richter Skale in that area since 1970 -, the tectonic activity beneath *"essentially ensured that a devastatingly strong earthquake would eventually rock the region"*.
The first building codes in Turkey began to be instated after the 1936* rupture under the Marmara Sea and additional building codes were added in 1999 after another earthquake.
Another country prone to earthquakes is Japan. There, Fukushima experienced a 7.3-magnitude earthquake leaving four dead. But in contrast to eastern Turkey, the economic system in Japan is able to provide and engineer structures to withstand moderate earthquake magnitudes. The interviewed expert, Professor Joshua Russell from the Syracuse University, explains that the lack of enforcing regulations in Turkey results in this difference.

Seismic Risk Mitigation Practices in School Buildings in Istanbul, Turkey
In 1999, the Kocaeli earthquake of magnitude 7.6 damaged a significant amount of primary and seconday schools in the earthquake-affected region. On average, the performance of school buildings was much better* than that of the general building stock. Out of 820 schools that were reportedly affected: 689 schools were only slightly damaged (repair without interruption of education) 131 schools had to temporarily terminate educational activities, 13 of them were heavily damaged and replaced with new seismically safer schools,

59 of them were repaired, 37 of them were strengthend and 22 of them were demolished and reconstructed *The OECD article doesn't elaborate on the performance comparison
source: https://www.oecd.org/education/innovation-education/33629220.pdf

Table 2 - Included since it refers to the 1999 earthquake and it is overall an interesting read

On average, there are fewer than 20 quakes over 7.0 magnitude in any year. From 2013 to 2022, only two were of the same magnitude as the one on Monday.

One reason for the destructive earthquake is the East Anatolian Fault which is a strike-slip. *"In those, solid rock plates are pushing up against each other across a vertical fault line, building stress until one finally slips in a horizontal motion, releasing a tremendous amount of strain that can trigger an earthquake."* (Reuters)
A well-known one is located in the US, the San Andreas Fault in California. Here, scientists are also warning that a catastrophic quake is long overdue.

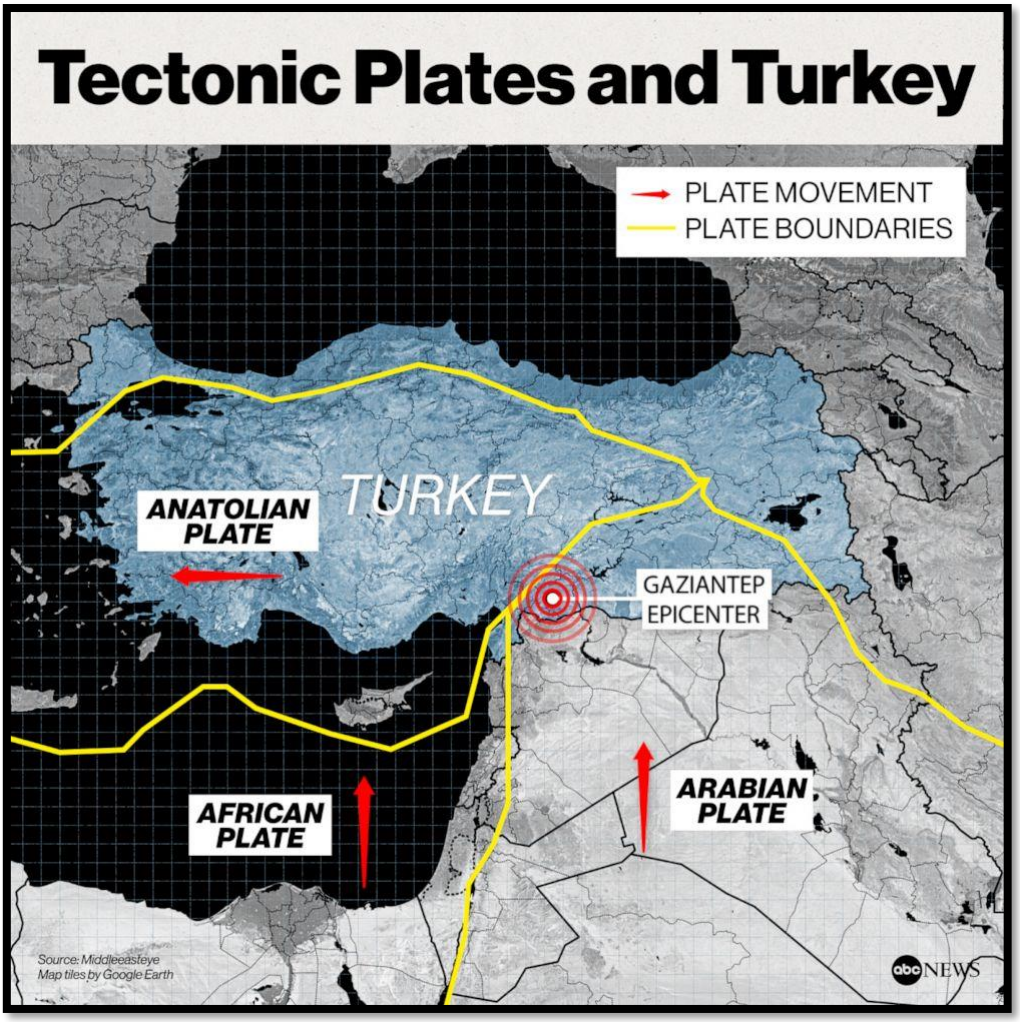


Illustration 16 - Tectonic Plates and Turkey (source: ABC News)

Another reason is that the earthquake involved a break on fault which stretched for 300 kilometers (186 miles). Susan Hough, a seismologist at the U.S. Geological Survey, told ABCNews that there's a correlation between size of the fault and the earthquake.

* While looking for more information on the building codes of Turkey in 1936 and 1999, I came across the study "Evolution of Seismic Building Design Practice in Turkey**!**" by an unknown author (judging from the number "2" before the title, I assume that it is very likely an excerpt from a journal or similar) where a more detailed insight was given:

Table 2-1 Key events in the evolution of seismic design codes in Turkey

Year	*Event*	*Code development*
1939	Erzincan earthquake (M7.9)	
1940	Committee formed to develop a seismic zonation map for Turkey	First seismic code published
1942		Earthquake zone map prepared; map promulgated in 1945
1943	Tosya earthquake (M7.2)	
1944	Gerede earthquake (M7.2)	Seismic code revised
1947		Seismic code revised
1949		Seismic code revised
1953		Seismic code revised
1958	Ministry of Reconstruction and Resettlement established	
1961		Seismic code revised
1963		Earthquake zone map revised
1966	Varto earthquake (M7.1)	
1967	Adapazari earthquake (M7.1)	
1968		Seismic code revised
1975		Seismic code revised; ductile detailing introduced
1992	Erzincan earthquake (M6.9)	
1997		Seismic code revised; ductile detailing required
1999	Izmit earthquake (M7.4) Düzce earthquake (M7.2)	

Illustration 17 - page 2

The 1968 revisal is designated as being "substantially different" from earlier codes. As the author explains: *"The 1968 code changed the procedures for calculating earthquake demands on building components, introduced requirements for detailing reinforced concrete components, and introduced modern concepts relating to spectral shape and dynamic response."* (p. 5-6)
Moreover, the code also introduced geometry and detailing requirements for reinforced concrete components.

In Syria, outdated building methods also contributed to the disaster. The Syrian seismic design code published in 2004, for instance, doesn't mention any MCE (Maximum Considered Earthquake) earthquake level anyhwere in the code (Ahmed Alhourani, Ji Dang June 2013, p. 3). The case study (authors already mentioned) *"A Framework for Performance-Based Seismic Design Approach for Developing Countries, A Case study of Syria"* (13 pages) goes more into detail and also proposes a solution (as well as including factors such as socio-economic conditions (present capability and future development).
Additionally, years of civil war left the infrastructure crumpling.

There are four major seismic sources in and around Syria: the Dead Sea Fault system (DSF), the Shear Palmyride Fault system (SPF), East Anatolian Fault system (EAF) south of Turkey and the Zagros Thrust Zone system (ZTZ) northwest of Iran.

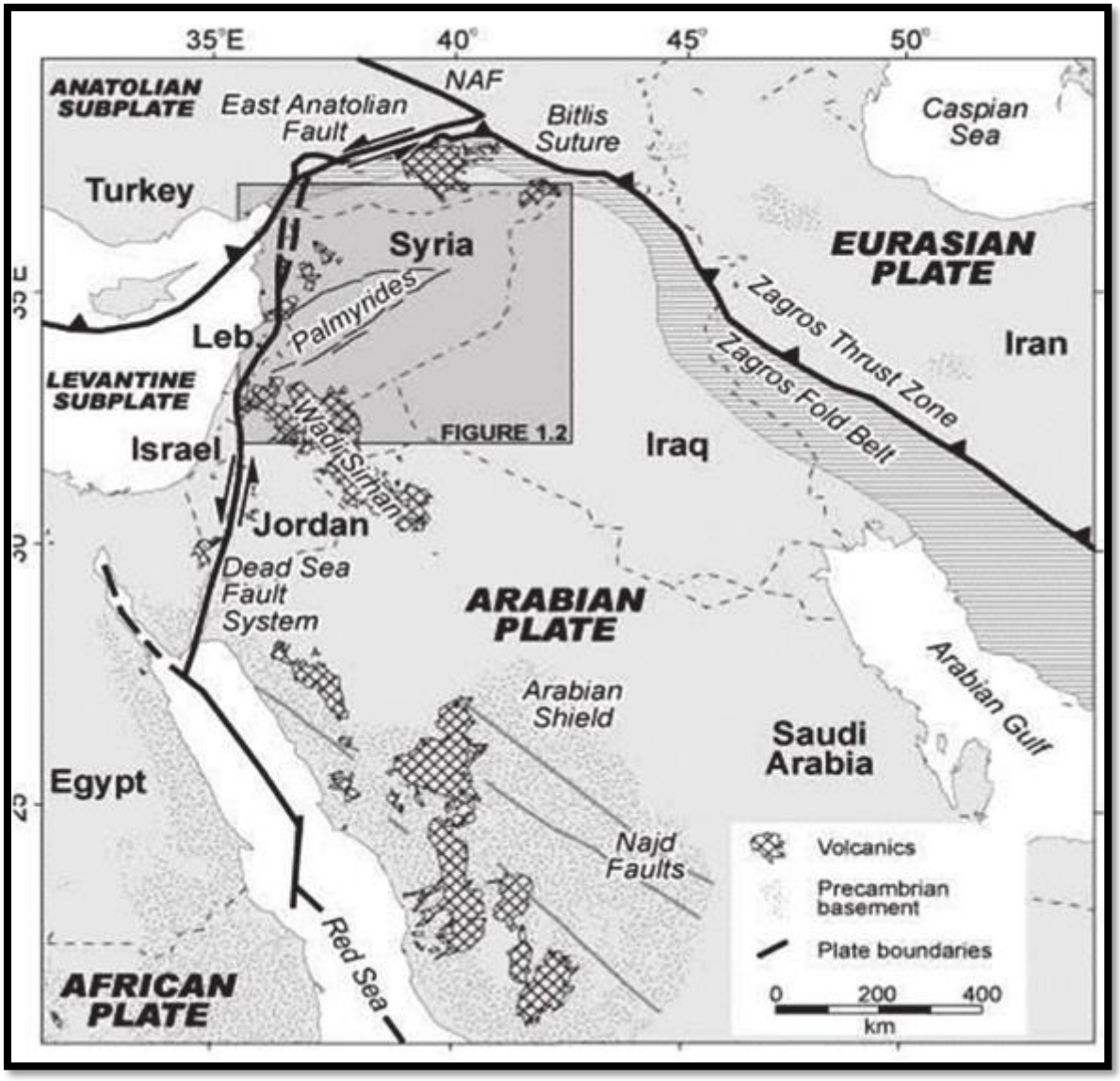


Illustration 18 - Tectonic features of Syria and surrounding region
(source: A Framework for Performance-Based Seismic Design Approach for Developing Countries, A Case study of Syria)

Kit Miyamoto, when interviewed by NPR, said that the building codes enacted after the 1999 quake near Izmit are good, but many structures predate those codes.

"Anything built prior to 2000 can be considered very dangerous," he says. Further, even with the newer building codes, enforcement is "not very robust," so even some of the latest construction is not necessarily up to standards. (NPR)

Author's Note

Here, I focused more on the cause of the severity of the earthquake and the nature of both countries Turkey and Syria (tectonic plates). I read the two studies to gain a greater insight into this topic, if you still have any suggestions or proposal for improvement feel free to comment or email me (this goes for all of my blog entries, the more the merrier - reader's letters are welcome too).

Sources

How regional fault lines led to such a destructive earthquake in Turkey, Syria
https://abcnews.go.com/International/regional-fault-lines-led-destructive-earthquake-turkey-syria/story?id=97005531

Explainer: Why was the Turkey-Syria earthquake so bad?
https://www.reuters.com/world/middle-east/why-was-turkey-syria-earthquake-so-bad-2023-02-06/

In Turkey and Syria, outdated building methods all but assured disaster from a quake
https://www.npr.org/2023/02/07/1154816277/turkey-syria-earthquake-why-buildings-collapsed

Evolution of Seismic Building Design Practice in Turkey (PDF, 20 pages)
! When I downloaded the file, Windows Defender showed three low risks.
It can be opened without being downloaded, at least when I accessed it over the search engine, don't know if it automatically downloads when directly linked.
https://teknolojikkazalar.org/get_file?id=4acb555634176

A Framework for Performance-Based Seismic Design Approach for Developing Countries, A Case study of Syria (website with pdf download, 13 pages)
https://www.researchgate.net/publication/280091949_A_Framework_for_Performance-Based_Seismic_Design_Approach_for_Developing_Countries_A_Case_study_of_Syria

Togo

Location: Togo (officially: the Togolese Republic) is a country in West Africa. The three neighbouring countries bordering her are Ghana (West), Benin (East) and Burkina Faso (North), to the South is the Gulf of Guinea.

Illustration 19 - Image: Wikipedia

General Information: Togo's surface area is 56,785 km², thereby it is about 1/3rd larger than Switzerland with 41,284 km². The population of Togo is 8.48 million and it is made up of 30 ethnic groups, the north and southwest is inhabitated by indigenous Togonese. In the north are the Gurma; the Natimba, Dye, and Konkomba; the Tamberma; the Basari; the Moba; the Losso (Naudem); the Kabre and Logba; and the Lamba (Namba); a small number of Atlantic-speaking Fulani; and the Kebu (Akebu). In the southwest live the indigenous Kwa peoples, also belonging to the central Togo group are the Kposo (Akposso), the Adele, and the Ahlo. Lomé is the capital of Togo, but there also other important cities like Kara, Sokodé, Kpalimé

and Atakpamé. French is the administrative language. Lastly, the form of government is a presidential republic and the last revision to the constitution was in 2019.

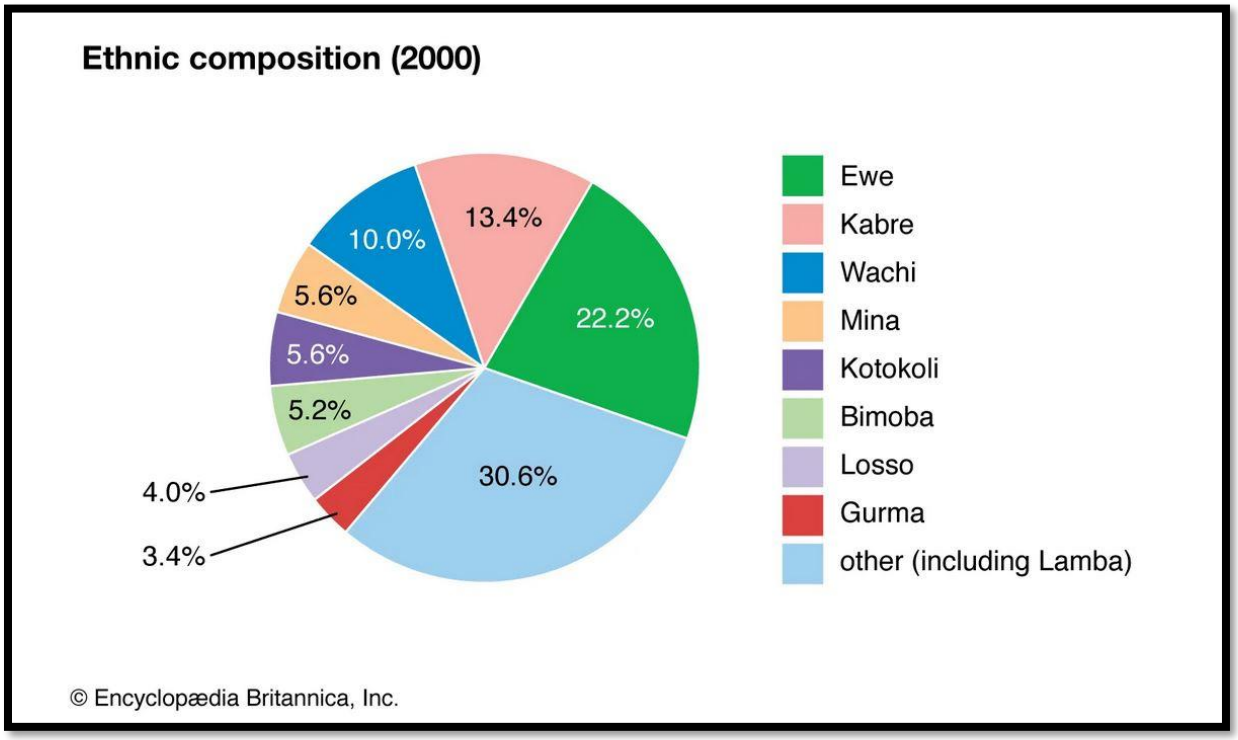


Illustration 20 - Ethnic composition of Togo (source: Encyclopedia Britannica)

Short History[1]: Before the colonial era, Togo was an intermediate zone between the states of Asante and Dahomey and its various ethnic groups lived in general isolation from each other. During the colonial era, it played an important role during the slave trade and in 1884 it became part of the Togoland German protectorate. For 30 years it remained a German colony, then it was occupied by British and French troops. In 1922, the League of Nations assigned eastern Togoland to France and the western portion to Britain. After the Second World War, in 1946, the British and French governments placed the territories under United Nations trusteeship where it would stay until it gained its independence on April 27, 1960 - only the former French area, the former British area was incoporated into the Gold Coast. 7 years later the government was overthrown by Gnassingbé Eyadéma who governed Toga dictatorial until 2005. Since then, slight tendencies towards democratization are observable. However, the dynastically-structured governing party still dominates the economic and political sphere.

News: On February 10 at 1533 (3:33 pm), africanews reported on a released 86-paged document which made headlines that week and led to discussions on social media, several opposition figures also called on the president (Faura Essozinma Gnassingbé, since May 4, 2005) to take action. The report revealed that **13 million euros** were spent on the purchase of 31,500 tonnes of rice by the Ministry of Commerce, without any trace of an order. Further, cash transfers meant for the poorest flowed sometimes to people who were not eligible.

Back in March 2020, after the discovery of the first case of coronavirus, the government created the **Covid-19 Response and Solidarity Fund (FRSC)**. The fund received technical and finanical support from international partners, such as the Union European, the IMF or even the World Bank. **In 2020, 108 billion FCFA (165 million euros) were spent.**

*"The opposition calls on the president to "act", like **MP Gerry Taama** who sees this report as proof of embezzlement of public funds. "At a time when **Covid-19** and the high cost of living lead Togolese to tighten their belts, it is intolerable that other compatriots (of) take advantage to enrich themselves," he said in a statement."*

On the same day at 1642 (4:42 pm), the Togolese government dismissed the allegations. For the executive, the Court *"did not establish a report of embezzlement or fraud"* and the government argued that *"[the] Court [recognized] that the possible ineligibility of an expenditure may [arose] from a context marked by extreme urgency due to the unpredictability of the crisis (…) This does not mean that the expenditure is fictitious or that the funds have been used in an illegal or even misappropriated way"*.

The **Dynamic Monsignor Kpodzro (DMK)** - consisting of seven opposition political parties and six civil society organizations - published a press release where they invited the public prosecutor to *"self-seize in this case"*, further, *"[the] DMK believes that once again, the Togolese people have just been betrayed by men and women who do not have their trust, and Faure Gnassingbé must draw all the necessary consequences," the statement added"*.

That's the development as of now*, for those who are now interested in Togo: the legislative elections are coming up, with the previous taking place in 2018 (boycotted by main opposition parties who cited irregularities in the preperations). A main Togo opposition party already held a rally ahead of the election with the ANC president saying: *"We want change in this country and the ANC is a political party that fights. The Togolese people are suffering and we must fight to get the country out of this situation."*
(More: https://www.africanews.com/2023/02/13/main-togo-opposition-party-holds-rally-ahead-of-elections/)
On an international level, Togo also participated in the Munich Security Conference, but the article is in French: *"Le Togo était représenté par une délégation conduite par le ministre des Affaires étrangères, de l'intergénération régionale et des Togolais de l'extérieur, le professeur Robert Dussey."*
(Article: https://icilome.com/2023/02/allemagne-une-delegation-togolaise-a-la-msc-2023/)
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(Article: https://icilome.com/2023/02/allemagne-une-delegation-togolaise-a-la-msc-2023/)

*at least on africanews, there's one from February 18 on the French website, but I'm still very much a French beginner which is why I wouldn't be able to correctly translate it (Article: https://icilome.com/2023/02/togo-gestion-des-fonds-covid-de-vaines-tentatives-pour-noyer-le-rapport-de-la-cour-des-comptes/)

Author's Note

The developments, both on the mismanagement of Covid-19 funds and the upcoming legislative election, are worth further attention. While writing about Togo I was glad learning about another country and I hope that I may even sparked interest in some for this African country. In case you want to know the full list of participants of the Munich Security Conference, which I mentioned at the end, check out the official website where it is in a pdf file listen: https://securityconference.org/en/msc-2023/participants/

Sources

[1] Der Neue Kosmos (p. 419)
Welt - Almanach & Atlas 2023
ISBN: 978-3-440-17319-0
Publisher: Kosmos

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https://www.britannica.com/place/Togo

News on Togo
https://www.africanews.com/search/Togo

News (French)
https://icilome.com/category/pays/togo/

(Released: 22nd February 2023, 9:26 pm/21:26 Uhr)

Science News #017

In Today's Science News, we learn about the discovery of a new orchid in Japan, a new substance in the fight against antibiotic resistant bacterium and how predictable renewable energy could lower costs.

Illustration 21 - Image by Foto-Rabe (Pixabay)

Article 1: An elegant new orchid hiding in plain sight

SD-Date: 17th March, 2023
Et-Date: 18th March, 2023
ScienceDaily-Summary: *"It is extremely rare for a new plant species to be discovered in Japan, a nation where flora has been extensively studied and documented. Nevertheless, botanists recently uncovered a stunning new species of orchid whose rosy pink petals bear a striking resemblance to glasswork. Interestingly, it can be found in familiar environments such as lawns and parks, and even in private gardens and on balconies. This research suggests that other new species may be hiding in common places."*
Open Access Study: https://link.springer.com/article/10.1007/s10265-023-01448-6

Background

Japan's flora has been extensively studied and documented; hence the discovery of a new taxon is an extraordinary event. The discovery happened during extensive field surveys on the Japanese *Spiranthes*, when Professor Suetsugu Kenji came across several populations of an uknown *Spiranthes* species with hairless flower stems, on the mainland of Japan. Until then, it was believed that the *Spiranthes australis* was the only species of its kind.

Illustration 22 - Pictured: Flower spike of Spiranthes australis in Barrington Tops National Park ((source: Wikipedia)

While the unknown taxon often grows alongside the Spirathes australis, it blooms about a month earlier. This gap leads to reproductive isolation between the two taxa.

Flora and Fauna
source: https://web-japan.org/factsheet/en/pdf/e03_flora.pdf (4 pages)

In Japan, there grow about 5,560 plant species (4,720 angiosperms, 40 gymnosperms, 800 ferns). Indigenous to Japan are 1,950 angiosperms and gymnosperms (35%), thus having more endemic species than other countries.

Method of Research

In a 10-year multi-institutional study, a team of researchers including Professor Suetsugu (Graduate School of Science, Kobe University), Professor SUYAMA Yoshihisa (Graduate School of Agricultural Science, Tohoku University), and Dr. Tian-Chuan Hsu (Taiwan Forestry Research Institute) set out to determine precisely how these two plants differed. The specimens were collected from various locations in Japan, Taiwan and Laos.

Suetsugu and his associates discovered that the now-called *Spirathes hachijoensis** is a cryptic species which exhibits a high level of molecular divergence by integrating results from DNA analysis, morphology, field observations, and reproductive biology.
Morphologically, there are only minimal differences.

*It was first spotted near Hachijo Island in Tokyo Prefecture, thus receiving the name hachijoensis. It can also be found in lawns, parks, on private gardens and on balconies.

(image on next page)

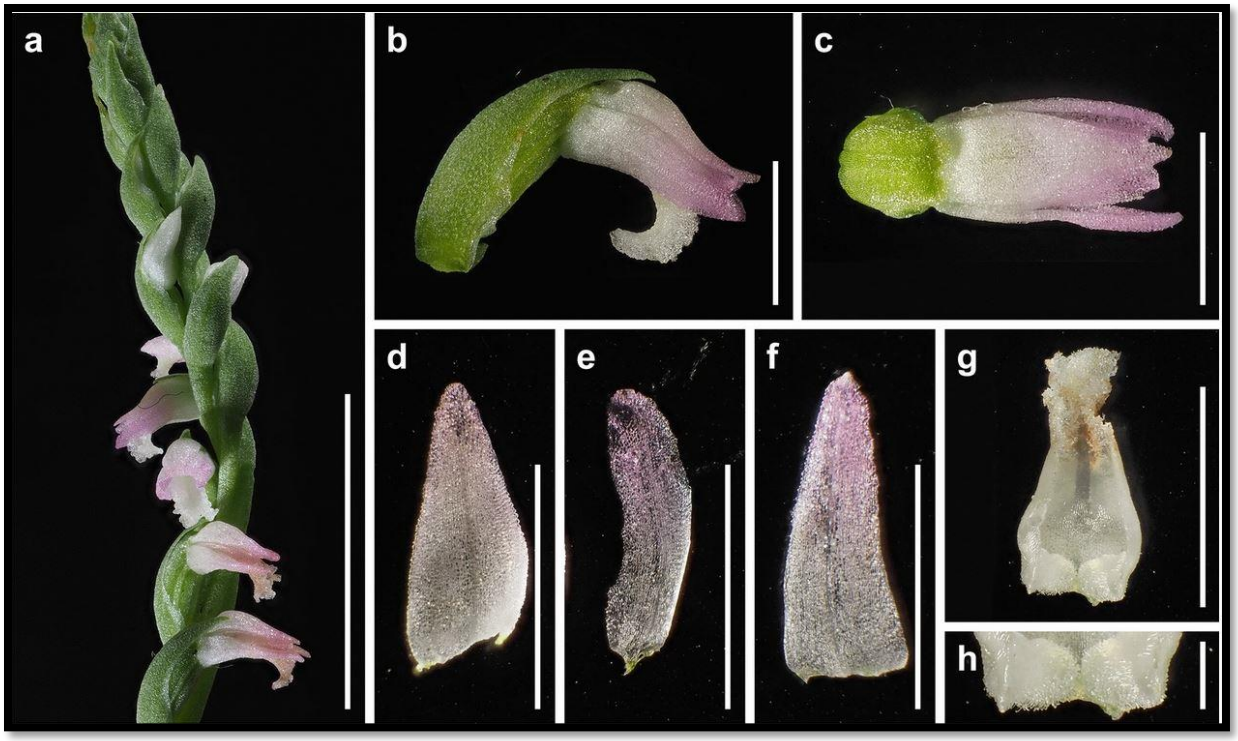


Illustration 23 - Spiranthes hachijoensis (Kyoko Kaneda & Mayumi Sugiura Ss205-4, KYO) on Hachijo Island, Tokyo Pref., Japan. **a** Inflorescence. **b** Flower, lateral view. **c** Flower, top view. **d** Dorsal sepal. **e** Petal. **f** Lateral sepal. **g** Labellum (source and description: Springer Nature)

Meaning

Both for the scientific community and the general public, this discovery of a new species in common locales emphasizes the importance of further exploration and species conservation (which is also enviromental protection). Who knows how many unknown taxa are out there? Whether they are in the own garden, the nearby forest or growing next to known algaes in coastal areas.

Source

https://www.sciencedaily.com/releases/2023/03/230317145030.htm

Author's Note

The article also mentions the Manyoshu, 'Japan's oldest extant anthology of poetry', in case you are interested in the poems I may have found the right website.

Man'yōshū 万葉集 (Link: https://www.wakapoetry.net/poems/anthologies/manyoshu-%E4%B8%87%E8%91%89%E9%9B%86/)

Excerpt: "Nevertheless, the *Man'yōshū* is probably the collection held in the highest esteem and regarded with the greatest affection in Japan today. Its poetry is felt to be fresh, direct and free of the complex word-play, allusions and restrictive rules which came to dominate later *waka*."

Article 2: Resistant bacteria are a global problem. Now researchers may have found the solution

SD-Date: 17th March, 2023
Et-Date: 19th March, 2023
ScienceDaily-Summary: *"A new substance has proven useful for treating staphylococcus infections in people with skin lymphoma. This is good news for the patients, but also for the global threat of antibiotics resistance."*
Open Access Study: https://www.jidonline.org/article/S0022-202X(23)00175-6/fulltext#secsectitle0010

Background

Antibiotics are medicines used to prevent and treat bacterial infection.
Antibiotic resistance occurs when bacteria adapts in response to the use of these medicine. It becomes a major problem when it can be bought for human and animal use without prescription. A similar problem exists in countries without standard treatment guidelines due to health workers and veterinarians overprescribing antibiotics and public over-use.

Staphylococcus aureus infections are usually not dangerous, but it can cause serious infections such as bloodstream infections, pneumonia, or bone and joint infections.
Multi resistant staphylococcus aureus or MRSA are often resistant to several antibiotics and, therefore, are difficult to control. This resistance against antibiotics is a global trend as other infections such as pneumonia, tuberculosis, gonorrhoea, and salmonellosis adapt as well. As a result, the treatment becomes harder and the situation can sometimes turn lifethreatening. For the healthcare system that means higher medical costs, longer hospital stays and increased mortality.

The study at hand produced positive results among skin lymphoma patients thanks to a new substance called endolysins. Without the need for antibiotics, it proved capable of killing both resistant and non-resistant staphylococcus aureus.

What Are Endolysins?
Excerpt from The Advantages and Challenges of Using Endolysins in a Clinical Setting published in The National Library of Medicine.
Link: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8071259/

"Endolysins are bacteriophage-encoded peptidoglycan hydrolases that act to lyse (= breaking down a cells membrane) bacterial cells by targeting their cell's wall, particularly in Gram-positive bacteria due to their naturally exposed peptidoglycan layer. These lytic enzymes have received much interest from the scientific community in recent years for their specificity, mode of action, potential for engineering, and lack of resistance mechanisms."

Method of Research

The research was conducted by Professor Niels Ødum, Emil M.H. Pallesen, Maria Gluud et al. at the University of Copenhagen - The Faculty of Health and Medical Sciences and published in the *Journal of Investigative Dermatology*. The substance was tested on skin samples from patients which were obtained with written, informed consent after approval by the Committee on Health Research Ethics as regulated by the Declaration of Helsinki.

The Declaration of Helsinki
(source: World Medical Association)
(full text: https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/)

First adopted in 1964, the Declaration of Helsinki has since been amended seven times and most recently in October 2013 at the General Assembly. It is a set of ethical principles regarding human experimentation.

In the section **Informed Consent** you can read up on the requirements and regulation.
Since the research used samples, I think it is covered by paragraph 32: *"For medical research using identifiable human material or data, such as research on material or data contained in biobanks or similar repositories, physicians must seek informed consent for its collection, storage and/or reuse. There may be exceptional situations where consent would be impossible or impracticable to obtain for such research. In such situations the research may be done only after consideration and approval of a research ethics committee."*

Results

The lab research yields positive results. According to Professor Niels Ødum, the endolysins not only eradicate staphylococcus aureus, but they also inhibit their ability to promote cancer growth. Since endolysins are not antibiotics, they do not care whether a bacterium is resistant or non-resistant to antibiotics.

Source

https://www.sciencedaily.com/releases/2023/03/230317145038.htm

Article 3: More predictable renewable energy could lower costs

TechXplore Date: 24th March, 2023
Blog Entry Date: 25th March, 2023
Summary: "*In a new study, researchers analyzed six existing solar farms in New South Wales, Australia and selected up to nine alternative sites. When they compared the data, the optimal location changed when the predictability of energy generation was considered which also led to a significant increase in potential revenue generated by the site.*"
Open Access Study: https://www.cell.com/patterns/fulltext/S2666-3899(23)00045-4

Method of Research

The researchers Sahand Karimi-Arpanahi and Dr. Ali Pourmousavi Kani from the University's School of Electrical and Mechanical Engineering analyzed six existing solar farms located in New South Wales, Australia and selected up to nine alternative sites.
Physical materials were not used in this study, it is formula-heavy (as I interpret it from the 'experimental procedures' section in the study) and for prediction methodology they used the ARIMA model among others.

What is ARIMA?
(source: https://www.mastersindatascience.org/learning/statistics-data-science/what-is-arima-modeling/)

Autoregressive integrated moving average (ARIMA) is a model used in statistics and econometrics to measure events that happen over a period of time. The model is used to either understand past data or predict future data in a series. Used when *"a metric is recorded in regular intervals, from fractions of a second to daily, weekly or monthly periods"*.

The authors of the study recommend the book *Forecasting: Principles and Practice* by Hyndman and Athanasopoulos for additional information on the model which you can find as an online version here: https://otexts.com/fpp2/index.html.

Findings

From August to October, the predictability of solar energy generation is the lowest in South Australia while it is the highest in New South Wales around the same time.

By considering the predictability in renewable plant investments, it can lead to better decisions with higher profits. Moreover, by comparing the rooftop PV density and predictability data in SA, the authors showed how policymakers can benefit from considering renewable generation predictability in policy design.

Note: The predictability measure cannot be used for long-term predictability (months and years ahead), it works well for short-term predictability.

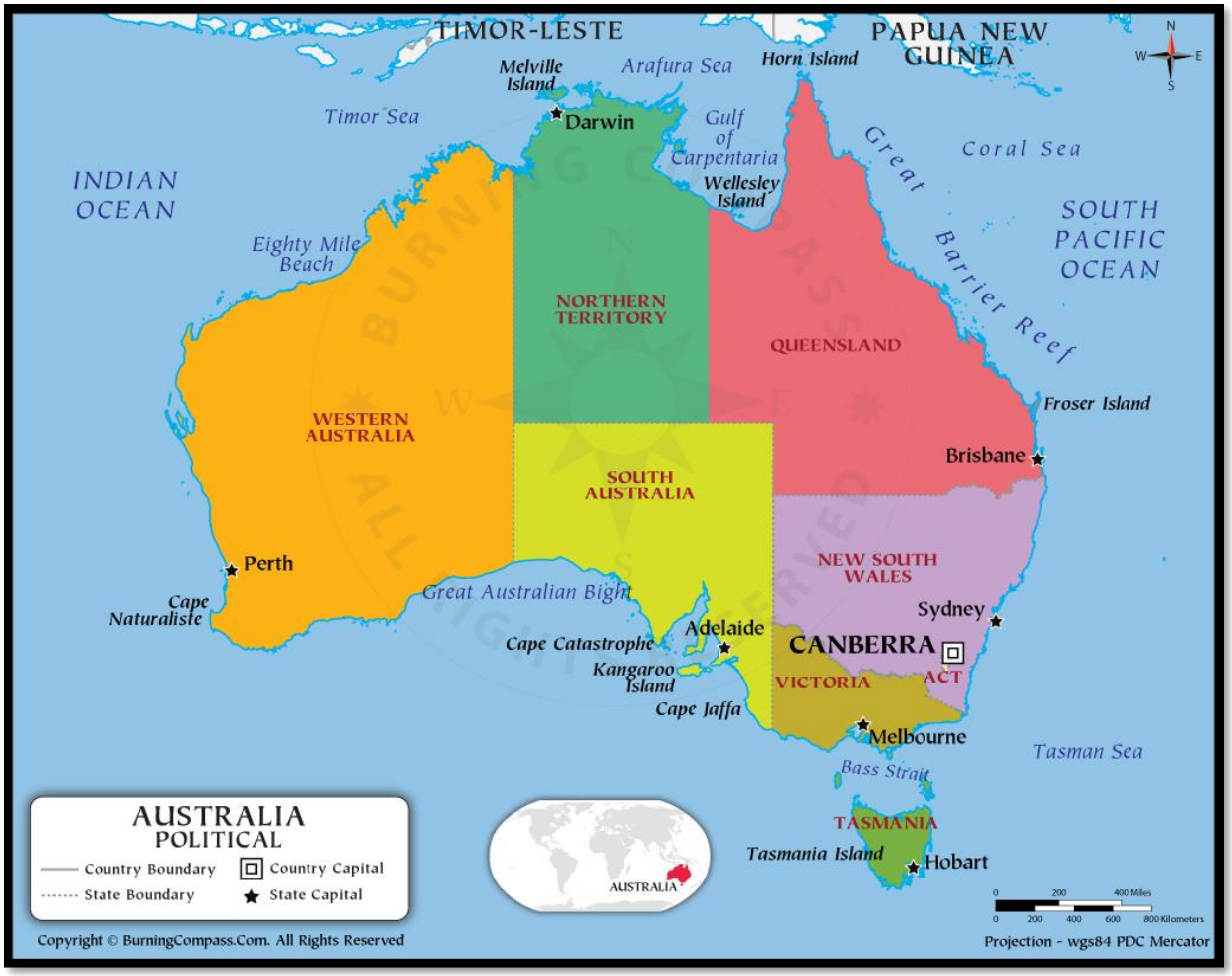


Illustration 24 - Map of Australia (source: burningcompass)

Lastly, the analysis may be applied to other applications in the energy industry as well.

"The average predictability of renewable generation in each state can also inform power system operators and market participants in determining the time frame for the annual maintenance of their assets, ensuring the availability of enough reserve requirements when renewable resources have lower predictability," said Dr. Pourmousavi Kani.

Source

https://techxplore.com/news/2023-03-renewable-energy.html

(Released: 25th March 2023, 2:52 pm/14:52 Uhr)

Artifical Intelligence: Responsibilities and Approaches

The development of artificial intelligence has been going on for decades now, in the light of ChatGPT it seems to have outpaced humanity in the area of text, image and video manipulation. Naturally, it led to discussions over the ethical usage and ramifications on society. With surprising ease, anyone can use it and make it look deceptively real.

In this blog entry, we shall therefore focus on the new responsibilities and think about approaches how to deal with this challenge. What I mention here may have already been said or written somewhere else, or you yourself thought and wrote about it. The more the merrier! What won't be subject of this discussion is any hypothetical super AI that could theoretically exist in the far future. Without furder ado, we shall begin.

It shall be understood that this blog entry contains mostly thoughts and measures that need to be refined, contributing to a public discussion that is essential for our future.
It is also important that we don't lose sight of existential matters such as the climate crisis, but we focus on that subject another time.

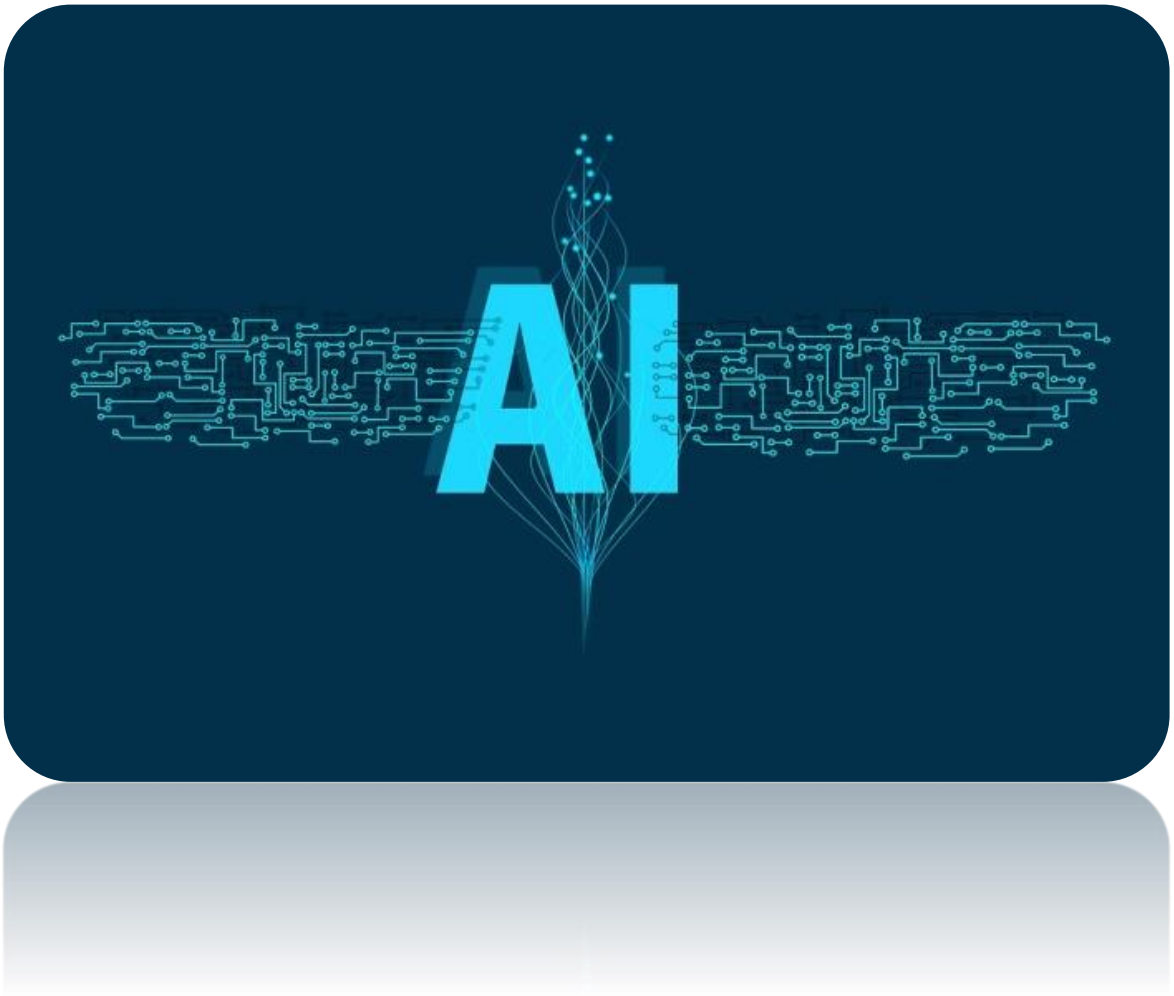


Illustration 25 - Image by geralt (Pixabay)

What is Artificial Intelligence?

Before we begin this discussion, it is best we start by defining what it is we are having a discussion about. For the definition, I use the one given by the Oxford English Dictionary:
"[Artificial Intelligence is] the capacity of computers or other machines to exhibit or simulate intelligent behaviour [...]*"*

Practically speaking, you ask ChatGPT a question and it attempts to answer it as if you were speaking to a human. Whether it already exhibits intelligent behaviour or merely simulates intelligent behaviour is a different question. Here, it is not relevant.

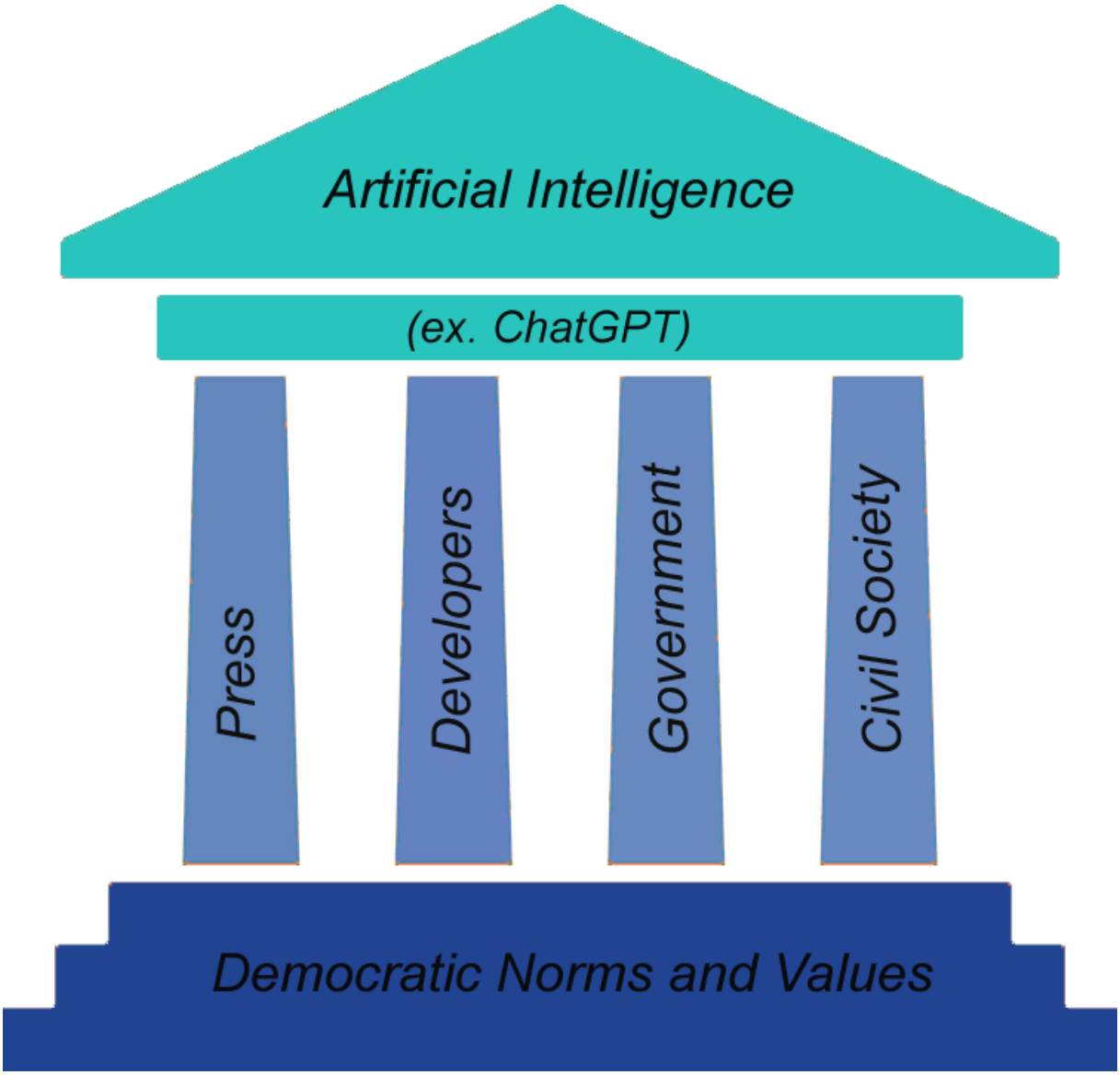
Its answers, of course, are only as good as the information and database it was provided with during its training and what it is given access to while it operates.

Responsibilities and Approaches

Artificial Intelligence requires a guiding hand, both during its development and application. The four categorizes, visualized as pillars, are broad and include **the Press** (both public and private, including their media presence as whole from classic newspapers to social media), **the Developers** (meaning the companies and programmers), **the Government** (also includes political parties as the bridge between the government and the people) and **Civil Society** (e.g. NGOs, registered associations, individual bloggers, people initiative). It is only applicable to democracies - or emerging democraties -, since only here an open exchange and public discourse is possible without the fear of repercussions or social sanctions on part of the government.

This fundament allows for productive discussions which seeds can grow to a bountiful harvest. Naturally, groups who are opposed to this very fundament (such as right-wing extremists) cannot - and shall not - participate to any extent. One has therefore prepare for disruption strategies on their part and attempts to destroy this fundament, as it is already the case (e.g. January 6, 2021 in the USA (groups such as the 'Proud Boys'), the Reichsbürger in Germany). Foreign influence needs to be accounted for as well, from Russian broadcasters like Russia Today to social bots used by China in social networks.
For a definition of these 'hostile influences', see tabel at the end.

…



The Press

It is the responsibility of the press, as it already is - or at least is supposed to be -, to clearly state where they got their image/photo or video from. For the average person it must be open to scrutiny, for instance by embedding the link to the picture in an article or listing it at the end under a section called 'sources' or 'links'. Through this measure the publisher maintains their integrity and reputation and the reader can be rest assured that what they see did in fact happen. Moreover, said websites (like dpa - the German Press Agency/Deutsche Presse-Agentur) should also always make it clear where and when they took the photo (very likely already part of the job, just mentioning it for the sake of completeness).

The Developers

The companies developing it bear a lot of responsibility, more than anyone else does. They decide which sources and database they train the AI with, which information it has access to

once it is operating and what the AI is programmed to do or not to do. Transparency is therefore key, as much as the trade secret allows (conflicts may still emerge as a result).

What is a Trade Secret?
(source: https://www.investopedia.com/terms/t/trade-secret.asp)

- Trade secrets are secret practices and processes that give a company a competitive advantage over its competitors (these can take a variety of forms, "such as a proprietary process, instrument, pattern, design, formula, recipe, method, or practice that is not evident to others").

- Trade secrets may differ across jurisdictions but have three common traits: not being public, offering some economic benefit, and being actively protected.

- U.S. trade secrets are protected by the Economics Espionage Act of 1996.-

The creation of an ethics committee within the company is therefore unavoidable. Their task is to document the entire development process, retroactively as well. The ethic committee, in turn, answers to the public (the press, congress/parliament, etc.). Ideally, the reasoning is written down and released as well - either in form of minutes or as part of the internal documentation.

The Government

The government is responsible for the regulatory framework, including the enforcement of an ethics committee. Just like the press, they are also obliged to show in detail when and where a photo was taken. Additionally, they should also include who wrote the statement or at least document it internally for journalists open to view.

A measure that likely needs a lot of public pressure before the government implements it, is a system that holds the government itself accountable. Any attempt - successful or not - to deceive the public through fraudulent images and text documents is to be punished.

Here, an independent organization should be formed that watches over the government and is qualified to interrogate and - if necessary - arrest politicians by revoking the privilege of Parliament - extending to ministers, head of states and other high representatives too. Only a court (most likely the supreme court of a country) is allowed to issue an arrest, in case of a state parliament it is the respective state court. The degree of the penalty is up to the court and depends on the severity of the fraud, of course (from disciplinary warning letters to prison time).

When it comes to education, tools such as ChatGPT should be made accessible. Once the technology exists, it will be used anyways. In the latter case, those who are already disadvantaged will experience more disadvantages while students with wealthier families and take full advantage of the new technology.

In lessons it could therefore be included and taught how to constructively use it, since the AI does not just repeat information but can also elaborate on it. The teacher, in turn, proof-

reads the essay or the answer of the AI. That way the AI nurtures critical thinking and could even help in the way of argumentation.

Civil Society

Society at large is already aware of ChatGPT, and as I'm writing this blog entry groups who talk and argue about Artifical Intelligence in this context have already formed or are in the process of being formed. It is up to the citizens to be mindful and ensure that both the press and the government always cite the details of where and when the photos were taken. It shouldn't take more than 5 minutes for someone to trace back the photo or video.
One could say it is also an extension of the freedom of information.

When it comes to blogs like this, local groups or national and international organisation we should also recognize our responsibilities. Mistakes may still happen, but there's no need to panic as long as the apology and revision is honest and sincere. Photos and videos created by an AI should still be designated as such to avoid confusion, especially if it is in form of a parody or other harmless projects that are protected by freedom of speech and artistic liberties.

A prominent and recent examples of an AI-created image is Amnesty International, the organization used a fake image depicting protests and police brutality in Colombia.
The documentation before Amnesty International published this fake image already raised awareness of police brutality in Colombia and contributed to a the growing acceptance of the need for reform. Hence I completey agree with Juancho Torres, who's a photojournalist based in Bogotá. He said: *"We are living in a highly polarised era full of fake news, which makes people question the credibility of the media. And as we know, artificial intelligence lies. What sort of credibility do you have when you start publishing images created by artificial intelligence?"* AI-generated images would also make it easier for authoritarian or corrupt governments to dismiss anything brought forward against them.

Under these circumstances, it may be overdue for a social contract in a literal sense where the various registered associations, organizations and so on join to agree on an ethical and transparent usage of AI-generated texts and images. Back to public discourse, I personally think that it is important to discuss the risk and chances, pro and cons, of AI in an open manner. That way no one is left behind and our democracies are ideal to not just give everyone a voice - even marginalized groups - but also listen to all of the voices.

This is a future only we can mould together, if it is supposed to be a better version of the present.

Hostile Influences

To fall in this category, a country, group or individual has to exhibit a constant destructive tendency. A destructive tendency **is not** counterproductive (*having an effect that is opposite to the one intended or wanted*, as defined by the Cambridge Dictionary); under a destructive tendency **is to** be a behaviour and attitude understood that aims to undermine elements like a **scientific consensus** (e.g. climate change) by spreading disinformation (deliberately spreading misinformation), threatens the **fundament of democracy** (e.g. norms, values, institutions) or attempts to poison **public discourse** (for instance by normalizing/triviliazing antisemitism, xenophobia or else, in this case disinformation plays a major role as well).

Mechanism: In order for this definition to work, long-term observations are necessary (esp. when new groups are formed or older groups radicalize themselves). For instance, confrontational behaviour on its own should not be seen as a sign for hostile influence.

Grey Areas: The grey areas may differ from country to country, most notably the prejudices. Here, it depends on how they are handled by society at large and whether the discourse has already been poisoned for decades. The process of detoxiciation can be a lenghty one, spanning over decades. Prejudices on an individual basis or group basis (e.g. a political party) have to be addressed and resolved, it prerequisties good faith (meaning that it must be done in an honest and sincere way).

Table 3 - Note: The definition may be subject to changes, if parts of it are considered to be too vague (-> feedback)

Conclusion

Artificial Intelligence confronts us with new challenges and problems, but none that cannot be resolved if the political will exists.

(Released: 29th May 2023, 11:47 pm/ 23:47 Uhr)

Science News #018

In Today's Science News, we learn about the discovery of unknown antibiotic-resistant genes in bacteria, the development of a new superconducting diode which could improve the performance of quantum computers and AI as well as evidence for phosphorus on Saturn's moon Enceladus.

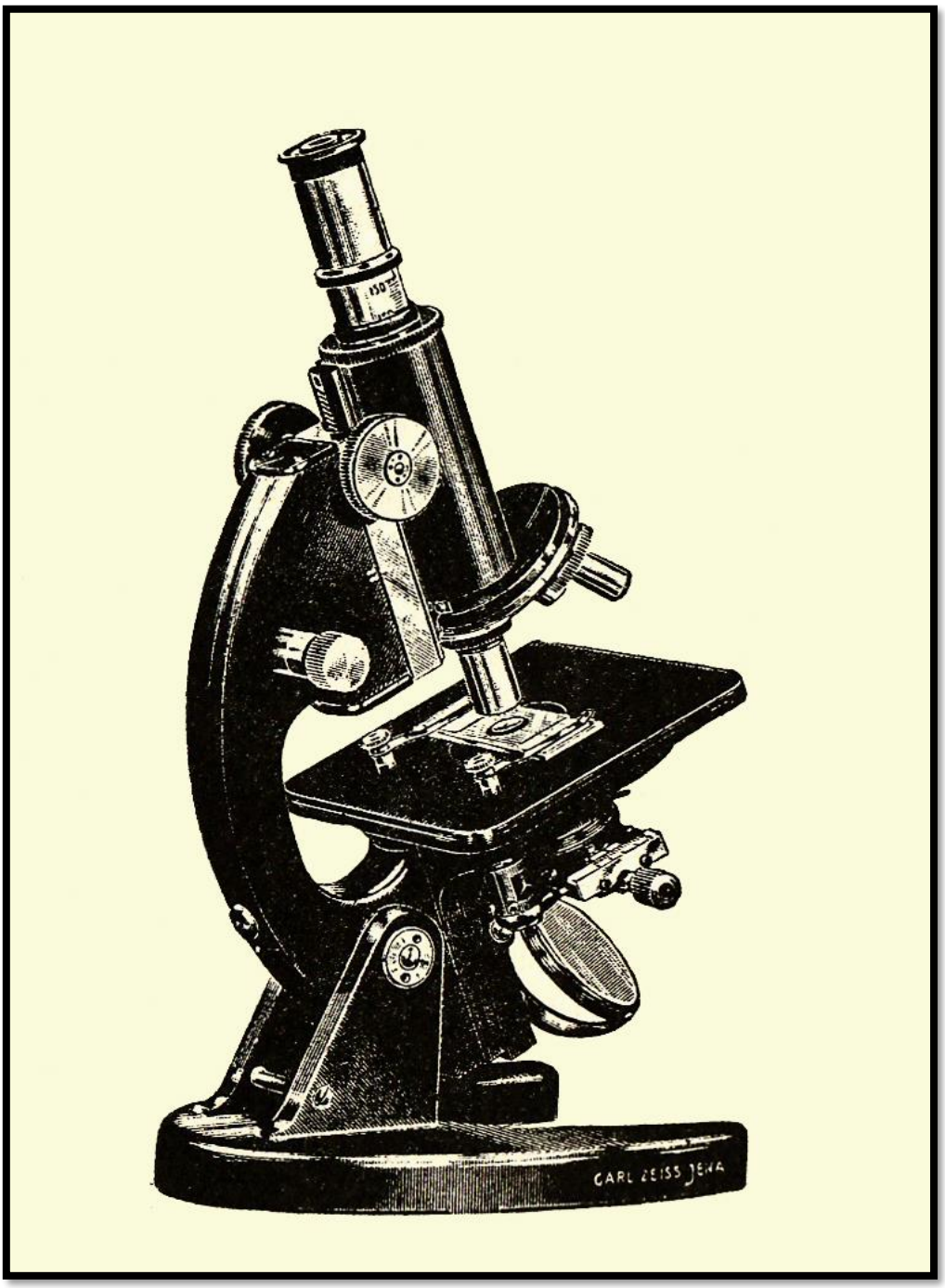


Illustration 26 - Microscope by Calsidyrose (Flickr)

Article 1: Previously unknown antibiotic resistance widespread among bacteria

SD-Date: June 5, 2023
Et-Date: June 11, 2023
ScienceDaily-Summary: *"Genes that make bacteria resistant to antibiotics are much more widespread in our environment than was previously realized. A new study shows that bacteria in almost all environments carry resistance genes, with a risk of them spreading and aggravating the problem of bacterial infections that are untreatable with antibiotics."*
Open-Access Study:
https://microbiomejournal.biomedcentral.com/articles/10.1186/s40168-023-01479-0

Method of Research

The study was conducted by the Chalmers University of Technology and the University of Gothenburg in Sweden. The researchers used DNA from two databases, the first being ResFinder that already contained thousands of previously known antibiotic resistance genes in bacteria and then extended upon it with a large number of new resistance genes they had found with their own analysis. In total, the resistance genes amounted to 20,000.

MGnify served as the second database, it contains large quantities of bacterial DNA from various sources *'such as bacteria living on and in people, in sewage treatment plants and from the soil and water'*. It was used to find out how common the resistance genes were in bacterial DNA. Overall, 630 billion DNA sequences were analysed.

For the analysis, the researchers used a method known as the metagenomics. It isn't new, but until now it hadn't been used to analyse new types of anti-biotic resistance genes in the aforementioned quantities.

Definition of Metagenomics
(source: https://www.genome.gov/genetics-glossary/Metagenomics)

"Metagenomics is the study of the structure and function of entire nucleotide sequences isolated and analyzed from all the organisms (typically microbes) in a bulk sample. Metagenomics is often used to study a specific community of microorganisms, such as those residing on human skin, in the soil or in a water sample." (June 7, 2023)

In 2007, a book was published called *"The New Science of Metagenomics: Revealing the Secrets of Our Microbial Planet"*. The National Library of Medicine made it acccessible on their website, or at least the part about Metagenomics. In case you are interested, you can read it here: https://www.ncbi.nlm.nih.gov/books/NBK54011/. The book is also available as a PDF-file (170 pages in total, see website for download).

Unlike in other studies, where the widespread genes that make pathogenic bacteria resistant were the the main focus, the research team sought to understand how common these resistance genes in general are by analyzing large quantities of DNA sequences.
As previously mentioned, they analysed 630 billion DNA sequences from different environ-

ments (in and on people, in the soil, from sewage plants, etc.). Before any information could be obtained their data required a great amount of processing, and the choice of tool was metagenomics that allows such vast quantities of data to be analyzed.

Findings

- In almost all environments, antibiotic resistance genes were found in bacteria - including of bacteria in and on people
- Resistance genes from bacteria living in and on people are 10x times more more abundant than previously known
- In the human microbiome, 75 % were not previously known at all

Aims

With these new findings established, the research team is currently working on the data integration into the international EMBARK-project (Establishing a Monitoring Baseline for Antibiotic Resistance in Key environments). The samples serve as the fundament to understand how the antibiotic resistance is spreading between humans and the environment.

Johan Bengtsson-Palme, assistant professor in the Department of Life Sciences at Chalmers, coordinates the project. He hopes they are able to detect pathogenic bacteria through the techniques they have developed before the bacteria has the chance to cause outbreaks in healthcare settings.

For those who want to know more: On the website I embedded, Bengtsson-Palme elaborates on the EMBARK-project: *"The lab coordinates EMBARK, which will generate such background data from relatively pristine and human-impacted environments, as well as from the human microbiome. This will provide a baseline for future monitoring efforts for antibiotic resistance. The project also involves standardizing protocols and making different monitoring practices comparative, which will enable a much broader use of the monitoring data that is already being generated."*

Sources

https://www.sciencedaily.com/releases/2023/06/230605181325.htm

https://www.chalmers.se/en/departments/life/research/systems-and-synthetic-biology/bengtsson-palme-lab/

Article 2: New superconducting diode could improve performance of quantum computers and artificial intelligence

SD-Date: June 6, 2023
Et-Date: June 16, 2023
ScienceDaily-Summary: *"A team has developed a more energy-efficient, tunable superconducting diode -- a promising component for future electronic devices -- that could help scale up quantum computers for industry and improve artificial intelligence systems."*
Open-Access Study: https://www.nature.com/articles/s41467-023-38856-0

Background

The typical diodes allow current to flow only one way in an electrical circuit and they can handle one input and one output. They are commonly made with semiconductors.
To be more precise, there's an n-semiconductor and an p-semiconductor as well as the p-n-junction which is between the two layers. The barrier between the two can be overcome by connecting the n-type and p-type materials to a battery source.

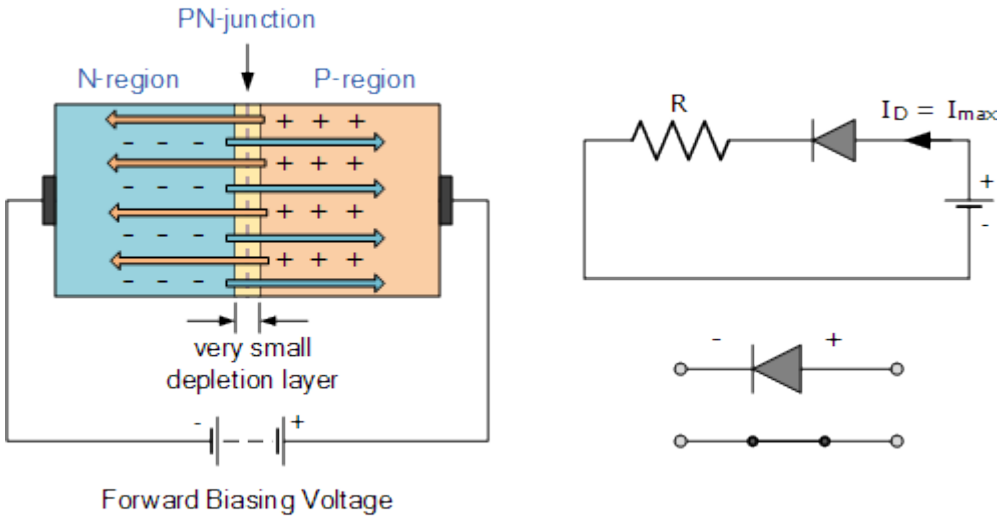


Illustration 27 - In case you want to know more about it, the website where I got it from - the source I embedded - seems to be ideal (source: electronics tutorials)

Superconductors are materials that conduct electricity without losses when the temperature is reduced below a a critical value. While it is poorly understood how this complete loss occurs, the earliest and most widely accepted explanation is known as the BCS-theory (named after the men who constructed it in the 1950s: Bardeen, Cooper, and Schreiffer). For the industry, the most important superconductors are multi-element alloys or ceramics.

Method

The research was conducted by Vlad Pribiag and Mohit Gupta of the University of Minnesota and included the University of Minnesota School of Physics and Astronomy graduate student Gino Graziano and University of California, Santa Barbara researchers Mihir Pendharkar, Jason Dong, Connor Dempsey, and Chris Palmstrøm.

The University of Minnesota researchers created the device by using three Josephson junctions, they *'sandwiched pieces of non-superconducting material between superconductors'*. The superconductors were connected with layers of semiconductors that allowed them to control the behaviour of the device through voltage. In contrast to other superconducting devices, which used materials that are difficult to fabricate, the researchers used materials that are more industry-friendly and deliver new functionalities as well.

Results

The device can handle multiple signal inputs and is highly energy efficient. Moreover, it can be used with any type of superconductor which makes it more versatile.

"Right now, all the quantum computing machines out there are very basic relative to the needs of real-world applications," Pribiag said. *"Scaling up is necessary in order to have a computer that's powerful enough to tackle useful, complex problems. A lot of people are researching algorithms and usage cases for computers or AI machines that could potentially outperform classical computers. Here, we're developing the hardware that could enable quantum computers to implement these algorithms. This shows the power of universities seeding these ideas that eventually make their way to industry and are integrated into practical machines."* (ScienceDaily)

Source

https://www.sciencedaily.com/releases/2023/06/230606111725.htm

https://www.electronics-tutorials.ws/diode/diode_3.html

Article 3: Key building block for life found at Saturn's moon Enceladus

SD-Date: June 14, 2023
Et-Date: June 16, 2023
ScienceDaily-Summary: *"The search for extraterrestrial life in our solar system just got more exciting. A team of scientists has discovered new evidence that the subsurface ocean of Saturn's moon Enceladus contains a key building block for life. The team directly detected phosphorus in the form of phosphates originating from the moon's ice-covered global ocean using data from NASA's Cassini mission. Cassini explored Saturn and its system of rings and moons for over 13 years."*
Open-Access Study: https://www.nature.com/articles/s41586-023-05987-9

Enceladus

Before we discuss the article, let's learn about Saturn's moon Enceladus - it is a perfect opportunity to get to know an inhabitant of our solar system.

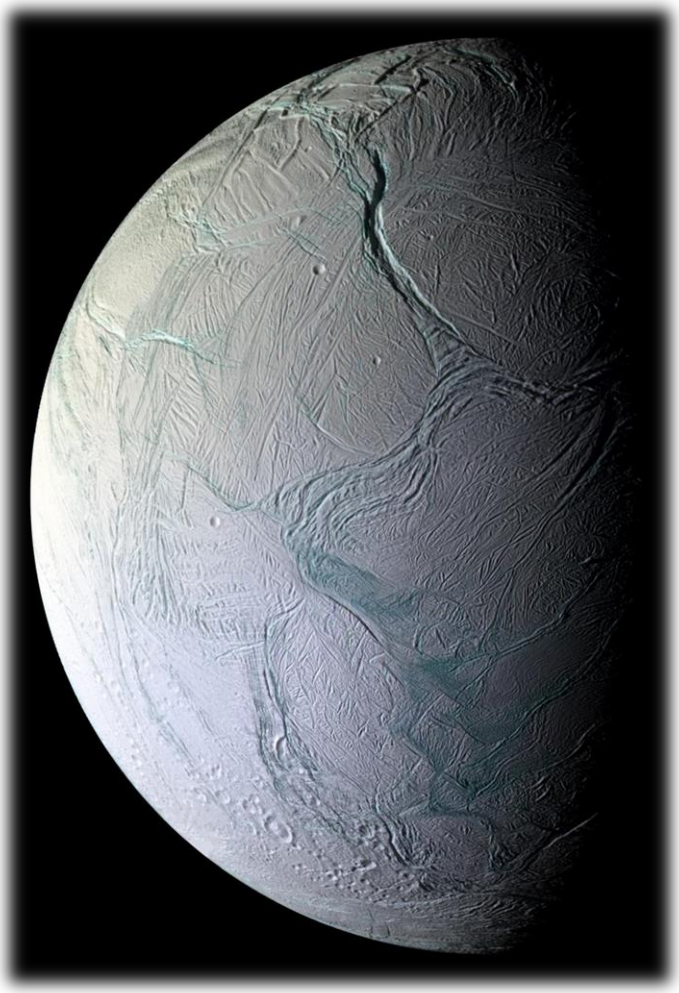


Illustration 28 - NASA's Cassini caputred this photo of Enceladus on October 9, 2008, after coming within 25 kilometers (15.6 miles) of the surface of Enceladus (source: NASA/JPL/Space Science Institute)

Enceladus was discovered on August 28, 1789 by the British astronomer William Herschel.

But it was actually his son, Jon Herschel, who suggested the name in his 1847 publication Results of Astronomical Observation made at the Cape of Good Hope. He chose this name because Saturn, known in Greek mythology as Cronos, was the leader of the Titans.

Greek Mythology
(source: https://www.greekmythology.com/Myths/Gigantes/Enceladus/enceladus.html)

The giants of the Greek mythology were born, when Cronus - son of Gaea and Uranus - castrated his father and the blood fell onto the earth (Gaea).

Enceladus was the primary adversary of goddess Athena during the Gigantomachy (the battle between the Giants and the Olympian Gods). She threw the island Sicily against Enceladus and he was buried under it. Henceforth, it was believed that Enceladus was the main cause of earthquakes and volcanic eruptions.

Enceladus is an icy moon with a diameter of 313 miles (504 km) and it orbits Saturn at a distance of 148,000 miles (238,000 km) every 32.9 hours, a day lasts equally long. It is 680 times lighter in mass than Earth's moon. In our solar system it is the most reflective body which is why the surface temperatures reach extreme colds of -330 °F (-201 °C).

Like our moon, Enceladus is tidally locked and shows always the same face to Saturn. Scientists think that the moon's ice layer may be as thin as half a mile to 3 miles (1 to 5 km) at the south pole and that the average thickness is about 12 to 16 miles (20 to 25 km). The jets [of materials] ejected by Enceladus produce Saturn's E ring, so studying this ring of Saturn means studying the oceans of Enceladus.

More about Enceladus on NASA's website:
https://solarsystem.nasa.gov/moons/saturn-moons/enceladus/in-depth/

Cassini's Analysis and the Researchers

Thanks to the jets that blow ice grains and gases into space, Cassini was able to analyze samples from Enceladus with its Cosmic Dust Analyzer and showed the presence of sodium phosphates. The observational results and laboratory analogue experiments of the Southwest Research Institute suggest *'that phosphorus is readily available in Enceladus' ocean as phosphates'*.

Further, they found out that in the moons plume-forming oceans, the phosphate concentrations are 100 times higher than in earth's oceans.

But why is the evidence of phosphate such a profound discovery? That question is answered by the article as well: *"Phosphorus in the form of phosphates is vital for all life on Earth. It is essential for the creation of DNA and RNA, energy-carrying molecules, cell membranes, bones and teeth in people and animals, and even the sea's microbiome of plankton. Life as we know it is simply not possible without phosphates."*

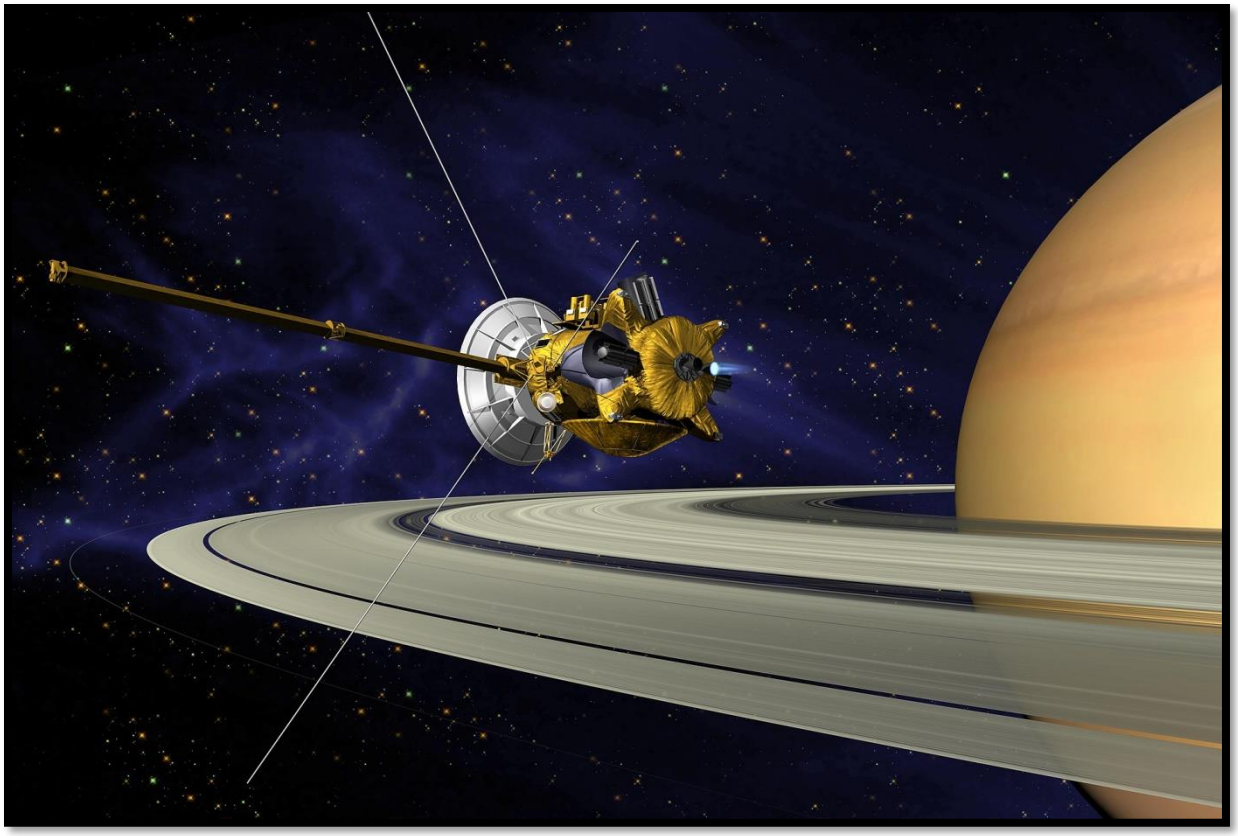


Illustration 29 - Artist concept of Cassini (source: Wikipedia)

Cassini-Huygens itself plunged into Saturn's atmosphere on September 15, 2017 after 20 years of service to protect moons of Saturn that could have conditions suitable for life. During its service, it executed 2.5 million commands, traveled 4.9 billion miles (7.9 billion kilometers), collected 635 GB of data, helped to publish about 4,000 science papers, completed 294 orbits, discovered 6 moons, made 162 targeted flybys of Saturn's moons, took 453,048 images and completed 360 engine burns. 27 nations participated.
(source: https://solarsystem.nasa.gov/missions/cassini/overview/)

Source

https://www.sciencedaily.com/releases/2023/06/230614220041.htm

Note: antimicrobial resistance has already been addressed by the UN, so the research of the first article could help immensely with the **National Antimicrobial Resistance Action Plans (NAP)** 170 countries have already finalized by November 2022.
(source: https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/antimicrobial-resistance-global-threat)

If you want to know about the self-assessment of each country, here you can find a visualization: https://amrcountryprogress.org/#/visualization-view

Author's Note: Last but not least, I'm considering to end the Science News blog series.
I still have my difficulties with English, as you may can see. Re-phrasing gets difficult at times and then I'm not satisfied with the quality. For now it is only a thought, if I end this series there'll be a final Science News article. Thank you for reading and have a nice day!

(Released: 16th June 2023, 10:37 pm/ 22:37 Uhr)

The Climate Crisis - An Existential Threat and the Greatest Challenge to Overcome

| A Plea |

The climate crisis is an existential threat to all of us and the greatest challenge humanity faces - from extreme weathers to entire regions becoming inhospitable. The effects can already be felt around the world, whether it be droughts in the US or floods in Pakistan.
If nothing or not enough is done, it will get worse. But we aren't helpless, the solutions are at hand: renewable energy and phasing out fossil fuels, to name two essential steps.
All it depends on is the political will to do so, then the mobilization will work as well.

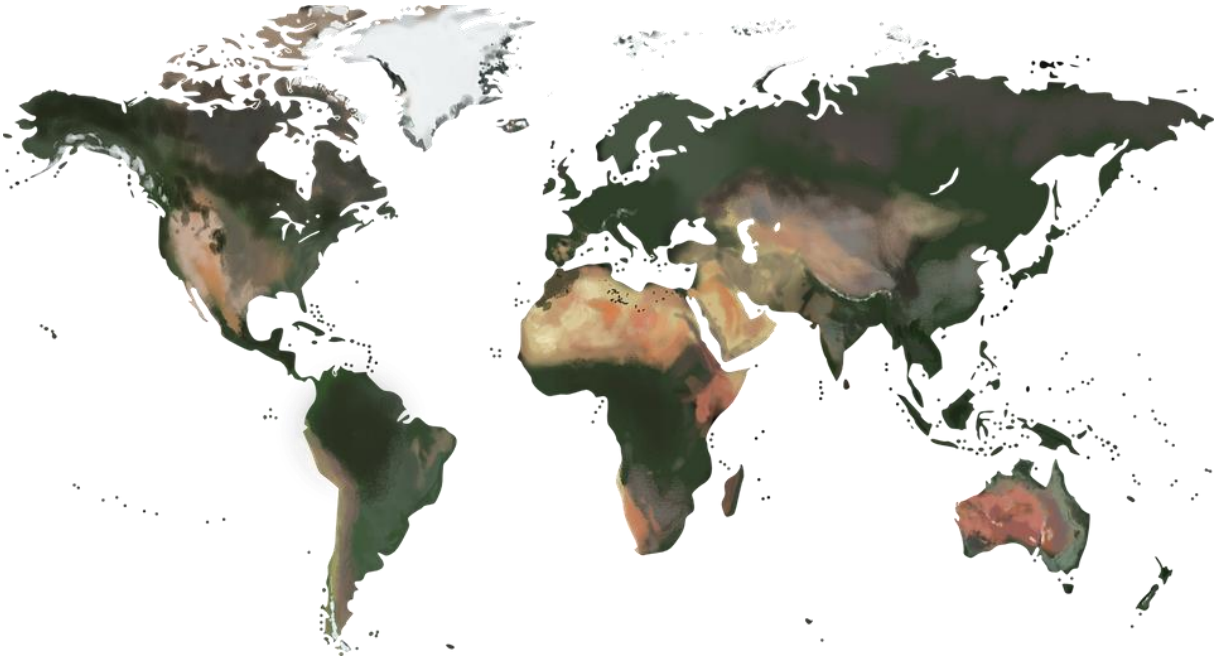


illustration 30 - World Map
(source: Pixabay)

First, we shall establish the facts, as laid out by IPCC Report in their Summary for Policymakers. As staggering as they may be, they are no reason to capitulate.

Then we move on to some examples of the climate crisis, from droughts to floodings.

In the third and last part we will discuss the solutions to this crisis and what can already be done on a regional and national level. On an international level it should ideally become a process with its own dynamic, but that may take some time before it happens.

The Reality of the Climate Crisis

The Summary for Policymakers states that *'it is unequivocal that human influence has warmed the atmosphere, ocean and land'* (p. 4). These rapid and widespread changes have occurred in the atmosphere, ocean, cryosphere (which encompasses the frozen parts of Earth, such as glaciers and icesheets) and biosphere (from the Greek word bio = life, it is made up of the parts of Earth where life exists - from the ocean floor to the mountaintops). Further, the observed increase of greenhouse gas concentrations since 1750 are irrefutably caused by human activities.

Global Annual Mean Temperature and Co2
(source: https://www.britannica.com/science/global-warming/Climatic-variation-since-the-last-glaciation)

When you hear about the 1.5 °C or 2.0 °C climate target, the number alone may sound abstract. The number on its own, with one's own experience, may leave the impression that it is the decision between wearing a sweater or a t-shirt. However, when compared to the temperatures of the Last Glacial Maximum one realizes how significant this seemingly little increase is: during that time, 21,000 years ago, the global annual mean temperature was about 4-5 °C (7-9 °F) colder than in the mid-20th century (1950s).
Back then, continental ice sheets extended into the regions now known as Europe and North America, reaching as far south as present-day London and New York City.

"At current rates of fossil fuel use, a doubling of CO_2 concentrations over preindustrial levels is expected to take place by the middle of the 21st century (when CO_2 concentrations are projected to reach 560 ppm). A doubling of CO_2 concentrations would represent an increase of roughly 4 watts per square metre of radiative forcing. Given typical estimates of "climate sensitivity" in the absence of any offsetting factors, this energy increase would lead to a warming of 2 to 5 °C (3.6 to 9 °F) over preindustrial times." (section: Carbon dioxide)
So, when such temperatures in the opposite direction caused ice sheets to extent to these great sizes, one only has to imagine what happens if Earth warms up to 5 °C.

Since 2011, the concentrations have increased with carbon dioxide (CO_2) reaching annual averages of 410 parts per million (ppm), methane (CH_4) 1,866 parts per billion (ppb) and nitrous oxide (N_2O) 332 ppb in 2019 (p. 4). It can be said with high confidence that the concentrations of CO_2 were higher in 2019 than at any time in at least 2 million years, for both methane and nitrous oxide they were higher than at any time in the last
800,000 years (very high confidence).

…

Human influence has warmed the climate at a rate that is unprecedented in at least the last 2000 years

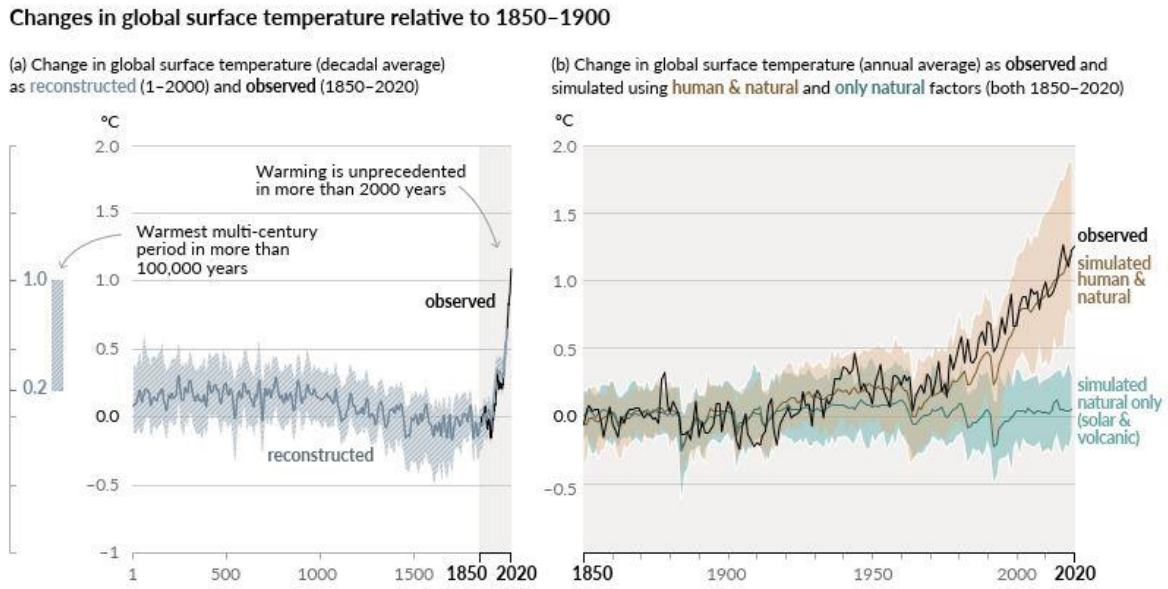


Figure SPM.1 | History of global temperature change and causes of recent warming

Panel (a) Changes in global surface temperature reconstructed from paleoclimate archives (solid grey line, years 1–2000) **and from direct observations** (solid black line, 1850–2020), both relative to 1850–1900 and decadally averaged. The vertical bar on the left shows the estimated temperature (*very likely* range) during the warmest multi-century period in at least the last 100,000 years, which occurred around 6500 years ago during the current interglacial period (Holocene). The Last Interglacial, around 125,000 years ago, is the next most recent candidate for a period of higher temperature. These past warm periods were caused by slow (multi-millennial) orbital variations. The grey shading with white diagonal lines shows the *very likely* ranges for the temperature reconstructions.

Panel (b) Changes in global surface temperature over the past 170 years (black line) relative to 1850–1900 and annually averaged, compared to Coupled Model Intercomparison Project Phase 6 (CMIP6) climate model simulations (see Box SPM.1) of the temperature response to both human and natural drivers (brown) and to only natural drivers (solar and volcanic activity, green). Solid coloured lines show the multi-model average, and coloured shades show the *very likely* range of simulations. (See Figure SPM.2 for the assessed contributions to warming).

{2.3.1; Cross-Chapter Box 2.3; 3.3; TS.2.2; Cross-Section Box TS.1, Figure 1a}

illustration 31 - Figure from p. 6 of the Summary for Policymakers

"Since 1750, increases in CO_2 (47%) and CH_4 (156%) concentrations far exceed – and increases in N_2O (23%) are similar to – the natural multi-millennial changes between glacial and interglacial periods over at least the past 800,000 years (very high confidence)." (p. 8)

This, of course, also affects the hot and cold extremes which include heat waves and cold waves. It is **virtually certain** that the first have become more frequent and more intense across most land regions since the 1950s, while the latter followed the opposite trend. The main driver of this change is human-induced climate change (high-confidence).
The report elaborates further: *"Some recent hot extremes observed over the past decade would have been **extremely unlikely** to occur without human influence on the climate system. Marine heatwaves have approximately doubled in frequency since the 1980s (high confidence), and human influence has **very likely** contributed to most of them since at least 2006."* (p. 8)

The change that is occurring in our climate is already affecting humanity, as the next figure will show. You may notice the striped hexagons (white-grey) and white hexagons, they indicate that there's a low agreement in the type of change for the region as a whole; the grey hexagons, on the other hand, were used when there was limited data and/or literature that prevented assessment. Other countries indicate at least medium confidence.

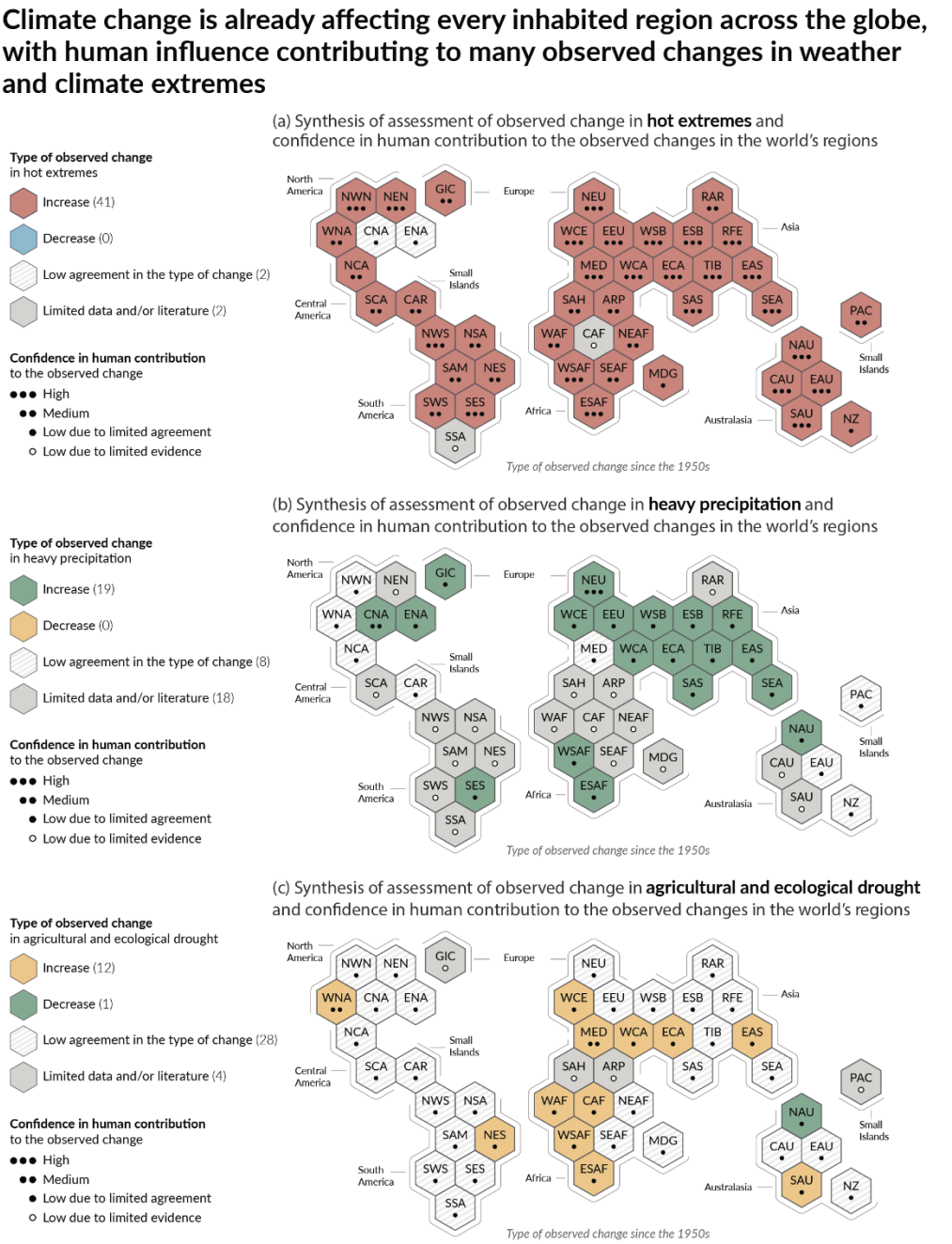


illustration 32 - Elaboration on the dots: three dots mean high confidence, two dots medium confidence and one dot low confidence. A single filled dot means there's limited agreement, whereas a single empty dot means limited evidence (p. 10)

Lastly, we will have a look at the extremes without and with human influence. The following graphic shows hot temperature extremes over land (10-year and 50-year events), heavy precipitation over land (10-year events) and agricultural and ecological droughts in drying regions (also 10-year events). On the far left it shows without human influence, then the present frequency of said extremes and on the right the changes from 1.5 °C to 4.0 °C.

Projected changes in extremes are larger in frequency and intensity with every additional increment of global warming

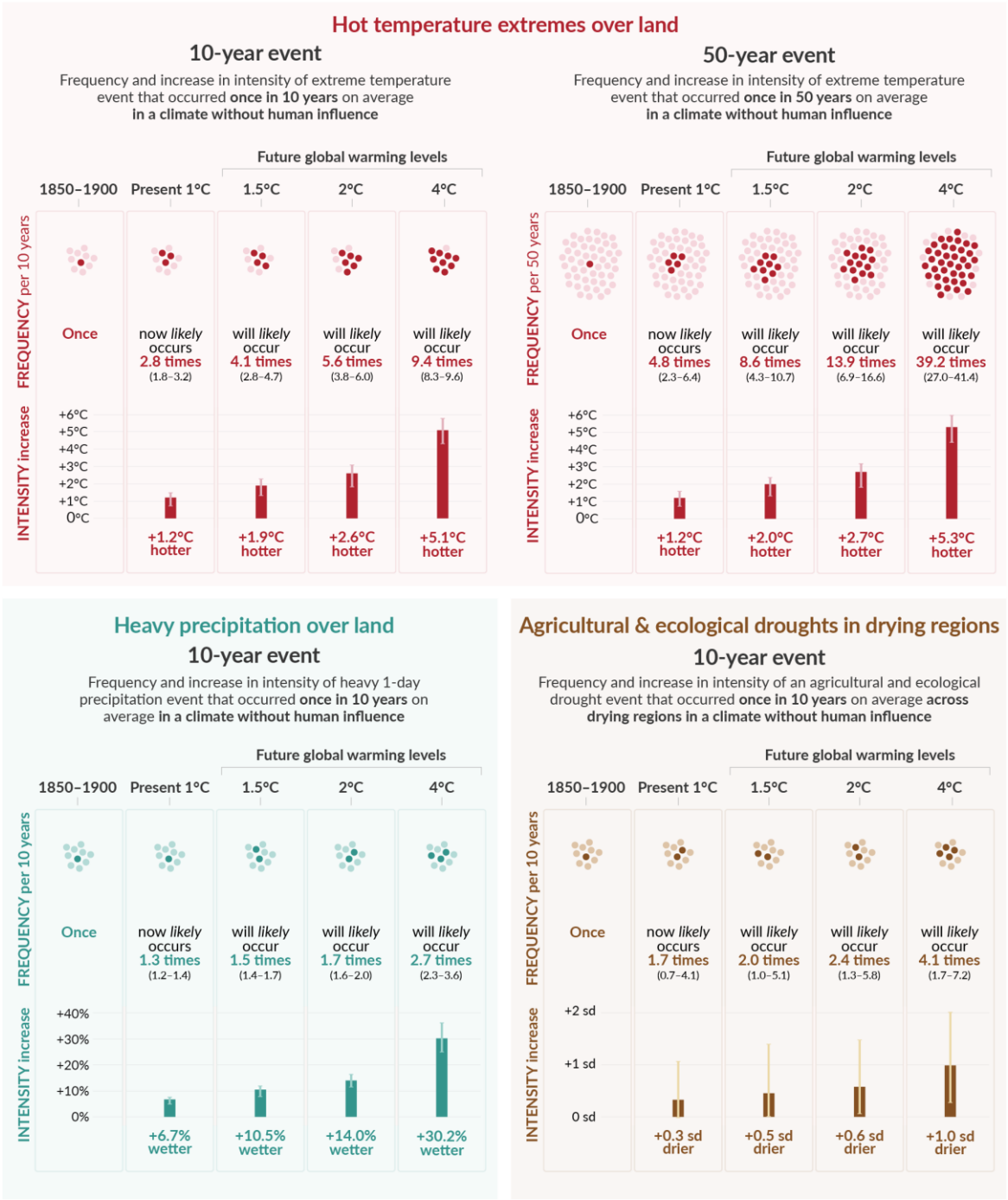


illustration 33 - Each dot represents one year, the dark ones indicate years where the extreme threshold is exceeded, while the light dots show years where the extreme threshold is not exceeded (p. 11-12)

Note

In the Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties (PDF-file, 6 pages.), the IPCC includes a table of the likelihood scale and explains beforehand how to interpret it: *"Likelihood may be based on statistical or modeling analyses, elicitation of expert views, or other quantitative analyses. The categories defined in this table can be considered to have "fuzzy" boundaries. A statement that an outcome is "likely" means that the probability of this outcome can range from ≥66% (fuzzy boundaries implied) to 100% probability. This implies that all alternative outcomes are "unlikely" (0-33% probability)."* (p. 3)

Virtually certain = 99-100 % probability
Very likely = 90-100 % probability
Likely = 66-100 % probability
About as likely as not = 33 to 66 % probability
Unlikely = 0-33% probability
Very unlikely = 0-10 % probability
Exceptionally unlikely = 0-1 % probability

It is a different matter when it comes to confidence which is not to be mixed up with probabilistics: *"Confidence should not be interpreted probabilistically, and it is distinct from "statistical confidence." Additionally, a finding that includes a probabilistic measure of uncertainty does not require explicit mention of the level of confidence associated with that finding if the level of confidence is "high" or "very high."* (p. 3)
Lastly, confidence results from both the level of agreement (high, medium, low) and the evidence (type, amount, quality, consistency).

Source

Summary for Policymakers (Working Group I)
https://www.ipcc.ch/report/ar6/wg1/

From Floods to Droughts

As we have seen in the previous section, heavy precipitation and droughts will happen in higher frequency. In this section, I'm going to list a few examples to show what may lie ahead in even greater intensity and frequency. Flooding occurs not only when rivers overflow due to heavy rainfall or ice begins to melt in mountainous parts, it can also be the result of long dry periods when the soil can no longer absorb the water or in urban areas where the surface is paved (NOAA).

Example 1: Germany - Ahr Valley

From July 12 to 19, 2021, various regions in Europe were hit by extreme rainfall which was generated by a quasi-stationary atmospheric low pressure system named "Bernd". Two federal states in Germany and adjacent regions in Belgium were hit the hardest. In fact, in Germany it was the costliest natural disaster in recent German history with losses of around €33 billion ($40 billion). With at least 189 people dead, it took more lives than any other flood in Germany in the past 50 years. Additionally, there were structual issues:
"Although heavy and disastrous rainfall had been forecast by the weather services a few days ahead, the early warning process and evacuation did not work well. Warnings from the issuing agency did not reach many of the intended recipients in a timely manner and automated early warning systems were either unavailable or did not function properly."

illustration 34 - source: **Deutsche Welle**

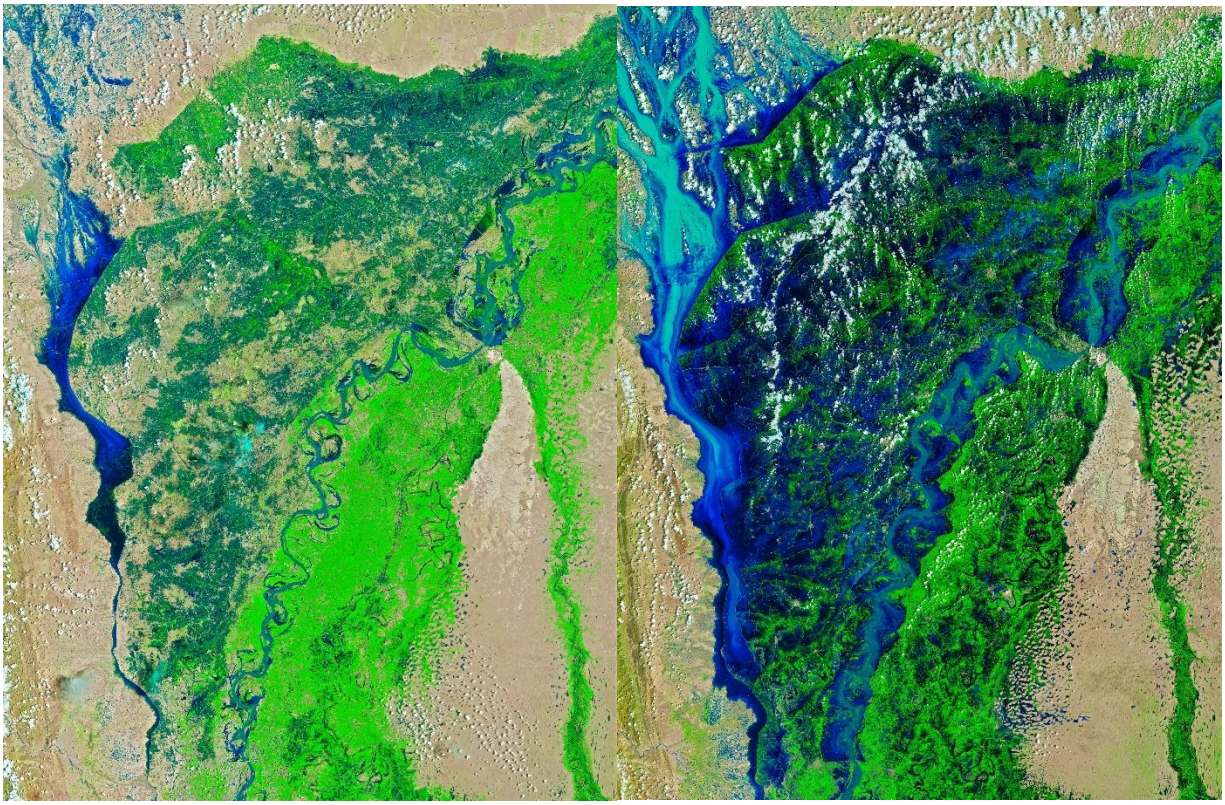
Source

For further reads, see University Bonn: https://www.geographie.uni-bonn.de/de/forschung/arbeitsgruppen/ag-schrott/research/ahr-valley

Example 2: Pakistan - 2022 Floods

In 2022, extreme monsoon rains resulted in the worst flooding in a decade with more than 33 million affected people, 767,488 destroyed and 1,277,000 damaged houses. The floodwaters killed at least 1,700 people and engulfed tens of thousands of square kilometers. 12,800 people were injured by the floodings, including 4,000 children.
500,000 Pakistanis were displaced. Sindh, Balochistan and Khyber Pakhtunkhwa (KP) provinces were most affected.

Further, the devastating flood destroyed 3.5 million acres of cropland (= 14,164 km²). For comparison, the land area of New York encompasses about 790 km² or 195,213 acres. On top of that, 1,162,000 livestock perished, thus wiping out livelihoods and jeopardizing Pakistan's food security. In Balochistan, Sindh, KP and Punjab 80 provinces were declared "calamity-hit". And in 41 of those provinces, an estimated 800,000 Afghan refugees were hosted with the majority being in four districts: Peshawar (210,000), Quetta (170,000), Nowshera (77,700) and Karachi (71,500). (source: reliefweb)



The comparison above shows the devastation caused by the flood and below you see the entire map of Pakistan. Unfortunately, the problems don't end there for Pakistan:
"The effect of the monsoon rains has been compounded by the continued melting of Pakistan's 7,000 glaciers. The country holds the most glacial ice found outside the polar regions. Climate warming and recent heat waves have precipitated several glacial-outburst floods. In the rugged northern part of the country, the combined rain and meltwater has turned slopes into hill torrents." (source: NASA Earth Observatory)

illustration 35 - Pakistan and her neighbours Iran (to the southern Left), Afghanistan (upper left, north-west) and India to the East. (source: NASA Earth Observatory)

Sources

Pakistan Flood Response: UNHCR Supplementary Appeal, September 2022 – December 2023 (https://reliefweb.int/report/pakistan/pakistan-flood-response-unhcr-supplementary-appeal-september-2022-december-2023)

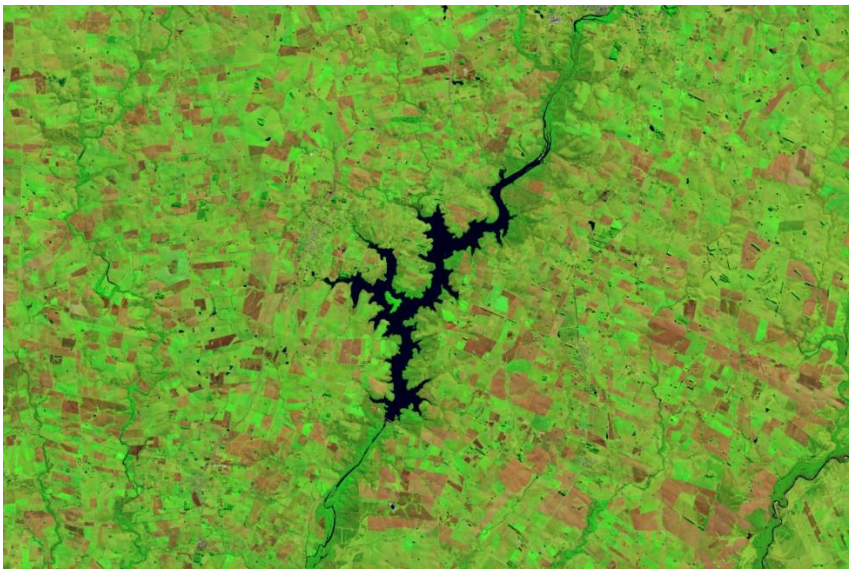
Devastating Floods in Pakistan
https://earthobservatory.nasa.gov/images/150279/devastating-floods-in-pakistan

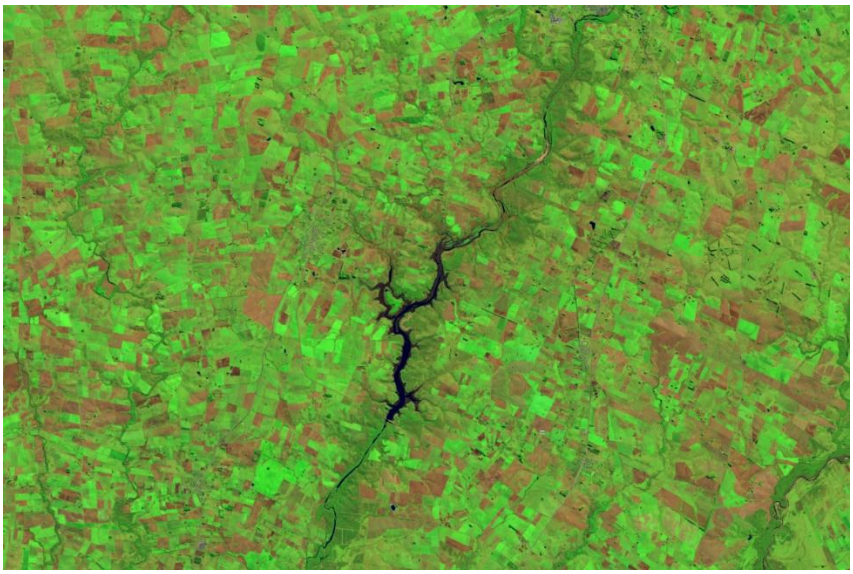
Geography and Travel: New York City
https://www.britannica.com/place/New-York-City

I used the following website to convert acres to km² and vice versa
https://www.unitjuggler.com/convert-area-from-acre-to-km2.html

Example 3: Uruguay Drought

Uruguay is experiencing a multi-year drought which led to the two main freshwater reservoirs, which provide water to the capital city Montevideo, to nearly run dry. Paso Severino, the larger of the two, was estimated to just hold 2.4% of its 67-million-cubic-meter capacity on June 28 (see images taken below by Operational Land Imager-2 on Landsat 9 in false colour to distinguish water more easily). The images below show Paso Severino; the first shows the reservoir on June 2, 2022 and the latter on June 13, 2023, about one week before the Uruguayan government declared a water crisis (source: NASA Earth Observatory).





The situation wasn't entirely unavoidable, as an article of The Guardian explains:
"The government says previous administrations, including the leftwing Broad Front coalition that governed from 2005 to 2020, did not invest adequately in water infrastructure.

Before the crisis, Lacalle Pou's administration had announced a $210m project to take safe drinking water out of the Rio de la Plata, leaving aside another project that had been designed but not started by the previous government.

José Mujica, the president between 2010 and 2015, has acknowledged some responsibility. "We all fell asleep," he said when asked about the crisis."

Similar to the catastrophe in the Ahr Valley in Germany, it is also a structural problem. While Uruguay may come out of the crisis slowly, according to the meteoroligst Mario Bidegain, water scarcity and water supply is going to be of great importance to all countries. Climate mitigation therefore also means securing the water supply globally.

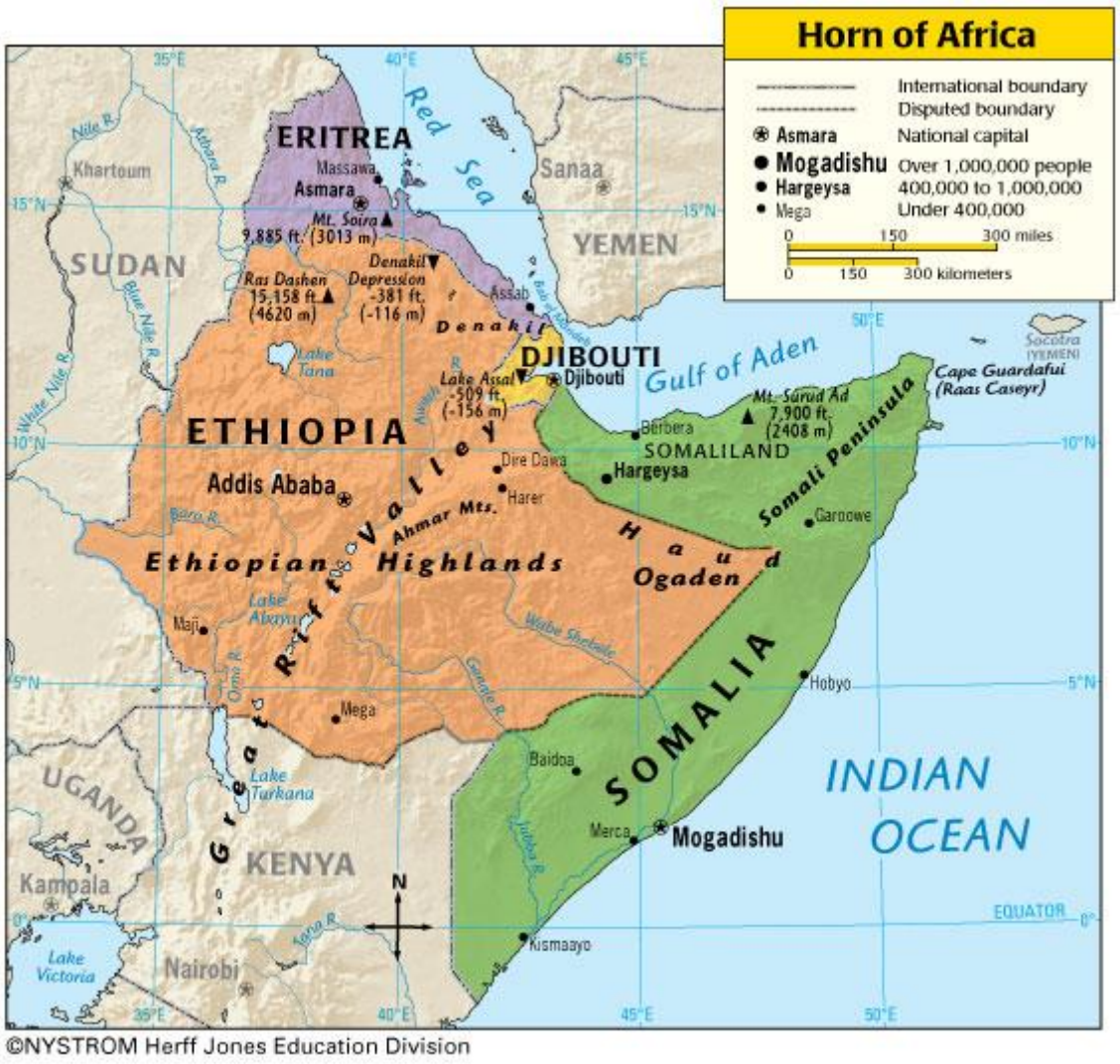
Source

Reservoirs Run Dry in Montevideo
https://earthobservatory.nasa.gov/images/151574/reservoirs-run-dry-in-montevideo

Drought leaves millions in Uruguay without tap water fit for drinking
https://www.theguardian.com/world/2023/jul/15/drought-leaves-millions-in-uruguay-without-tap-water-fit-for-drinking

Example 4: Drought in the Horn of Africa

The Horn of Africa is a region that is home to the countries Djibouti, Eritrea, Ethiopia and Somalia. Broader definitions exist too and when they are used, parts or all of Kenya, Sudan, South Sudan and Uganda belong to the region too (source: Britannica). In this instance, the report on the drought by OCHA reliefweb also includes Kenya.
In recent years, the region has been hit by a series of droughts leading to crop failures and a lack of water and food. Heavy rain in recent months led to flooding which has caused widespread destruction and displacement, thus worsening the humanitarian situation. Further, due to the flooding health risks such as water borne diseases are now a concern as well. In Somalia and Ethiopia, over 2 million have been internally displaced *"while over 260,000 new refugee and asylum-seekers have crossed into drought affected areas of Kenya, Ethiopia and Somalia since January 2022"* (reliefweb).



©NYSTROM Herff Jones Education Division

illustration 36 - The Horn of Africa as defined by Britannica
(source: [africa blogspot])

For a better overview, I made a table which includes the points of the article *"East and Horn of Africa, and the Great Lakes Region: UNHCR Drought Situation Response Update #10 - May 2023"* by the reliefweb. I also included a few facts about each country from the book *"Der Neue Kosmos - Welt Almanach & Atlas"*.

Ethiopia	Somali region	Somalia	Kenya
			
Quick Facts			
Surface Area: 1,104,300 km² **Population:** 117.88 Million **Capital:** Addis Abeba **Currency:** 1 Birr = 100 Santim **National Holiday:** May 28 (end of the Derg-Regime 1991)	-> Regional state of Ethiopia	**Surface Area:** 637,657 km² **Population:** 16.36 Million **Capital:** Mogadishu **Currency:** 1 Somalian-Shilling = 100 Senti **National Holiday:** July 1 (founding in 1960)	**Surface Area:** 580,367 km² **Population:** 54.99 Million **Capital:** Nairobi **Currency:** 1 Kenyan –Shilling = 100 cents **National Holiday:** December 12 (independence in 1963 and founding of the republic in 1964)
Drought Situation			
▪ Out-of-season flooding caused widespread destruction and displacement across Somali, Oromia, and Southern Nations Nationalities & Peoples' (SNNP) regions ▪ 7,400 cholera cases including 116 deaths (as of May 15) ▪ A further scale up of aid is needed to fill the gap in partner presence, logistics, essential medical supplies, and shortage of oral vaccines.	= Somali region is the most affect by droughts = 35,000 households displaced = 23,000+ livestock have died = 100,000 hectare of farmland have been destroyed during the flood = In order to address the immediate needs of drought and flood-impacted people, the Ethiopia Humanitarian Fund and the Central Emergency Response Fund prepared the coordinated allocation of $40 million	▪ Shabelle river overflew leading to widespread flooding Beletweyne and surrounding areas ▪ In May, downpours brought respite from the extreme drought conditions, but not enough to reverse impact of historic drought ▪ 345,000 new internal displacements (flooding: 266,000; conflict: 41,000 and drought: 35,000) ▪ Over 1.25 million overall in 2023 ▪ Top humanitarian needs of the displaced families: shelter (76%), food (12%) and livelihood (10%)	▪ Arid and Semi-Arid Lands (ASALs) region experienced five consecutive below-average rainy seasons, thus continuing immense humanitarian needs ▪ In 2023, 6.4 million (including 5.4 million severely food insecure people) required assistance ▪ Long rains in arid counties also led to flash floods here, impacting both livelihood and infrastructure such as roads ▪ 17 counties (out of 47) still experience drought conditions

For further reading, or in case you want to read the article of the reliefweb yourself, you'll find them in the sources as per usual.

Sources

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https://www.britannica.com/place/Horn-of-Africa

East and Horn of Africa, and the Great Lakes Region: UNHCR Drought Situation Response Update #10 - May 2023 (https://reliefweb.int/report/somalia/east-and-horn-africa-and-great-lakes-region-unhcr-drought-situation-response-update-10-may-2023)

Horn of Africa Map Pictures
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Book: Der Neue Kosmos - Welt Almanach & Atlas
Publisher: Kosmos
Language: German
Pages: 720 (Ethiopia p. 54, Somalia p. 385, Kenya p. 234)
Price: €26.00 ($29.18 US, 22.28 GBP)

Example 5: Canadian Wildfire

For our last example, we look to the Americas and to Canada in particular. By now, you certianly have heard about the fires raging in Canadia and that the consequences were even felt in the United States (meaning the smoke that led to a drastic decline of air quality). Cause of these major outbreaks was a combination of unusual heat, dry lightning and drought. On July 13, nearly 600 out-of-control fires burned throughout the country.

Environment Canada had to issue air quality warnings for several communities in British Columbia, Alberta, and the Northwest Territories as dense plumes of smoke streamed east.

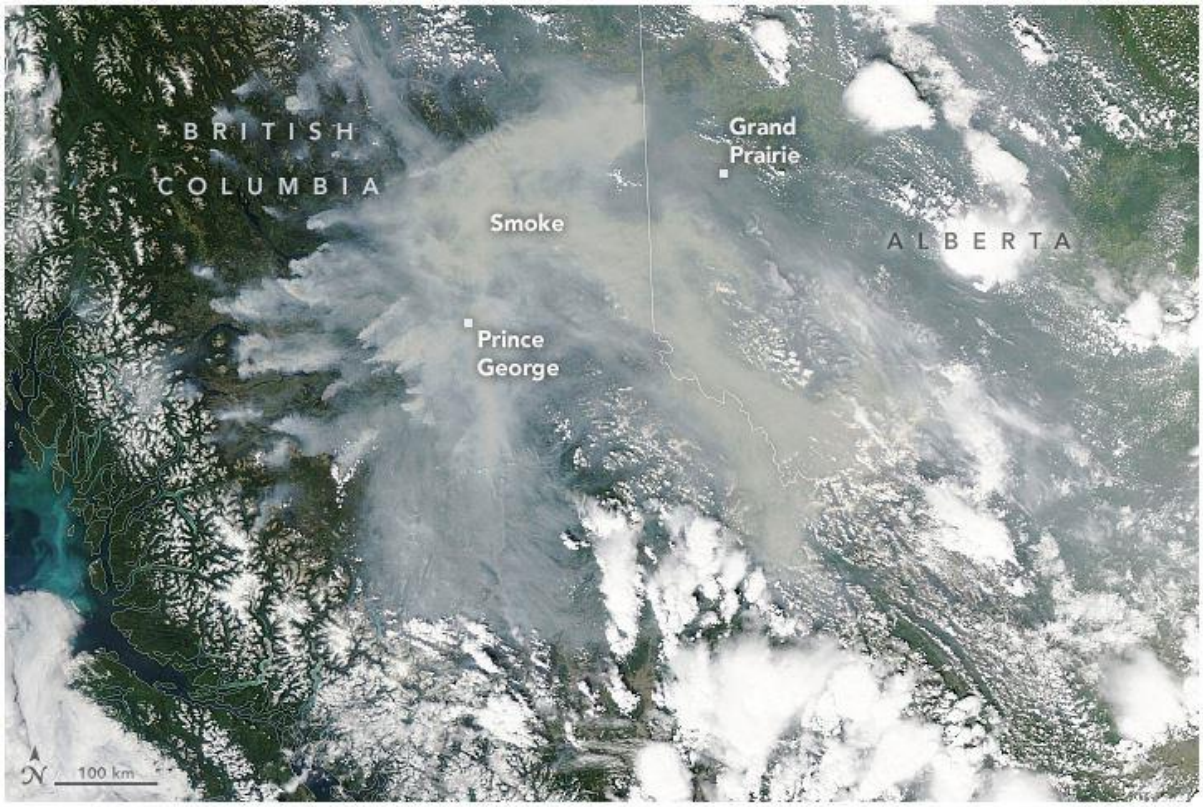

illustration 37 - July 12, 2023 (source: NASA Earth Observatory)

A record was also set for pyrocumulonimbus (pyroCb), which are smoke-infused storm clouds: *"This surge in activity has made 2023 the most active year for pyroCbs both in Canada and worldwide since we began tracking their numbers closely about a decade ago." As of July 13, with about six weeks left in the Canadian fire season, Peterson and colleagues had observed 90 pyroCbs in Canada and 104 worldwide in 2023. The previous records, both set in 2021, were 50 for Canada and 100 worldwide.* As of July 12, 2023, 1.2 million hectares (3 million acres) had burned in British Columbia - 30 times the average for that point in year. **At a national scale**, the fires had charred **9.4 million hectares**, an area about the size of the state of Indiana. In 1997, it was the second-highest with 7.1 million hectares burned.

Wildfires do occur naturally, but climate change can cause hotter, drier conditions that can

exacerbate wildfires, research has shown. A 2018 study on Canada wildfires suggested that "human-induced climate change contributed greatly to the probability of the observed extreme warm temperatures, high wildfire risk, and large burned areas." A 2023 study arrived at similar results for California wildfires: "Our results indicate that nearly all the observed increase in burned area is due to anthropogenic climate change." (CNBC)

Source

Fires Rage in British Columbia
https://earthobservatory.nasa.gov/images/151578/fires-rage-in-british-columbia

Wildfire smoke hits New York again: 'We are truly the first generation to feel the real effects of climate change,' Gov. Hochul says (June 28, 2023)
https://www.cnbc.com/2023/06/28/canadian-wildfire-smoke-is-impacting-air-quality-in-new-york-again.html

Solutions to the Crisis

We've seen the destruction weather extremes cause, but next to ocean acidification, sea level rise and many other threats they are not the only thing we have to worry about. There's no benefit in painting a picture of doom and gloom, especially since we - the people who live now - are at a turning point of human history. We can still prevent the worst and pressure politicians and governments into doing the right.

In the graphic below, you can see the different scenarios for carbon dixoide emissions (on the right for the other greenhouse gases respectively) while b) shows the impact on global surface temperature. **SSP3-7.0 and SSP5-8.5** show the worst case where the CO_2 emissions roughly double and the temperature could increase to 4 °C and more by 2100.
SSP2-4.5 shows CO_2 emissions remaining around the current levels until the middle of the century, global surface temperature nearly increasing to 3 °C. Finally, **SSP1-2.6 and SSP1-1.9** show the best case scenario with low and very low greenhouse gas emissions.
Around or after 2050, the CO_2 emissions would decline to net zero and then followed by negative CO_2. The global surface temperature would be around 1.5°C or nearly 2°C.
The darker shade in the bar chart displays the observed warming to date.

…

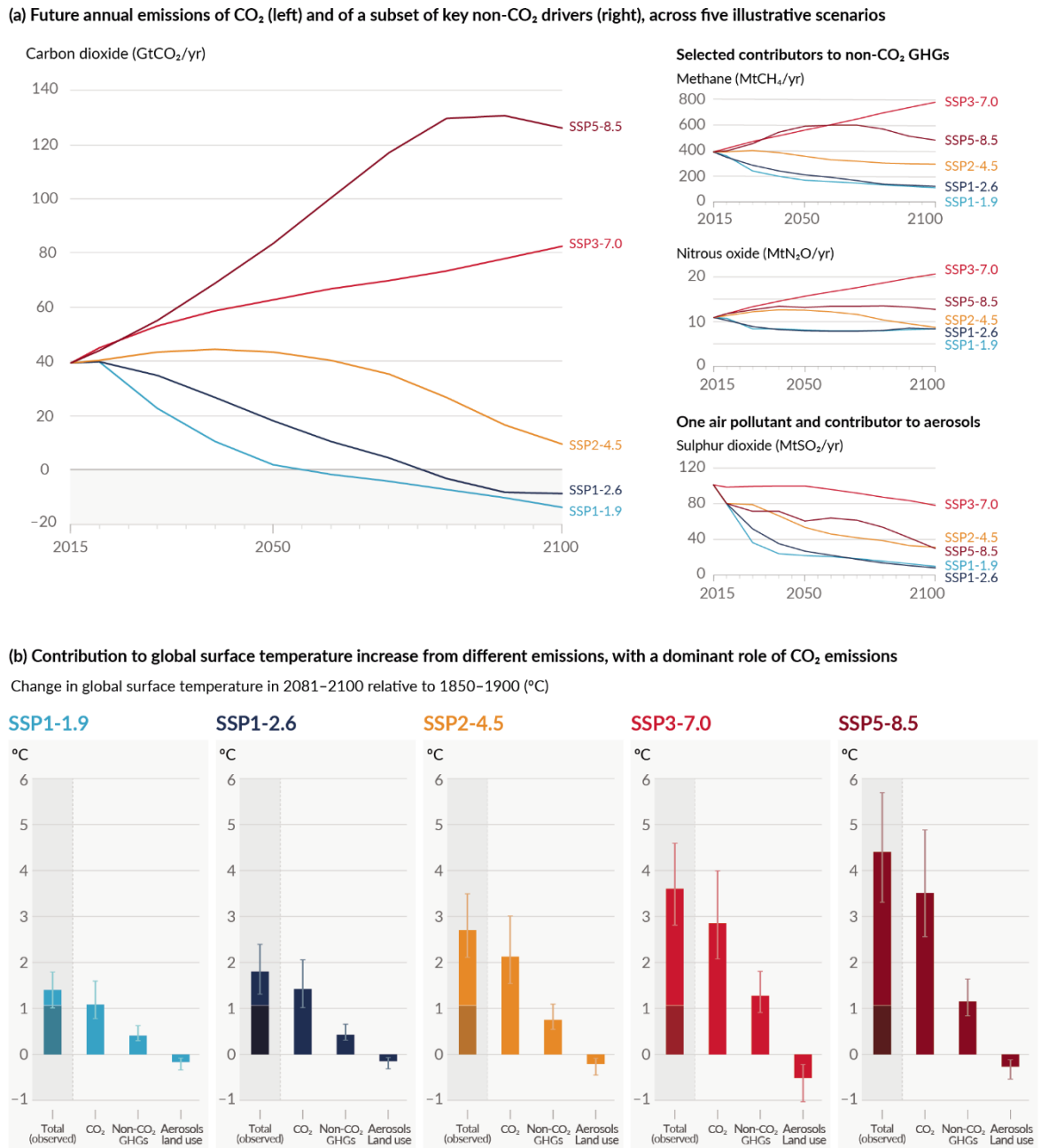

illustration 38 - p. 12-13

Of course, even in the best-case scenario not everything can be reversed in the near term. As it is stated in D. 1.6 on page 30: *"If global net negative CO2 emissions were to be achieved and be sustained, the global CO2-induced surface temperature increase would be gradually reversed but other climate changes would continue in their current direction for decades to millennia (high confidence). For instance, it would take several centuries to millennia for*

global mean sea level to reverse course even under large net negative CO2 emissions (high confidence)." Mitigation and Adaptation are therefore both of great importance.

Mitigation

In order to combat climate change, we first need to understand where our emissions are coming from. For this, we use a chart which shows the breakdown of global greenhouse gas emissions in 2016, published by Climate Watch and the World Resources Institute.
When talking about climate change mitigation, one shouldn't focus solely on one sector as all are contributing to this crisis and each tonne further warms the planet.

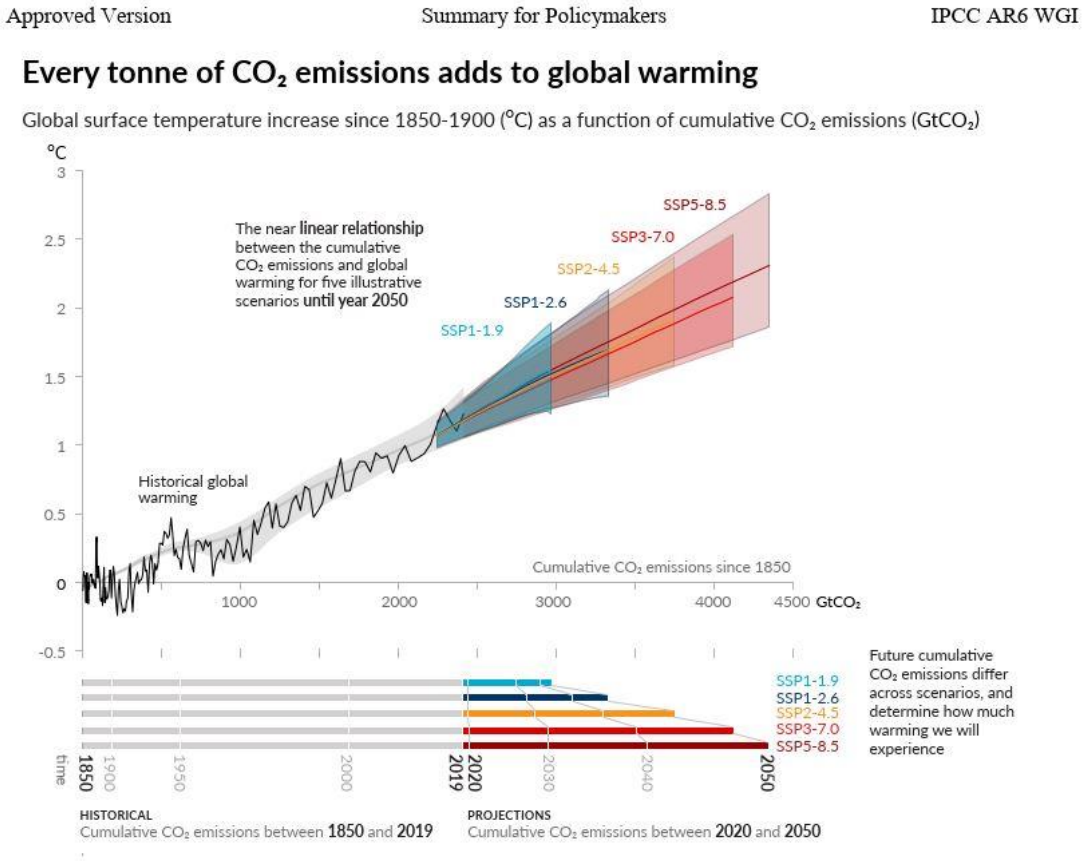

Figure SPM.10: Near-linear relationship between cumulative CO2 emissions and the increase in global surface temperature.

illustration 39 - p. 28 (Working Group I)

Without further ado, here's the chart that will be of key importance in this section:

…

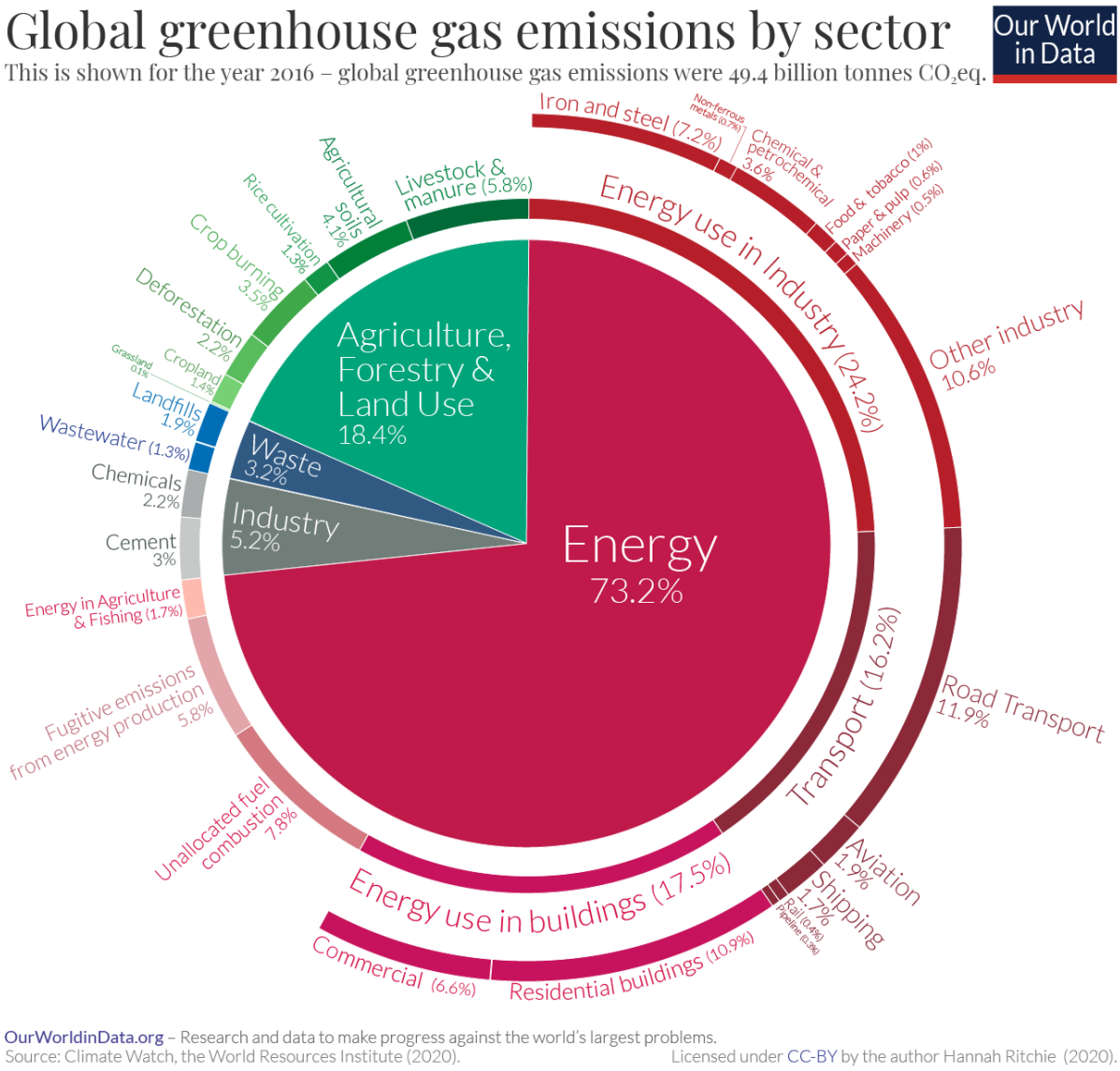

illustration 40 - (source: Our World in Data)

As we can see, the biggest contributor to global Co2-emissions is the energy sector. Nearly taking up three-quarters (73.2%); of these, 17.2% fall onto energy use in buildings; 16.2% on transport (road transport making up the most with 11.9%) and 24.2% on industry.
The second biggest contributor to global Co2-emissions is the sector agriculture, forestry and Land Use with 18.4% where livestock and manure take up 5.8%. Further down with 5.2% is the industry, or to be precise: direct industrial processes like cement where Co2 is created as a byproduct when limestone ($CaCO_3$) is converted to lime (CaO). Lastly, waste is the fourth and lowest contributor with 3.2%, landfills make up nearly two-third of it (1.9%) and wastewater 1.3%.

The following solutions have already been implemented to some extent or another, renewable energies for instance (solar panels, hydropower, wind turbines, etc.).
Nuclear energy is more in a grey area (as the energy production itself is carbon neutral), but it is preferable to coal power plants. Hence, it should be seen as complementarily (if the circumstances allow) to renewable energies.

The Energy Sector

Both residential (10.9%) and commercial (6.6%) buildings could reduce their Co2-emissions by installing solar panels on their roofs or as a project of a municipality (solar farm).

illustration 41 - Installation of a solar farm in Davidson County, North Carolina in 2011 (source: energynews.us)

In addition to providing green energy, solar farms and other renewable projects also create jobs that will always be needed. Then there's also the reduction of dependency on energy companies. Of course, there may be the objection that the sun doesn't always shine - and that's where energy diversification comes into play. Whether it is on a national or regional level, next to solar farms wind turbines, biogas and hydropower (where possible) would also be build. Environmental protection and species conservation always play a role too when renewables are planned, that is why some areas are unfit in their entirety. Nevertheless, conflicts will arise and then the option is between a limited impact on the ecosystem and the uncontrollable that is brought by fossil fuels like coal power plants.

The industry, which is responsible for 24.2% and thus almost a quarter, would in turn also benefit from offshore and onshore wind turbines as well as other renewable energy sources. And the quicker fossil fuels are phased out, the better. The workers who are employed by these industries should then either be compensated to live a decent life (for instance if they are near or already past retirement age and can't adjust), supported through advanced training and introductory training (some may prefer to stay in the energy sector) or provide other

options if desired (perhaps the one or other, if the support structure exists, wants to get a higher educational qualification). Ideally, companies like Exxon Mobile are brought before court - especially the top management - for actively spreading disinformation about climate change while knowing about the climate science (Scientific American: Exxon Knew about Climate Change almost 40 years ago).

Finally, cooling during the Summer months and heating during the Winter months require air conditioners and furnaces. Both emit Co2 as well, but one doesn't have to relinquish it in order to be reduce the emissions. Instead, systems like the heat pump can even reduce your electricity use for heating by around 50% which in turn means more money is available for personal or family budgeting.

"High-efficiency heat pumps also dehumidify better than standard central air conditioners, resulting in less energy usage and more cooling comfort in summer months."
(US Department of Energy)

In the Winter months, it works more efficiently too if integrated into your old system: *"Although most heat pumps use electric resistance heaters as a backup for cold weather, heat pumps can also be equipped in combination with a gas furnace, sometimes referred to as a dual-fuel or hybrid system, to supplement the heat pump. This helps solve the problem of the heat pump operating less efficiently at low temperatures and reduces its use of electricity."*

If there's the political will, it is certainly possible to one day save 17.5% to 41.7% of Co2-emissions by steadily transitioning to renewables (and neutrals) without having to fear to lose the current standard of living. Through technology transfer to poorer countries, the standard of living can be increased everywhere while simultaneously protecting the environment. It is going to be a long process, but one that is well worth it!

Finally, we move to transport with 16.2% and more specifically road transport.
60% of road transport emissions come from passenger travel (cars, motorcycles and buses) and 40% from road freight (lorries and trucks). As both make up 11.9% of the Co2-emissions, *"this means that, if we could electrify the whole road transport sector, and transition to a fully decarbonized electricity mix, we could feasibly reduce global emissions by 11.9%"* (Our World in Data, Section: Energy by Sector). This, of course, also requires a charge station infrastructure that needs yet to be built. When it comes to traffic within cities, the use of bicycles can be increased by adding bike lanes, invest in public transport (from bus and trams to subways and intercity railway connections) and reducing the amount of parking lots and increase the price for parking tickets.

Agriculture, Forestry & Land Use

In this sector, the biggest source of Co2-emissions is livestock and manure (5.8%).
You likely already know that beef and lamb tend to have a high carbon footprint, the reason

for that being a process called 'enteric fermentation' which happens when microbes in their digestive systems break down food. A byproduct of this process is methane.
Therefore, eating less is an effective way of reducing the emissions of one's diet.

Besides, considering how meat of different sorts are produced (from cattle to poultry) in factory farms there's also an ethical perspective to changing one's diet. If meat consumption decreased, more crops would be available to humans too.

Deforestation makes up 2.2% of the Co2-emissions in this sector. While it doesn't sound like much, it is still 988 million tonnes of Co2. Naturally, reforestation is here the answer and it is also already practiced. It should always be done with native plant species, as they are used to the climatic conditions and the locals know to make best use of their traits.
Reforestation is a slow process, spanning over one to two decades (or even longer), which is another reason why the climate crisis must be tackled on various fronts.

"And even a tree-planting campaign can be doomed by a "misplaced emphasis on how many trees are planted rather than how many survive," the study warned. It calls for developing guidelines on what seeds will thrive in different environments, especially as climate change shifts plant species to new regions.

"It's not just about planting a tree. It needs to be done thoughtfully and well, because you can't just stick a tree in the ground and come back in 100 years and have a forest," said Edge. It takes an immense amount of money, labor, and patience to turn a seed into a sapling. "We don't want to just waste our time sticking a seedling in the ground that'll die."
(national geographic)

Sources

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https://ourworldindata.org/emissions-by-sector

Exxon Knew about Climate Change almost 40 years ago
https://www.scientificamerican.com/article/exxon-knew-about-climate-change-almost-40-years-ago/

Heat Pump System
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Planting trees helps fight climate change—but we need billions more seedlings
https://www.nationalgeographic.com/environment/article/planting-trees-helps-fight-climate-change-but-we-need-billions-more-seedlings

Adaptation

Adaptation, as described by the Journal Nature, is the *"process of adjustment to actual or expected climate change and its effects"*. We are already more than 1 °C above the 1850-to-1900 baseline and it will continue to rise through mid-century and very likely beyond.
Two years ago, when the article was published in Nature, 2021 was a year of record-breaking extremes that span from massive heatwaves and wildfires in the United States and Canada, to deadly floods in China and Germany.

China: The Flooding in the northern Shanxi Province (October 11, 2021)
(source: https://www.bbc.com/news/world-asia-china-58866854)

Less than three months after extreme rains in the Henan province left more than 300 people dead, torrential rain caused more than 17,000 houses to collapse and triggered landslides across more than 70 districts and cities in the province. More than 120,000 had been resettled as a result. Overall, around 1.76 million people were affected.

Between 1981 and 2010, the northern Shanxi Province saw an average rainfall in October of 25mm. The extreme rainfall skyrocketed it to 185.6mm - the sevenfold.

In the following article by Nature, published on October 28 2021, the authors outline three opportunities for research to accelerate adaptation. These are 1) the Mechanisms of the Paris Agreement to raise ambitions, 2) ensuring resilience of multilateral, domestic, and private investment and 3) research must accompany adaptation actions.
https://www.nature.com/articles/s43247-021-00294-5

Working Group II of the IPCC wrote, among other things, about the adaptation measures. There's already good news regarding adaptation planning and implementation. Both have continued to increase and the growing public and political awareness of climate impacts and risks *"resulted in at least 170 countries and many cities including adaptation in their climate policies and planning processes (high confidence)"* (p. 20). There are multiple additional benefits generated by adaptation *"such as improving agricultural productivity, innovation, health and well-being, food security, livelihood, and biodiversity conservation as well as reduction of risks and damages (very high confidence)*" (p. 20).

There are two very informative graphics included in the report of Working Group II, on page 22 and 23 respectively. Neatly summarized, the first graphic presents the key risks, the adaptations and responses, the potential feasibility, synergies with mitigation and the dimension of potential feasibility. As it is scientifically evaluated, you'll see the same use of likelihood and confidence as in Working Group I.

…

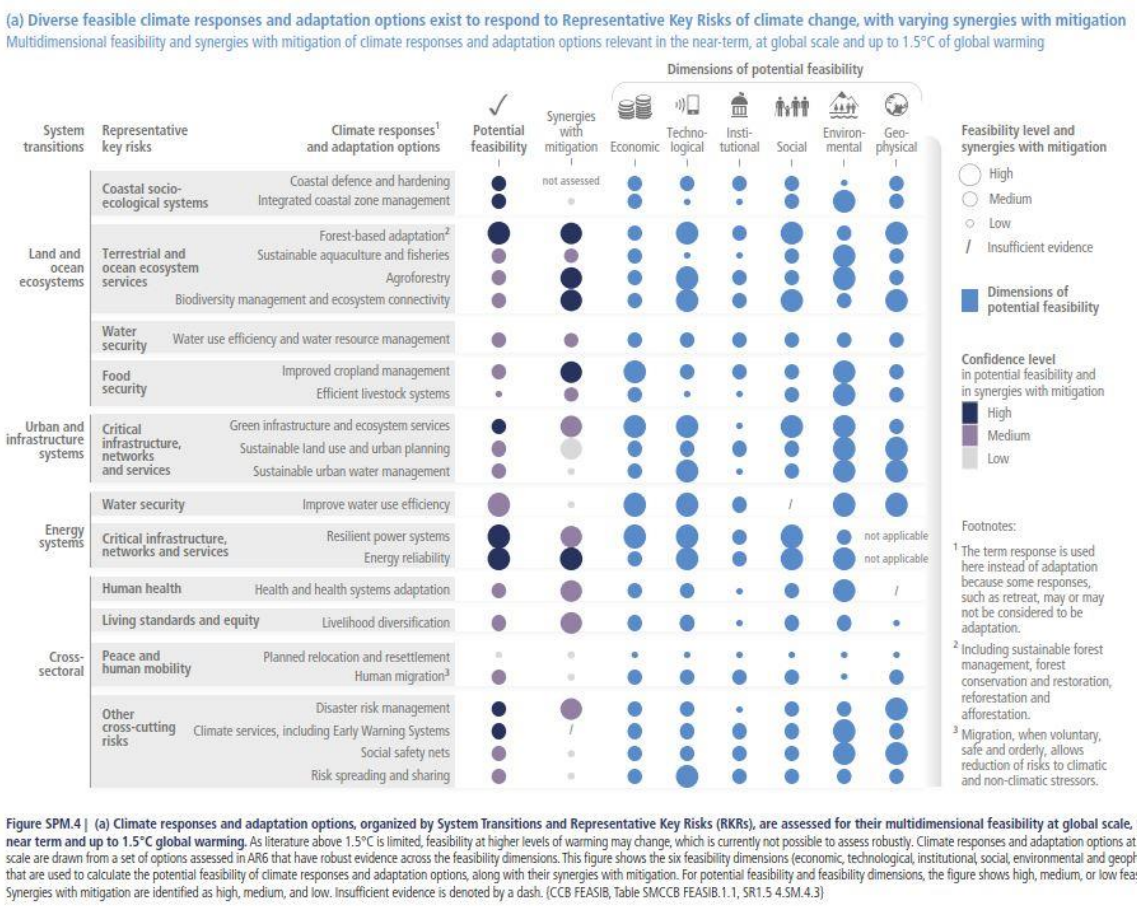

Figure SPM.4 | (a) Climate responses and adaptation options, organized by System Transitions and Representative Key Risks (RKRs), are assessed for their multidimensional feasibility at global scale, in the near term and up to 1.5°C global warming. As literature above 1.5°C is limited, feasibility at higher levels of warming may change, which is currently not possible to assess robustly. Climate responses and adaptation options at global scale are drawn from a set of options assessed in AR6 that have robust evidence across the feasibility dimensions. This figure shows the six feasibility dimensions (economic, technological, institutional, social, environmental and geophysical) that are used to calculate the potential feasibility of climate responses and adaptation options, along with their synergies with mitigation. For potential feasibility and feasibility dimensions, the figure shows high, medium, or low feasibility. Synergies with mitigation are identified as high, medium, and low. Insufficient evidence is denoted by a dash. (CCB FEASIB, Table SMCCB FEASIB.1.1, SR1.5 4.SM.4.3)

illustration 42 - p. 22

The second graphic shows how the climate adaptations and responses affect ecosystems, ethnic groups, gender equity and low-income groups. Further, the researchers also included how it relates to the Sustainable Development Goals.

(there wasn't enough space here for the figure to fit in, so it is on the next page – otherwise making it smaller would make it even harder to read)

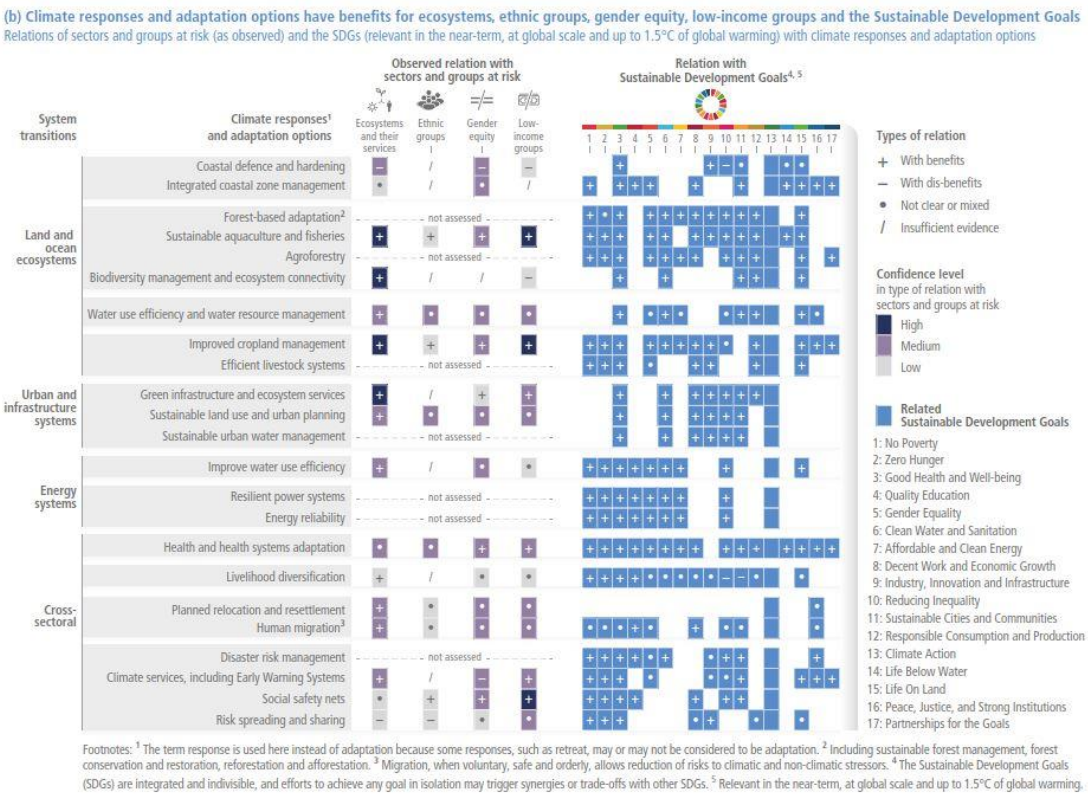

illustration 43 - p. 23

I hope you can read the graphics, because I took a screenshot of both and then imported them here. The quality may be compromised as a result.

Before I turn to an example, let's quickly take a look what the report has to say on ecosystems within this framework of adaptation and response. In Section C, 2.4 and 2.5 we find the scientific assessments:

"Conservation, protection and restoration of terrestrial, freshwater, coastal and ocean ecosystems, together with targeted management to adapt to unavoidable impacts of climate change, reduces the vulnerability of biodiversity to climate change (high confidence). The resilience of species, biological communities and ecosystem processes increases with size of natural area, by restoration of degraded areas and by reducing non-climatic stressors (high confidence). To be effective, conservation and restoration actions will increasingly need to be responsive, as appropriate, to ongoing changes at various scales, and plan for future changes in ecosystem structure, community composition and species' distributions, especially as 1.5°C global warming is approached and even more so if it is exceeded (high confidence). Adaptation options, where circumstances allow, include facilitating the movement of species to new ecologically appropriate locations, particularly through increasing connectivity between conserved or protected areas, targeted intensive management for vulnerable species and protecting refugial areas where species can survive locally (medium confidence)."

For humanity in general it would be beneficial to view nature through the holistic lens, in

nature ethics holism means that ecosystems as a whole have the right to exist. When decisions are made, their right to exist is recognized and flows into the considerations. It naturally includes the conservation and protection of existing nature reserves and undoing damage done to the environment to the best possible extent (restoration). Conflicts will continue to emerge, and the one or other has to yield, but it is going to be sustainable.
This brings us to the benefits of the adaptation and response policies of C2.5:

"Effective Ecosystem-based Adaptation reduces a range of climate change risks to people, biodiversity and ecosystem services with multiple co-benefits (high confidence). Ecosystem-based Adaptation is vulnerable to climate change impacts, with effectiveness declining with increasing global warming (high confidence). Urban greening using trees and other vegetation can provide local cooling (very high confidence). Natural river systems, wetlands and upstream forest ecosystems reduce flood risk by storing water and slowing water flow, in most circumstances (high confidence). Coastal wetlands protect against coastal erosion and flooding associated with storms and sea level rise where sufficient space and adequate habitats are available until rates of sea level rise exceeds natural adaptive capacity to build sediment (very high confidence)."

illustration 44 - Coastal wetland (source: Texas A&M)

The majority of all documented adaptation is made up by water-related risks and impacts (see p. 21, C. 2.1). Consequently, I'll broach on the subject of coastal wetland (as you can see in the image above), it is an important subject since many large cities are near the coast and at risk of sea level rise and flooding. Not to mention the danger posed by rivers.

For this example, I'll focus on the coastal wetlands in the US (otherwise it would go beyond the scope of the discussion and make this entry too long).

Coastal wetlands play an important role for commercial fishing, because over 90 percent of all commercial and recreational fish and shrimp species spend some part of their life cycle in a coastal salt marsh. This means for the fisheries industry at the Goalf Coast, that the loss of these wetlands would not only impact the fish and shrimp species but also have serious and substantial impacts on said industry. Additionally, they also play an indirect but critical role in maintaining water quality of coastal estuaries and open water by cleaning pollutants and sediment from urban runoff before it enters the bays and oceans.

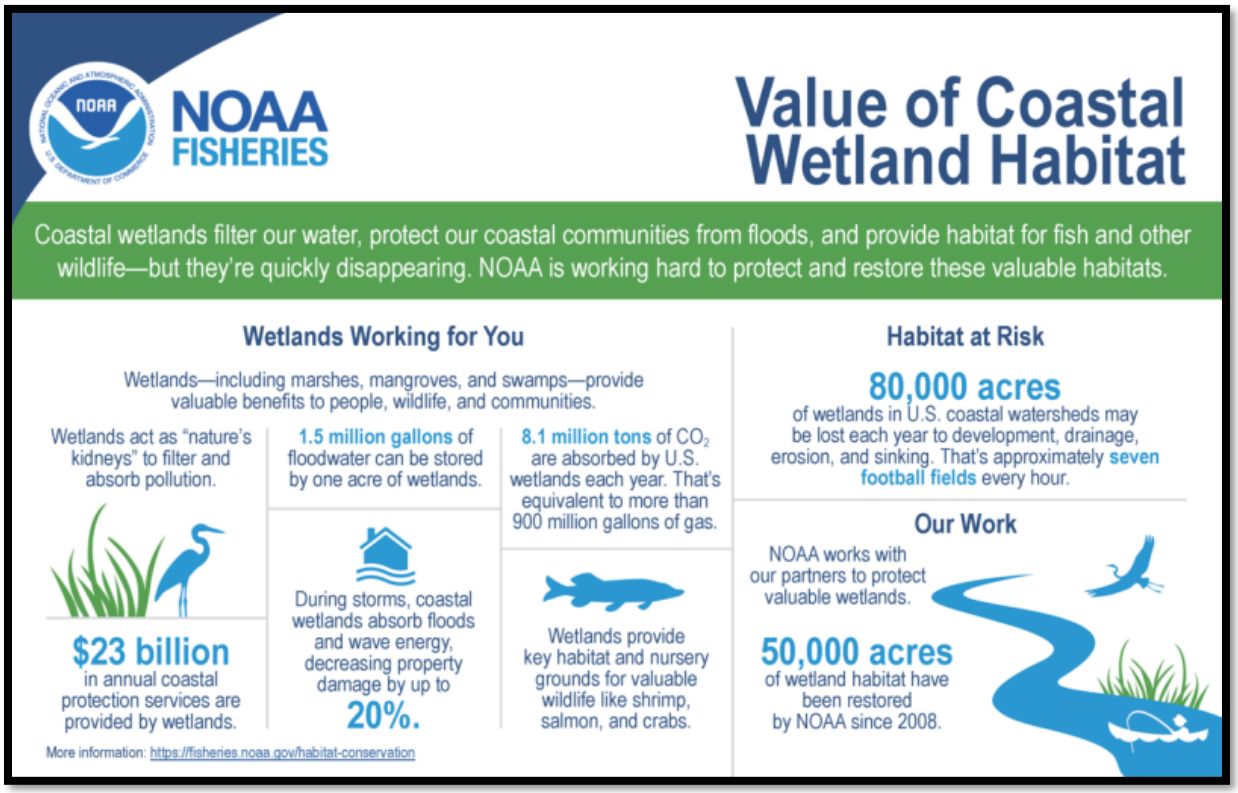

illustration 45 - Coastal Wetland Infographic (source: NOAA)

Only few wetlands will likely be able to migrate as the sea level rises, since the conditions need to be very gently to migrate landward. In many areas, the topography rises too quickly which will lead to a loss until the sea level rises enough to reach higher elevations.
In other words: the wetlands loss results in changes that last for centuries.
"In addition, many areas just inland from coastal salt marshes have been developed and protected with bulkheads or seawalls, such that wetlands are impeded from migrating inland."
(source: Texas A&M Agrilife Extension)

The article mentions ways to protect these wetlands, with one being the most promising and 'most easily applicable' legal framework. A similar mechanism to the rolling easement provisions of the Texas Open Beach Act is proposed.

The Texas Open Beach Act - Explanation by Texas A&M

Unique among most states, Texas maintains a "rolling easement" on the Gulf shores to protect public access to the state's beaches. The concept embodied in the TOBA has been termed a "rolling easement" and it evolved from Texas common law which recognized that Gulf beaches have been used by the public since "time immemorial" and that barrier islands are constantly shifting. The TOBA allows private land owners to develop their beachfront property as long as that development does not interfere with public access. As the vegetation line gradually moves the public access easement takes effect.

The Texas Open Beaches Act (TOBA) was passed in 1959 to assure that the public has the "free and unrestricted right of ingress and egress to and from" public beaches, defined as the area between the line of vegetation and the mean low tide line. Because the vegetation and low tide line shift due to natural coastal processes, the demarcation lines for public beaches are not static. The public's right of access, or easement, moves as well.

The TOBA prohibits the construction of an "obstruction, barrier, or restraint of any nature which would interfere with the free and unrestricted right of the public" to access the beach. Holding back the sea, either through bulkheading or seawalls is, therefore, not permitted along public beaches. One thing that should be noted is that the public easement created by the TOBA does not affect the title to the property to which it attaches. The TOBA, however, makes that ownership subject to an easement that allows the public free and unrestricted use of the beach.

Another solution is the reconstruction of wetlands that have been lost to erosion and subsidence. According to the author, considerable progress has already been made.

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https://coastalresilience.tamu.edu/home/wetland-protection/policy-framework/bay-and-ocean-side-submerged-lands-some-fundamental-differences-in-law-and-management/the-texas-open-beaches-act-an-exceptional-example-of-a-rolling-easement/

A Very Narrow Timeframe

On April 10 2022, I already wrote about the climate crisis in Science News #013 (for the time being, the series is decommissioned). I'll only include the summary at the end, which shows the key points of the Nature Article.

- 2025 is the latest date that global emissions should peak and then decline drastically, for a 50% chance to limit warming to 1.5 °C.
  In order to achieve the current goal, Co2-emissions would need to nearly halve by 2030 and reach 'net zero' by 2050.
  Our current course - scientists estimated - puts us on a path for a 3 °C rise above pre-industrial levels,

- On a positive note: the price of renewable-energy technologies strong decreased and the global economy overall is getting cleaner.
  Between 2010 and 2019, global energy intensity decreased by 2% annually - reversing a trend from the decades prior,

- In order to the reach the 1.5 °C goal, some fossil fuels must remain underground.
  Models slightly above this limit say that emissions from currently existing and planned fossil fuel projects exceed it,

- Net-zero emissions cannot be achieved by reducing Co2-emissions alone, carbon dixodie extraction will also be needed,
  This can be achieved by reforestation, improving agricultural practices or a variety of nascent technologies that are able to to capture carbon emissions,

- Global economic growth wouldn't be hindered by aggressive action to curb emissions.
  While the GDP is projected to shortly dip mid-century with climate policies enacted, most research suggests that the economic benefits of limiting warming outweighs the cost of mitigation,

- Wealthy countries will need to aid low-income countries financially to address inequities in vulnerability to climate change and to speed up the clean-energy transition in a way that benefits all.
  Nations with the lowest amounts of greenhouse gas emissions are often those who are the most affected: the 88 countries that compromise the Least Developed Countries and Island Developing States are collectively responsible for 1% of historical carbon emission.

When someone still asks why we should act quickly, tell them what they would prefer:

Sophisticated actions now which costs can be easier calculcated with a fair distribution of burdens, or inaction that leads to an unknown amount of costs and burdens in the future with more severe damage to infrastructure, property and public goods?

There's more uncertainty in a future where inaction and complacency rule than in a future where a transformation takes place in all sectors and in society as a whole which have already begun. And it will benefit everyone too, as we have seen. It can even reduce one's electricity bill! The standard of living we enjoy in fully economic developed countries can exist everywhere else too, and we don't even need to go to another planet.

Source

IPCC's starkest message yet: extreme steps needed to avert climate disaster (paywall)
https://www.nature.com/articles/d41586-022-00951-5

Further Thoughts

Well, I wouldn't be Baroque if I didn't think about philosophy and ethics on such an important and broad topic. But I will keep it short, very short. It is about Climate Justice, a term you've likely heard about by now. I recommend the following read, and while it refers to the Fifth Assessment Report of the IPCC the content is still relevant:
https://plato.stanford.edu/entries/justice-climate/

I consider myself a climate integrationist, meaning that I view climate change *'in light of a general theory of justice and in conjunction with other issues'*. The issues include poverty, migration, trade, culture, and so forth. In contrast, isolationist treat the ethical issues posed by climate change in isolation from other issues like I have mentioned. In section 1 it is perfectly explained: *"A second point that those who favour an Integrationist approach might make is that climate change is causally interconnected with a wide variety of other phenomena—such as economic growth, poverty reduction, migration, health, trade, natural resource ownership, and cultural rights—such that it is artificial to treat it on its own. Climate change does not present itself to us as a discrete problem that can be treated separately. Rather it is part and parcel of a larger process. It is an upshot of people's activity (primarily through the use of energy) and, as such, it is causally intertwined with economic growth, poverty alleviation, urban design, and land use."* It is more complex, but that way more detailed and taylored solutions can be found in cooperation with nations, both on a national and regional level.

On Intergenerational justice, I see myself in the egalitarian position. *"Those who adopt an egalitarian perspective, for example, might think that current generations have a duty to act in such a way that they do not create stark inequalities within future generations [...]. This is relevant in this context because climate change tends to exacerbate existing inequalities [...]."*
(Section 3.1) I personally want that humanity not just survives, but actually thrives.
What we do now to mitigate and adapt also benefits us, and it greatly benefits future generations who do not have to worry about food, water and stability. By tackling it together on various levels, from regional to national, it can also be a democratic revolution and entrench democratic values even deeper. Thus improving not only the standard of living, but also the quality of living. But I will elaborate on this philosophy in another article, for now it describes what I lacked the words for before.

Thank you for reading! Have a nice day!

(Released: 23rd July 2023, 8:10 pm/20:20 Uhr)

Science News #019

In Today's Science News, we cover my favourite scientific field: astronomy. It was the first to spark my interest in the sciences and one that I love to this day. Without further ado, let's begin with the news. Today we will learn about a new giant rock planet the size of Neptune and a discovery that will reshape our understanding of how galaxies evolve.

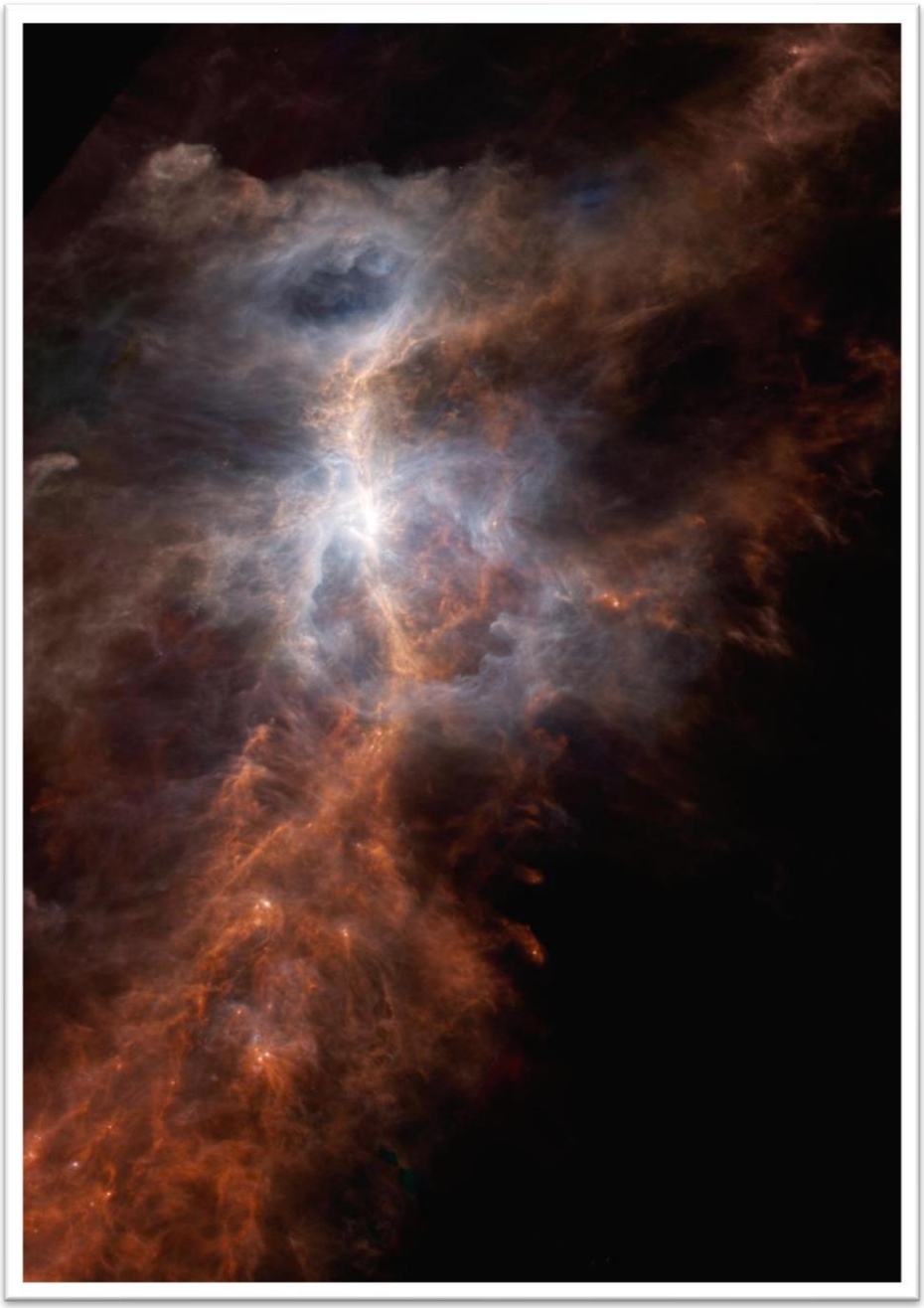

illustration 46 - Today's image shows the Orion nebula, here an excerpt from NASA's description: "This immense nebula is the closest large region of star formation, situated about 1,500 light years away in the constellation of Orion. The parts that are easily observed *"This immense nebula is the closest large region of star formation, situated about 1,500 light years away in the constellation of Orion. The parts that are easily observed in visible light, known alternatively as the Orion Nebula or Messier 42, correspond to the light blue regions. This is the glow from the warmest dust, illuminated by clusters of hot stars that have only recently been born in this chaotic region."* (Source: NASA Image and Video Library)

Article 1: New giant planet evidence of possible planetary collisions

SD-Date: August 31, 2023
Et-Date: September 17, 2023
ScienceDaily-Summary: *"A Neptune-sized planet denser than steel has been discovered by an international team of astronomers, who believe its composition could be the result of a giant planetary clash."*
Not Open-Access: https://www.nature.com/articles/s41586-023-06499-2

Method of Research

A science team around Luca Naponiello of the University of Rome Tor Vergata and the University of Bristol contributed to the study by modelling giant impacts to figure out how this immensely dense planet may came to be. The researchers used the computational facilities of the Advanced Computing Research Centre, University of Bristol, to perform their simulations. They were funded by the Science and Technology Facilities Council (STFC) and China Scholarship Council.

illustration 47 - The BlueCrystal HPC of the Advanced Computing Research Centre (source: Advanced Computing Research Center)

Findings

As stated above, the researchers created a model to simulate how a Neptun-sized planet could turn out to be this dense. First things first. Let's get to know Neptune a bit.

…

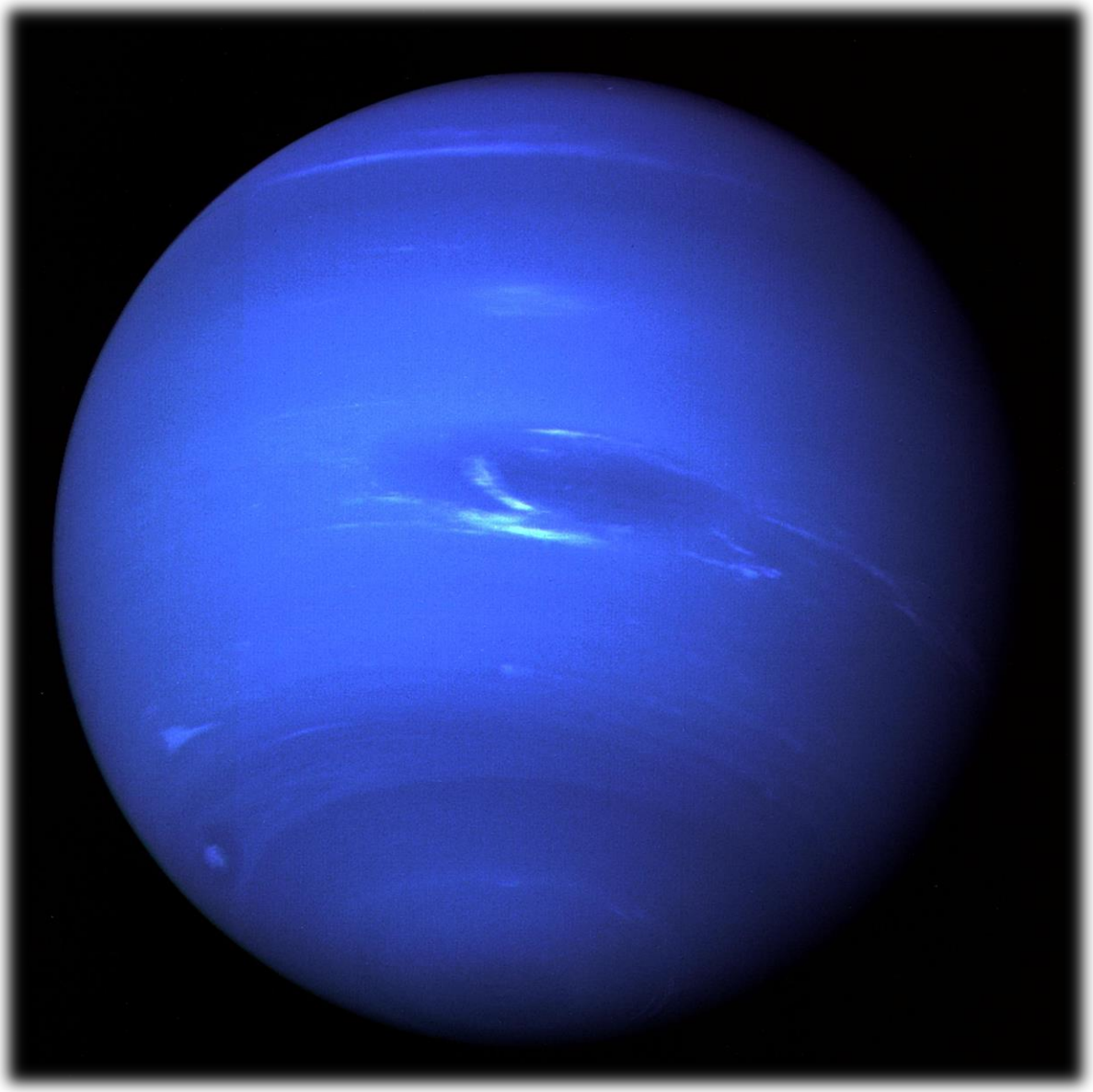

illustration 48 - This image was taken by Voyager 2 with its green and orange filters on narrow angle camera, the image published on October 30 in 1998. (source: NASA)

Neptune, the eight planet of our solar system, was discovered in 1846 by Johann Galle (June 9, 1812 - July 10, 1910) using predictions of Urbain Le Verrier (March 11, 1811 - September 23, 1877). Thus becoming the first planet located through mathematical calculations.

It is 4,473,929,981 Km (2,779,970,350 miles) away from the sun - more than 30 times the distance between the sun and our planet! Unlike the planet the researchers modelled, Neptune is a gas giant - or rather an ice giant, because most of its mass is a hot, dense fluid of "icy" materials: water, methane and ammonia. The core is small and rocky.
A Neptunian day lasts much shorter than our days here on Earth, with only 16 hours needed to rotate once. A Neptunian year, on the other hand, lasts 165 Earth years. This means that when it was discovered in 1846 in took until 2011 to get to the same position again. For fur-

ther information on Neptune, read the NASA Overview. In case you want a more in-depth look, here you can read it.

Finally, what is the density of Neptune? It's 1.638 g/cm³.
Earth is about three times denser with 5.514 g/cm³, in our solarsystem it is the planet with the highest density. The reason being that Earth is a rocky planet whereas Neptune, a gas planet, consists largely of noble gases.

Now to the finding: in order for TOI-1853b to result in what can now be observed, the initial planetary body *"would likely have needed to be water-rich and suffer an extreme giant impact at a speed of greater than 75 km/s"*. The planet-planet collisions it experienced during its formation stripped away some of the lighter atmosphere and water *"leaving a substantially rock-enriched, high-density planet"*.
Its density is higher than steel (7.80-7.83 g/cm³).

While it is an extreme planet, it provides new insights into the formation and evolution of planetary systems as well as new evidence for the prevalence of giant impacts.

Source

https://www.sciencedaily.com/releases/2023/08/230831121723.htm

Article 2: Astronomers find abundance of Milky Way-like Galaxies in early Universe, rewriting cosmic evolution theories

SD-Date: September 22, 2023
Et-Date: September 23, 2023
Science-Daily Summary: *"Galaxies from the early Universe are more like our own Milky Way than previously thought, flipping the entire narrative of how scientists think about structure formation in the Universe, according to new research."*
Open-Access: https://iopscience.iop.org/article/10.3847/1538-4357/acec76

Background

For a long time it was thought that disk galaxies, such as ours, were rare in the early universe because they were considered to be too fragile to exist and that their 'delicate shapes' would have been destroyed due to the common occurrence of mergers. Astronomers using the Hubble Space Telescope believed that galaxies had mostly irregular and peculiar structures that resemble mergers. The term used for referring to the structural properties of a galaxy is called 'morphology', it is based on the Hubble classification.

Galaxy Morphology

In 1926, Edwin Hubble proposed a galaxy classification scheme on which nearly all current systems are an outgrowth from. Hubble's classification is based on the optical appearence of galaxy images on photographic plates, but it only considers the most prominent features: **disks**, **bulges** (*"the dense spheroidal swarm of stars often found in the centres of spiral and S0 galaxies"* - Swinburne University) and **bars** (temporary structures from gravitational instabilities, they occur in 50% of all disk galaxies).

In Hubble's scheme, they are divided into three general classes: ellipitcals, spirals and irregulars. He further subdivided them into finer groups. However, in order to get a more complete morphological classification, you need to include other features such as **stellar halos**, **warps** (in the outer regions of a galaxy), **shells** (they are ripples of increased brightness which can only be seen on long exposure images) and **tidal tails** (created through gravitational interactions between galaxies, gas and stars are stripped from the outer regions of the galaxies with one trailing and the other preceding each galaxy).

Gérard Henri de Vaucouleurs (25 April 1918 - 7 October 1995) developed a more detailed subdivision of galaxies in 1959 which has since then evolved considerably. The subdivision includes different families, varities and stages.
"The de Vaucouleurs system is so detailed that it is more of a descriptive code for galaxies than a commonly used classification scheme." (Britannica)

Sources
I. https://astronomy.swin.edu.au/cosmos/G/Galaxy+Morphology
II. https://www.britannica.com/science/galaxy/Types-of-galaxies

Prior to the discovery, which was achieved thanks to the James Webb Space Telescope (JWST), it was also thought that disk galaxies such as the Milky Way (our home galaxy) formed in in the Universe's middle age. How the advancement of technology helps us in better understanding our near surroundings (on Earth) and outer surroundings (outside of Earth) can also be seen in astrophysics: **Hélène Courtois** (born 1970) identified with her team the Laniakea Supercluster (where our galaxy is located in). In 1999, her research into charting our region in space came to a halt because the telescopes weren't capable of clearly identifying the nature of the Great Attractor. And with it the competition between the different groups from North America, Europe and Australia froze too. Some turned to numerical simulations instead since they couldn't confirm or disprove their hypothesis.

Courtois also decided to use this forced break to become acquainted with numerical simulation and there she discovered her passion for fractal mathematics. 7 years later, in 2006, telescopes benefited greatly from the progress in technology which took place so she could resume the search for the Great Attractor (*Finding Our Place in the Universe* (En.), *Voyage sur les flots de galaxies - Laniakea, notre nouvelle adresse dans l'Univers* (Fr.), *Von der Vermessung des Kosmos und der Entdeckung von Laniakea* (Ger.), p. 75-76 and p. 82).

Further technological progress also made the JWST possible which resulted in this discovery.

The Finding

The international team of researchers, which included the University of Manchestor and University of Victoria in Canada, discovered that disk galaxies like the Milky Way were ten times more common in the early universe with many galaxies going as far back as 10 billion years or longer when they formed.

The study was published in the *Astrophysical Journal*.

In a numerical simulation conducted by Marcel Neeleman et al. (May 20, 2020), disk galaxies as large as ours may even have formed through the accretion of cold material and mergers as early as one billion years after the Big Bang. Unfortunately, the study is not open access (you can still read the abstract which I recommend) so you either can purchase it or you can access it through your institution (make good use of it if you can). In case you can't do either, we are in the same boat.

I'll have Christopher Conselice, *Professor* of Extragalactic Astronomy at The University of Manchester, have the last word on the meaning of this discovery: *"These JWST results show that disk galaxies like our own Milky Way, are the most common type of galaxy in the Universe. This implies that most stars exist and form within these galaxies which is changing our complete understanding of how galaxy formation occurs. These results also suggest important questions about dark matter in the early Universe which we know very little about. [...] Based on our results astronomers must rethink our understanding of the formation of the first galaxies and how galaxy evolution occurred over the past 10 billion years."*

Source

https://www.sciencedaily.com/releases/2023/09/230922110758.htm

Just One More Thing

In June 21, 2017, the Hubble Telescope discovered a massive dead galaxy that also challenged the theories of galaxy evolution. I'll leave it here too, including the image with the description of NASA.

…

illustration 49 - "This artist's concept shows what the young, dead, disk galaxy MACS2129-1, *right, would look like when compared with the Milky Way galaxy, left. Although three times as massive as the Milky Way, it is only half the size. MACS2129-1 is also spinning more than twice as fast as the Milky Way. Note that regions of Milky Way are blue from bursts of star formation, while the young, dead galaxy is yellow, signifying an older star population and no new star birth."* Credits: NASA, ESA, and Z. Levy (STScI)

"Why this galaxy stopped forming stars is still unknown. It may be the result of an active galactic nucleus, where energy is gushing from a supermassive black hole. This energy inhibits star formation by heating the gas or expelling it from the galaxy. Or it may be the result of the cold gas streaming onto the galaxy being rapidly compressed and heated up, preventing it from cooling down into star-forming clouds in the galaxy's center."

https://www.nasa.gov/feature/goddard/2017/hubble-captures-massive-dead-disk-galaxy

OSIRIS-Rex

Soon I'll write about the OSIRIS-REx mission. You may already have heard about it, the satellite will return the probes of an asteroid that will help us to better understand the history of our solar system. It was launched in 2016, arrived at the asteroid Bennu in 2018 and took samples in October 2020 after orbiting around it for two years, then it made its trip back and it is going to parachute the probe it collected to the Department of Defense Utah Training Centre around 8:55 am local time (16:55 in Brussels/Germany and 15:55 (3:55 pm) in the UK)*.

I'm very excited and have been for two weeks since I've read it in an issue of the Scientific American. While I'll not be able to watch the NASA livestream (can be found here: https://www.nasa.gov/nasalive), I'm going to closely follow the development.

Thank you and until next time!

*Addendum (24.09.2023, 4:05 pm CEST): Utah is 8 hours behind where I live, so I corrected the time. And in case you are unfamiliar with the US state, you might have heard its name from a dinosaur that was named after it: the Utahraptor (unearthed in 1991).

(Published: September 24, 2023 at 1:55 pm/13:00 Uhr)

Note:

2023 was quite a busy year, hence I didn't have the time to write as much as I'd have liked. I'm not sure whether that'll change in 2024, but while I may publish less, I'll still continue the blog – it just takes longer between each blog entry. I apologize for any inconvenience.