REVOLVE

QUARTERLY INSIGHTS INTO A CHANGING WORLD

N°53 | Fall 2024



Sustainable Aviation Fuels

How to Decarbonize Air Travel & Trade p.10

Sustainable Travel Tips p.18 Night Train Travelogue p.26 Women on the Move p.35
Agroecology to Save Water p.52 The Sundarbans p.60 Irish Peatlands p. 68



Trains, Planes, and No More Automobiles!

Delving into the theme of mobility, we must reflect on the evolving landscape of transportation and its profound implications for our environment and society. The need for sustainable mobility solutions has never been more pressing, especially given the climate challenges we face – and will keep facing.

We explore the potential of night trains as a sustainable alternative to air travel with a travelogue that highlights personal stories revealing the joys and challenges of journeys across Europe, while emphasizing the need for a cultural shift towards more eco-friendly modes of transport, and sustainable travel tips to make the best out of train travels.

In this issue, we also examine the critical state of peatlands in Ireland, which play a vital role in carbon sequestration: Restoring these ecosystems is essential for biodiversity and for mitigating climate change and our coverage highlights the importance of preserving these natural landscapes as part of a broader strategy for sustainable land management.

The Sundarbans, a UNESCO World Heritage site, are also highlighted, illustrating the delicate balance between human activity and environmental preservation in a region that faces significant threats from climate change – and our coverage calls for urgent action to protect its unique biodiversity.

Women face serious challenges with or in their daily commute all over the world, and our VIEWS section brings an illustrated story on such struggles that are so often overlooked.

Water conservation in arid regions is another focal point for REVOLVE. As we face increasing droughts and water scarcity, innovative solutions are imperative and urgent. Our article on saving water in dry climates showcases successful strategies that can be implemented globally, reinforcing the idea that local actions can have far-reaching impacts.

At REVOLVE, we remain committed to providing insights that inspire action towards a more sustainable future. We invite our readers to engage with these stories and share their own experiences and ideas for promoting sustainable mobility.

Thank you for being part of this journey with us. Together, let’s navigate the path towards a resilient and sustainable world.

Send us your comments about a world without cars, and other ideas:
editors@revolve.media

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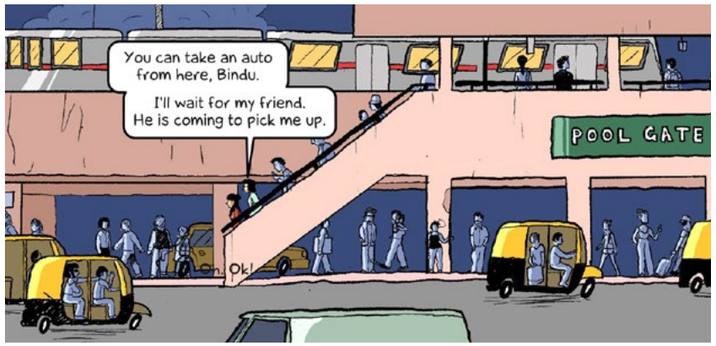
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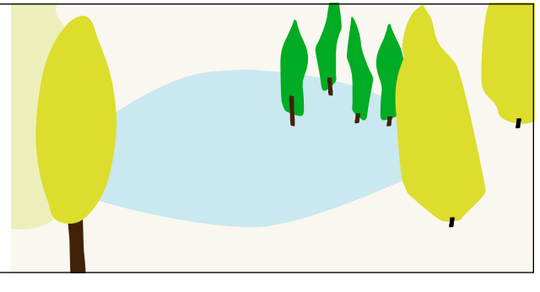
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REVOLVE x Sustainability

REVOLVE is committed to climate-conscious reforestation and tree-planting initiatives as part of our company's sustainability policy to mitigate the impact from our business and project travel activities.

revolve.media/sustainability





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Cover image:

Philippines Airlines aircraft being loaded with cargo, Hồ Chí Minh airport, Vietnam.

Photo: Ethan Nguyen / Pexels

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Evolving Urban Mobility in Oman

WRITER: **MOHAMMED AL ASFOOR**
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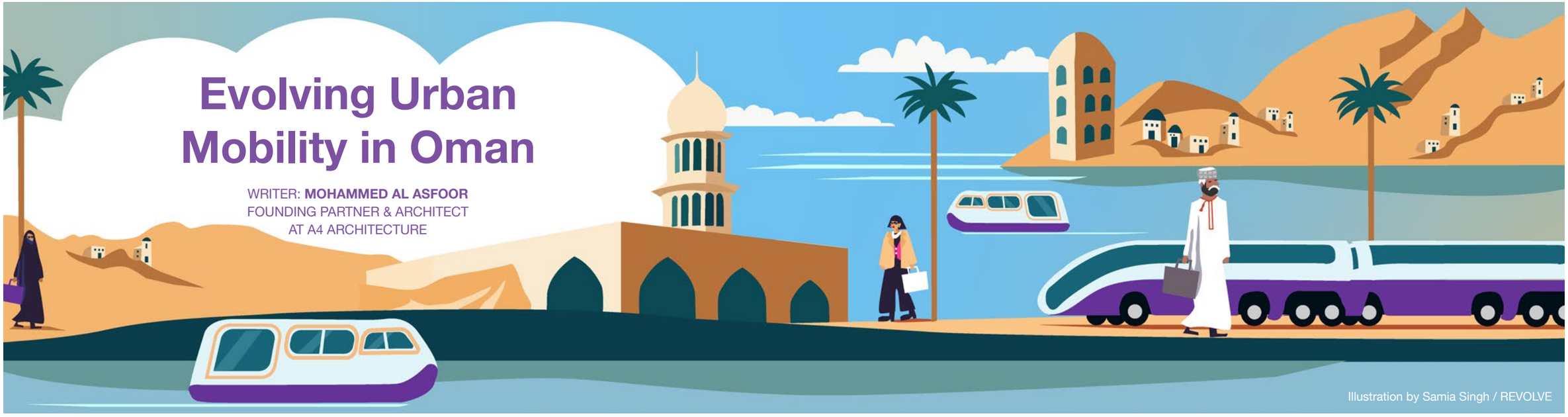


Illustration by Samia Singh / REVOLVE

Getting off the highway and onto the bus in Oman.

The 15-minute city is "an urban planning concept in which most daily necessities and services, such as work, shopping, education, healthcare, and leisure can be easily reached by a 15-minute walk, bike ride, or public transit ride from any point in the city." The concept has grown in popularity since the COVID-19 pandemic and in response to the increased urban challenges posed by climate change. One major benefit is its potential to reduce car dependency, leading to lower fuel emissions and air pollution. But can this be applied in countries and cities built with decentralized urban models?

The Sultanate of Oman has undergone rapid transformation since 1970, beginning with the period termed the "Renaissance" defined by the ascension of His Majesty Sultan Qaboos to the throne. This modernization effort spurred urbanization in what had been a largely rural society. However, due to topographical limitations combined with high population growth, this urban development followed a car-centric model, leaving Omanis with limited development of public transportation infrastructure.

From the 1950s to now: Oman as a car-centric country

Before 1970, Oman's rural landscape was shaped by a decentralized network of small towns, each connected by organic routes.

During the "Renaissance", the country saw rapid development, particularly within the larger Muscat area. From 1970 to 2001, Oman's population grew by more than 200%, intensifying the need to establish a clear plan for the expansion of the city and connecting the growing villages in the Muscat region. To address this question, a feasibility study -was conducted in the 1970s and concluded that the natural topography had led to an overcrowded urban layout that limited car integration and the city's expansion would need to be focused on other areas.

As a result, the decision was made to expand the city's development westwards towards the airport. Today, the city is connected from east to west by the Sultan Qaboos Highway, a central artery connecting the city's numerous neighborhoods. Given that the goal of this expansion was intended to accommodate cars, modern Muscat's urban planning differs greatly from the denser and more organic layout of old town Muscat.

This approach worked well until the 1990s. Increasing car ownership and access, combined with Muscat's geographical constraints and rising land prices, pushed people to move to more affordable towns and commute to the city.

Today, cars dominate Muscat, and public transport remains limited. Personally, I don't know anyone who regularly uses the bus, as the lack of last-mile solutions makes driving a more convenient option for most people.

The Ministry of Transport is currently developing the Green Mobility Strategy 2025-2028, which aims to enhance public transport routes, introducing diverse mobility options and better connecting the city. As we wait to see how these plans develop, a key question arises: Could building entirely new spaces be a sustainable solution to address Oman's urban growth?

Mobility solutions in Oman

In addition to integrating public transport into our existing cities, Oman is looking to build new developments that take a holistic look at the residents' needs. To date, the existing "walkable" urban development projects in Oman have been created to cater non-locals, and those with higher incomes. For example, The Wave, "Oman's First Master Planned Community" offers residents walkable access. But the majority of Omanis are priced out of these kinds of communities.

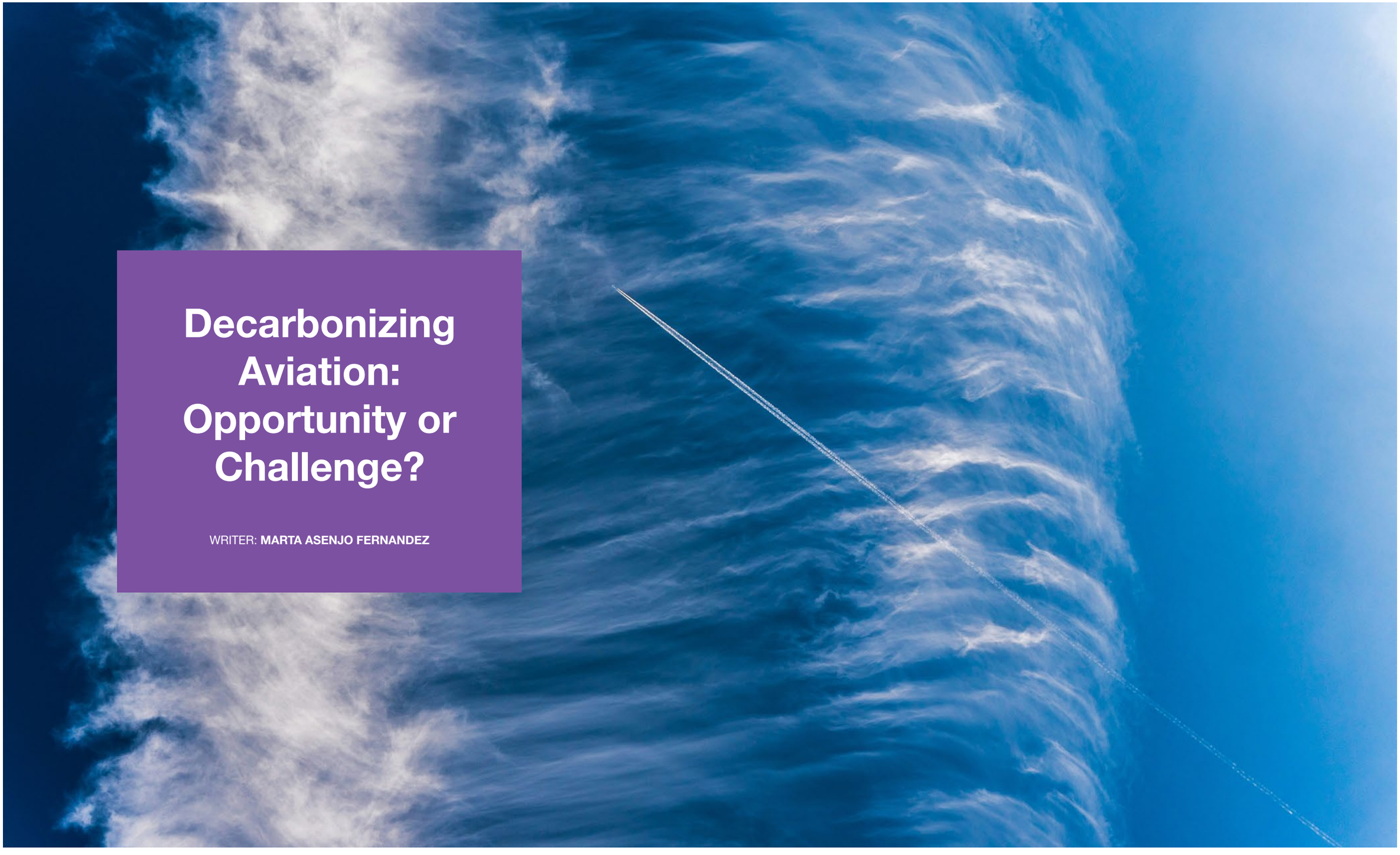
People in Oman tend to have the idea that Dubai, the hyper-manufactured city of the United Arab Emirates (UAE), is the development ideal. Some believe that if we don't have a metro that's suspended in the air and passing through futuristic-looking stations, then it's not worth doing. This points to another challenge: Building a collective vision of the future. Where are we going? Rather than looking at what others have, we should ask ourselves what future we want to design/create? Dubai's history and vision is a different story than ours, so, our solutions should look different too.

Oman's Vision 2040 proposes the development of several "sustainable" cities, including the largest, the Sultan Haitham City (SHC). SHC is to be created following a holistic approach. Further, it is being marketed as a place for all Omanis, with housing affordability supported by partnership with local banks and some 5% of the units being earmarked for housing assistance. The construction only began in February 2024, and we have yet to see how these plans will come to fruition. Still, we are headed in a promising direction.

Ironically, in taking a holistic approach to city planning, we have designed a model that returns to organic community growth reflected in the close-knit villages our country has grown from. We have seen that dispersed cities struggle with a lack of social cohesion, and with upcoming plans in Muscat and the country at large, I hope that we are working towards building the connections, literally and figuratively, that, ultimately, is the goal at the heart of urban mobility system design.

Decarbonizing Aviation: Opportunity or Challenge?

WRITER: **MARTA ASENJO FERNANDEZ**



1

The aviation sector must tackle both soaring emissions and growing flight demand by embracing sustainable aviation fuels and reducing air travel.

Air travel's convenience is unparalleled, enabling people to connect across continents in the matter of a few hours. In 2023, 6.3 million commercial flights crossed the European Union, showcasing the high demand for flight travel. However, this convenience comes at a significant environmental cost. The aviation industry is one of the largest contributors to global warming, generating the highest climatic impact per passenger kilometer. In 2022, it accounted for 3.8% to 4% of the EU's total greenhouse gas (GHG) emissions, making it the second-largest source of transport-related emissions after road transport.

The aviation sector's dependence on fossil fuels, responsible for 75% of global GHG emissions, poses a key challenge for the sector's decarbonization efforts. Beyond CO_2 emissions, airplanes emit water vapor, nitrogen oxides, sulfur dioxide, and soot particles, all of which contribute to harmful atmospheric processes. For example, contrails formed by the aircraft trap heat, further exacerbating global warming.

In an effort to tackle this challenge, the EU has introduced the RefuelEU aviation regulation, establishing a target of a 2% minimum use of Sustainable Aviation Fuels (SAF) by 2025. The high energy density required for long-haul flights makes SAF a key element of the sector's decarbonization strategy, and aircraft fuels should supply 70% of the total aviation fuels by 2050. However, achieving these targets is not an easy ride.

The opportunity: Sustainable Aviation Fuels (SAF)

Sustainable aviation fuels present an opportunity to reduce emissions from the aviation sector, but they are not without limitations. Research indicates that the demand for SAF is projected to grow by 65.7% annually over the next six years. However, there are still obstacles on the road for widespread adoption of SAF in the aviation industry.

Sustainable aviation fuels fall into four primary categories, each with its own benefits and limitations. Crop-based biofuels, while initially promising, have been deemed "unsustainable" by the mobility organization Transport and Environment due to their competition with agricultural land and resulting indirect land-use change (ILUC). Used cooking oils (UCOs) and animal fats face limitations like low availability and risks of fraud, exacerbated by their competing uses in other sectors. Advanced Biofuels, though promising, also risk displacement effects. E-kerosene stands out as the most sustainable option, with scalability potential, though it requires energy-intensive production and strict supply chain management to prevent fraud and ensure transparency.

E-kerosene holds the most potential for scaling up to meet aviation's needs, though its high energy demands remain a challenge. Overall, the production of SAF requires significant investments and technological advancements.

Currently, SAF are more expensive to produce than traditional jet fuels, and their implementation remains limited. To overcome these barriers, policy support, industry collaboration, and strategic investments will remain crucial factors for upscaling SAF production and making these alternatives more accessible.

In an interview with REVOLVE, Mika Järvinen, Associate Professor of Mechanical Engineering at Aalto University, highlights that the number of certified SAF production routes is expected to increase from seven to more than 10 in the coming years. However, he warns that without rapid growth in SAF production – which currently accounts for just 0.2% of global kerosene demand – the sector's decarbonization goals may be unattainable.



2

Circular economy models

Circular economy models offer a framework for partially addressing aviation's decarbonization challenges through the promotion of resource efficiency and waste reduction. The EU's Circular



3

For aviation, applying circular economy principles means rethinking sources for fuel production and consumption.

SUSTAINABLE AVIATION FUELS

There are 4 main kinds of SAF:

Advanced Biofuels

E-Kerosene

Used Cooking Oils & Animal Fats

Crop-Based Biofuels

4%

3 Aviation contribution to EU carbon emissions.

4 Air travel is the form of transport with the highest climatic impact per passenger kilometer.

2 Biofuels production in the EU has grown to nearly 300,000 barrels of oil equivalent per day.

30%

1 From 2019 to 2023, there was an increase in flight volume of almost 30%.

Source: (1) The Guardian, (2) Statista, (3) European Commission, (4) Carbon Market Watch
Illustration by Dariana Guevara / REVOLVE

Economy Action Plan (CEAP), part of the European Green Deal, was introduced in 2020 to reduce reliance on natural resources and promote sustainable growth.

For aviation, applying circular economy principles means rethinking sources for fuel production and consumption. By using waste-based materials – such as biomass, used cooking oils, and other agricultural residues – as feedstock for SAF production, the industry can reduce its dependence on fossil fuels while tackling broader waste management challenges.

However, as research from Transport and Environment (T&E) reveals, the availability of these waste-based fuels is limited and insufficient to meet aviation's needs.

Circular fuels: A model of circular economy for decarbonizing aviation

Circular Fuels is an EU-funded project with the potential of applying circular economy principles for transforming the aviation industry. This project aims to develop an advanced SAF production process using solar energy and waste-based raw materials, such as agricultural and forestry residues. These feedstocks will be heated using concentrated solar heat and converted into bio-oil, emitting no additional CO_2 from this process. Green hydrogen, produced through solar energy, is then used to remove oxygen content, creating more efficient advanced biofuels. biofuels.

By focusing on waste materials and renewable energy sources, Circular Fuels highlights the potential of circular economy principles to drive aviation's transition away from fossil fuels and make SAF more affordable. The decarbonization of the aviation industry requires the implementation of multiple technologies and policies, and using advanced biofuels could be a way to limit the total emissions. As Järvinen notes, the project avoids the pitfall of increasing demand for primary materials, such as virgin forests, by relying solely on waste-based resources. Moving forward, innovative methods like capturing CO_2 from the air or seawater and repurposing it as raw material could further enhance sustainability.

The path forward

To successfully decarbonize the aviation sector, the development and deployment of SAF must be supported by a combination of e-kerosene production and circular economy principles, and a reduction in flight demand.

Collaboration across sectors, such as fuel producers and SAF suppliers, and the application of strong policy frameworks are crucial for overcoming the barriers to SAF production and adoption. Additionally, taxing fossil kerosene and using the revenues for climate action could further support the sustainable transition of the sector, while enhancing the industry's role in the global transition towards a low-carbon and circular economy.

While some types of SAF offer immediate opportunities to lower aviation's environmental impact because of their compatibility with the current aircraft fleet, infrastructure and workforce operations, they only represent 0.2% of total global fuel use. Moreover, the life cycle impacts of SAF have led these alternatives to sometimes been referred to as 'a cure worse than the disease'. Continued innovation in aircraft design, operations, and maintenance, alongside circular economy strategies is thus vital for the achievement of long-term sustainability.

To decarbonize successfully the aviation sector, SAF development and deployment must be supported by a combination of e-kerosene production and circular economy principles, and a reduction in flight demand.



4

Flying less

Decarbonizing the aviation sector is inherently challenging given the industry's reliance on fossil fuels and the technical limitations of alternative energy sources. The growing demand for flights, along with the expansion of air freight operations, further complicates the efforts to make aviation more sustainable. It is no secret that the fastest and most efficient way to decrease aviation emissions is by reducing air travel. Opting for more sustainable modes of transportation, such as trains, not only lowers environmental impact but also offers unique experiences that flying simply cannot match.

The path to decarbonizing the aviation sector requires a balanced approach that includes a reduction of air travel and a widespread adoption of sustainable aviation fuels. SAF, when combined with circular economy principles, can represent a viable solution for mitigating aviation's environmental impact while maintaining the demands for global connectivity. By shifting to renewable energy sources and rethinking fuel production, SAF can play a key role in cutting down emissions, especially for long-haul flights where alternatives are limited. The simultaneous reduction in non-essential flights and increased SAF implementation represents a powerful strategy for the aviation sector's transition towards a more sustainable model.

Ultimately, re-imagining how fuels are produced, and resources are managed is key to enhance aviation's impact in the global shift toward a low-carbon, circular economy. This journey requires collaboration, technological innovation, and commitment across all actors involved. Despite the immensity of the challenge, the potential rewards – including reduced emissions and sustainable, long-term growth – make the journey worth pursuing. The combined approach of reducing unnecessary air travel and advancing SAF technologies offers a promising pathway to achieving the sector's decarbonization goals. Still, we must not forget, as Mika Järvinen states: "The most important solution to reduce emissions is, of course, to reduce all consumption – including flying." ●

1. Sky surfing, airplane contrail in a wave of clouds. Photo: Nick Tsinonis / Unsplash
2. Airplane in a clear blue sky. Photo: John McArthur / Unsplash
3. View out of an airplane window. Photo: Valentina Chernobay / Unsplash
4. Loader lifting cargo to aircraft cargo bay level, Hong Kong International Airport. Photo: James Shliu / Wikimedia

Let's Explore Europe by Rail!

PHOTOGRAPHY BY & INTERVIEW WITH
CLARA FRANCKEN, DIGITAL STORYTELLER

1

Sustainable travel tips and ideas from Clara Francken, vlogger, podcaster, and slow travel advocate.

With the goal of traveling more sustainably, Clara Francken, a 28-year-old podcaster and vlogger from Belgium, began her journey across Europe by train. Traveling by train comes with its ups and downs but every trip leaves you with a story to tell. In this article, Clara shares a few of her stories with REVOLVE.

How did you decide to start traveling by train?

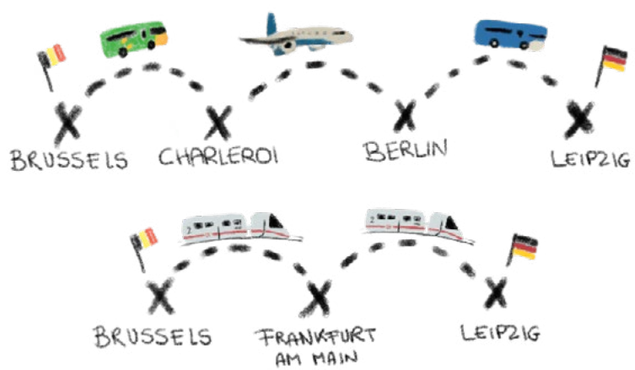
It all began with my long-distance relationship which led me to travel from my home country, Belgium, to my partner's, Germany.

I met my partner during my Erasmus in 2018 in Leipzig, Germany. After my exchange, we needed to visit each other to make the long-distance relationship work. At the beginning, we used to travel by plane, flying Ryanair from Berlin and Charleroi Airport or vice versa. Although the tickets were cheap, I quickly realized that the full trip wasn't cost- or time-effective. True, the flight was only one hour long but, when you combine that with the pendle bus to Charleroi Airport, the early check-in, and another final bus between Berlin and Leipzig, the travel time and price increased.

The main reason why I chose to travel by plane was because I assumed that flying was the cheapest option. However, when I thought about the emissions that flying generates, together with the not-so cost or time-effectiveness of flying from Charleroi to Berlin, I started researching other travel solutions. After some Internet digging, I discovered that I could find affordable train tickets



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3



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5

between Belgium and Germany, with only one transfer per trip. The cheapest ticket I ever found was €17,50 for a one-way trip. Traveling by train also had other benefits that I had not thought of, such as the ability to work thanks to quiet zones and stable internet connections—I now mostly edit videos on the train.

Many people dislike trains because of the delays. Have you encountered a lot of delays over the years?

I certainly have — too many to count! But I would like to add that I always made it to my destination. It is all about the right mindset: if you focus on the negative, you will end up joining the grumpy German passengers complaining about the country's train system. However, I choose to see delays as small, unexpected, adventures that will also get me a refund. Refunds for delays in Germany are up to 50% of the ticket price and, with the frequent delays, I can almost always count on getting some money back, which I then save for future trips.

Did you ever sleep elsewhere because of a delay?

Yes, once, but, usually, if the delay is severe, the train company arranges replacement buses, or, if I am lucky enough to know someone nearby, I ask them to pick me up. However, I did have to sleep in a hotel not long ago when I missed a connection because of delays on my train from Leipzig to Frankfurt. We all watched our connecting train leave right in front of us. Even crew members were frustrated, as the delay meant they wouldn't get home that evening either. Service attendants were also affected, as they had to make another train wait because they still needed to provide drinks on board. The train company Deutsche Bahn was very helpful, though—they gave me a coupon for a nearby Ibis Hotel, with free breakfast included, and a train ticket for the next day.

Have you been on multi-day trips in Europe?

I have taken the Interrail ticket for multi-day trips — between Germany and France, Belgium and Spain, and for what has been my longest train trip: Greece to Germany. For those trips, Interrail proved to be the cheapest option, a reminder that it is worth checking all the available options when traveling on a budget. In this case, I calculated the price of the Interrail ticket plus seat reservations and compared it to regular train and plane tickets. It is important to check the seat reservations because, in many countries, these are mandatory, in addition to your Interrail ticket.

How was your experience traveling from Greece to Germany by train?

The Interrail phone application has a feature that shows you an overview of your trips. For instance, for my trip between Athens and Munich, the app recorded the following statistics: a total of 11 trains, equaling 6,890 km and 35 total hours onboard. Given that I stayed in multiple cities along the way, the journey felt longer. For getting from Greece to Germany, there are two alternative modes of transport and routes: crossing the Balkan countries, which requires multiple buses, or taking the ferry from Greece to Italy. The ferry was the best solution for getting there in a reasonable amount of time.



6



7



8

Checklist for Cheap Train Tickets

1. Book 1-2 months before departure
2. Choose off-peak times (weekdays, early mornings)
3. Compare national websites with comparison websites (Trainline, Omio)
4. Check for student/age-related discounts
5. Look out for discount periods (such as summer sales)
6. Subscribe to railway newsletters to get discount codes
7. Use discount cards from national railway companies
8. Utilize loyalty programs if possible
9. Use rail passes for multi-day journeys (Interrail)
10. Compare buying split tickets to buying the full journey at once

What is it like to travel solo?

It was fun, exciting and made me feel alive. What I loved the most was the flexibility that comes with traveling solo. At the same time, I didn't feel alone for multiple reasons. Firstly, I traveled to many places where I already had friends with an apartment and a couch for me to crash on. Secondly, when traveling solo, it's easy to make friends along the way. When embarking on the Greece journey, I quickly realized that. When taking the bus between Athens and Patras, to get to the ferry, I got to know two other Interrailers, just by looking for the bus stop. In Patras we then proceeded to find the road to the ferry port together, looking after each other's bags whilst the other has to leave, exchange stories of our previous travels…

Visit Clara Francken's YouTube channel

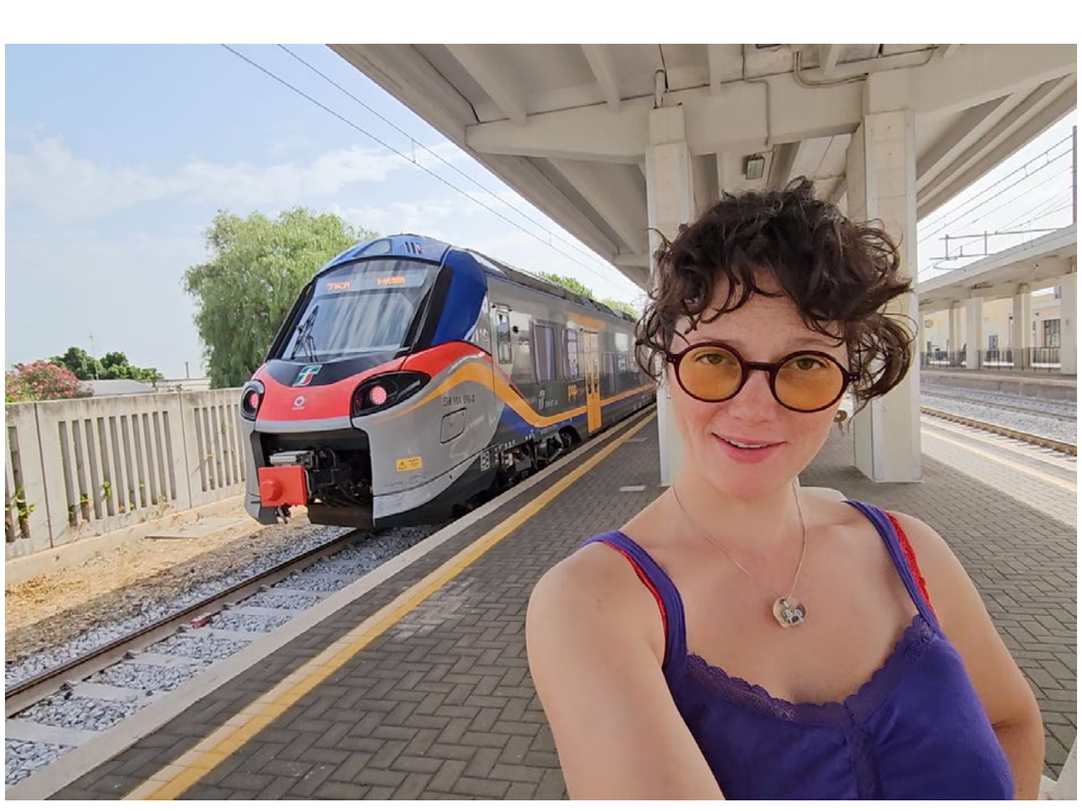
1. View from Italian train window.
2. Belgium-German train.
3. Flight vs train drawing.
4. Athens to Munich drawing.
5. Waiting for the train at the gate in Germany.
6. Italian ferry on Interrail trip.
7. Germany - sleeping cabin view.
8. Italian countryside.
9. Italian train selfie.

Once we arrived at the port of Patras, we had to walk towards this gigantic red and white ship. It had an escalator at its entry, many different rooms to sleep in, a dining room and even a casino. Whilst looking for where I was going to sleep over night, we met another person who was doing the same thing. We had dinner and breakfast together and even explored Italy together the first day before saying goodbye and never seeing each other again. So, you see, strangers can easily become friends or a safe place when traveling solo.

Why is traveling by train important to you?

For me it is all about the environmental impact and truly experiencing the journey. Train travel stands out as one of the most eco-friendly modes of transportation because it emits significantly less CO_2 per passenger and kilometer when compared to cars and planes. My second reason for experiencing the journey is about having a true understanding of the distance. Unlike air travel, where you quickly jump from one country to another, trains offer a gradual transition where you can observe the changing landscapes and interact with locals. I feel more conscious of my surroundings, which I find important as I am often on the road.

I also want to inspire others to travel more sustainably, which is why I started my YouTube channel, where I share tips and experiences about train and bicycle travel. I also host a podcast called "Travel Devil", where I interview fellow travelers about their eco-conscious journeys.



9

Jump on the Night Train to Berlin!

WRITER: **EMMA FINNAMORE**

1

I took the night train from Brussels to Berlin and loved it!

“Come to Berlin,” my friend Diego messaged me one day.

It was a week until his birthday and he wanted to spend it celebrating in the abandoned airport-turned-park Tempelhofer Feld, weather permitting (it did not). I had not been in Germany for ages.

Before moving to Belgium last year, I had promised between tears and goodbye kisses that I would visit lots, but of course in reality only made it back twice for weekend trips that felt too short. I knew it would be a shame to pass up such an invitation. I missed laughing and discussing stupid politics with old friends from university and the taste of Club-Mate with vegetarian döner.

I wanted to celebrate too! Was it possible? I turned to my oracle.

Scrolling Google results of alternative modes of transport, I stopped at the idea of the Nightjet, a sleeper train. It was expensive but practical and fit my chaotic schedule. I weighed my options. I would rather eat glass than go to Charleroi. On the other hand, I had lovely memories of being a student in Russia and taking the night train back to St Petersburg from an excursion in the Arctic.

The 27 hours emerging from the polar night were spent by the window, watching the tundra go by, or in the bright green dining car, listening to the Soviet disco played over the speakers and making friends with my cabin mates.

An adventurous spirit possessed me. I booked the ticket.

Railway renaissance

The Nightjet rail service is run by the ÖBB, the Austrian transit company, and their Brussels-Berlin line goes three times a week: on Monday, Wednesday, and Friday. The distance is 1053 kilometers, which takes 13, 14, or 15 hours to cover depending on the stops, usually departing from Gare du Midi at 7pm and arriving at the Hauptbahnhof from 8 to 10 am. Not bad.

Tickets are sold in three tiers associated with varying levels of comfort and price tags. The seating carriage, as it sounds, requires its passengers to be in an upright position like on an airplane, and is by far the cheapest option coming in at around 40 euros. The second option, the couchette carriage, with full beds and breakfast included, costs 70 euros (or about €100 when it’s last minute like mine was).

The sleeper cabin is the more luxurious version, spacious and including a private WC with a shower and ranging from 90 to 134 euros. Like a hostel on wheels, ‘ladies compartments’ are available at no extra cost.

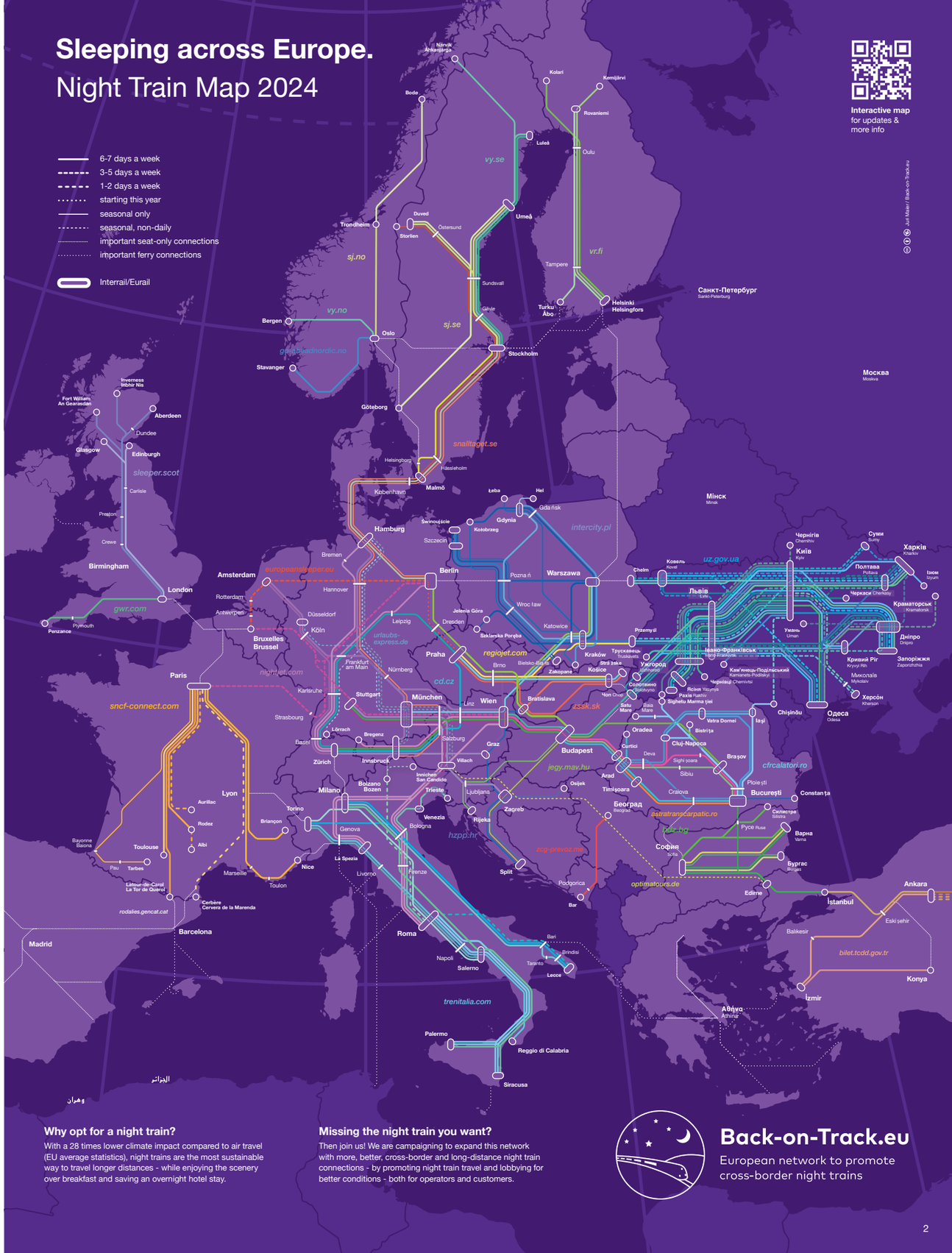
Sliding open the doors to my compartment, I was greeted with an outdated but functional little cabin. The two couches on either side could be flipped into two beds with some easy adjustments. An attendant with beads of sweat on his forehead came by, speaking quickly in a German accented by the Austrian mountains and taking personal breakfast orders.

Unfortunately, there was no dining car on this train (although upon further research they do exist on other night trains connections with other operators). My Euro disco dreams were dashed. Still, it was hard not to feel excited before the train left the station. The atmosphere was social, and it seemed like it was everyone’s first time on a train. With a long journey ahead, us passengers made ourselves comfortable.

Within five or ten minutes of finding their cabin, the crew of six friends with heavy backpacks were laughing and sharing beers. The Flemish woman in the cabin next door and I were in the hallway. We had both already taken off our shoes and spoke to each other in our socks, speaking a half-German half-Dutch as unusual as the situation. She was taking pictures of her home for the night with her phone. “I just have to,” she said to me. “Isn’t it so much fun?”

We are in the midst of the railway renaissance; for the past few years it seems as if night trains have been making a comeback. Due to the rise of budget airlines, they were steadily in decline, experienced by my generation only through the stories told by our parents about their interrail summers in the 80s.

The 2021 European Year of Rail helped revive the bygone magic of night travel that is spreading now across the Continent.



Night travel offers a more climate-friendly way to traverse the continent, as the use of transportation services in our globalized world increases.

This has changed, however, since 2021, the official "European Year of Rail", night trains have experienced a resurgence, expanding across the continent. Passengers can book from a variety of operators from Munich to Zagreb, Rome to Pompeii, Amsterdam to Barcelona.

The sustainable option

Night travel offers a more climate-friendly way to traverse the continent, as the use of transportation services in our globalized world increases. Long-distance night trains compete with planes, shorter distances with cars. In both cases, rail is more carbon-efficient.

According to back-on-track.eu, a website developed by train enthusiasts (who have been right all along, I am realizing. Justice for trainspotters) to map out night train journeys, night trains have on EU average a climate impact 28 times lower than air travel in terms of greenhouse gas (GHG) emissions. My booking to Berlin came with a little note that said I saved 224.6 kilograms of CO_2 compared to the same distance taken as a roadtrip.

A vibrant interconnected web of night connections between European countries could also change the social habits of people and incentivize more rail travel in general. Imagine the establishment of a railway between the island of Ireland and the rest of the continent. The pollution caused by popular journeys by air – between Dublin and London, for example – could be vastly reduced. Irish citizens would finally be empowered to make environmentally conscious decisions, an option which they currently do not have.



4



3

Still, it is not easy to compete with low-cost flights. Even considering check-in and security, taking a flight from Charleroi on a budget line would have taken me less time to reach Berlin, and prices on seasonal discounts can reach the single digits. Such convenience and affordability are incredibly attractive to young travelers who have started to think that waking up at strange hours or wearing all their clothes at once to avoid baggage fees is just what traveling is.

A Transport & Environment (T&E) report published in 2023 illustrates how member states could easily lower the price of night train tickets through policy measures. They cite a study which found that a large majority of those in Germany, Poland, France, Spain, and the Netherlands would be willing to use night trains, but that 73% of respondents think that rail travel on the same route should generally be cheaper than air travel, so making such travel more accessible to the public is of major interest to train operators.

Tickets on night trains are more expensive for compounding reasons, but especially because of the liberalization of the transit system in Europe and the lack of a level playing field between modes of transport. There are several bureaucratic and structural challenges to overcome in the industry.

Night trains are costly to own: they can only run at night, carry less passengers, and must pay tolls (TAC, or track access charges) to get from A to B. In comparison, cars do not have such an obligation to be permitted use of EU roads, they just drive relatively unregulated.

Night trains and their sleeper cars have an air of excitement to them, alluding to mysteries from a bygone era.



5

Policy recommendations set forth by T&E and other climate-oriented organizations include the elimination of the TAC tax, and harsher control of aviation, especially implementing a tax on kerosene. Taxation of commercial aviation fuel is currently prohibited worldwide, although it remains a massive source of pollution.

Making European airlines pay for their intense environmental impact could have a positive influence globally. Such changes could also take the steps needed to make night train travel more affordable and accessible for travelers.

The case for making life more fun

Back on the train to Berlin, the motion helped me fall asleep quickly, and I woke up to my alarm to see the sunrise. Sharing a breakfast of bread, jam, and hot tea as the European countryside rushed past, I felt that this experience was not just an interval, lost or wasted time, but as much a part of my holiday as seeing old friends or exploring the city.

Night trains and their sleeper cars have an air of excitement to them, alluding to mysteries from a bygone era. Frequented by artists, writers, spies, night trains have a certain status as a literary and cultural setting of adventures, the epitome of the bohemian movement. The Orient Express and Trans-Siberian Railway are legendary. Has a budget airline ever been described as anything even close to that?

Combining travel and accommodation, night trains could save both time and money if properly supported by the Member States. They are worth investing in for their potential contribution to reducing carbon emissions and mitigating climate change.

Europe has the opportunity to usher in a new era of mobility and to capitalize on the mystique and adventure of travel by night. The most climate-friendly mode of travel could be the main one. ●

1. Nightjet. Photo: Harald Eisenberger / ÖBB
2. Map of all night train lines currently running in Europe. Image: Juri Maier / Back-on-Track.eu (adapted by REVOLVE)
3. Couchette carriage in a Nightjet train. Photo: Simon Tartarotti / Unsplash
4. Nightjet train attendants. Photo: Simon Tartarotti / Unsplash
5. Nightjet. Photo: Harald Eisenberger / ÖBB

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Daily Transit Struggles: Women on the Move

A DATA COMIC BY THE OMI FOUNDATION

In cities around the world, the daily commute is a routine task that millions of women undertake, yet it is fraught with challenges that are often overlooked.

Public transportation, the backbone of urban mobility, is not designed with women's diverse needs in mind. From safety concerns and accessibility issues to high travel costs, women face a range of obstacles that can turn a simple journey into a daunting experience. But women are not a homogeneous group; their challenges vary widely depending on their age, socioeconomic status, and identity.

Bindu, a young woman who has recently moved to a new city for her job, is eager to explore and find the most convenient mode of transport to reach her workplace every day. To her dismay, however, she soon realises that finding a safe, convenient, and affordable transport mode is not easy. These concerns are poignantly highlighted in OMI Foundation's Data Comics 'Moving While Woman: Bindu's Big City Journey', where Bindu's experiences reflect the multifaceted challenges faced by women in urban environments. The comics delve into the distinct challenges encountered by women, as a heterogeneous group, from marginalized castes and communities,women with disabilities, senior citizens, women travelling with children, and trans/ non-binary individuals. OMI's data comics, designed in collaboration with Leewardists, is available in English, Hindi, Tamil, and Kannada.



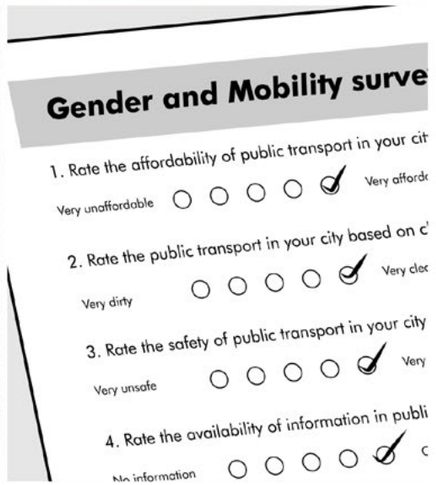
PRESENT DAY...
Name - Bindu's mother.
Status - scared.
And it was just you on the platform, alone, with all these men staring at you!
Nothing of this sort happens to you, right?
And there were no women! I felt so... ...scared!
Do you travel alone?
IS IT SAFE?
You don't travel late at night, do you?
Are there a lot of men?
Do you...
...EVENING, BIG CITY.
MOM!!
MOM!!
Name - Bindu
Status - excited to be in big city. (currently angry)
You have been having these nightmares ever since I left for this job in the city.
And mom, a lot of women travel alone here! Sometimes as late as 12 AM.
Just because everyone is doing it, doesn't mean you have to do it too.
I was just giving you an example and, I have my friend accompanying me. Say Hi, Mariam!
Name - Mariam
Status - confused.
He He! Hi Auntie!
And it is just 7:30 PM mom! Chill! It's normal.
And public transport in big cities come with modern facilities.
Good toilets
Security personnels
Escalators and lifts.
And the station is well lit..
And completely safe!
But Bindu, having modern facilities does not make it...safe...
Mom! It's all good. Trust me, please?
I've to go home now. I will call you later. Bye.


Hey! Excuse me! Can I take a moment of yours..
Huh?
Huh?


Yes?
Would you like to participate in a survey?
Name - unknown
Status - desperate to get at least one survey.

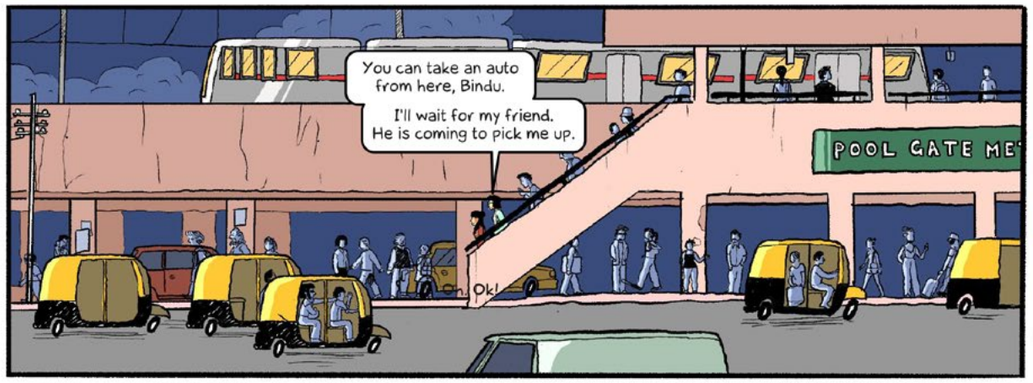

We are asking women of this city if they find public transport to be adequate.


Oh! Yes, I would like to participate!


Gender and Mobility surve
1. Rate the affordability of public transport in your cit
Very unaffordable
Very afford
2. Rate the public transport in your city based on c
Very dirty
Very clea
3. Rate the safety of public transport in your city
Very unsafe
Very
4. Rate the availability of information in publi
No information


Hmm. Safe? Yes. Frequent? Yes. Clean? Yes. Yes. Yes and yes.
...


???
That was a good survey. Let's go Mariam.


You can take an auto from here, Bindu.
I'll wait for my friend. He is coming to pick me up.
POOL GATE ME
Ok!

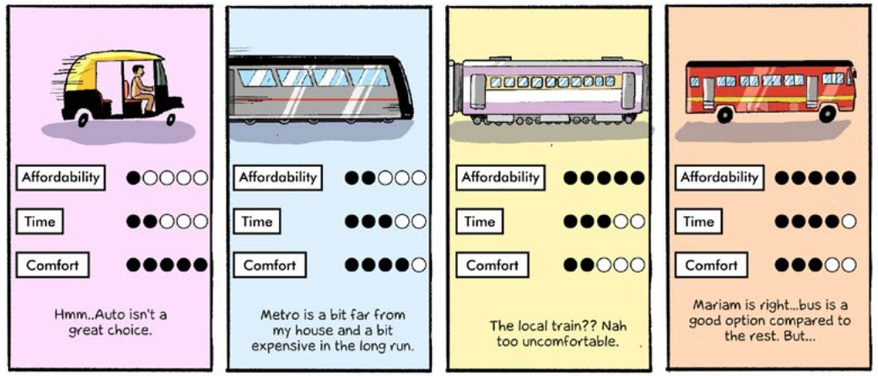

Thanks for showing me around the city and the new metro too. I guess it will be my choice of transport to office daily.
I am glad you liked it. But can I suggest something?

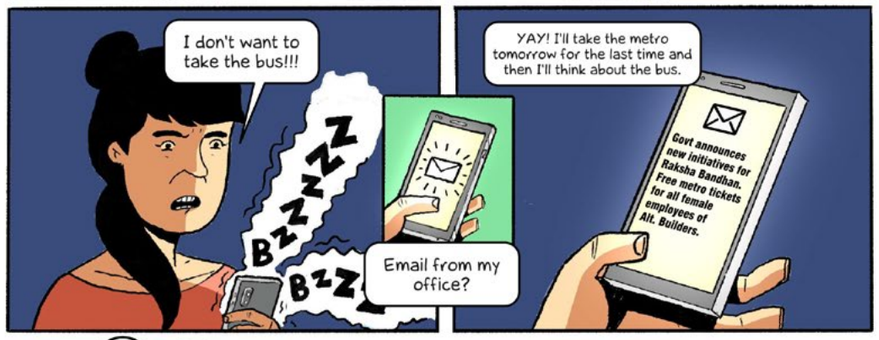

Take the bus.
I mean for your route; it is much cheaper and faster.

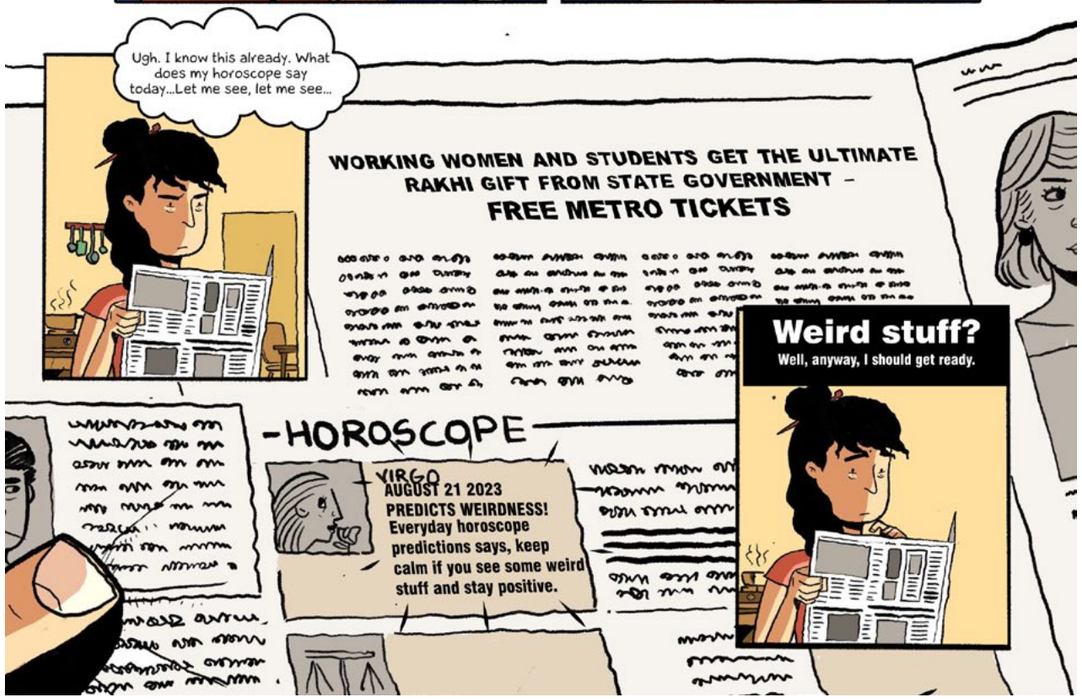

And you won't have to walk or take an auto to the metro every day.
Oh! I will think about it. Thanks for the suggestion.


Bye! Text me when you reach.
Bye! You too!


Let me do my own research. I have been in the city for a week now, after all.


Affordability
Time
Comfort
Hmm..Auto isn't a great choice.
Affordability
Time
Comfort
Metro is a bit far from my house and a bit expensive in the long run.
Affordability
Time
Comfort
The local train?? Nah too uncomfortable.
Affordability
Time
Comfort
Mariam is right...bus is a good option compared to the rest. But...


I don't want to take the bus!!!
BZZZZZ
BZZ
Email from my office?
YAY! I'll take the metro tomorrow for the last time and then I'll think about the bus.
Govt announces new initiatives for Raksha Bandhan. Free metro tickets for all female employees of Alt. Builders.


Ugh. I know this already. What does my horoscope say today...Let me see, let me see...
WORKING WOMEN AND STUDENTS GET THE ULTIMATE RAKHI GIFT FROM STATE GOVERNMENT –
FREE METRO TICKETS
-HOROSCOPE
VIRGO
AUGUST 21 2023
PREDICTS WEIRDNESS!
Everyday horoscope predictions says, keep calm if you see some weird stuff and stay positive.
Weird stuff?
Well, anyway, I should get ready.

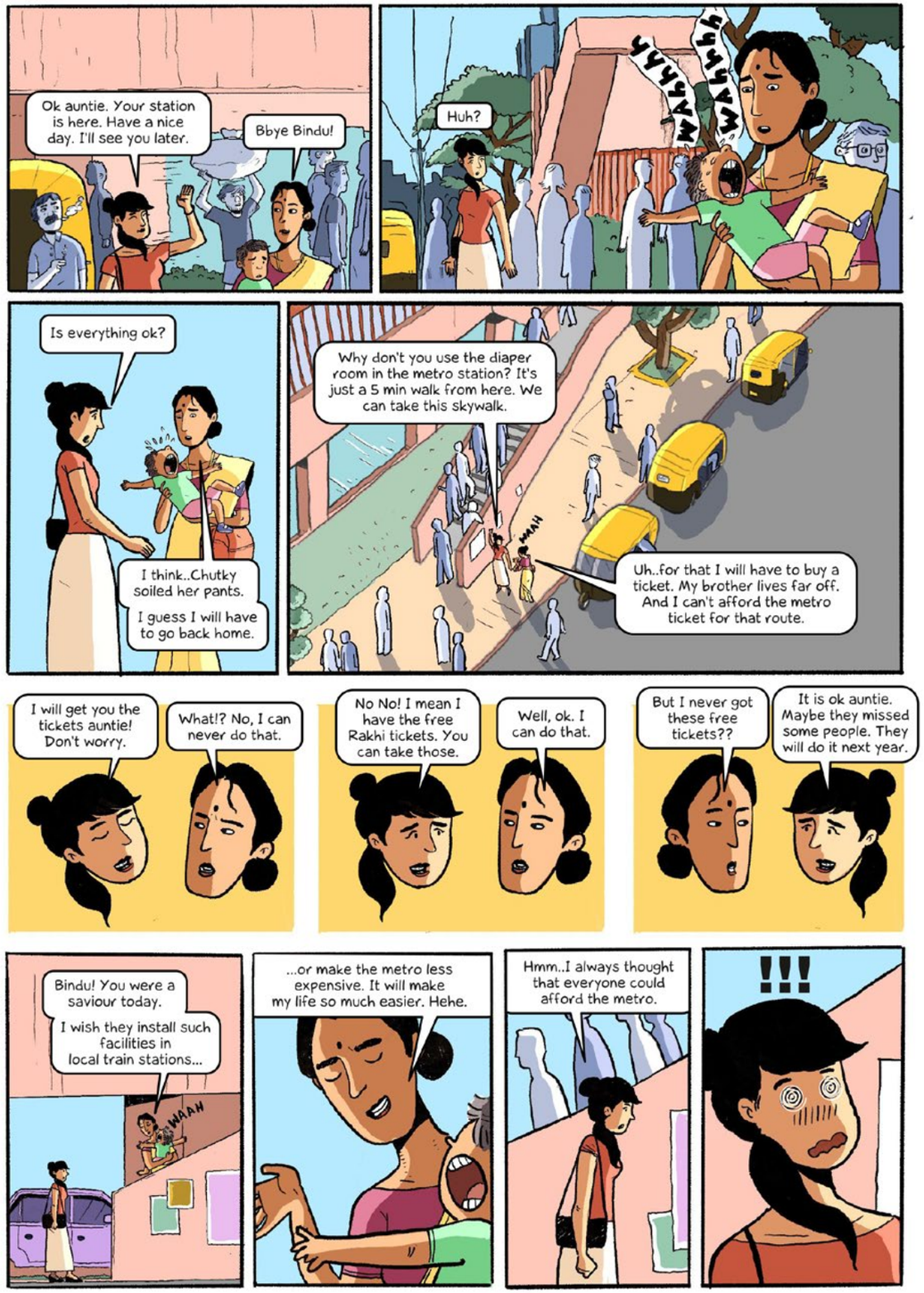

Hello Bindu!
307
Name - Shanti auntie
Status - happy. always.
Daabagoobirgttt
MONDAY.
Hi Shanti Auntie!
03

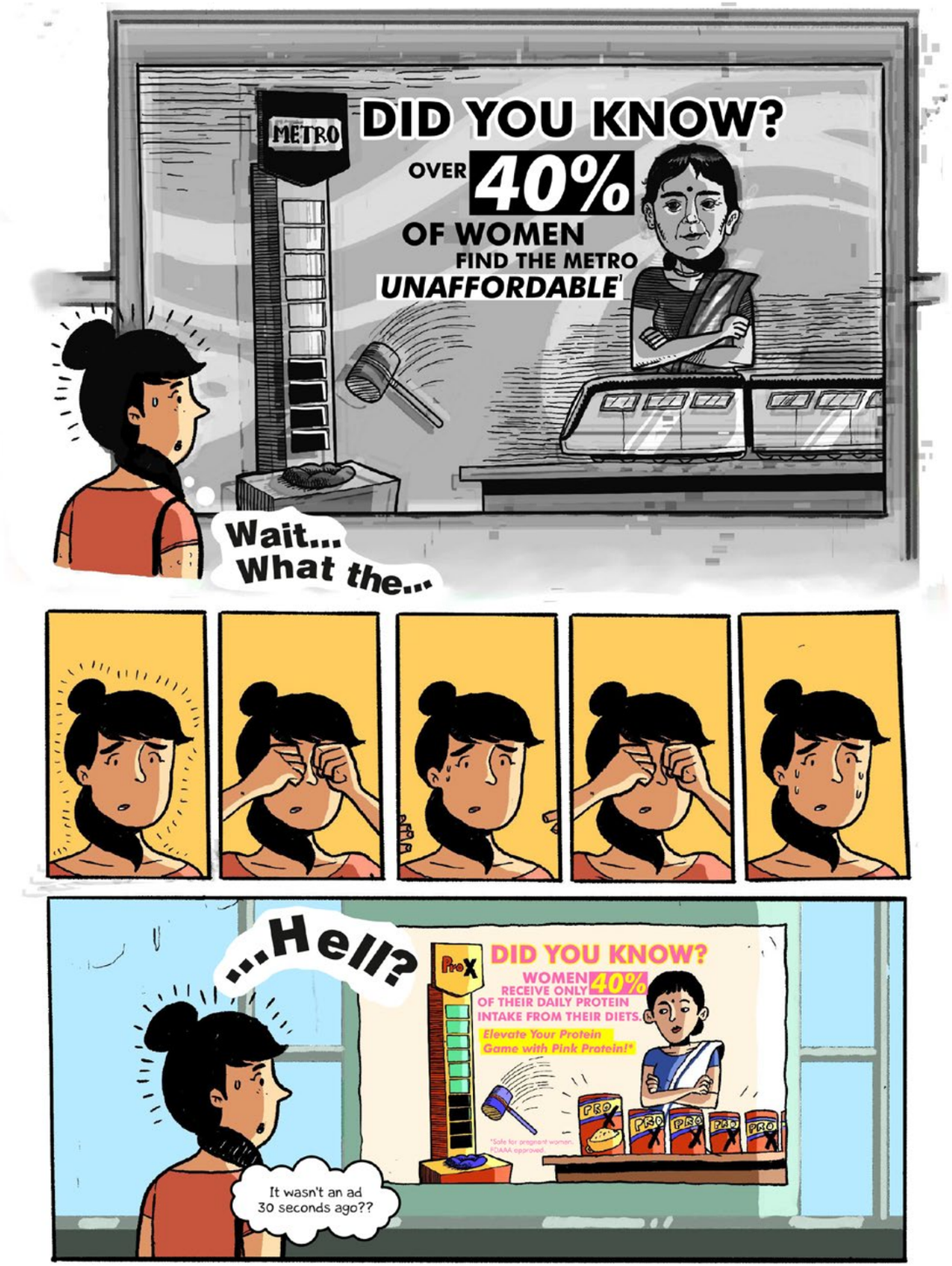

Going somewhere?


Yes, I am going to meet my brother in the other part of the city.
Oh yes for Rakhi! Will you be travelling by metro?


Hehe. No, I travel by the local train. But I can walk with you.

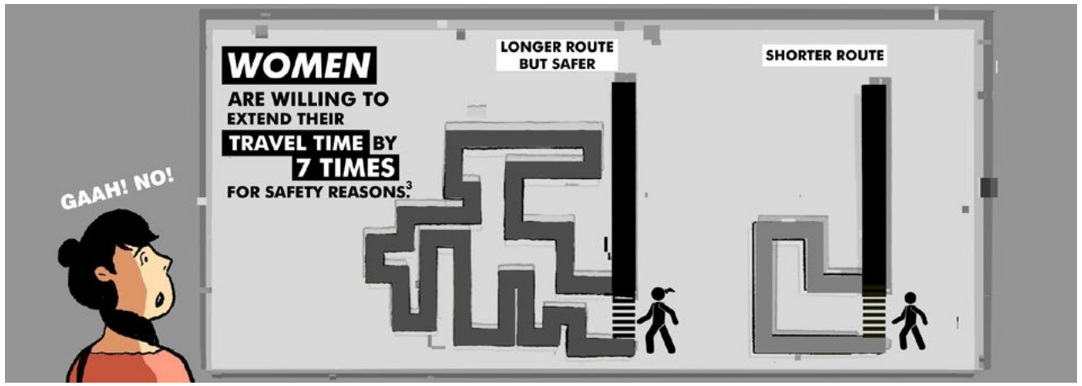

Come, I will show you a shorter route to the station.
Oh, wow Shanti Auntie! This saves us 10 mins! How do you know this?
I have been here all my life. I know every bit of this area. Hehe.


Ok auntie. Your station is here. Have a nice day. I'll see you later.
Bbye Bindu!
Huh?
WAAAAH
Is everything ok?
I think..Chutky soiled her pants.
I guess I will have to go back home.
Why don't you use the diaper room in the metro station? It's just a 5 min walk from here. We can take this skywalk.
Uh..for that I will have to buy a ticket. My brother lives far off. And I can't afford the metro ticket for that route.
I will get you the tickets auntie! Don't worry.
What!? No, I can never do that.
No No! I mean I have the free Rakhi tickets. You can take those.
Well, ok. I can do that.
But I never got these free tickets??
It is ok auntie. Maybe they missed some people. They will do it next year.
Bindu! You were a saviour today.
I wish they install such facilities in local train stations...
WAAH
...or make the metro less expensive. It will make my life so much easier. Hehe.
Hmm..I always thought that everyone could afford the metro.
!!!


METRO
DID YOU KNOW?
OVER 40% OF WOMEN FIND THE METRO UNAFFORDABLE
Wait... What the...
...Hell?
ProX
DID YOU KNOW?
WOMEN RECEIVE ONLY 40% OF THEIR DAILY PROTEIN INTAKE FROM THEIR DIETS.
Elevate Your Protein Game with Pink Protein!*
*Safe for pregnant women. UAMA approved.
It wasn't an ad 30 seconds ago??

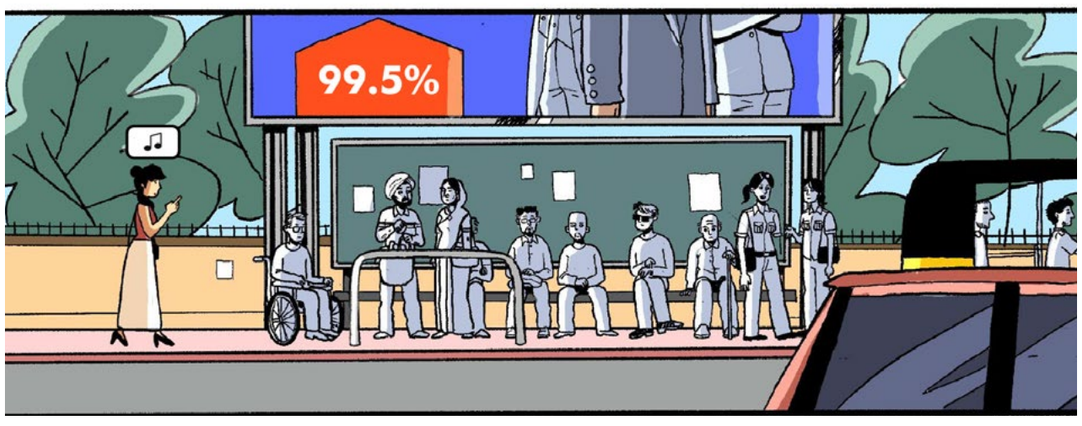

Oh no!! I am late for the office. I better run.
SECURITY
Why is there a long line at the security?
mom
???
!!!
I will not take the responsibility!
I won't either!
You do the security check for him!
No! You do the security check for her!
!!!


LATER...
What a weird day. Wait, my horoscope said that!
But am I imagining weird things because my horoscope said so or...
POOL GATE ME
OH NO!
No autos on this route...
Guess they don't accept rides for shorter distances.
I'll have to walk back to my house. Argh.
I will take the shorter route that Shanti auntie showed me.
...
Wait...
...Is this the same route?
It doesn't look so safe now...
I guess...I'll take the longer route. At least it'll be safe.
Another billboard. I don't want to look at it. Should I?
Sometimes the shortest route is not the fastest.
TRUST MAP MY CITY.


WOMEN
ARE WILLING TO EXTEND THEIR TRAVEL TIME BY 7 TIMES FOR SAFETY REASONS.[3]
LONGER ROUTE BUT SAFER
SHORTER ROUTE
GAAH! NO!


TUESDAY.

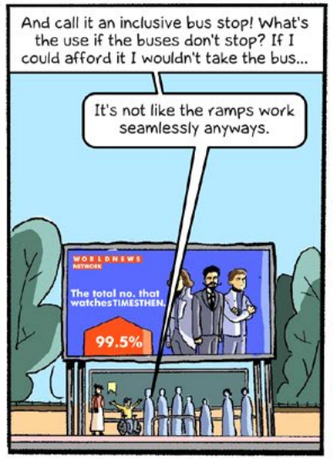

Today's Virgo Horoscope brings an intense day. The surprises that come your way will be good for you but may challenge you and push you out of your comfort zone. Your detail-oriented personality will come in handy to handle any issues that arise.....
Amazing! What a start to the day.


99.5%


RAAASSCALLSSS!! Absolute RASCALS!

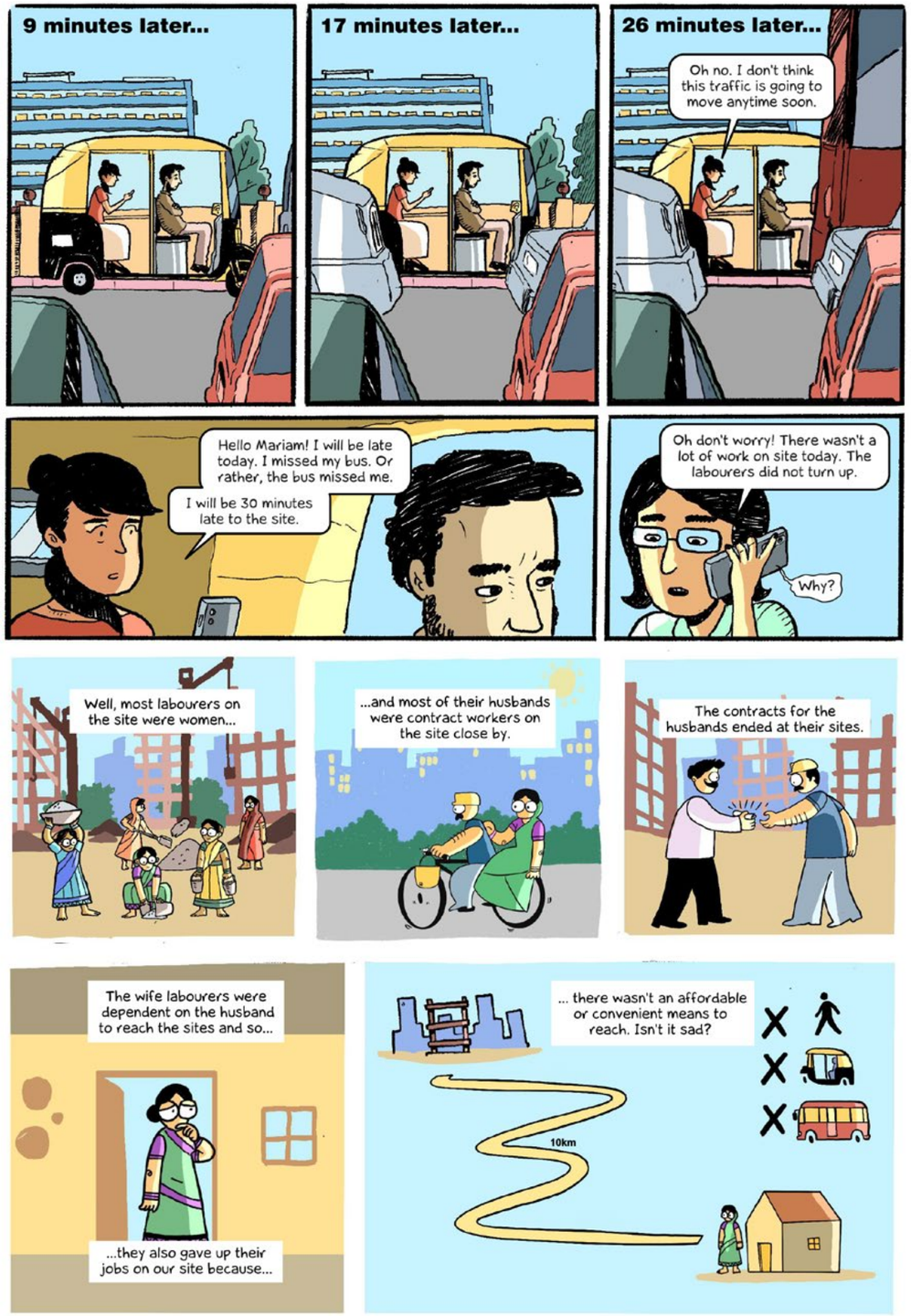

These buses don't stop when they see a wheelchair user.


They say that there are ramps to make the buses and the stops accessible.


And call it an inclusive bus stop! What's the use if the buses don't stop? If I could afford it I wouldn't take the bus...
It's not like the ramps work seamlessly anyways.
WORLDNEWS NETWORK
The total no. that watchesTIMESTHEN.
99.5%


!!!!!
Oh my god! How come I never thought about this!


AMONG THE WOMEN WITH DISABILITIES, 54.1% USE PUBLIC TRANSPORT REGULARLY, AND OF THEM, 66.5% FIND PUBLIC TRANSPORT INACCESSIBLE[6]
66.5%
Of course!
That's it! I'm taking an auto!





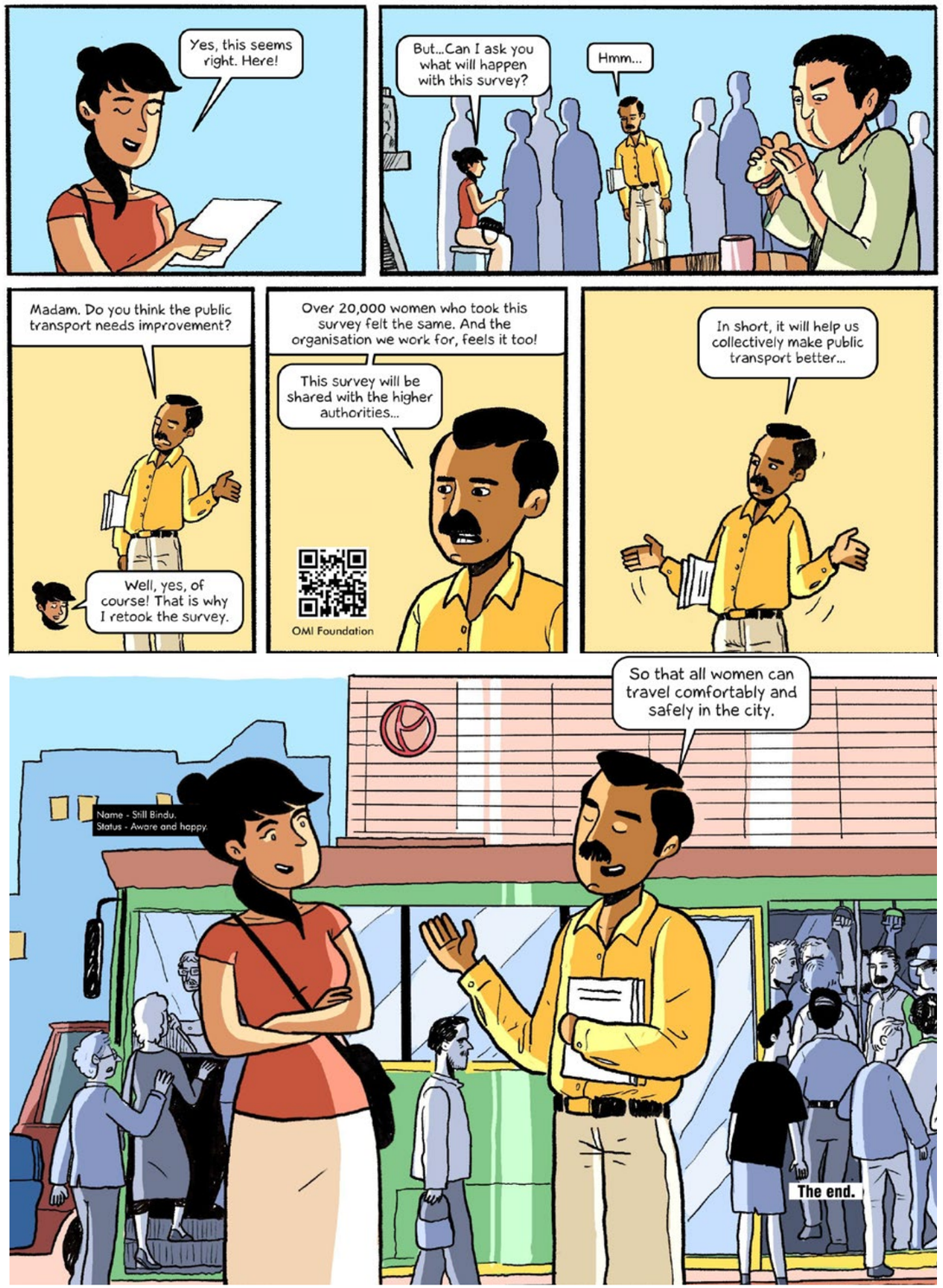
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Writing:
Shreya Khandekar & Anuj Kale; *Leewardists*

Illustration & Coloring:
Kaniska Mutum Singh & Rishikant Patra; *Leewardists*

Our data comic aims to spark meaningful conversations, build collaborations, and inspire action among city planners, administrators, law enforcement, civil society, and everyday commuters. Together, we can create safer, more affordable, inclusive, and accessible cities across India. We invite you to explore the full version of our data comics, available in English, Hindi, Tamil, and Kannada. Feel free to share it with your friends and family, and join us on this journey to build a more inclusive and sustainable future for all.

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Saving Water in Dry Climates

WRITER: **DANIELA DEKEN**
PHOTOGRAPHY: **BELEN G. CARMONA**



1

How Cape Verde can benefit from agroecology.

Off the western coast of Africa lies the archipelago nation of Cape Verde, a stunning collection of 10 volcanic islands that cover a mere 4,033 square kilometers and are home to a population of approximately 580,000 people. Like other countries in the West African region, this small nation faces urgent challenges due to its environmental vulnerabilities, high poverty rates, and global rising temperatures.

However, unlike its neighbors, Cape Verde also possesses limited arable land and is highly dependent on food imports. Factors such as water scarcity have led to more than 80% of food being imported, making the country particularly vulnerable to external disruptions in supply chains. Improving the stability of the agricultural sector is pivotal to a more resilient future for this island nation.

Cape Verde's agricultural challenges

The country's landscape is characterized by steep slopes, deep valleys, and small-scale, family-oriented farmed land. Only about 11% of the total area of Cape Verde can be used for agriculture, with the biggest island, Santiago, providing 52% of the nation's agricultural land.

Most West African agriculture is highly dependent on rainfall, and Cape Verde is no exception. The two types of agricultural systems identified in the country are rainfed agriculture, practiced on the slopes during the rainy season, and irrigated agriculture, practiced year-round mainly on the lower slopes of the valleys and on small plateaus. However, almost 82% of all farming depends on rainfall, making Cape Verde very sensitive to unpredictable weather.

The subtropical and dry climate of Cape Verde includes a long dry season, with several islands influenced by dry winds from the Sahara. Over the past years, due to climate change, the frequency and duration of the dry seasons have increased, causing severe periods of drought. Since the 1960s, the mean precipitation has been noticeably decreasing. Extended periods of drought can cause major problems, even in the areas with irrigation (using water from dams) as there are no permanent surface fresh water sources in Cape Verde, and together with the irregular and insufficient rain, this has the largest negative impact on agriculture and water supplies.

Extended drought has many negative consequences across all 10 islands, such as the reduction of groundwater supplies, fewer animals, soil erosion, and desertification. The mountainous terrain of the islands and unpredictable rainfall also cause random yields, resulting in unsteady agricultural productivity. Consequently, Cape Verde's economy also struggles.

The country is highly dependent on money and food from abroad and imports significantly more than it exports. Current agricultural production only covers approximately 10-15% of the food needs of Cape Verde's growing population. The present-day system mostly focuses on producing enough food for the local population, leaving very little to sell or trade.

"We feel the impact of climate change very strongly on all the islands," explains Amilton Ary Fonseca Lopes, agriculture specialist at Associação de Defesa do Património de Mértola (ADPM), an association that runs several conservation, promotion, and resource enhancement projects in Cape Verde. "Precipitation has diminished drastically, and the previous drought period was three years of no rain. Agriculture and small-holder farmers suffer the most from this," he adds.

Armindo Cosme Duarte, a farmer and agricultural technician, confirms these effects and emphasizes how increased temperatures have negatively affected farmers and their businesses. "The sun used to be less hot, and this has created many problems for us. One of the worst ones is the increase of pests," he says, adding that "this has caused a huge shock to the economy of the agricultural sector."

Agroecology in Cape Verde

CIRAWA

WATCH NOW!

What is agroecology?

To address Cape Verde's pressing issues, such as water scarcity and soil degradation, agroecology emerges as a potential remedy. Defined as a sustainable farming approach that harmonizes with nature, agroecology aims to recover the relationship between humans and natural ecosystems to ensure soil health and biodiversity, by working with, not against, the elements of the natural environment.

Its reliance on farmer-to-farmer knowledge exchange and compatibility with the structure of West African agriculture makes it a promising and adaptable solution without requiring extensive land restructuring. Overall, agroecological practices will lead to more sustainable and climate resilient food supply systems, increasing nutrition security for all.

How agroecology can benefit Cape Verde

Several important elements of agroecology could be of value to Cape Verde. First, the diversification of crops is key to ensuring food security and nutrition. An example of diversification could be the use of intercropping, which is the process of combining complementary tree and crop species in lines on a piece of land to increase spatial diversity and use natural resources (mainly water and light) more efficiently. This would enhance the use of Cape Verde's limited available farmland and increase the resilience of agricultural soils to erosion and heavy rain thanks to diversified root systems.

Further techniques such as using improved seed quality and storage ensure farmers can grow crops that are resistant to extreme weather conditions marked by increased temperatures and more intense rainfall. This is essential, as farmers are highly affected by these phenomena.

Sustainable farming practices in harmony with nature might offer a path towards resilience and self-sufficiency.



2



3



4

"We see climate change happening in front of our eyes. In February, the sun is already as strong as it used to be in May, killing plant leaves and drying our soil," says Josefa Delgado, farmer and president of the Women Association of Planalto Leste (AMUPAL).

Another essential element is co-creation and the sharing of knowledge. Education plays a fundamental role in sharing and implementing agroecological innovations that can address challenges across food systems and adaptations to climate change. Blending traditional and indigenous knowledge, producers' knowledge, and global scientific knowledge is central to this process.

Josefa gives an example of this, as she explains how she shared with her community that covering soil with dead leaves from the forest keeps moisture in the soil for a longer period and increases the amount of nutrients, which leads to improved crop yields. She sparked enthusiasm among other farmers, who adopted the practice after seeing the benefits it provided on Josefa's land.

A third agroecological approach of high importance to Cape Verde would be efficiency; innovative agroecological practices produce more using fewer external resources. Reducing dependency on external resources empowers farmers and producers, and enhances their resilience to natural or economic shocks. This is vital to Cape Verde's path to becoming less dependent on imported food and other resources.

However, perhaps the most important agroecological practices for Cape Verde are efficient resource management and recycling, especially when it comes to water; sustainable and efficient water use in the country is vital to mitigate water scarcity. Practices such as intercropping, agroforestry, mulching, and even cover crops contribute to this, but more is needed to decrease dependency on rainfall. The island nation also needs to increase water availability by building and improving water collection, retention, and distribution infrastructures.

According to the FAO, a total of 45% of Cape Verde's irrigated land already uses drip irrigation systems, which highly improves water availability and utilization efficiency. However, it is still necessary to provide more guidance and training to farmers on how to use these water-saving systems and how to achieve proper maintenance of them to ensure increased profitable water reuse for food production.

> "We strongly feel the impact of climate change on all Cape Verde islands."
>
> Amilton Ary Fonseca Lopes

Barriers and opportunities

Several hurdles impede the widespread adoption of agroecology in Cape Verde. Firstly, financial accessibility poses a significant obstacle, as most investments in West African agriculture largely favor export commodity production, leaving smallholder farmers, particularly women, struggling to secure credit for transitioning from subsistence farming.

Secondly, issues surrounding land and water access aggravate the situation, exacerbated by rapid population growth, urban expansion, and land grabbing, resulting in reduced resources for local food production. Additionally, limitations in accessing seeds and natural materials, inadequate markets for agroecological produce, insufficient political support, and inadequate research funding, all contribute to the challenges faced in Cape Verde.

> "We see climate change happening in front of our eyes."
>
> Josefa Delgado

Thirdly, educational issues arise. Across most of the islands, there is a notable absence of official training in agroecology and, as Delgado also comments, "farmers do not even know they are already doing agroecology," with only a handful of available courses that are sporadic and reliant on external funding and temporary research projects.

This lack of education also reflects on the price to be paid for this type of product, as no added value costs are charged for agroecological products, and they enter the market at the same price as conventional products.

Several steps can be taken to promote and advance agroecology in Cape Verde, and in other West African countries as well. Adopting integrated food policies that bring together different sectors' strategies under a common food system goal could be a strong way forward. By having long-term plans and involving various groups in deciding what is essential for food systems, these policies can create a unified approach toward agroecological transitions.

Linking food sovereignty and territorial development to new economic models can help agroecology thrive. When



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societies recognize the extra benefits agroecology provides for the environment and communities and create systems to support these advantages, it could encourage its growth alongside traditional economies.

"The strong point of agroecology is to profit from what we already have here on the island and to not depend on external markets. It helps us, and especially smallholder farmers, to gain a certain autonomy, which is really what we are looking for to create better food security in Cape Verde," says Fonseca.

Furthermore, positioning agroecology as a response to crises like diseases and climate threats could be crucial. As these challenges increase, agroecology's emphasis on diversity and adaptability becomes more valuable, potentially making it a vital part of climate mitigation strategy and crisis response.

Cape Verde faces complex challenges that require innovative and sustainable solutions. Alleviating poverty, combating desertification, tackling water scarcity, and decreasing dependency on food imports are important yet challenging tasks for the future. However, agroecological practices might offer a path in the right direction.

These practices include better water management (including capturing and storing water), maximizing the efficient usage of water resources in agriculture, and providing guidance and training to farmers. Furthermore, improving the infrastructure of irrigated areas to reduce the dependency on rainfall, targeted agricultural policies, and more research on how to reuse water safely can bring great benefits. Sustainable farming practices in harmony with nature will take time to grow, but undoubtedly pave the way for a resilient and self-sufficient Cape Verde.

Projects such as CIRAWA, an EU-funded initiative that puts people and ecosystems at the center, also contribute to these goals. CIRAWA is developing new agroecological-based practices that build on existing local and scientific knowledge to help create more resilient food systems. They work with smallholder farmers to improve food nutrition, local livelihoods, and ecosystem health in Cape Verde, as well as other West African countries such as Senegal, Ghana, and the Gambia.



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1. Farmer working on an agroecology field in Santo Antão, Cape Verde, on 26 February 2024.
2. David Fonseca, farmer and president of the Association of Young Farmers from the Peri-Urban Area of Porto Novo (AJAZPUN), works in the CIRAWA project agroecology experimental field located in Casa do Meio, Santo Antão, Cape Verde, on 26 February 2024.
3. CIRAWA project agroecology experimental field in Casa do Meio, Santo Antão, Cape Verde, on 26 February 2024. They practice intercropping, growing several kinds of crops in lines together with trees in one field.
4. João Lima, farmer and agricultural technician, harvests carrots in CIRAWA project agroecology experimental field in Casa do Meio, Santo Antão, Cape Verde, on 26 February 2024.
5. A drip irrigation field in Santo Antão, Cape Verde, on 26 February 2024.
6. Dry land in a coastal area close to Porto Novo, Santo Antão, Cape Verde, on 26 February 2024.

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Introducing the Sundarbans

PHOTOGRAPHY & TEXT:
STUART REIGELUTH

1

The Sundarbans – the largest mangrove forest on earth – reveals the real challenges of ecosystem restoration.

Despite its resilience, the Sundarbans ecosystem is under siege from multiple fronts. Climate change poses a significant threat, with rising sea levels and more frequent, intense storms leading to erosion and flooding. These changes jeopardize the delicate balance of this habitat, endangering the species that call it home. The cumulative impact of these threats is profound, making the Sundarbans one of the most vulnerable ecosystems to the changing climate.

*

The landscape is flat and dull. The mangrove trees are a few meters high, 3-4 meters maximum. They look like clumps of variegated broccoli, all different shades of green. The boat pushes off from the broken cement jetty. The water is a muddy metallic blue beneath a thick gray sky. No other boats are out on the water. The monotony of nature is tangible.

Imminent boredom encroaches with the lulling sound of the old motor in the stern and lapping of the ripples in the bow; a gentle fan spreads out in the wake as the boat advances slowly. Sitting in a plastic chair on the wooden deck, you hear music playing over a loudspeaker from a building on the banks of the Bay of Bengal.

In late October 2023, it's Durga Puja season, celebrating the power of women behind all of life and creation, a particularly popular festival in Kolkata, the capital of West Bengal. The luring music reverberates across the water, disappearing into the thick foliage of the world's largest mangrove habitat – the Sundarbans.

Of trees and tides

Mangroves comprise 3% of the forested territories on Earth. They are unique for their ability to survive in salt water and are located primarily along coastal areas. They thrive in the coastal intertidal zone, where they adapt to fluctuating tidal conditions and salinity. Mangroves are renowned for their resilience to storms and tidal waves, which partially explains their low height since taller trees do not survive strong winds and waves.

Mangroves are also known for countering climate change with their long leggy roots preventing erosion from water directly correlated with rising seas and increased flooding.

The Sundarbans are the world's largest mangrove forest spreading across some 10,000 square kilometers, comprising over 60% of India's total mangrove forest area and containing 90% of its mangrove plant species.

Located in the massive delta formed by the confluence of the Ganges, Hooghly, Brahmaputra, Padma, and Meghna rivers debouching into the Bay of Bengal, the Sundarbans are split between West Bengal, India (roughly 40%), and the other 60% to the east of the national border, making up most of south-west Bangladesh.

The forest is divided in that there is little to no transboundary cooperation around conservation, preservation, or restoration efforts. And yet it is united in the tremendous variety of trees that spread across the lands adjacent to the shared bay: there are said to be 26 species of mangroves with over 80 associated varieties.

Sundari is one of the most common species and since 'bon' means 'forest' in Bengali, the compound word Sundarbans means the 'forest of Sundari,' also home to the mighty Bengal tiger and mysterious evasive forest deity called Bonbibi.

This divided forest is somehow united by the continual transport of low barges carrying fly ash from the factories of Kolkata to Dhaka, the capital of Bangladesh. Fly ash is the waste left from coal burning in incinerators that can be packed and processed to make bricks, cement, and other construction materials.

Mangroves are also known for countering climate change with their long leggy roots preventing erosion from water directly correlated with rising seas and increased flooding. abandonment.

The Story of Bonbibi

There are many variations of this tale that each time reinforce that a female deity resides in the Sundarbans. The story goes that there was once a young man who was down and out, without a job or livelihood. He was foraging in the forest for sustenance when a tiger came upon him. Sensing the imminent danger the young man was in, Bonbibi appeared and beat the tiger away with a stick (*ghodaz*). The story ends there as a symbol of her protective powers. The story of her struggle with another deity, Dakkhin Rai, is longer and for another time. There are little shrines (and some homestays) for Bonbibi in many places throughout the India Sundarbans: each with some incense, marigolds maybe, most often with a woman figure holding a stick standing or sitting next to her brother Shah Jangali. She is called upon mostly by the moule (honey collectors) and woodcutters before entering the forest for protection against tigers.



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The barges ride the current downstream along the Hooghly River from Kolkata, turn off their engines, wait for the tide to rise (saving some precious cheap diesel fuel), and ride the rising tide up through the Sundarbans towards Dhaka. In a strange, convoluted way, this fly ash trade contributes somewhat to the circular economy.

The highest tide

The tides rise and fall with the waning and waxing of the moon. The highest tide (*vora kotal*) is with the full moon (*poornima*) and known as the 'death tide' (*mora kotal*). These salt tolerant mangrove forests have unique adaptations that allow them to survive in high salinity levels and tidal flooding. The great contemporary novelist and climate commentator, Amitav Ghosh, writes beautifully about the power of these currents and the speed at which they move in *The Hungry Tide* (2004), in which he describes the efforts to study and save the Irrawaddy dolphins that are largely going extinct.

The tide comes in twice a day, rising to a couple of meters during high tides, moving in and out between the roots of the mangroves, moving up and down the muddy banks. Tigers usually catch their favorite prey, the spotted deer, by the waterfront because it is harder to get them in the dense foliage inland. This imperceptive tide moves fast and represents the raw essence of life: uncontrollable yet predictable in its relentless force and persistence.

During high tide, visibility vanishes as it is next to impossible to see through the leaves. With the lower tides, it is possible to see further into the forest, beneath the canopy. Everything is affected by tidal conditions.

The little red 'fiddler' crabs with their disproportionately big right pinchers enjoy digging in the mud, and the mud-skippers (*menumash* in Bengali) thrive in the intertidal sludge on the banks where deer and tiger paw prints can be found. The tigers avoid the 'breathing roots' – those spikes protruding from the mud for the mangroves to aerate and not get too water-logged."

The tide is faster coming in, and slowest going up the rivers. The innumerous creeks visible a few hours ago between the different species of mangroves have now disappeared. There are so many creeks and little alleyways that cannot show up on Google Maps for the speed at which they are submerged by the rising tide, then reappear with the lower tides.

The Sundarbans are a primordial biome as they act as a dense buffer absorbing the impact of recurrent cyclones coming up off the Bay of Bengal, thwarting to some extent the devastation of the high winds and waves.

The Sundarbans are a primordial biome as they act as a dense buffer absorbing the impact of recurrent cyclones coming up off the Bay of Bengal, thwarting to some extent the devastation of the high winds and waves.

So, in the meantime, the best recourse is to plant trees and as many mangroves as possible to thwart the 'severe,' 'very severe,' or 'extremely severe super cyclonic storms' (as they are referred to by the Indian Meteorological Department – IMD) that come spinning up the Bay of Bengal.

With the support and partnership of the Sustainable Green Initiative (SGI) of India, Anil's crew is busy planting different kinds of mangroves along the shallower inter-tidal zones, where men and women stand up to their knees in the thick gray mud.

On afforestation and restoration

"The cyclones have intensified since I was a boy," says Anil Mitri, founder (1999) and director of the Bali Nature (and) Conservation Society. "We are not going to repair this road. We are putting bricks in the water to help stop the waves for next time." There are big investment plans to build breakwaters to stop the stormwater from crashing over the coast, but they are nowhere to be seen.

Ecosystem restoration and afforestation have their merits, but the volatile realities of incremental violent climate altercations are undeniable.



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As the boat chugs through the Sundarbans, numerous plantation areas are visible by the lower height and lighter hue of the saplings, as well as by thin wooden spikes set in the mud connected by some fencing or string for the fishermen not to bring their boats there. White egrets and black cormorants like to rest on the thicker spikes. A white and black kingfisher drops over another wooden pole and flies across the water.

In 2022, Anil Mitri claims that his Bali Society planted over 600,000 bain, keora, and kankra mangroves, which could be due to the economies of scale in India and the fact that photos provided show hundreds of locals participating in the afforestation efforts. With satellite imagery from Google Earth, some of the sites shared by Anil include Nagendrapur, Rupamari, Sandeshkhali, Uttar Mokamberia, Nikarighata, Dighirpar, and Ramkarchar.

As of July–August 2023, they had planted some 70 lakhs (700,000) worth of trees in adjacent areas such as Amjhara, Kanthalberia, Madhusudhanpur-Ramkrishna, Madhusudhanpur, Chandipur, and Naraharipur.

Where do all these mangroves come from? SGI has a large nursery in the town of Canning, inland from the Gadhlaki jetty by about a half hour, on the banks of the Matla River – also known as the 'mad, drunk one' for its volatility and unexpected movement. Access to this nursery from the main road is by moped and then on foot through derelict houses, some chicken coops, and over a rickety bamboo bridge that holds strong for all those crossing for a visit.

Hundreds, thousands of rows of baby mangroves grow in little black holders plugged into the moist earth. Canning is named after Lord Canning who was the first viceroy of India– he had great ambitions of establishing Kolkata as the capital and center of trade for the East India Company and the subsequent expansion and consolidation of the British Empire.

Back on the water, Anil brings his binoculars up to his glasses and scans the mangrove foliage. This low palm-like frond mangrove is called '*hetal*' in Bengali, also known as '*tiger bush*' locally. A tiger and her two cubs were spotted earlier in the morning here so the boat drives around in circles going back and forth along the banks, gazing into the bush.

"The tiger sees us," Anil says, "but we can't see the tiger." This elusive magnificent beast blends in easily with the camouflage of the forest. "The tiger is king of the forest," says Nabu, the local tour guide accompanying the sortie. No tiger spotted today.

Then the species of mangrove changes and these are the 'walking trees' with their long-legged roots that were made famous in *Avatar: The Way of Water* (2022), in which giant versions of these mangroves act as tree-houses for the Awa'Atlu, a Metkayina sea-village people, and as breakwaters in some sense, protecting them against the waves (natural elements) and invaders (humans).

Further on there is long *dhami* ghas (honey grass) that deer like to eat. "This is a good hunting spot for the tigers," Anil explains and brings his binoculars to his glasses again.

Anil was born and bred on the island of Bali adjacent to the Sundarbans. His family and neighbors were all 'poachers' but not in the Western sense of killing wild animals to sell their tusks or hides. Rather, they would hunt deer and fish. The Sundarbans and its environs are a fishing society.

Everyone has a story about a tiger here. Tigers visit the villages like dogs walk around neighborhoods in cities, mostly looking for food. "If you try to run, the tiger will kill you," Anil says. His neighbors would call him when a tiger was visiting their village. He used his stunner gun to tranquilize one tiger, and another was too fierce and jumped at them. Like Bonbibi he used a stick to hit the tiger. "Tigers are in my heart," he says, "they are part of my life."

The boat passes the embankments of Bali Island where the roads have collapsed due to erosion from storms and seawater. The 'Super Cyclonic Storm Amphan' of May 2020 left unprecedented damage worth an estimated $13 billion. A broken cement jetty extends into the muddy waters. "We can plant more mangroves, but the water is still coming," Anil says and shrugs off the apparent futility of the endeavor. Mangrove roots need soil to grasp onto; erosion also causes the death of the mangroves.

The best recourse is to plant trees and as many mangroves as possible to thwart the 'severe,' 'very severe,' or 'extremely severe super cyclonic storms' that come spinning up the Bay of Bengal.

They have the most incredible capacity to survive in salty water with their unique breathing root system, but they need soil. Even the thick mud that fishermen sludge through up to their knees, casting out their nets by hand, is hard for the resilient mangroves to endure.

Ecosystem restoration and afforestation have their merits, but the volatile realities of incremental violent climate altercations are undeniable. On Etihad Airline flights, there are self-promotions playing on the TV screens embedded in the back-of-seats saying: "Adopt a mangrove tree in the Etihad forest" – as if emitting carbon emissions from flying could be compensated by adopting a tree.

In the United Arab Emirates, mangrove forests are becoming a luxury tourist destination. Here: emerging from the monotonous landscape of the Sundarbans, a woman in a bright orange sari is walking down another jetty that extends across the mud to the water; she gives a small parcel of food to two men who are sitting in a long wooden fishing boat, waiting languidly at the end of the pier; the orange fabric flaps in the wind, flickering like a flame against the grays and browns of the water and land; then she turns and goes back up the cement steps and walks along the path above the collapsed embankment, holding the orange cloth tossed over her black hair.

1. Walking mangrove trees.
2. Village home backyard on Bali Island, adjacent to the Sundarbans.
3. Bonbibi forest deity home stay.
4. Boats at the Ghatlaki jetty providing transport around the Sundarbans.
5. SGI mangrove nursery at Canning.
6. SGI mangrove nursery at Canning.
7. Woman preparing nets on her fishing boat.
8. Road collapse embankment on Bali Island.

Unraveling Ireland's Peatlands

WRITER: **CAROLANNE O'BRIEN**



1

Once considered desolate wasteland, peatlands now emerge as vital carbon captors and biodiversity havens.

We have no prairies
To slice a big sun at evening—
Everywhere the eye concedes to
Encroaching horizon,

Is wooed into the cyclops' eye
Of a tarn. Our unfenced country
Is bog that keeps crusting
Between the sights of the sun.

Bogland, by Seamus Heaney

Extending across more than 960,000 hectares, peatlands blanket almost 14% of Ireland's land area, equivalent to almost 137 million football fields. However, despite their vast expanse, the opening lines of Seamus Heaney's "Bogland" evoke a barren landscape, a landscape devoid of the expansive vistas traditionally celebrated in the hymns of nature. Instead, peatlands appear as creatures of rugged beauty with a haunting allure and yet wholly enclosed and inhospitable.

This portrayal has deep historical roots as boglands across Ireland have long been viewed as marginalized wastelands, observed through the lens of poverty and hardship, valued only for their provision of fuel among less affluent rural communities. Consequently, these lands were drained for agricultural use and later extensively exploited for mass peat production, emerging as a pivotal source of fuel and later electricity.

Yet, within Heaney's verses lies a nod to changing perception. Today, amidst a global climate and biodiversity crisis, the perceptions surrounding peatlands in Ireland are changing. Now recognized as carbon-rich ecosystems hosting vast wildlife habitats, there is growing acknowledgment of the need for their restoration and conservation. No longer seen solely as wastelands or sources of fuel, peatlands are valued for their crucial role in mitigating climate change and preserving biodiversity.

Nature's crucial carbon captors

Despite covering only 3% of the Earth's land surface, peatlands store approximately 15-30% of the world's soil carbon in the form of peat—twice as much carbon as all of the world's forests combined. As you walk across the boglands of Ireland – the most extensive type of peatland in the country – your feet sinking into the wet ground, you would never suspect the scars these lands bear, nor the remarkable carbon-capturing capacity hidden beneath your steps.

Boglands that have escaped the influence of human exploitation play a crucial role in carbon capture through a process involving special plants like sphagnum moss. Sphagnum mosses possess a remarkable ability to absorb and retain water, holding up to 20 times their weight. This feature enables them to play a vital role in capturing carbon dioxide from the air. As these plants die and decay, the waterlogged conditions of the bog prevent them from fully decomposing, allowing layers of peat to accumulate over time. This accumulated peat acts as a storage unit, trapping the carbon from the dead plants inside it. As long as the bog remains wet and undisturbed, this carbon remains locked away underground.



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Tristram Whyte, Conservation Policy and Fundraising Officer at the Irish Peatland Conservation Council (IPCC), explained that this process is far from simple. He uses an analogy to illustrate the intricate environmental repercussions: likening the draining of a section of a bog to a sink. When you drain a sink, the water doesn't just disappear from the immediate area around the plug; instead, it affects the entire sink. Similarly, draining even a small portion of a bog doesn't isolate the impact; it affects the entire ecosystem.

This analogy underscores a critical point: the release of carbon due to bogland degradation exacerbates climate change as the entire bogland transforms from a carbon sink into a carbon emitter. "If you're removing peat from a bog, it's not sequestering carbon; you've drained it. It's leaking off carbon and is essentially an open mine." This issue is compounded by ongoing bogland degradation across Ireland, where 47% have been degraded for socioeconomic reasons and turbary rights – granting citizens the authority to extract peat for fuel on their land.

However, the far-reaching consequences of bogland destruction also trigger another pressing and perhaps more visible issue: habitat loss.

Boglands across Ireland have long been viewed as marginalized wastelands, observed through the lens of poverty and hardship, valued only for their provision of fuel among less affluent rural communities.

Guardian of habitats

In their natural, healthy state, peatlands teem with life, from the high-pitched call of the curlew to the silent movements of the viviparous lizard. Yet due to years of peat extraction, forestry, and agricultural reclamation, these once thriving habitats have been stripped of their resident flora and fauna, rendering them eerily silent and desolate – perhaps even more stark than Heaney could have imagined.

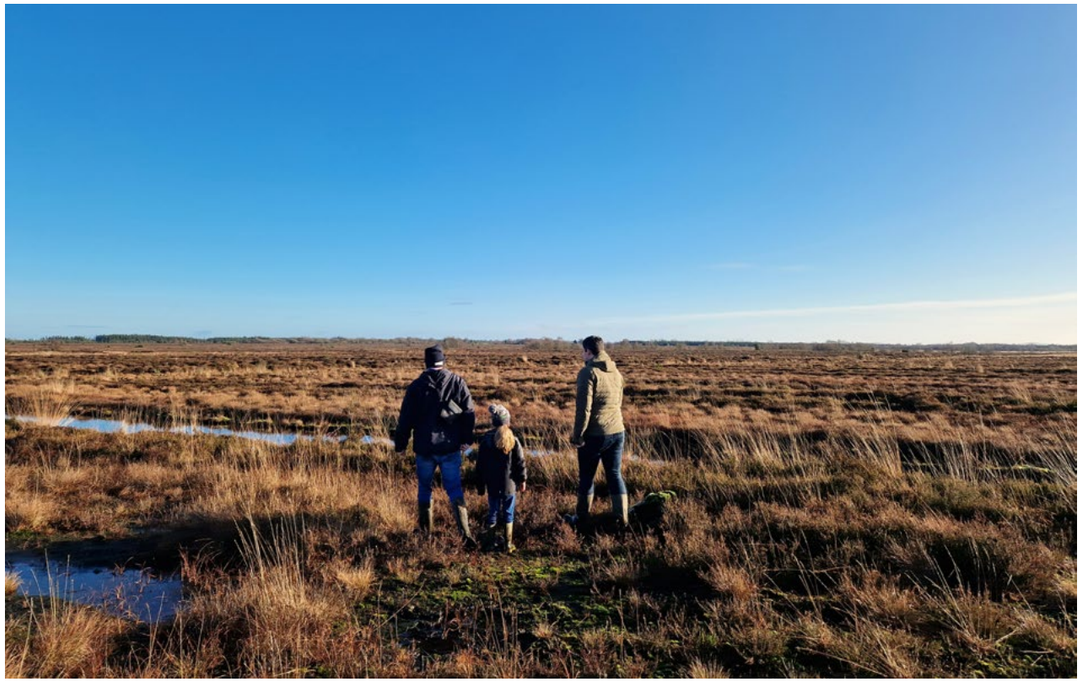
Whyte tells us, "If you look in the EPA Bogland report, it says 90% of peatlands in Northwestern Europe have been drained and destroyed. So, if you remove 90% of a type of habitat, you're going to have a biodiversity crash. And that's what's happened in Ireland," leaving just 1% of peatlands across the country still capable of sustaining life.

This type of loss prompted the Irish government to declare a climate and biodiversity emergency in 2019, making Ireland the second country in the world to do so. This emphasized the urgent need for conservation efforts to protect Ireland's remaining peatlands—the fragile guardians of both carbon capture and biodiversity. However, despite the urgency signaled by this declaration, progress in restoring boglands and safeguarding their habitats has been slow.

Whyte highlights a historical issue dating back to 1999 when the Irish government agreed to halt peat extraction on bogs designated as Special Areas of Conservation (SACs). Unfortunately, enforcement of this agreement was lax, and Irish citizens continued to drain and extract peat. Complicating matters, the government lacks the authority to de-designate these protected sites to re-protect them, with many having already been significantly degraded.

Recognizing that reshuffling the conservation network is hindered by legal constraints, the IPCC initiated the 'Save the Bog' campaign, advocating for the purchase of boglands as the most effective means of conservation.

While this initiative has seen successful conservation on bogs such as Ketts Lough, where the Marsh Fritillary butterfly and a small population of Greenland White Fronted Geese can be seen, and Girley bog, where the skylark still sings, governmental challenges persist, indicating a need for further action.



3

Unraveling governmental challenges

Unraveling the complexities of these challenges, particularly in light of the EU Nature Restoration Law, is crucial. This law, aimed at ecological restoration, has ignited discussions about the impact of conservation practices on the longstanding economic value and cultural significance of these lands. As Ireland strives for ecomodernity — an equilibrium between ecological protection and economic prosperity — the delicate balance between heritage preservation and sustainable progress becomes even more intricate.

In this evolving landscape, REVOLVE delved into the nuances with member of the Dail, the Irish Parliament, TD Denis Naughten, a long-standing member of the Irish government, to understand how the nation is navigating this complex balance and addressing the debates between conservation and economic interests.

Unfortunately, debates around the Nature Restoration Law were scarce amongst parliamentarians in Ireland, with Naughten highlighting this as a failure of the yellow card system, introduced under the Nice Treaty. According to Naughten, debates on this matter never met a conclusion, and with the law now adopted as of February 2024, the window for submitting concerns is firmly closed.

The concerns Naughten speaks of extend to the impact of the law on agricultural land situated on previously drained peatland sites. Presently, the Nature Restoration Law proposes a mandate to rewet 30% of drained peatlands under agricultural use by 2030, with the goal of reaching 50% by 2050.

While Naughten acknowledges that Ireland has “enough public peatlands for restoration through the Just Transition process,” the challenge lies in incentivizing farmers to voluntarily participate in the rewetting process. Agricultural rewetting, under this watered-down law, remains voluntary, emphasizing the need to strike a delicate balance that allows agricultural activities to continue while effectively reducing emissions – an evident speed bump on the road to ecomodernity.

However, rather than seeing this solely as an obstacle, it’s imperative to view it as a call to action. As rewetting initiatives on public land gain momentum, the rising water table is already encroaching on adjacent agricultural properties, rendering them less usable, even without directly touching them. This emphasizes the pressing need to expedite efforts and implement measures promptly to address the unfolding challenges, safeguarding both environmental and agricultural interests.

Navigating the impact of peatland restoration on agricultural lands

Today, amidst a global climate and biodiversity crisis, the perceptions surrounding peatlands in Ireland are changing.

The urgency of addressing the impact of peatland restoration became even more apparent during discussions with dairy farmers Séan and Joe Glennon in the midlands of Ireland. Their farm is situated near Cranalagh More Bog, located in County Longford, which is visibly damaged from years of peat cutting, mostly to obtain peat for horticultural soils. As we walked this section of bogland with Joe, towering mounds of peat still awaited collection, serving as haunting reminders of the extensive excavation and habitat destruction that occurred in this area.

Nevertheless, a section of this land known as Ardagullion Bog, located in the northern part, underwent rewetting for restorative purposes in 2018 and 2019. This process has yielded promising results, with red-listed birds of conservation concern (BoCCI) such as the Meadow Pipit, Snipe, and Redshank returning to the area.

However, it has also raised the water table on their land, and combined with a year of increased rainfall, their fields have become unfit for cattle to graze on. Joe expressed the impact, saying, “This year was unbelievable. We only had June, and then we were having to put the cattle inside with the amount of rainfall, everywhere was soggy and soaking. Those fields that we had there were quite dry, quite fertile. Now, we can’t even drive a tractor in there.”

As we walked the lands, this change was unmistakable.

Despite the challenges to their agricultural processes, Séan and Joe, along with many others in the community, support the work being put into restoring these lands. They also noted a lack of governmental consultation with residents, which may have better prepared local farmers to adjust to the impact of wetter fields on their livestock and farming processes. They openly speak of the climate changing in front of their eyes and the need for better government support and better planning required to face a new future.



4

Exploring adaptation pathways for irish peatlands

Adaptation is key and while it appears slow in Ireland, progress is being made in other areas across Europe into how restoring drained agricultural peatlands could provide economic benefits. Efforts like the EU-funded projects MarginUp! and NBSOIL are already pioneering sustainable soil management practices, particularly in restoring drained peatlands, with a focus on economic viability and ecological integrity, through paludiculture – the practice of farming on wet and rewetted lands.

One individual contributing to this movement is Shahsharif Mohammadshafi Shaikh, a mechanical engineer and researcher with ATB, actively involved in MarginUp!’s German-use case. His work as part of the project revolves around processing biomass sourced from crops such as reeds, canary grass, and cattail, naturally growing on restored peatlands into new products.

Shahsharif and ATB’s methods of processing and extruding such crops have already led to the production of various new products, including greening pellets, animal bedding, biofertilizers, biofuel, and substitute materials such as paper, cardboard, and materials for 3D printing. However, considerations for energy efficiency and profitability remain paramount among the numerous factors to be weighed.



5

“Profit is actually one of the main concerns,” Shahsharif explains.“Farmers listen to what will give them money and so we have to work in that sense as well.” Over the next 12 months, Shahsharif plans to enhance efficiency while exploring the potential for producing additional products from crops considered ‘useless’ on restored peatland sites.

Replicating these efforts elsewhere is of course complex and requires thorough scientific study and understanding of various factors, including climate, crop characteristics, and processing parameters.

Nonetheless, with careful consideration and prior research, projects like MarginUp! offer hope for the widespread adoption of sustainable agricultural practices, contributing positively to environmental conservation and socio-economic development. It serves as a model that Ireland could adapt to progress toward an ecomodern society.

This all-flips Heaney’s “Bogland” on its head, transforming the eerie landscape of Irish boglands into a hopeful vision. “Our unfenced country” is a blank canvas, and our boglands are no longer “crusting” but yearning for revival and worthy of inclusion within the hymns of nature.

Progress in restoring boglands and safeguarding their habitats has been slow.

1. A mound of turf extracted from bogland in Ireland. Photo: Shawn Williams / Canva
2. Cranalagh More Bog, Longford, Ireland. Photo: Carolanne O’Brien / REVOLVE
3. Cranalagh More Bog, Longford, Ireland. Photo: Carolanne O’Brien / REVOLVE
4. Mound of excavated peat, Longford, Ireland. Photo: Carolanne O’Brien / REVOLVE
5. Agricultural Field, Longford, Ireland. Photo: Carolanne O’Brien / REVOLVE



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Sustainable Expert: Insights into SAF

INTERVIEW WITH **MIKA JÄRVINEN** AND **MUDASSER INAYAT** , RESPECTIVELY ASSOCIATE PROFESSOR AND POSTDOCTORAL RESEARCHER, DEPARTMENT OF MECHANICAL ENGINEERING AT AALTO UNIVERSITY

1

Researchers race to develop and certify sustainable aviation fuels made of biowaste to meet EU targets.

The aviation transport is one of the most carbon-intensive sectors, accounting for 14.4% of the European Union's total transport emissions. To reduce the sector's emissions and support the EU's transition to being climate-neutral by 2050, the Fit for 55 package has proposed a set of measures, including the increased use of greener aviation fuels. So far, efforts have been carried out to reduce CO_2 emissions in the transport sector, including the use of electric vehicles as a potential solution. However, replacing fossil kerosene on large passenger transport and long-haul flights, remains a challenge. Thus, the aviation sector is still in need of greater innovation and higher deployment of sustainable fuel alternatives.

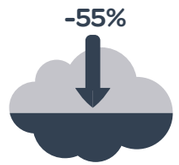
The Fit for 55 package aims to increase the use of Sustainable Aviation Fuels (SAF) on aircrafts and sets more ambitious targets to ensure relevant pricing of aviation emissions. In particular, the RefuelEU aviation regulation will require aviation fuel suppliers to ensure that of the fuel available to EU airports in 2025, a minimum of 2% must be SAF, increasing to 70% of all fuels in 2050. Part of this SAF will be supplied with green hydrogen and the production of advanced biofuels, such as forestry waste and agricultural residues, which are more sustainable than crop-based biofuels.

Globally, are SAF available on markets?

As of 2022, there were seven certified SAF production routes and more than 10 routes are expected to become available, or certified, during the upcoming years. Circular Fuels' solar-driven fast pyrolysis oil production and its solar H_2 upgrading is hopefully one of them. In 2022, SAF covered only 0.2% of the global need for kerosine, so there is a significant need for further development to reach the emission targets set for the aviation sector.

How circular can fuel production and consumption really be and for which SAF there is more potential?

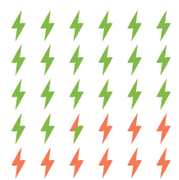
At Circular Fuels, we are focusing only on waste-based materials without creating a case that the side/waste-product starts to increase the need for primary material. This can easily be the case with, for example, virgin forest or woody materials. Of course, when burned in the jet engine, the loop ends. Going forward, we should develop methods that capture CO_2 from air and seawater, and that return the used carbon as a raw material.



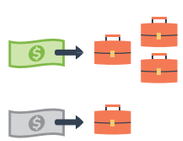
The European Commission has adopted a set of proposals to make the EU's climate and energy policies fit for reducing greenhouse gas emissions by at least 55% by 2030.



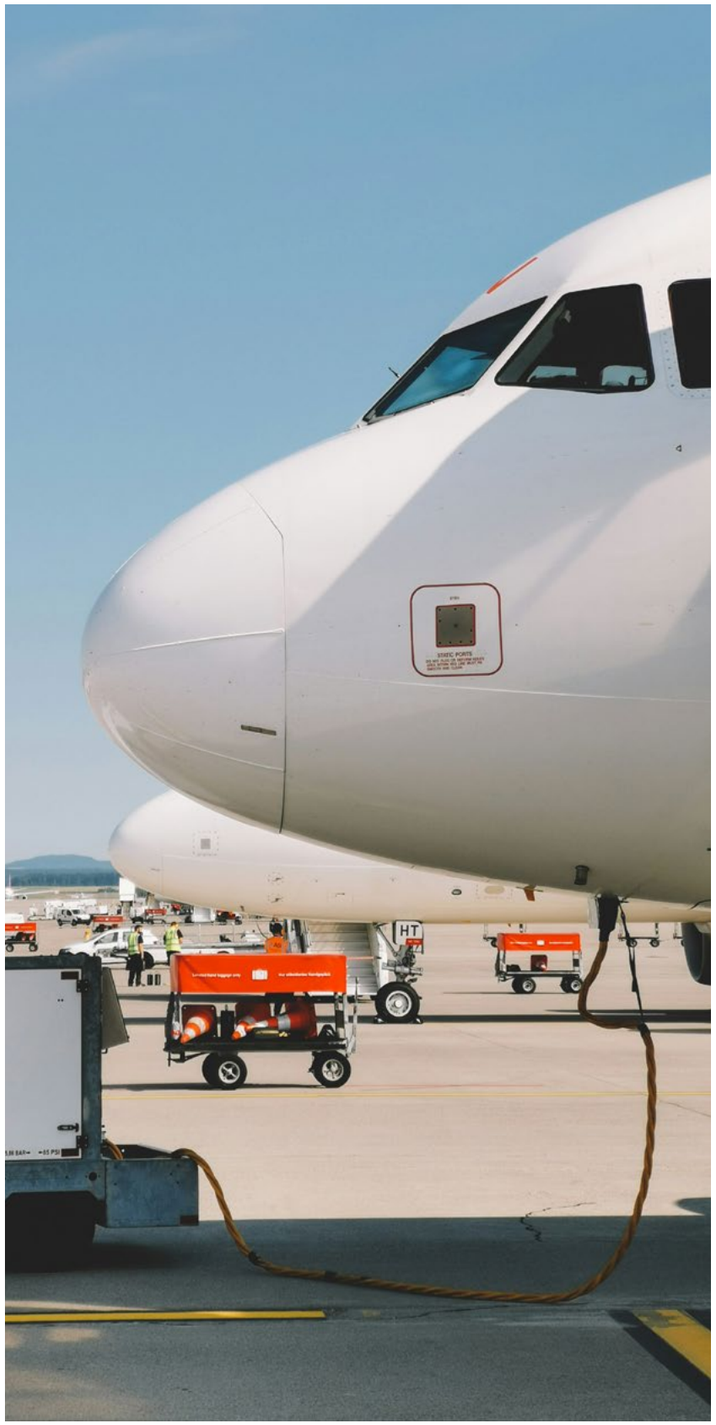
Europe to be the first climate-neutral continent by 2050



70% of jet fuels at EU airports will have to be green by 2050



Every dollar of investment in renewables creates three times more jobs than in the fossil fuel industry.



Considering the many SAF and more sustainable aircraft technologies being explored, what should EU policymakers prioritize in innovation and development?

When it comes to innovation and development, there is a need for establishing a shared framework regarding what exactly encompasses 'sustainability' while also defining what comprises a sustainable biomass source. Perhaps we need to set incentives and funding support mechanisms to upscale renewable energy generation and production processes of green hydrogen. To make SAF more feasible, there is a need to implement support mechanisms for concentrated solar heat systems and removing harmful fossil subsidies (both direct and indirect).

How can the production of SAF ensure that produced fuels do not lead to adverse effects on land and climate?

We need to only use waste-based materials and ensure that we are not increasing the production of the primary product – which would generate more waste. If, and as, sustainable waste-based materials are probably not sufficient to cover the overall need for replacing all fossil consumption, we need to also work hard to further develop the e-kerosine pathway, producing SAF from sustainable green hydrogen and captured CO_2. The source of CO_2 can be biogenic, and the sustainability of the source must be secured. We need to develop Direct Air Capture of CO_2 methods, and study Direct Ocean Capture technologies. The most important solution to reduce emissions is, of course, to reduce all our consumption, including flying.

How will the Circular Fuels project create more sustainable fuels, considering that the produced SAF are limited?

In the future, we will need to have all possible processing pathways and waste-based raw materials in use. There is no single solution. Regarding the Circular Fuels project, we are developing a new solar fuels concept that maximizes the utilization of the raw material since it is not burned to run the processes but, rather, all energy is acquired from the sun. We also need to boost the implementation of the e-Kerosine pathway.

What is the most innovative aspect of the Circular Fuels project and what benefits can it bring to society and the environment?

The most innovative aspect of Circular Fuels is the utilization of solar energy, both as solar heat to run the thermal conversion processes and as solar PV power to produce solar green hydrogen via electrolysis. By doing this, Circular Fuels is avoiding the burning of raw materials.

How will the Circular Fuels project ensure that the feedstock used will not limit the needed use of debris for improving soil fertility and water saving through mulching?

The Circular Fuels project is focusing only on waste-based raw materials; such as demolition wood and different straws from agriculture. We are mapping and reporting the available volume of these in several EU countries. We will exclude straw streams that are needed and currently used for soil improvement - without creating a new need for them.

Circular Fuels is an EU project that aims to develop sustainable aviation fuels from agricultural waste and used demolition wood waste. Solar heat is used to first convert waste materials into bio-oil, which is then converted to high quality jet fuel by processing it with solar electrolysis-based green hydrogen.

1. Cockpit dashboard. Photo: Shaun Darwood / Unsplash
2. Sustainable Aviation Fuels fact sheet, Circular Fuels. Illustrations: Émile Noël / REVOLVE
3. Aircraft waiting patiently at Zurich Airport. Photo: Unleashed Agency / Unsplash

Circular Fuels

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From the Wild to the Oscars

REVIEWED BY **MINORA PARASHAR**

Documentary Film: The Elephant Whisperers
Directed by: Kartiki Gonsalves
Year of Release: 2022
Oscar: Best Documentary Short Film 2023



Imagine a world where the bond between humans and animals goes far beyond the ordinary, becoming a lifeline of mutual understanding and deep empathy. "The Elephant Whisperers" (2022) takes us to the lush landscape of Tamil Nadu in southeastern India, where a determined man and a herd of rescued elephants begin an extraordinary journey of healing and connection. This documentary isn't just a story – it's an emotional adventure that reveals the deep, often unnoticed, harmony between different species.

From the very first scene, I was immediately drawn in by the breathtaking beauty of India's nature. The rich greenery, colorful sunsets, and tranquil rivers made for an enchanting backdrop that transported me to another world within my country. The cinematography captures the essence of the wilderness in a way that feels magical. I could practically feel the soft breeze, hear the rustling leaves, and imagine the elephants moving gracefully through their natural habitat.

The story of Bomman and Bellie struck a chord with me. This incredible couple's unwavering dedication to nurturing orphaned elephants in Tamil Nadu is awe-inspiring. Watching them with Raghu and Ammu – the elephants they treat like family – brought tears to my eyes. The profound bond they share with these gentle giants is heartwarming and real. Their story is a beautiful testament to the extraordinary connections that can blossom between humans and animals. It filled my heart with warmth and joy.

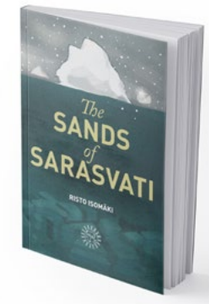
The documentary also brings to light how elephants hold a special place in Indian culture. By following Bomman and Bellie, we discover the unique traditions and deep respect that the local community has for these majestic animals. Learning about this cultural background adds an extra layer of understanding to the film, giving us a deeper insight into the bond between humans and elephants.

"The Elephant Whisperers" is more than just a documentary – it's a powerful reminder of the importance of conservation and our role in preserving our planet's diverse wildlife. Watching it really resonated with me, showing just how crucial it is to take action to protect our environment. The film stayed with me long after it ended, filling me with optimism and strong purpose to help preserve our beautiful planet.

This film integrates breathtaking visuals with compelling storytelling, delivering impactful messages that linger long after the final scene. It's a powerful nudge to appreciate the beauty of nature and the meaningful connections we can foster when we approach life with an open heart. Whether you're passionate about animals, care deeply about conservation, or just love a good story, this Oscar-winning gem is a must-watch.

Watching it is a memory I'll cherish forever.

What Ever Happened to Atlantis?



REVIEWED BY **STUART REIGELUTH**

The Sands of Sarasvati
Risto Isomäki
Original title: Sarasvatin heikkaa
Translated by Owen F. Witesman
Helsinki: Into Publishing, 2013.
345 pages. ~~29.00 euros~~ 9.9 euros.

Writing a science fiction story that also feels credible is difficult. Much of the genre is about some form of alien life 'out there' that we are contacting or that is coming to see what we are doing on Planet Earth, usually to abuse us in some form or another. The aliens are almost always the bad guys, especially in Hollywood, except for the Avatar series where humans are the bad guys, but then again in some distant fantastical floating-island extraterrestrial place.

What we have here is a 'science fiction' book rooted in the reality of the global climate crisis. This is not Ursula K. Le Guinn taking us to an allegorical planet in *The World for World is Forest* (1972) (as her critique of the Vietnam War), where humans are deforesting the land and exploiting its people. This is Finnish science writer, editor, and activist, Risto Isomäki, narrating the quest to find a rapid solution to the melting glaciers on Earth.

Indeed, flipping the words of the misleading 'science fiction' section heading where The Sands of Sarasvati is on sale in English at the Helsinki Airport, this is more a book of fiction explaining science. Isomäki knows his topic and threads the explanations into the dialogue quite smoothly. At times, it reads like a 'dummy's guide to science' and comes across as somewhat pedantic. But the characters save the plot by bringing the narrative to life.

We have Sergei Savelnikov – a Russian submarine expert sent on a mission to investigate the unexpected find of underwater ruins protruding from the sub-sea sands in the Gulf of Cambay (or Khambhat) off the western coast of India. There he meets marine archaeologist Amrita Desai, who is coming out of a difficult divorce. While pontificating theories about the lost city of Atlantis, a careful romance emerges between them. Somewhat cliché.

Then there is Susan Cheng – a young researcher working on the Greenland Ice Sheet at the Nugssuaqk Research Station who is requested by Sergei to investigate some satellite images. To verify the findings, she takes Pierre Chamberlain – a French photojournalist who joins her on a nail-biting trip across the glacier to discover that the meltwater lake has disappeared beneath it, building up a massive amount of subterranean water that risks overflowing into the sea…

This could become a blockbuster Hollywood movie. There is also Kari Alanen – the 'mad scientist' who has devised a way to counter the melting glaciers by using windmills to fan massive quantities of mist water over the glacier in the hope that the particles would freeze and turn to snow which would help reflect the sun more again. Kari also pontificates about the mega-tsunamis and the phenomenon of washing huge boulders up hills as if they were pebbles.

Somehow, Kari's plan turns into "Operation Ice Wind" and is approved by India, Iran, China, and Pakistan – a most unlikely combination for finding rapid agreements. But we are beyond geopolitics now and firmly in the realm of fantasy where 100,000 windmills are approved, ordered, and on their way to be installed in Greenland to halt the melting glaciers and replenish with snow. Renewables to the rescue! This is going to be a blockbuster movie.

Meanwhile, we do learn a lot about glacial lakes, meltwater, the colossal power of shifting ice, icebergs, the fragmented Arctic, and the methane clathrates stored deep in the ice: "If you chipped off a piece of that ice and put a match to it, it would burn." (p.31) Burning ice is a fascinating phenomenon.

Learning so much about science in a fictional way is commendable. This is climate disaster literature at its best because whatever happened to Atlantis could also happen to us, and that is worth trying to understand better.



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