REVOLVE

QUARTERLY INSIGHTS INTO A CHANGING WORLD

N°58 | Winter 2025/26



Underwater Explosives

Munitions Dumps p.10

Tipping Points p.18 Frozen World p.19 Sustainable Renovations p.52
Arctic Resilience p.58 Outsourcing Romance p.67 Grape Expectations p.84

ERTICO presents

EUROPEAN CONGRESS

ISTANBUL
27-29 APRIL 2026



EUROPE'S PLATFORM FOR INTELLIGENT TRANSPORT SYSTEMS

Take part

Where technology, collaboration and deployment shape the future of smart and sustainable transport.

3,000+	100	140+	45%	55%
ATTENDEES	SESSIONS	EXHIBITORS	PUBLIC	PRIVATE SECTOR

2026.itseuropeancongress.com

ORGANISED BY: ERTICO ITS EUROPE

IN COLLABORATION WITH:

HOSTED BY: ISTANBUL METROPOLITAN MUNICIPALITY, isbak

SUPPORTED BY: REPUBLIC OF TÜRKIYE MINISTRY OF TRANSPORT AND INFRASTRUCTURE, TSB, AUSTÜRKİYE ITS TÜRKİYE

Introducing Ocean Remediation

The vastness of our oceans can be difficult to fathom. It is perhaps partly for this reason that the consequences of damage we inflict on them seem intangible, unrelatable, and distant. The ocean's climate challenges can be tricky to communicate – rising sea levels are a slow burn compared to wildfires. In some cases, the ghosts of our past (mis)treatment of the ocean are coming back to haunt us.

Over 1.5 million tonnes of unexploded munitions lie at the bottom of the North and Baltic Seas, a dangerous hangover from the World Wars. Cast into the abyss and forgotten about for years, these ordnance dumps have become a growing problem in Europe and beyond. They hinder marine development projects and slowly release dangerous chemicals into underwater ecosystems, a process that is accelerating as our oceans warm. Time to remediate this!

Our oceans absorb excess heat and emissions from human activity in staggering quantities. Take a peek at any reliable chart and you will see that ocean temperatures have been steadily climbing each year, almost without fail, since the 1990s. The effects of this warming are starting to accelerate. Coral reefs are on the cusp of widescale decline, polar ice sheets, and glaciers are in retreat, and weather systems are becoming less predictable and more intense.

In her Guest Editorial, international environmental and ocean lawyer and IPOS co-lead Tanya Brodie Rudolph calls for new models of ocean governance that marry scientific knowledge with policy and community action.

Then, we head below the waves as Ahmetcan Uzlaşik navigates the risks and repercussions of dumping munitions in the sea – who should clean it up, and how? Renowned climatologist James Hansen shares his thoughts on whether we can avoid more climate tipping points before our first VIEWS takes us to the frozen corners of our world with a tour of the cryosphere.

We stay with that topic in our next feature from Samrat Deb, who tells us about Trans-Himalayan peatlands. Over to Catalonia next, where Nicolás Marín takes a look at a brand-new project on circular water in agriculture. Next, Anna Nazario spotlights efforts to make our building stock more energy efficient before Lauren Beauchamp travels to Finland to learn about community resilience in a warming Arctic.

Our second VIEWS looks at the social implications of outsourcing Europe's floriculture industry before Tom Lovett uncorks the secrets of extracting biofuel from Spanish wineries. Then, it's over to Asya Al Marhubi for some circular architecture and Hollie Fisher for some culture.

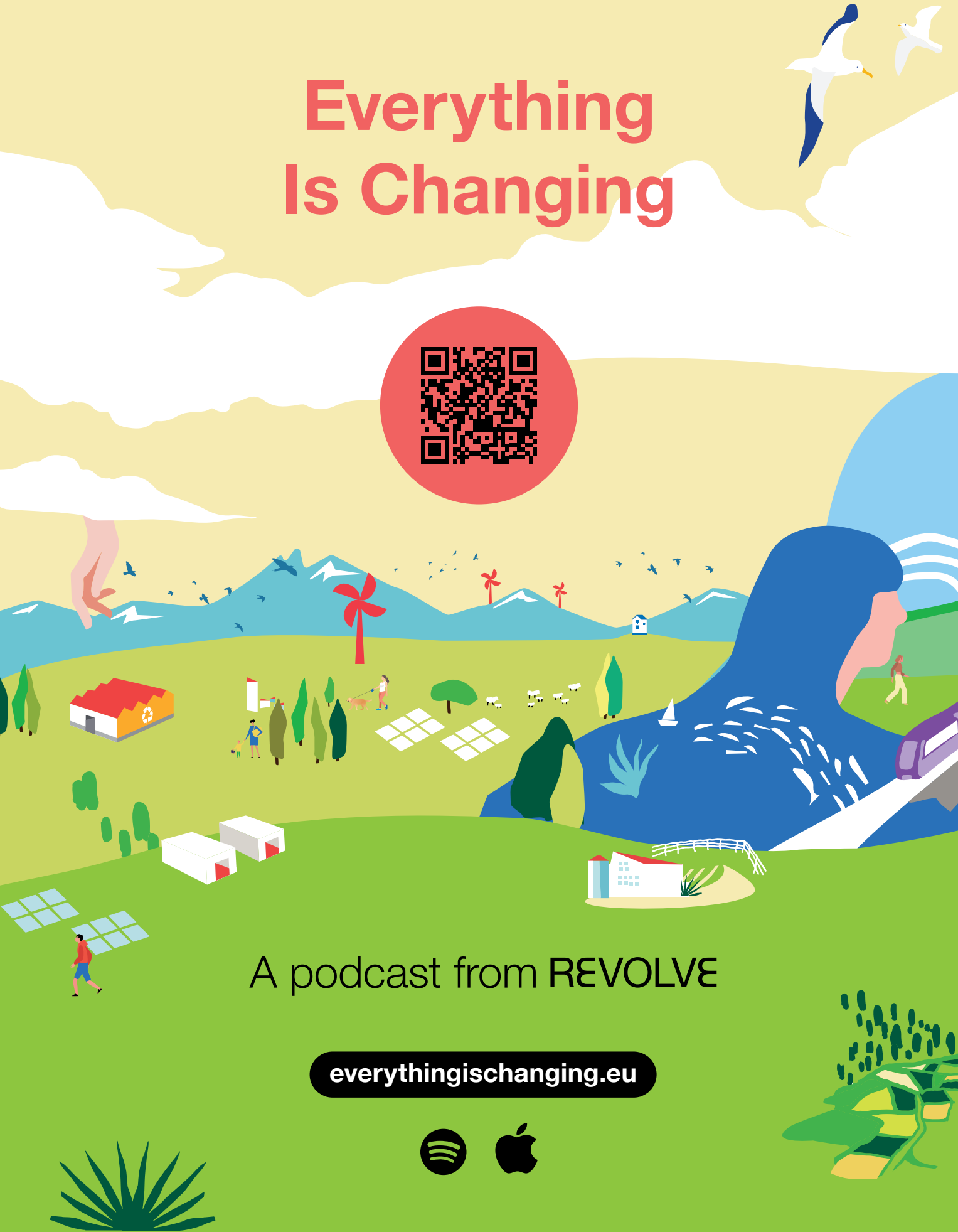
Enjoy reading REVOLVE and send us your comments at: editors@revolve.media



Jake Threadgould

Editor-in-Chief

Everything Is Changing



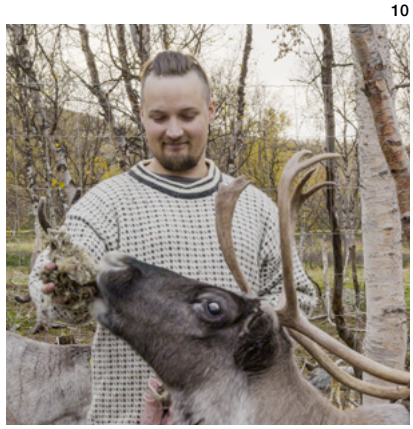
A podcast from REVOLVE

everythingischanging.eu



10



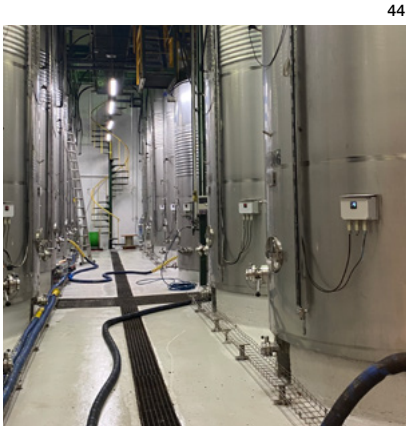


36

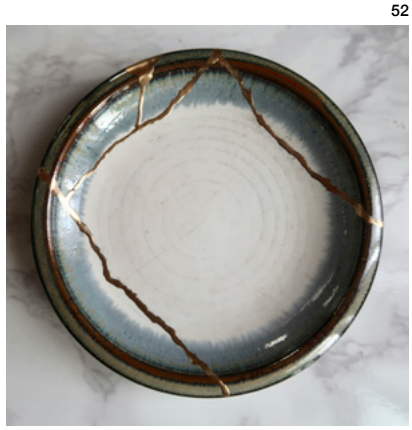


44

52



60



76

Water

N°58 | Winter 2025/26

08 Guest Editorial
Towards better ocean governance

10 Underwater Explosives
Clearing dumped munitions

18 Tipping Points
James Hansen's warning

19 Frozen World
Explore the cryosphere

36 Himalayan Water
Resource security in the mountains

44 Agro-innovations
Circular water solutions in farming

52 Sustainable Renovations
Boosting building efficiency

58 Arctic Resilience
Climate action from northern Finland

67 Outsourcing Romance
Europe's flower industry moves abroad

84 Grape Expectations
Turning wine into fuel

92 Circular Architecture
A changing mindset

98 Last Refuge
Where politics & climate clash

CONTRIBUTORS



Tanya Brodie Rudolph

Co-lead Towards IPOS

p.8



Ahmetcan Uzlaşık

Journalist and Podcast Host, REVOLVE

p.10



Samrat Deb

Alexander von Humboldt International Climate Protection Fellow

p.36



Nicolás Marín Navas

Content Creator, REVOLVE

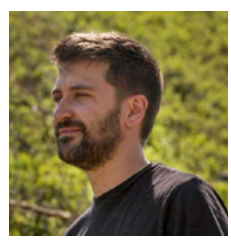
p.44



Lauren Beauchamp

Managing Editor, REVOLVE

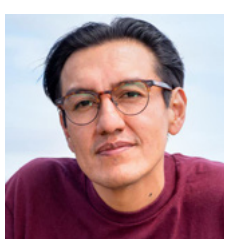
p.58



Bernat Marrè Costa

Journalist

p.67



Santiago Rosero

Journalist

p.67



Tom Lovett

Copywriter and Visual Storyteller, REVOLVE

p.84

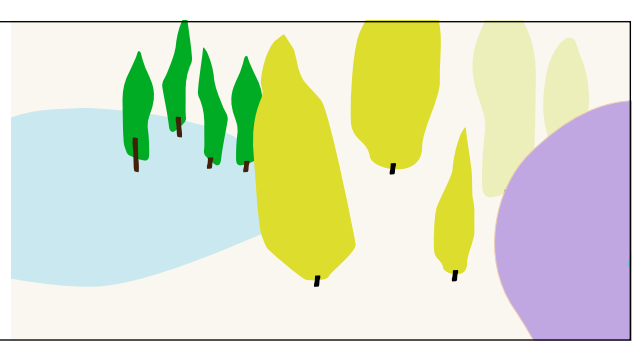
Cover image:

Caption: Shell Cases and Diver on the wreck of SS Thistlegorm. The SS Thistlegorm is a British merchant navy ship sunk in 1941 that is now a world-renowned wreck dive site in the Red Sea, Egypt. It rests on the seabed at Shaab Ali, a lagoon about 40 kilometers from Sharm El Sheikh, and is famous for its preserved wartime cargo, including tanks, motorcycles, and rifles, as well as for the abundance of marine life that has made the wreck its home. Photo: Rich Carey / Shutterstock

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





Charis Brice

Photographer, REVOLVE

p.20



Anna Nazario

Press Officer, REVOLVE

p.52



Giovanny Jaramillo Rojas

Journalist

p.67



Asya Al Marhub

Content and Policy Manager, REVOLVE

p.92



Hollie Fisher

Media Relations Manager, REVOLVE

p.98

Editor-in-Chief

Jake Threadgould

Editor-at-Large

Stuart Reigeluth

Managing Editor

Lauren Beauchamp

Photo Editor

Charis Brice

Correspondents

Ahmetcan Uzlaşık
Anna Nazario
Asya Al Marhubi
Hollie Fisher
Nicolás Marín Navas
Tom Lovett

Graphic Designers

Dariana Guevara
Émile Noël
Marc Rechdane
Samia Singh

Digital Managers

Gary Leleu
Sébastian Van Loock

Photography

ABB Photo
Aleix Ventayol
Artists Eyes
Berta Vicente Salas
Christian Thiel
Dahian Cifuentes
Deyan Georgiev
Elevate
Fiona Frommelt
Flanders Marine Institute
GEOMAR
Heino Eisner
Helena Lopes
IOPAN
Irina Damrabruaskas
Lucas van Oort
Mathias Berlin
Mika Baumeister
Milivoj Kuhar
Mozgova
Nora Holley
Oksana Yermoshenko
Osbmxhouse
Parth Menghal
Photostravellers
Pyty
Rich Carey
Riho Kitagawa
Ryzhkov Oleksandr
SeaTerra
Space Oak
Tamara Kulikova
Tartezy Images
Tima Ilasov
Vadim_N
Valerie Sidorova
Vilma Norokorpi
Viñas del Vero
Walter Frehner
Wei Huang
Wirestock Creators
Wolfgang Weiser

We ensure that our publications meet the highest environmental standards. Our zero-waste policy means that we reduce and reuse before recycling: all extra copies are distributed at sustainability events. For more details, visit: revolve.media/sustainability

REVOLVE Group is dedicated to communicating sustainability. With offices and staff in Barcelona, Brussels, Lisbon, Mumbai, and Vienna, we publish an international magazine ISSN 2033-2912 (print) and ISSN 2983-7456 (digital) that compiles the 'best of' from our online content in quarterly issues focusing on water (winter), ecosystems (spring), energy (summer), and transport (autumn) with the circular economy as a recurrent theme. To subscribe, order back issues, or discover all our publications, including our country and industry reports, visit: revolve.media/kiosk

creative commons

REVOLVE content is licensed under Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0). All content in this magazine can be reused for other publications online and in print, as long as the respective authors and REVOLVE are referred to properly. For additional copies, PDFs, contributor details and other inquires, please contact: info@revolve.media | +32 2 318 39 84



Tipping Points and Lifelines: The Future of Our Ocean

WRITER: **TANYA BRODIE RUDOLPH**
CO-LEAD TOWARDS IPOS,
INTERNATIONAL OCEAN LAWYER

Interconnected governance needed to protect the planet's beating heart.

If the Amazon is the lungs of our planet, then the ocean is its beating heart. Covering more than 70% of the Earth's surface, the ocean regulates climate, sustains life, and connects communities across the globe. Its health is inseparable from the survival of life on Earth. Yet, for much of human history, the ocean was treated as a vast, ungoverned space – too expansive, too mysterious, and seemingly too resilient to require rules. Today, that perception has been shattered. The ocean is at the centre of the planetary crisis, facing unprecedented pressures from climate change and human activity.

Our ocean absorbs over 90% of excess heat from global warming, captures about a quarter of human-made carbon emissions, and produces half of the oxygen we breathe. But this life-support system is under threat. Warm water coral reefs, for example, have already reached a critical tipping point. Global warming of beyond the 1.2°C threshold, which is where we are already, puts these ecosystems at risk of collapse which will potentially reduce coral extent to below 10% of its current range.

Such a dieback would devastate biodiversity, fisheries, coastal protection, and the cultural fabric of tropical and coastal states. Similarly, the Atlantic Meridional Overturning Circulation (AMOC), a key system of ocean currents, faces the danger of slowing or collapsing. Its disruption would have cascading consequences for global climate, including altered weather patterns, sea-level changes, and threats to food and socio-economic security worldwide. These are high-risk tipping points that demand urgent attention.

Yet, the ocean can also be a source of solutions. The foundation for turning the ocean's health around is meeting the ambitious global targets we have set as humanity. For the ocean, these include UN Sustainable Development Goal 14 (Life Below Water) and the Kunming-Montreal Global Biodiversity



Illustration by Dariana Guevara / REVOLVE

Framework's goal to protect 30% of the ocean by 2030. Achieving these requires more than aspiration; it requires governance, science, and communities working in harmony. In order to accelerate the implementation of these targets, the International Platform for Ocean Sustainability (IPOS) was launched during the 2025 UN Ocean Conference in Nice, France, to translate scientific and other types of knowledge into actionable policy solutions at national and regional levels.

Moreover, the High Seas Treaty has now been ratified by 60 countries and is set to enter into force in January 2026. This represents a landmark step in legally protecting marine life across two-thirds of the ocean. By establishing marine protected areas, regulating environmental impacts, and managing marine genetic resources, it addresses the longstanding gaps in high seas governance.

Through inclusive approaches to ocean governance and with innovative and ambitious actions, we can create lifelines for the ocean and foster resilience for coastal communities. Belize's reefs, revitalised through policy grounded in science and local engagement, were removed from UNESCO's World Heritage in Danger list within three years. In Kenya, the Kuruwitu Locally Managed Marine Area overcame initial resistance, with fish stocks rebounding and incomes tripling, demonstrating that ocean protection can deliver both ecological and social benefits.

The ocean crisis is immediate and accelerating. Global dedication, political will, financial investment, scientific expertise, and local knowledge must converge through governance as interconnected as the ocean itself. Without swift action, we risk losing not only the ocean's extraordinary biodiversity but its vital role as the planet's life support system. The time to act is now – the ocean cannot wait, and neither can we. ●



The Sea's Forgotten Arsenal

WRITER: **AHMETCAN UZLAŞIK**



1

Off our coastlines lie the loose ends of war, with shells, mines, and poison lurking beneath the waves. The question is not whether danger exists, but how – and how fast – we can clean it up.

For many, the sea is a place of joy, relaxation, and adventure. For fishers and offshore workers, it provides a living. As we look to the future, it offers space for renewable energy like windfarms. But beneath these same waters lies the legacy of wars and conflicts gone by. Across Europe, and beyond, millions of tonnes of bombs, mines, shells, and even chemical weapons, rest on the seabed. They were dumped, forgotten, or lost in battle. Some have sat there for more than a century, decaying slowly. And as they decay, they leak toxic chemicals, endangering those who work at sea, threatening marine life, and delaying ocean projects that could drive the future of a blue economy.

This is not just a Cold War mystery or a World War II footnote. It is a problem that still lurks beneath ocean waves. Fishers in the Baltic Sea have accidentally pulled up shells. The UK has over one million tonnes of dumped ammunition in its waters. Germany has already spent over €100 million clearing a small bay, and it is only one hotspot among many.

According to Prof. Dr. Jens Greinert, a marine geologist at GEOMAR Helmholtz Centre for Ocean Research, responsibility for sea-dumped munitions has long been vague. “It has potentially never been decided who is responsible, but to my knowledge it has been silently agreed that each country has to deal with the munition in its own territory, its 12 nautical miles and Exclusive Economic Zone (EEZ), if it was dumped prior to 1972,” he tells REVOLVE. The 1972 London Convention established that polluting the ocean is no longer permitted, and whoever causes pollution is responsible. As he notes, most of the dumped munitions date to before the mid-1950s, meaning today’s governments must face a problem they did not create.

A resurfacing issue

Over the years, most of the attention drawn to munitions dumps came from environmental scientists and local divers – people who saw the problem up close. But now the political world is realising the need to take action – or is at least debating it. France and Germany have pledged to work together on mapping dangerous sites and testing safer recovery methods. The EU is pushing for a coordinated strategy to address the issue. More than 60 countries worldwide deal with these risks, and developing nations are asking for help as storms and warming seas make old weapons degrade faster.

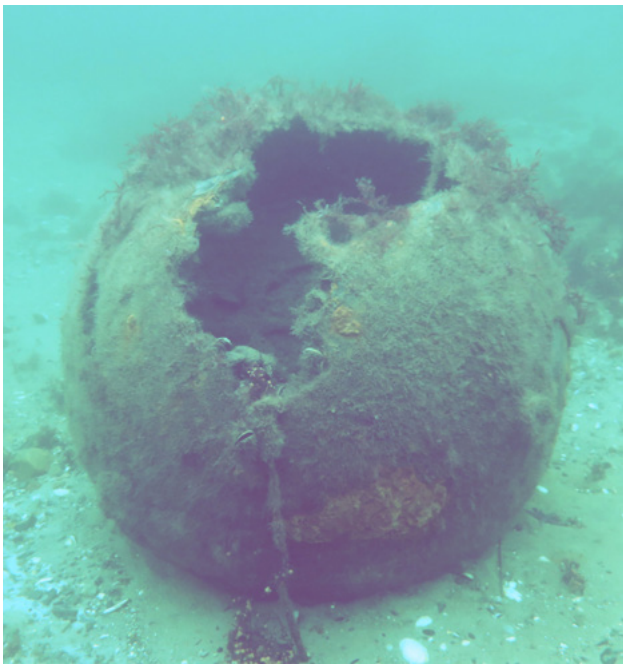
Greinert says awareness has increased as offshore wind, pipelines, and port construction run directly into munition-strewn seabeds. “Offshore constructions are hindered and get more expensive due to marine unexploded ordnance (UXO) remediation,” he says, noting that the economic burden is one reason governments are now paying attention.



2



3



4



5

Germany has launched one of the most ambitious efforts. "The BMUKN (Federal Ministry for the Environment, Climate Action, Nature Conservation and Nuclear Safety) started a €100 million program for test remediation activities in German waters and the development of an offshore munition disposal plant," Greinert says, adding that insufficient disposal capacity remains the key bottleneck. Germany leads the EU pack in remediation investment, while other countries watch on to see how effective the measures are.

> "Addressing sea-dumped munitions isn't only an environmental challenge, it's also a matter of maritime security and regional stability."
>
> – Paul Trautendorfer, Science-Policy Advisor, JPI Oceans.

Bringing the issue to light

Despite this increased awareness, headlines still focus on individual cases of accidents; mysterious beach finds or even incidents about how discarded mines are related to some mafia organisations. Yet the real story is larger: vast stretches of the seabed remain a battlefield that never healed. Clearing it will take technology, cooperation, and money – lots of money – and it will decide how safely we can fish, build wind farms, protect ecosystems, and use the sea in the decades ahead.

The importance of clearing these munitions is pertinent to important sectors like energy. The construction of the Nord Stream 1 gas pipeline between Russia and Germany involved the removal of over 100 munitions from waters belonging to Russia, Finland, Sweden, and Germany, according to the UN Ocean Conference's briefing *No Time To Waste: Tackling Submerged Munitons in European Seas.*

Paul Trautendorfer, Science-Policy Advisor at JPI Oceans, a research



6

platform, tells REVOLVE that "addressing sea-dumped munitions isn't only an environmental challenge, it's also a matter of maritime security and regional stability. We need coordinated action across nations, not just to protect ecosystems, but to prevent these materials from being misused or posing new risks."

Moreover, an international report from the Geneva International Centre for Humanitarian Demining (GICHD) comprehensively showed that underwater ordnance is not just Europe's burden, but a global one, from the Baltic to the Pacific, from old war trenches off Northern Ireland to reefs near Japan. Climate-driven corrosion, new offshore wind zones, and destabilised sea regions have turned what once lay in deep sleep into active risk. Suddenly, the story of forgotten mines and chemical shells became something else: a political priority, a security concern, and a race against time.

Ghosts of WWII

When the Second World War ended, nations focused on rebuilding on land. At sea, the real aftermath sank in steel. In disarming Germany and disposing of surplus weapons, Allied ships carried vast stockpiles of munitions, from contact mines with Hertz-horn triggers to magnetic and acoustic mines tuned to attack passing vessels,and dumped them at sea. Tens of thousands were scuttled in deep trenches and left to decay across the North and Baltic Seas, from Beaufort's Dyke in Scotland to Bornholm, a Danish island.

These dumping grounds host torpedoes, aerial bombs, chemical weapons, and more. Militaries continued to dump old weapons in the sea throughout the 1950s, something that now haunts coastal states.

Saltwater corrodes metal slowly but relentlessly. By the 21st century, metal shells had weakened, sediments had shifted, and storms had moved forgotten explosives. Meanwhile, offshore industries such as wind farms, energy pipelines, and subsea telecom cables expanded into the same waters where wartime debris lies buried.

When rust turns to risk

Old munitions beneath the sea operate like slow poison. As they corrode, they leak toxic chemicals into the marine ecosystem.

Studies in the Baltic Sea show that TNT and its breakdown products enter mussels and flatfish near dump sites, and these substances are known for their toxicity and links to cancer. Heavy metals like lead also leach into the food chain and bioaccumulate over time, according to multiple reports by the GICHD.

The rate of corrosion varies between 25 to 250 years depending on the material, but climate change, through rising water temperatures, acidification, and stronger storms can accelerate these processes, increasing contamination and exposure risks for marine life and coastal populations.

In addition to the ocean floor, such munitions are also found in rivers and inland waterways, where fluctuating water levels and floods can move or expose them. As climate change intensifies droughts and lowers water levels, previously submerged explosives can resurface, posing renewed risks to nearby communities, navigation, and the environment, as can be witnessed in the Danube River in Serbia.

Beyond the environmental toll, this contamination threatens fisheries, tourism, and local economies that depend on healthy waters, making the slow corrosion of these weapons not only an ecological crisis but also a human one. For example, in the Solomon Islands, unexploded ordnance from the Second World War still washes up on beaches or is disturbed by fishers. In 2021, an explosion in Honiara killed one man and injured three others when villagers unknowingly built a fire over a buried shell. It was the third fatal blast in just six months and just one of many other incidents reported around the world.

Although there are many existing international treaties and regional conventions that acknowledge the urgency of the issue, fragmented legal frameworks prevent most European countries from taking concrete action.

> **“For a clear strategy we need a commitment by the EU in the form of an EU-wide fund supported by the member states.”**
>
> – Prof. Dr. Jens Greinert, Marine Geologist, GEOMAR.

For Europe to act decisively, Greinert argues that political clarity is essential. “For a clear strategy we need a commitment by the EU in the form of an EU-wide fund supported by the member states,” he says, emphasising that decisions must serve the greater good, not national interests. “Open and transparent rules are needed to decide where in Europe clearance should start.” The biggest barrier today, he says, is political hesitation: “Many countries would not



7



8

be able to answer, based on facts and data, if they have a problem or not, and under which conditions they would act."

A new era?

For decades, clearing this unexploded ordnance relied on a patchwork of methods, with divers risking their lives to lift individual shells, Remotely Operated Vehicles (ROVs) crawling across the seabed to pick up rusted bombs, or, when danger loomed, blasting munitions where they lay, a quick but environmentally damaging solution that even that even bubble curtains – underwater air barriers used to contain debris and reduce noise – struggle to soften. These approaches worked for single objects and came with many risks but they were never designed for the vast, densely layered munition fields left behind after the wars.

Several research initiatives have started laying the groundwork for more systematic action. The German-led CONMAR project unites scientists, authorities, industry and NGOs to map ammunition in the North and Baltic Seas and trace how toxic compounds move through ecosystems and food chains. Meanwhile, EU-supported projects including MUNI-RISK, MUNIMAP and MMinE-SwEEPER work to clarify legal responsibilities between member states and identify the bureaucratic gaps that continue to stall coordinated clean-up.

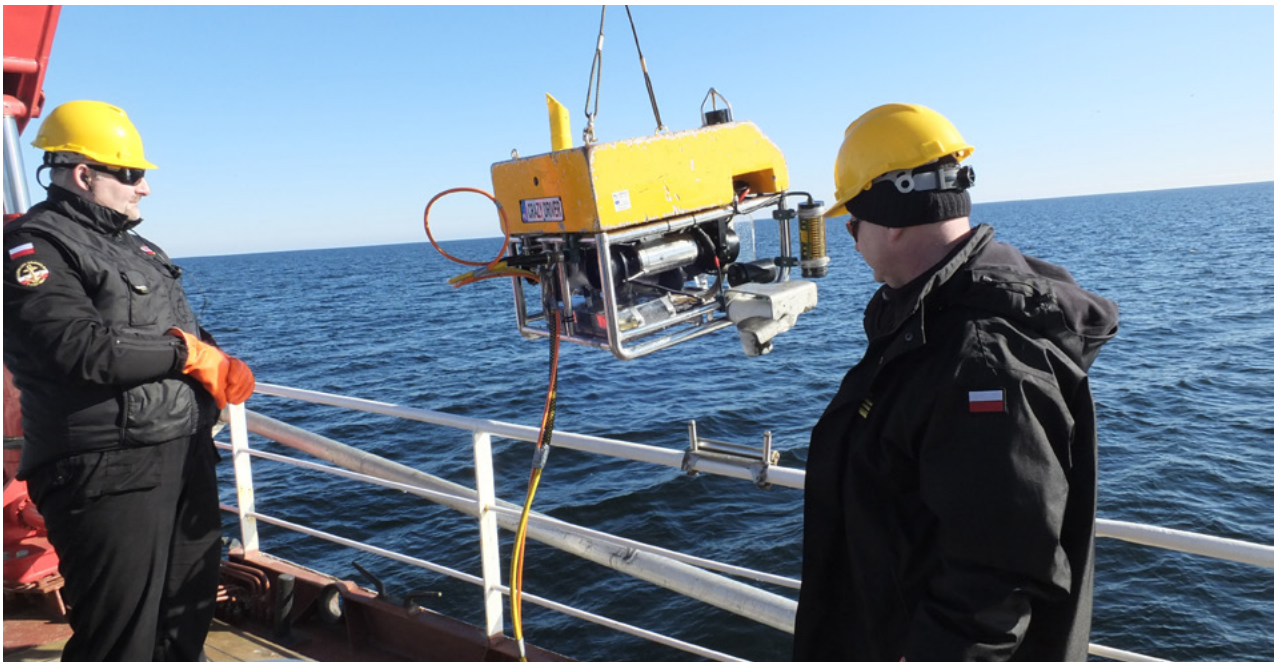
Yet these efforts rarely confront the central obstacle: industrial-scale removal. As Greinert notes, most people imagine isolated shells, but the underwater reality is different: "If you have a munition pile, then you have the next 50 by 60 metres full of munitions… and how to clear that, that is a different ball game."

Germany's recent trials highlight the scale mismatch. Divers managed to clear one pile in 30 days, but Lübeck Bay alone contains more than 500 such piles. Clearing a single one cost millions, which is not feasible according to Greinert.

Recent ecological studies in Lübeck Bay highlight that decade-old shells and mines have been colonised by dense communities of fish, crabs, starfish and mussels, often forming richer ecosystems than the surrounding seabed. Removing munitions at scale therefore does not just eliminate a source of toxins and explosion risk, but it also strips away hard surfaces that many species now depend on as artificial reefs. Any future clean-up strategy will need to replace this accidental habitat with safer structures if it is to protect both people and marine life.



9



10

This is precisely the gap that the new EU-funded CAMMera project un by GEOMAR is designed to fill. Unlike earlier initiatives focused on mapping or environmental monitoring, CAMMera turns directly to what Greinert calls "the missing piece": developing the technologies required to recover and dispose of munitions at industrial scale.

"We know where the munition is, we know what the environmental impacts are… but the final grabbing of specific munition objects with the aim of doing this in industrial scale and the disposal, that is missing," he explains.

Beyond the technology, CAMMera also examines whether Europe could support a viable business model for long-term remediation. According to Greinert, the European Parliament expects concrete answers. The project's mandate is not "research for the sake of research," he says, but to produce a clear proposal for how such operations could be organised and funded. "They want to have a document where they can simply read, and say OK, this is what we do, this is where the money could come from," Greinert explains.

If CAMMera, together with the wider "Munitions in the Sea" community of interconnected EU-funded and national projects, succeeds, Europe may finally move from fragmented pilots to a unified strategy capable of addressing the millions of tons of munitions lying offshore. It signals the start of something that has long been missing: shifting from understanding the problem to building the means to actually solve it.

The seabed may hold the last unresolved chapter of Europe's old wars, but new conflicts are already adding fresh dangers, from drifting mines in the Black Sea to unexploded ordnance washing ashore on Ukrainian and Romanian coasts. With old munitions corroding and new ones entering the water, the problem is no longer historical; it is accelerating. What happens next, whether Europe confronts this growing threat or continues to look away, will shape the safety of its seas and the security of the people who depend on them. ●

1. A heavily corroded torpedo head rests on the seafloor – a reminder that munitions remain intact enough to threaten offshore workers and marine ecosystems. Photo: GEOMAR
2. A cluster of rusting aerial bombs lies partially buried in Lübeck Bay, Germany, one of Europe's most densely contaminated munition hotspots. Photo: GEOMAR
3. Munition pile in the Baltic Sea. Photo: GEOMAR
4. A decayed sea mine sits among sand and is encrusted by marine life. Photo: GEOMAR
5. UXO Diver. Photo: SeaTerra
6. A rusty, decaying ground mine surrounded by algae and marine organisms shows how wartime weapons have become accidental artificial reefs. Photo: GEOMAR
7. A recovered munitions casing, hauled up from the seabed. Photo: SeaTerra
8. The uncrewed surface vessel Gobelijn surveys munition dumpsites. Photo: Flanders Marine Institute
9. A specialised remotely operated vehicle (ROV) crawler grips to the seafloor to maneuver around buried munitions. Photo: SeaTerra
10. Preparation for an AUV (autonomous underwater vehicle) launch. Photo: IOPAN

Beyond the Point of No Return

Climate scientist James Hansen on 2°C, sea-level rise, and the race against time.

Dr. James Hansen has spent decades warning policymakers that the laws of physics will not bend to politics. His 1988 testimony to the United States Congress marked a turning point in global climate awareness.

The former director of NASA's Goddard Institute for Space Studies and now adjunct professor at Columbia University's Earth Institute, Hansen spoke to REVOLVE on the sidelines of the ATLAS25 Climate Tipping Points Conference in Helsinki.

You have said that the 1.5°C target is already dead. What about 2°C?

We have already reached 1.5°C. The planet is out of energy balance, more energy coming in than going out by over one watt per square metre. That may sound small, but it means several tenths of a degree more warming is inevitable.

We will hit 2°C within the next couple of decades. Without purposeful action to alter the planet's energy balance, that threshold will be exceeded. The IPCC's RCP 2.6 scenario, meant to cap warming around 2°C, is already off track.

It is frustrating to hear leaders insist that 1.5°C is still possible with "more ambitious promises." That is simply not true. The physics says it is too late. We should have acted decisively 10 or 20 years ago.

How soon could multimetre sea-level rise become a reality, and would it be irreversible?

Sea-level rise is complex, but history tells us it can happen fast. During the last interglacial period, the Eemian, about 120,000 years ago, sea level rose several meters in under a century, likely due to West Antarctic ice-sheet instability.



James Hansen at the ATLAS25 Conference, Helsinki. Photo: Vilma Norokorpi/Operaatio Arktis

That is the real danger now. We are eroding the ice shelves that stabilise West Antarctica. Within 50 to 150 years, we could see multimetre sea-level rise, a largely irreversible disaster.

However, it is not yet inevitable. If we could cool the Southern Ocean, we might halt or even reverse ice-shelf loss. But first, emissions must come under control. Without that, nothing else matters.

How should policymakers prepare for potential climate tipping points?

I do not believe we have crossed an irreversible threshold yet, but signs are troubling. The Atlantic overturning circulation does appear to be weakening, and a shutdown is possible. That would disrupt Europe's climate – inconvenient, yes, but survivable.

The true catastrophe would be several metres of sea-level rise. Over half of the world's major cities lie on coasts. That is something humanity simply cannot afford to let happen.

You have mentioned France and Sweden as examples of nuclear energy aiding decarbonisation. What role do you see for nuclear power today?

At present, renewables alone cannot provide consistent baseload power because they are intermittent. We still need a complement, and right now that is either fossil fuels or nuclear.

We should have invested long ago in next-generation, ultra-safe reactors that can burn existing nuclear waste, use thorium, and produce high-temperature heat for industry. These designs exist but remain underdeveloped. We cannot build them overnight.

Partnerships, especially with countries like China that can deploy technology rapidly, could accelerate the transition. Cooperation, not competition, will help us phase down emissions fast.

For the full interview and more, head to revolve.media/interviews

VIEWS

The Cryosphere: Earth's Frozen Shield



The cryosphere is the name scientists have given to all the frozen water on our planet. It comes from the Greek word *kryos*, meaning "cold" or "ice." These frozen environments form a complex system that helps regulate Earth's climate and sustain life.

The cryosphere takes several forms. Snow cover – including the seasonal kind that gets stuck on your boots – stores water and reflects sunlight away from the Earth. Glaciers are slow-moving rivers of ice formed from compacted snow that carve out landscapes. Ice sheets and ice caps are vast masses of glacial ice found in the polar extremes of the planet. Ice sheets hold nearly two-thirds of the world's freshwater. Sea ice is frozen ocean water that forms and melts with the seasons, creating a unique habitat for polar ecosystems. River and lake ice are seasonally frozen freshwater bodies of water. And finally, permafrost is soil that remains frozen for at least two consecutive years, locking in enormous amounts of carbon.

Although the frozen world can feel distant to those who live in milder climes, it plays a critical role in stabilising the global climate. Its bright, reflective surfaces send much of the Sun's energy back into space, helping to keep the Earth cool. This frozen shield also stores and slowly releases freshwater, moderating sea levels and supporting billions of people and lifeforms. But the cryosphere is rapidly changing. Rising global temperatures are melting glaciers and sea ice, shrinking snow cover, and thawing permafrost.

Understanding the cryosphere means understanding how tightly Earth's systems are linked both to each other and to us.

This edition of VIEWS serves as an introduction to the cryosphere around the world and is the first chapter of an ongoing series exploring different locations of the CryoSCOPE project.

Cover: Polar wildlife is highly exposed to the effects of global warming. Arctic summer ice is shrinking by almost 13% per decade, severely impacting wildlife that depend on this habitat, a trend confirmed by satellite data since 1979. Photo: Mozgova / Shutterstock

Above: Seasonal snow cover, though temporary, plays a key role in reflecting sunlight, storing water, and linking urban life to the planet's broader frozen systems. Photo: Christian Thiel / Shutterstock
Below: Japan is home to some of the snowiest inhabited regions on the planet. Photo: Nora Holley



Fjallsárlón, a glacial lagoon in Iceland, located on the southern end of Vatnajökull glacier. Photo: Wei Huang / Shutterstock





The cryosphere's textures – the ridged salt-white crust of sea ice and the compressed, bluish grain of glacier ice – show the physical forces that shape and reshape frozen water across the planet. These textures reveal movement, pressure, and the transformation of water into a solid state.
Photos: Pyty / Shutterstock (Above), Tamara Kulikova / Shutterstock (Below)





Above: In this scene from Alaska, the cryosphere reveals its layers – snow falling over a frozen river, a trace of melt at its edge, and distant peaks locked in glacier and cloud. Photo: Wirestock Creators / Shutterstock
Below: This aerial view of the fractured surface of a frozen lake reveals the power and fragility of the cryosphere. Photo: Ryzhkov Oleksandr / Shutterstock







In Longyearbyen, Svalbard, Norway, the exposed face of rapidly thawing permafrost shows layers of ice, soil, and long-frozen organic matter. Permafrost covers nearly a quarter of the Northern Hemisphere and stores twice as much carbon as the atmosphere. This means that if all the organic carbon currently frozen in permafrost were released as CO_2 or methane, it would roughly double the total amount of carbon currently in the atmosphere. Photo: Photostravellers / Shutterstock



Above: The Milky Way can be seen high above the snow-dusted, sheer peaks of the Himalayas, the highest mountain range on Earth. Photo: Parth Menghal / Indian Institute of Technology, Chennai / CryoSCOPE Project.
Below: A rare view of the Cascade Volcanic Arc across Washington and Oregon, USA. Mount Rainier rises in the foreground, with Mount St. Helens, Mount Adams, and Mount Hood in the distance. Photo: Charis Brice / REVOLVE





Above: Greenland's interior is covered by an ice sheet, which at this point near Kangerlussuaq meets a river that carries away the meltwater. Photo: Vadim_N / Shutterstock
Below: Two people stand beside the glacier and icebergs of the southeast area of Fjallsjökull, Iceland. Photo: ABB Photo / Shutterstock







The Greenlandic Ilulissat icebergs, formed from glacier ice more than 250,000 years old, tower above the water at up to 60 metres (197 feet) high, and stem from the nearby Jakobshavn Glacier. Photo: Mathias Berlin / Shutterstock





A vivid illustration of the cryosphere's layers and how each is directly connected to affected by the next. This image captures an Icelandic glacier lagoon filled with icebergs, surrounded by frozen permafrost and snow-covered mountains. Photo: Oksana Yermoshenko / Shutterstock



The Cascades in summer mark one phase of the cryosphere's continuous cycle – snow becomes water, water sustains life, and soon, snow will return. This delicate exchange between frozen and fluid connects mountains to oceans and reminds us that the cryosphere is not static but a living system, shaping the planet's climate, water, and future. Photo: Charis Brice / REVOLVE



CryoSCOPE

PROCESSES • MODELING • FORESIGHT

cryoscope-project.eu

Transforming Data into Climate Resilience for Cold Regions

- Open Data & Knowledge Sharing
- Real-World Applications
- Strengthening Climate Insights
- Enhancing Observations
- Advancing Climate Modelling
- Assessing Cryospheric Hazards

Funded by the European Union

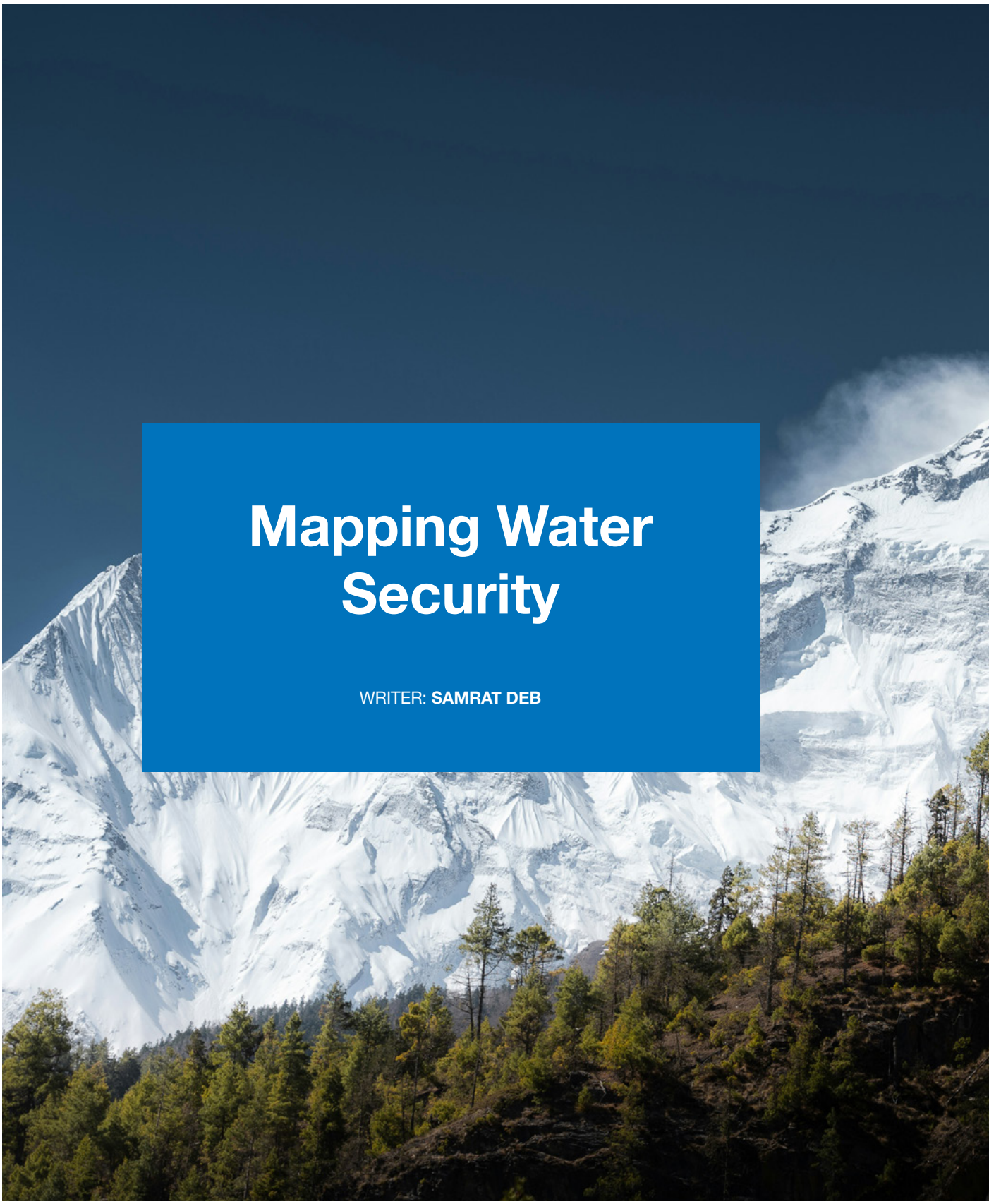
Project funded by

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Education, Research and Innovation SERI

पृथ्वी विज्ञान मंत्रालय
Ministry of Earth Sciences
Government of India



Mapping Water Security

WRITER: **SAMRAT DEB**



1

Peatlands are vital for water security in the Trans-Himalayas, but current knowledge gaps mean protection is impossible.

There's a saying in Ladakhi: "If you have no water, you have no settlement". For the Ladakhi people, living in the high-altitude Ladakh region of northern India, part of the Trans-Himalaya, ensuring access to water has always defined their survival. This remote and rugged landscape, spanning northern India, Nepal, Tibet, and Pakistan, is characterised by extreme elevation and harsh environments. Communities like the Ladakhi have long relied on meltwater from snow and glaciers to sustain themselves. Yet today, climate change threatens these vital water sources, turning villages into ghost towns and pushing communities to the brink of crisis.

The solution to water resilience might lie in the region's peatlands and high-altitude meadows: natural water reservoirs that could help combat drought. However, these landscape features are poorly studied and are under threat, and their potential for supporting communities in a changing climate remains largely unknown. Mapping them is a crucial step toward developing a better understanding of their potential and ensuring water resilience for the future.

Melting glaciers threaten water supplies

The Indian Trans-Himalaya covers over 184,000 square kilometres – more than 5% of the country's landmass – at elevations ranging from 3,000 to 5,000 metres. These heights experience some of the world's most limited rainfall, with regions like Ladakh receiving only about 100 mm annually – less than a tenth of India's national average of 1,083 mm. UNESCO refers to this area as the "Cold Desert Cultural Landscape." Here, snow melt, glaciers, wet meadows and peatlands provide vital sources of water for over 330,000 inhabitants, supporting



2



3

agriculture, daily needs, and livelihoods. But as glaciers retreat and snowfall patterns shift due to warming temperatures, these natural water sources diminish, severely impacting access to clean water and endangering the very existence of these high-altitude communities.

Satellite analyses of Ladakh, by the South Asia Institute at Heidelburg University, reveals significant changes between 2000 and 2019: winter and spring snow cover decreased, while summer snow slightly increased – indicating a change in snowfall timing and intensity. These changes disrupt the snowpack accumulation vital for water storage in the Trans-Himalayan region. In addition to changes in the snowfall pattern, long-standing glaciers in the region have been retreating rapidly.

The Chhota Shigri glacier in Himachal Pradesh, a 9-kilometer-long valley glacier that feeds the Chandra River, is the longest continuously monitored glacier in the Himalayas. Its ongoing ice loss reflects reduced snow and ice accumulation during winter months, highlighting the impacts of changing climate patterns. Similarly, long-term studies have documented the retreat of the Baga Shigri glacier, which, according to research published in Physical Geography in 2017, receded approximately 1.1 kilometres between 1965 and 2014 – roughly the length of two football fields.

As these glaciers continue to shrink at an accelerated rate, downstream water flows are projected to peak by mid-century before gradually declining each year. This pattern suggests that regions relying on glacial melt for their water supply will experience severe flooding until 2050, only to be followed by prolonged periods of droughts. The outlook is troubling for both communities and ecosystems that depend on glacial water, facing an uncertain and increasingly challenging future.

While the Indian government is aware of the current situation in the region and is implementing short-term measures to provide water to local communities living in the Trans-Himalayas, greater emphasis should be placed on long-term, nature-based solutions that can effectively store water and improve community resilience.

Nature's finest water reservoirs

One promising natural solution to the water crisis in the Trans-Himalayan region is the protection and restoration of peatlands and high-altitude wet meadows. Globally these water-logged ecosystems are vital, with peatlands storing around 10% of the world's freshwater, according to the Natural Conservancy, and acting as essential water buffers. Made up of undecomposed organic matter, peatlands feature large pores that enable them to absorb and retain substantial volumes of water.

Many peatlands worldwide, including those in the Himalayas, are characterised by Sphagnum moss, which can hold up to 20 times its dry weight in water. A preliminary study published in January 2025 by GIZ India in collaboration with Wetlands International South Asia and the Indian Ministry of Environment, Forest and Climate Change, estimates that peatlands cover approximately 260,000 hectares in the Indian Himalayas.

Once water is stored in peatlands, it is gradually released into streams, helping to prevent sudden floods and maintain a steady flow throughout the year. During dry periods, peatlands serve as critical water reservoirs, buffering the impacts of droughts and ensuring a more reliable water supply. Research published in the Journal of Hydrology in 2023 on the Andes of South America from – a landscape similar to the Trans-Himalaya – show that peat-forming bofedales, a type of high-altitude wetland, can provide as much as 98% of the water flowing into rivers and streams during the dry season. This "sponge effect", absorbing and releasing water, underscores the vital role that peatlands play in providing a natural hydrological buffer and maintaining water availability during dry periods.



4



5

In arid, high-altitude regions like the Trans-Himalayas where snowmelt is the primary water source, peatlands function as natural flow regulators. They store winter and spring snowmelt and release it slowly during late spring and summer – crucial times for the survival of villages in the region. As climate change causes earlier snowmelt and reduces overall snowfall, peatlands could help delay water runoff and extend water availability, aiding communities in coping with increasingly brief and unpredictable periods of water supply.

Beyond their water-regulating functions, peatlands play a significant role in carbon storage. According to the *Global Peatlands Assessment: The State of the World's Peatlands* by the UN Environment Programme, despite only covering about 3% of Earth´s surface, peatlands store almost a third of the world's carbon. Peatlands provide critical biodiversity habitat for various species and support local livelihoods through grazing. However, although they are highly significant, peatlands remain understudied and undervalued, research published in the Journal of the Society for Conservation Biology in 2025 demonstrates that only 17% of the world's peatlands fall under protection.

In India, there's a significant knowledge gap about the extent and locations of peatlands, with only 1% of India's peatlands officially mapped. How can we effectively protect and manage ecosystems when we lack fundamental information about their location and extent?

Overcoming the knowledge gap

As part of the Alexander von Humboldt Foundation's International Climate Protection Fellowship, my research involves demarcating and mapping high-altitude peatlands in the Trans-Himalayas to explore the correlation of peatlands with the water availability. By doing so, I aim to develop a better understanding of the existing synergies between these ecosystems and local water flow. This knowledge can inform conservation strategies, ensuring that peatlands are effectively protected and integrated into water management policies to strengthen climate resilience and support sustainable development in the region.

The mapping process involves examining remote sensing and GIS-based datasets combined with ground truthing – visiting and physically verifying the data. However, because of the geopolitical uncertainty of the region and very limited research in the past, there is significant data unavailability in the region. To address this challenge, the research focuses on gathering community knowledge along with high-tech modelling and satellite datasets to overcome data gaps in the region.

In the Trans-Himalayan region, my initial findings indicate that peatlands are widespread particularly in areas where groundwater emerges. Mapping indicates that their distribution is largely influenced by topographic features – such as valley bottoms and gentle slopes – as well as climate. These areas are also essential for controlling the sources of rivers and streams. Protecting these zones would help maintain a steady flow of water, ensuring it remains available for communities and ecosystems.

An additional urgency to protecting peatlands is that when they become degraded or dried, they release large amounts of CO_2 – research published in Nature Climate Change in 2021 estimates that drying peatlands could release an additional 860 million tonnes of CO_2 into the atmosphere each year – significantly contributing to climate change. Therefore, to achieve broader climate, water, and biodiversity goals it is essential to accurately assess the extent and ecological health of peatlands in areas such as the Trans-Himalayas. This understanding will be key to developing national strategies focused on conserving healthy peatlands and restoring those that are degraded.

Mapping is the fundamental first step to ensure that peatlands are recognised and integrated into India's broader conservation strategies. By understanding the location and function of peatlands – and their role in regulating snowmelt within the fragile environment of the Trans-Himalayas – we not only move towards protecting an essential ecosystem, but we help safeguard community resilience by protecting the foundation of any mountain settlement: water.

1. A view of a Himalayan mountain with a forest in the foreground. Photo: Slava Auchynnikau / Unsplash
2. Peatlands in the Hanle marshes. Photo: Samrat Deb
3. Settlement of the nomadic Changpa community in the peatlands of Ladakh. Photo: Samrat Deb.
4. A bird's eye view of the Himalayan Mountains. Photo: Nicole Park / Unsplash
5. Peatlands in Chushul valley, Ladakh. Photo: Samrat Deb.
6. Livestock grazing in peatlands in Ladakh. Photo: Samrat Deb.



6

india.revolve.media

SUSTAINABLE INDIA





Testing the Waters

WRITER: **NICOLÁS MARÍN NAVAS**



1

Europe's water shortages are spurring the cross-border transfer of farming innovations.

Catalan authorities loosened water use restrictions in April 2025 after a wet winter and spring returned the region's reservoirs and basins to healthier levels. A sigh of relief for citizens? Perhaps temporarily. The period of historic drought in Catalonia served as a palpable warning that challenges are set to multiply as urban demand, tourism, agriculture, and industry all vie for water in a hotter, drier climate.

Drought has changed the way people talk about and value water in Catalonia (and indeed Spain more widely). Reclaimed wastewater, once associated mainly with industrial use, is increasingly viewed as a solution in areas involving direct human consumption. Yet such proposals leave a sour taste in the public's mouth.

A 2025 survey by the Elcano Royal Institute, a leading Spanish think-tank, found that while more than 80% of Spaniards support using reclaimed or desalinated water for non-potable purposes such as irrigation, industrial processes, or urban cleaning, only 39% would accept reclaimed water for cooking and just 25% for drinking. Acceptance rises to 63% and 43%, respectively, when it comes to desalinated water.

Even with high regulatory standards and proven safety, there is a persistent psychological barrier. This "yuck factor", as researchers call it, illustrates that technological readiness alone cannot guarantee adoption, and that public trust must be built alongside pipes and filters.

Agriculture accounts for an estimated 65% of all water usage in Catalonia, according to the Catalan regional government, which makes the sector fertile ground for innovation as authorities ponder ways to rethink how the increasingly precious resource is managed.

What's the difference between drought and water scarcity?

A meteorological drought is a prolonged lack of precipitation, while scarcity (also known as hydrological drought) refers to there not being enough water available for all the different things we use it for.

Water scarcity can be gauged by means of the water exploitation index (WEI), an indicator that reflects the pressure on resources of fresh water and measures annual water consumption as a proportion of the total available.

Source: CREAF



2



3

Reimagining water's second life

At the European level, regulation on minimum requirements for water reuse entered into force on 26 June 2023 across most Member States. The then Commissioner for Environment, Oceans, and Fisheries Virginijus Sinkevičius said at the time that the new standards meant "consumers and farmers can be confident in the quality and safety of agricultural produce irrigated with reclaimed water."

The regulation establishes uniform standards for water quality, along with clear rules for monitoring, risk management, and public transparency. As of 2023, only 2.4% of total treated urban wastewater in the EU was being reclaimed and reused. Spain, one of the EU's most water-stressed countries according to the European Environment Agency (EEA), has aligned national policy with the European framework.

Catalonia's experiment in circular water

Catalonia has become an emblematic case for understanding how technology, regulation, and public perception intersect in Europe's response to water scarcity. The region's drought accelerated experimentation with advanced treatment systems and indirect potable reuse, positioning it as a testing ground for Europe's circular water future, and for its social acceptability.

At the BETA Technological Centre at the University of Vic (BETA-VIC), researchers experienced this challenge directly through the RE-AQUA project, which demonstrated the feasibility of reusing wastewater from abattoirs and agro-industrial operations.

Speaking to REVOLVE, Esther Vega, Senior Researcher at BETA VIC, explained: "We framed reclaimed water as a high-quality resource rather than 'reused wastewater'." The project maintained constant communication with public authorities, the Catalan Water

Public trust must be built alongside pipes and filters.



4

Agency, the Department of Health, and the Department of Climate Action, Food and Rural Agenda, to ensure that all information was reviewed and validated. “That transparency offered both technical and administrative assurance,” Vega added.

The project also confronted skepticism both from industry stakeholders and from public institutions wary of the food-related applications of reclaimed water. “We faced skepticism mainly from industry stakeholders concerned about product safety and regulatory liability,” says Alexandre Galí, BETA VIC’s Environmental Unit Coordinator. “From public or regulatory stakeholders, the concern was in the food-related applications that imply reuse water in indirect contact with food and the way to monitor the pollutants to verify water quality.”

From local practice to European amplification

Across Europe, water scarcity is becoming a major agricultural issue. Agriculture accounts for roughly 29% of water use in the EU, according to the EEA, although that figure can rise substantially in southern EU nations, reaching above 80% in Greece, studies have found.

Finding ways to grow food with less water, and reuse what is already available, is increasingly urgent. In Catalonia, projects such as RE-AQUA and its successor RE2AQUA are showing how local innovation can drive that change. Yet the real test lies in scaling these lessons beyond regional borders.

That is precisely what AQUAGRI-KNOW sets out to do. Funded by the EU and coordinated by BETA-VIC, the project brings together 13 organisations from five Member States to advance the circular water value chain, a model that rethinks how water moves through agriculture, from source to use and back again. Rather than treating water as a one-way flow, AQUAGRI-KNOW promotes a closed-loop approach: optimising water use, developing WaterSmart crops, enhancing the water-soil interface, and enabling water reuse.

The project builds directly on the experiences of EIP-AGRI Operational Groups, which have tested innovative water-saving and reuse solutions across Europe. It collects and harmonises this knowledge, aligns it with EU and national policies, and transforms it into practical, farmer-friendly tools. These are then shared through workshops, peer-to-peer exchanges, and trainings led by the project’s Ambassadors Programme, a network of farmers and practitioners who act as multipliers of change in their local communities.

This way, AQUAGRI-KNOW ensures that successful Catalan models can inform water-stressed regions elsewhere, from southern Italy to eastern Poland, and acts as both amplifier and connector, bridging the gap between local experimentation and continental strategy.

Toward a circular water culture

AQUAGRI-KNOW draws its strength from real-world experience, connecting the lessons of 12 Operational Groups (OGs) from across Europe, including the likes of RE-AQUA and RE2AQUA. In Belgium, WaterReserve piloted drainage and rainwater infiltration techniques across test plots, proving that better rainwater conservation during dry periods can stabilise groundwater levels and reduce losses, though its success depends on local soil conditions and farmers' willingness to manage higher water levels.

Another Belgian OG, Waterketen, explored the reuse of treated industrial wastewater from sectors like dairy, breweries, and food processing. By evaluating treatment technologies and nutrient content, the project created a practical framework for safely integrating reclaimed water into irrigation systems, improving sustainability while offering cost savings for both farmers and industries.

Elsewhere, other OGs are rethinking resilience from the ground up. In Poland, Nova Trawa developed a drought-resistant ryegrass variety enhanced through symbiotic endophytic fungi, a naturally modified alternative to genetic engineering that reduces dependence on plant protection products and water use. In southern Italy, InnovaLegumi reintroduced legumes into cereal rotations, improving soil fertility, nitrogen balance, and overall water efficiency while boosting yields and reducing reliance on synthetic fertilisers.

AQUAGRI-KNOW also focuses on what happens beyond the field. The project's cross-visits and Ambassadors Programme bring together farmers, researchers, and policymakers, fostering direct exchange and trust across borders. Ambassadors act as local champions who adapt innovations to their specific contexts and show, through practice, that circular water management is both viable and beneficial. These exchanges are where policy meets reality, where a farmer in Belgium can learn from a Catalan pilot, or an Italian cooperative can share lessons with a Polish reuse initiative.

Healthier soils mean healthier water systems

Healthy soils are another cornerstone of AQUAGRI-KNOW's circular water value chain. Soil is not just a substrate for crops, it is a living system that regulates moisture, stores carbon, and sustains biodiversity. Recognising this, the project supports OGs that restore the soil–water interface, showing that resilience begins below the surface.

In Cyprus, Oliver Nicosia Vegs brings together farmers, researchers, and industry partners to improve water and energy efficiency across the agri-food chain. The group promotes precision irrigation, smarter fertilisation, and soil management practices that cut water consumption by around 20%, while increasing crop quality and stress resistance. These measures also enhance farmers' competitiveness, allowing them to produce high-value crops with lower environmental impact.



5

Further, SatAgro in Poland and Nitrati Ferrara in Italy are testing how technology and soil restoration can work hand in hand. SatAgro integrates satellite-driven tools that monitor soil-water capacity and crop nitrogen demand in real time, helping farmers irrigate and fertilise only when necessary. In Italy's Emilia Romagna region, Nitrati Ferrara combines organic composts and conservation agriculture to increase soil organic matter and reduce nitrate leaching, lowering water pollution and the overall farm water footprint. Together, these OGs demonstrate that healthier soils mean healthier water systems, reinforcing the link between sustainable land management and long-term water security.

Transferring the know-how

Turning innovation into real change along the circular water value chain takes more than technology, it requires knowledge, adaptation, and collaboration. AQUAGRI-KNOW was designed precisely for that reason: to bridge the distance between what research produces and what farmers actually need. The project follows a clear five-step approach that helps translate the principles of circular water use into everyday farming practices.

It starts by gathering and organising existing knowledge. Outcomes from Operational Groups and other EU-funded projects are compiled into a shared data platform, ensuring that technical results, costs, and lessons learned remain accessible and relevant to those working on the ground. From there, the focus shifts to context, aligning these findings with both EU and national policies while grounding them in the everyday realities of farmers across Europe.

Once the groundwork is laid, the third step translates research into practice. Technical studies become practical tools: guidelines, interactive booklets, and short summaries that farmers can use directly in their fields. The final stages bring this knowledge to life. Through training sessions, cross-visits, and peer-to-peer exchanges, farmers share experiences and adapt new ideas to their local contexts. In parallel, AQUAGRI-KNOW feeds these insights back into broader EU networks and policy discussions, helping ensure that what works on the ground informs the next generation of agricultural policy.

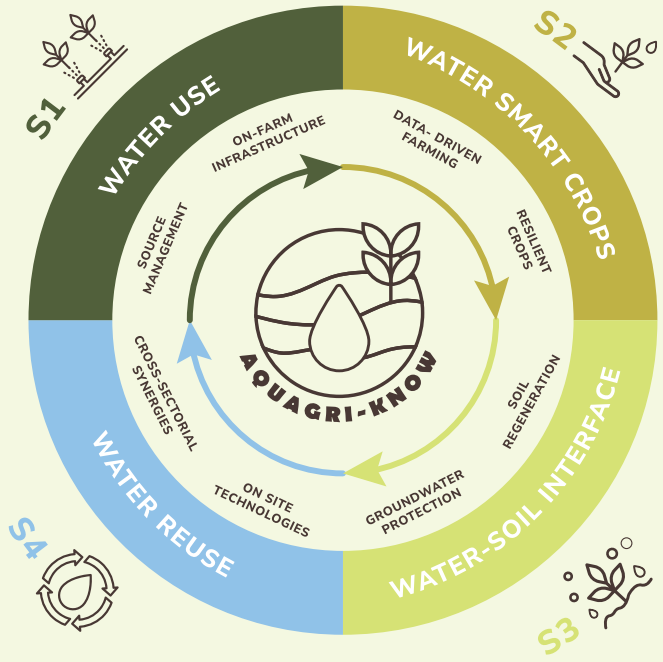
This exchange between practice and policy lies at the heart of adaptation. AQUAGRI-KNOW demonstrates that resilience is not achieved through infrastructure alone, but through a deeper shift in how we value and manage water, moving from using more to using better. By linking Catalonia's local innovations with Europe-wide networks, the project helps turn regional breakthroughs into shared progress, where farmers across climates and countries learn from one another and build trust through experience.

These exchanges are where policy meets reality, where a farmer in Belgium can learn from a Catalan pilot, or an Italian cooperative can share lessons with a Polish reuse initiative.

1. A farmer measures the irrigation water with a digital pH meter in the irrigation channel. Photo: Deyan Georgiev / Envato
2. Cracked and dry ground. Photo: Valerie Sidorova / Pexels
3. Hydroponic irrigation on a vegetable farm. Photo: Osbmxhouse / Envato
4. A vineyard in Catalonia. Photo: Aleix Ventayol / Unsplash
5. A water management system machine works alongside a state-of-the-art floating solar farm. Photo: SpaceOak / Envato

Empowering farmers with practical knowledge and innovative solutions for efficient on-farm water management

AQUAGRI-KNOW is a three year project funded by the European Union that focuses on improving water management in European agriculture. By working with 12 EIP AGRI Operational Groups, which bring together farmers, researchers, and advisors, the project promotes innovative practices and helps connect research with practical use on farms.



Key facts and figures

DURATION IN MONTHS	36
COUNTRIES INVOLVED	5
BUDGET	€1.99M
PARTNERS	12
AFFILIATED ENTITIES	1
OPERATIONAL GROUPS	12

- **Water Use**. Smarter irrigation & source management
- **WaterSmart Crops**. Resilient, low-water-demand crops & digital tools
- **Water-Soil Interface**. Soil regeneration & groundwater protection
- **Water Reuse**. Closed-loop systems & agri-food wastewater reuse

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

aquagri-know.eu

AQUAGRI-KNOW

aquagri-know

allabout_soil



Retrofitting Europe's Buildings

WRITER: **ANNA NAZARIO**



1

Buildings account for 40% of Europe's energy consumption, making their renovation essential for climate and social goals.

In 2022, more than 41 million Europeans – nearly 10% of the population – were unable to heat their homes in winter, while 19% could not keep cool during heatwaves. The cost is both financial and environmental as buildings account for 40% of the EU's total energy consumption and generate 35% of energy-related greenhouse gas emissions, with heating and cooling accounting for the majority of that.

As the climate crisis intensifies, the problem will only grow. By 2100, up to 100 million Europeans may be exposed to extreme heat, according to the European Commission's Joint Research Centre. Yet our buildings are unprepared: 85% of EU buildings were built before 2000 and 75% of those perform poorly on energy efficiency.

To align with the European Green Deal and the revised Energy Performance of Buildings Directive (EPBD), residential building emissions must fall by 16% within five years and 20-22% by 2035. Achieving this requires nothing less than a transformation in how we design, renovate, and live in our homes.

Breaking the cycle of inefficient housing means rethinking construction and renovation practices. Solutions include better insulation and high-performance windows, smart climate control systems, and thoughtful building orientation to reduce heat gain in summer and retain warmth in winter.

These measures reduce emissions, cut energy bills, and create healthier, more comfortable living spaces. But they are only part of the equation. The energy that powers our homes must also come from cleaner, renewable sources – solar panels, wind turbines, geothermal systems, and district heating networks – integrated into both new and existing buildings.

The challenge is scale and cost. Most of Europe's housing stock is old and inefficient, and retrofitting can be disruptive and expensive. Yet compared to rebuilding, retrofitting saves resources, reduces waste, and accelerates decarbonisation.

A model for circular renovation

One EU-funded project leading the way is RE-SKIN, which combines energy efficiency with circularity in the renovation of public housing in France and Spain, a school in Bulgaria, and a community building in Italy.

The project's goal is to cut energy consumption in existing buildings by up to 90%. Using bio-based insulation materials, renovations can be carried out externally, meaning tenants remain in their homes during the process – a socially inclusive innovation.

Additional benefits include: 60% lower carbon emissions during retrofitting, 40% lower emissions across the building's full lifecycle, use of recyclable and dry construction materials, compatibility with existing structures without



2

overloading them, and faster, less intrusive renovation processes that minimise disruption for residents

RE-SKIN shows that retrofitting is not just a technical upgrade, it is a social revolution aimed at making housing both affordable and sustainable. By using what we already have instead of demolishing and rebuilding, the project keeps materials in use longer and reduces environmental impact.

By 2100, up to 100 million Europeans may be exposed to extreme heat

– European Commission's Joint Research Centre.

Real-world examples

In the Italian city of Milan, the project is working on the retrofitting of a community house that serves 16 residents, some of whom are in vulnerable situations like addiction recovery. Here, the retrofitting focuses on two areas: the roof and the façade.

For the roof, RE-SKIN uses an innovative building-integrated photovoltaic thermal (BIPVT) system which builds on previous research to create roofs that not only withstand extreme weather but also generate both electricity and thermal energy. Adapted from curtain wall technology for rooftops, this system ensures better durability against heavy rain and strong winds.

The renovated roof will be made from recycled aluminum, bio-sourced insulation, and repurposed photovoltaic (PV) modules, making it both resilient and environmentally responsible.

As for the façade, the demo site will use multifunctional cladding that combines an external thermal insulation system, thermal energy recovery, and versatile finishing to ensure the inhabitants can keep as warm or as cool as needed. In this method, traditional insulation foam is replaced with bio-sourced insulation foam, while standard metal sheets are substituted with sustainable steel. Further enhancements include recycled aluminium profiles and an optimised mounting system to reduce installation time.

This new façade design provides dynamic thermal insulation, weather protection, and integrated space for wires, vents, sensors, and pipes.





3

Rethinking purpose

For transformation to truly take root in the sector, systemic changes are needed. Many affordable housing units across Europe are outdated, poorly insulated, and equipped with inefficient heating systems. The renovation landscape remains fragmented and underfunded, while rising energy prices disproportionately impact vulnerable populations – from low-income families to the elderly. Without intervention, this reality will deepen social inequalities, worsen health outcomes, and hinder climate progress.

The RE-SKIN project contributes not only innovative solutions but also strategic insights. It demonstrates the need for stronger EU funding commitments, such as the Recovery and Resilience Facility and REPowerEU, to accelerate renovations in affordable housing. With this, local communities should be empowered through targeted training, stakeholder engagement, and inclusive financial mechanisms like subsidies and low-interest loans. By scaling up modular retrofitting systems and integrating digital monitoring tools, Europe can reduce energy use, curb emissions, and ensure that the transition to energy-efficient buildings is both equitable and far-reaching.

Citizen driven renovations

On a smaller, regional scale in Belgium, Wallonia illustrates how innovation and citizen engagement can transform renovation into a mass movement. Belgium's building stock is among the least efficient in Europe: in 2022, only 3% of houses and 11% of apartments met A-level standards, far below what is needed to hit the 2050 climate targets, according to real estate company Realo.

To tackle this, the region launched RENOBATEX.ID, a €15 million program under the Walloon Recovery Plan that funds 25 pilot projects led by associations, municipalities, businesses, and citizen groups. The objective is to develop solutions to remove the many obstacles to renovation, whether financial, psychological, or technical.

Some RENOBATEX.ID projects tackle legal uncertainty and administrative complexity, like LocaRéno, which created a model renovation lease to help tenants and landlords find win-win agreements. Others focus on immediate energy solutions.

Collective action is another cornerstone. The Audit 360° developed by Objectif Réno Copro helps co-owners make informed decisions on renovation priorities. In La Louvière, Renocity proved that a neighbourhood-based approach can triple the renovation rate in just months. In Namur, "Apéro Réno" evenings make energy renovation a convivial topic, while Ruenovation experiments with group renovation among neighbours to simplify procedures and reduce costs.

Social inclusion is also crucial. The Réno WaTT'chers project supports low-income households through a mix of group workshops and individual coaching, showing that energy transition can go hand-in-hand with social justice.

Several projects focus on improving citizens' skills. PRO & MOI, for example, empowers them to take charge of their own renovation projects through self-renovation supervised by professionals, while FRIES and Coup d'Boost RENO combine technical and practical support through training courses and participatory projects.

RENOBATEX.ID is also focusing on innovation, as demonstrated by IsoFabric, a new textile-based insulation material that transforms mountains of discarded clothing into bio-based material, and Sumhotori, a modular, prefabricated system that speeds up renovations while improving their quality.

Finally, as energy efficiency alone cannot be sufficient to achieve the 2050 targets, some projects focus on energy



4



5

conservation. This is the case for the "SlowHeating" workshops that enabled hundreds of households to lower indoor temperatures inside their homes by more than one degree without sacrificing comfort and at minimal cost.

What unites these projects is a shift in perspective: putting citizens at the heart of energy renovation. Because the energy transition cannot be decreed through subsidies or regulations alone; it must be built through trust, support, and social innovation.

A common thread is clear: citizens are placed at the heart of energy renovation. Regulation and subsidies alone cannot drive the transition – trust, participation, and collective intelligence are essential.

A lifeline for people and the planet

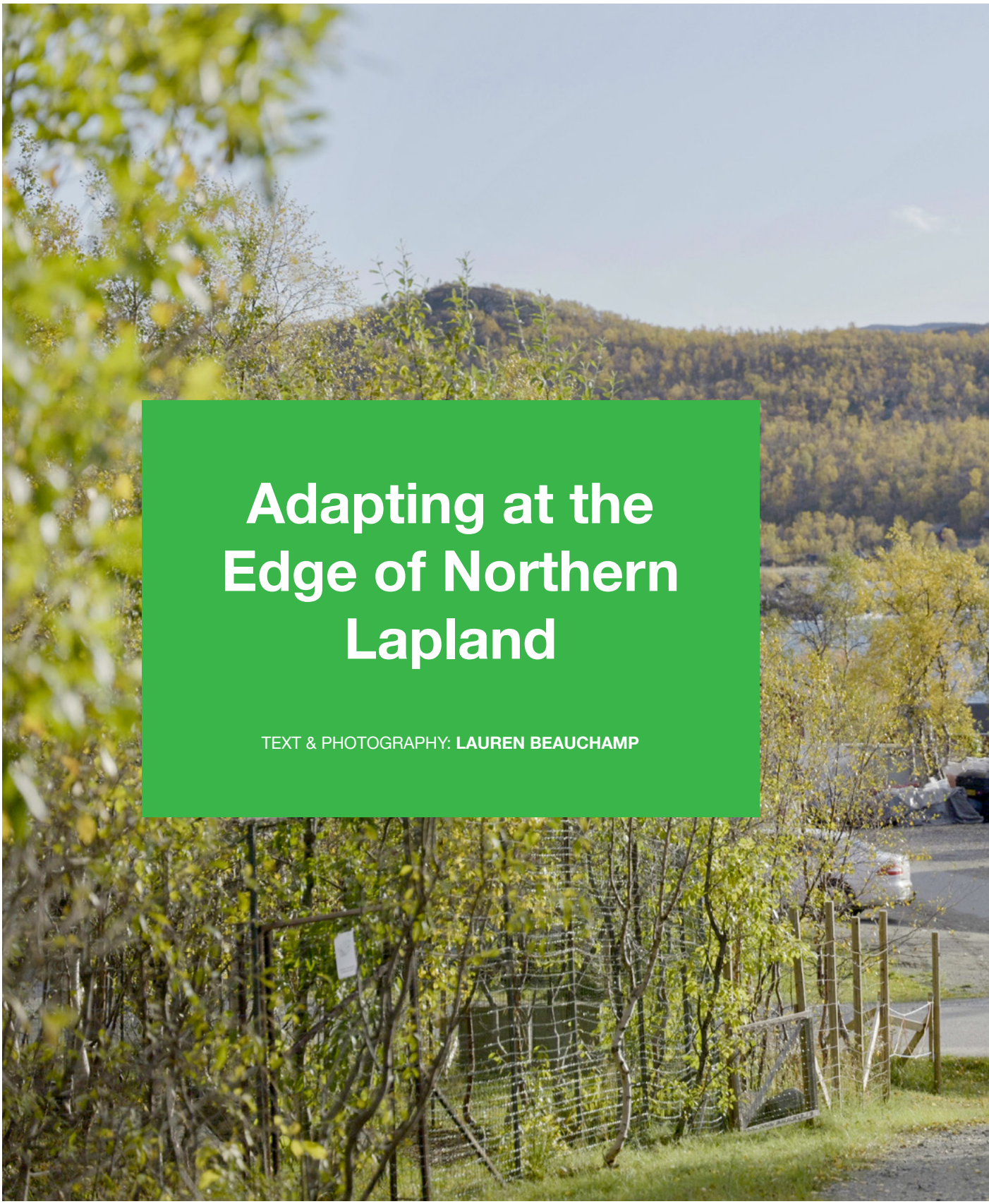
From RE-SKIN's holistic renovations to Wallonia's citizen-led experiments, the message is the same: large-scale energy renovation is possible if as a society we dare to reinvent how it is done. Retrofitting is not only about insulation and boilers – it is about social justice, solidarity, and empowering people to become actors of change.

As the 2050 climate neutrality deadline approaches, Europe must scale up these solutions as they are our lifeline against rising bills, worsening heatwaves, and a warming planet.

1. Building restoration work. Photo: Artists Eyes / Unsplash
2. Interior renovation in progress. Photo: Milivoj Kuhar / Unsplash
3. Multifunctional cladding that combines an external thermal insulation system, thermal energy recovery, and versatile finishing. Photo: RE-SKIN
4. Insulation made from old clothes. Photo: IsoFabric
5. A render of a proposed studio made from circular materials. Photo: Reecit

Belgium's building stock is among the least efficient in Europe: in 2022, only 3% of houses and 11% of apartments met A-level standards.

– Realo.



Adapting at the Edge of Northern Lapland

TEXT & PHOTOGRAPHY: **LAUREN BEAUCHAMP**



1

In Finland's far north, communities are turning tradition, tourism, and science into a blueprint for climate adaptation.

The light falls in long, pale ribbons over the mountains. The air is dry, almost electric, and the snow begins to fall for the first time this season. This is Kilpisjärvi – a village closer to Norway than to most of Finland – where the landscape is more tundra than forest, and climate change is not an abstract concept but a lived reality.

Lapland at a crossroads

Lapland is warming four times faster than the global average. Here, the rhythm of life – reindeer herding, tourism, and scientific observation, is being rewritten by the warming climate. "Some winters it rains in January," a local reindeer herder says. "The ice comes thick on the snow, and the reindeer can't dig through." Yet in this fragile environment, communities are finding new ways to adapt by blending science, local knowledge, and creativity.

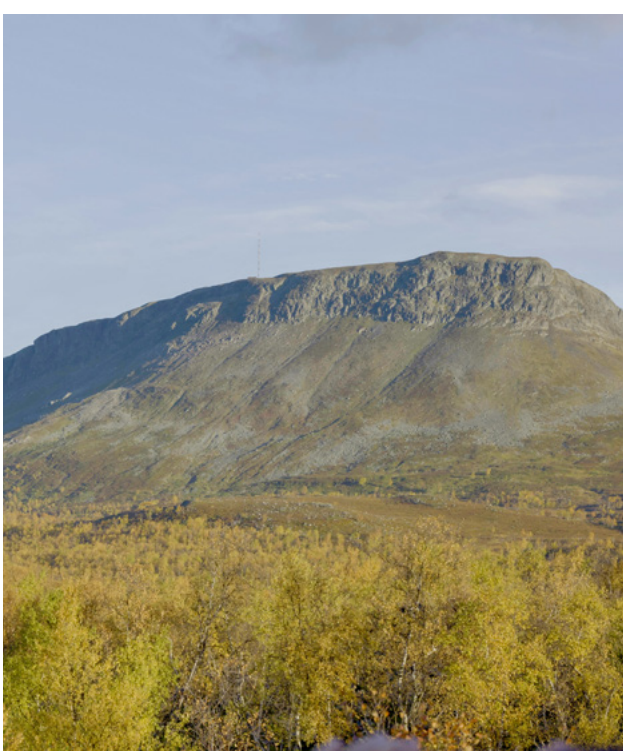
That's the goal of MountResilience, a Horizon Europe project uniting 47 partners from 13 countries to accelerate climate adaptation in Europe's mountain regions. Lapland is one of its demonstration areas – a living laboratory where scientists, entrepreneurs, and Indigenous people work together to design solutions that protect both livelihoods and landscapes.

"Local and traditional knowledge should not be overlooked," says Taru Lindell, Project Manager for MountResilience in the municipality of Utsjoki. "That's how the plans become real, because people trust them."

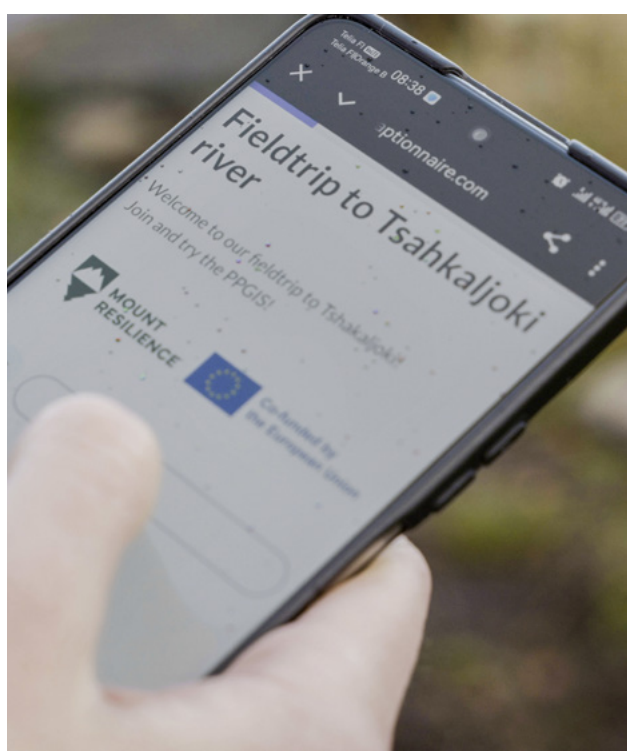
Mapping change

Utsjoki sits at the top of Finland, where reindeer herding and tourism are the twin engines of the local economy. Both depend on stable seasons. Both are now under strain. Lindell has spent the past year guiding adaptation planning for reindeer herding companies and local governments by translating climate data into something people can act on. "While we still have snow during winter, the season is becoming shorter. Winter starts a little bit later than before and it ends earlier than before," she says. "That means the whole calendar shifts – feeding, moving, tourism, everything."

From October 2024 to February 2025, the Finnish MountResilience team collected over 220 map markings from residents of the pilot areas, Utsjoki and Enontekiö, using Public Participation Geographic Information Systems (PPGIS). The tool allows locals to record visible environmental changes,



2



3





4

from shifting treelines to flooded rivers, and link those observations to scientific and policy discussions.

Together, these maps form a community-based record of change: locals marking the drying rivers, shorter snow seasons, and the arrival of new species – the small signs of a shifting Arctic.

> "Local and traditional knowledge should not be overlooked. That's how the plans become real, because people trust them."
>
> – Taru Lindell, Project Manager, MountResilience.

Science in the snow

At the Kilpisjärvi Biological Station, the change is measured in birch buds and insect counts. Established in 1964, the station is part of the University of Helsinki and serves as one of Finland's longest-running Arctic research centres. "Every small change here means something big," says Hannu Autto, the station's service manager. "We see the birch line move higher up the slopes. New moss and insect species appear. Even the streams behave differently."

To bridge that gap, the Kilpisjärvi Biological Station now works directly with local municipalities and schools. Students and residents visit to learn how environmental monitoring links to planning decisions – from water management to land use. "Science can describe what's happening," Autto says, "but I think there's an intrinsic value that people are directly participating when these changes are coming. MountResilience helps turn that knowledge into adaptation."

Tourism in transition

That connection is visible a few kilometres away, in the cosy, family-run Cahkal Hotel, where Margit Eskonen has spent two decades building her dream. After years of working in Rovaniemi's hospitality industry, "doing everything from cleaning rooms to managing them," she laughs – Margit decided to open her own boutique lodge in Kilpisjärvi with her husband Ville. "My husband had a dream of having a bed and breakfast next to the mountains," she says, "and I had a dream to have my own hotel. So, we made a combination of our dreams, and now we have a hotel next to the mountain."

The 'boutique and experience hotel' located 400 kilometres above the Arctic

> “Every small change here means something big.”
>
> – Hannu Autto, Service Manager, Kilpisjärvi Biological Station.

Circle, thrives on the beauty of the seasons: the northern lights in winter and midnight sun in summer. But both, she notes, are changing. “Winters have become less stable,” she explains. “The snow used to come like clockwork. Now it might melt in February and freeze again the next day. For tourism, that’s very hard.”

Through the MountResilience project, Margit and her husband Ville participated in the PPGIS mapping exercise, identifying how climate variability could affect their business. “We started looking at how to make tourism more year-round. Adaptation for us means finding new ways to keep people coming, even if the snow doesn’t,” she says. “It’s also important to keep cross border operations and collaboration strong. At the moment we collaborate closely with Norway’s Lyngenfjord region, and we also work together with local businesses to boost the shoulder seasons.”

Her perspective aligns with that of Nina Forsell, Executive Director of the Finnish Lapland Tourist Board (LME), which represents hundreds of tourism companies across the region. Nina helped design adaptation training for pilot businesses through MountResilience. “Our role is to gather knowledge and make it practical,” Forsell explains. “We meet with local people – not only those working in tourism, but others in the community as well – and talk through the changes they see, the signals they’re noticing. We bring that practical knowledge together with scientific information and then try to make it easy to use.”

LME is now working with 10 pilot companies in Utsjoki and Enontekiö, guiding them through adaptation training and helping each business develop its own adaptation plan. “Based on those pilots, we’ll refine the model so it can be scaled and used more widely,” she adds. “In tourism, there has been a lot of work on sustainability, but very little on adaptation planning. That’s the gap we’re trying to fill.”



5

Tradition at the edge of change

The next morning, frost glitters across the tundra road leading to the Tornensis reindeer farm, where father and son, Lars Aslak and Juha Tornensis give tours and explain their culture to visitors. The Tornensis family are Sámi – the Indigenous people of northern Lapland – who also live in parts of northern Sweden, Norway, Finland and Russia. Their livelihood depends on the landscape's delicate balance.

"We are more at the mercy of nature than people in the south," Lars Aslak says. "They have fields; we have snow."

Kilpisjärvi's Sámis have lived in this region for centuries, long before non-Sámi settlers arrived in the 1970s. The Tornensis family, whose name was Latinised generations ago, trace their roots in the area back over 500 years. Today, only two Sámi families live in the village, and Northern Sámi remains their mother tongue.

Reindeer herding is only one part of Sámi livelihood traditions, alongside hunting, gathering, and fishing. Yet herding remains deeply symbolic, a link between culture and survival. "We have adapted to climate change for hundreds of years," Lars Aslak says. "But now the seasons are different. The reindeer need more food, and it costs more to keep them alive."

The changing conditions have also altered customs. Herders now slaughter younger reindeer for meat because it is more tender and more marketable – a departure from tradition, where only older reindeer were eaten to allow them to live longer. "It feels wrong," Juha Tornensis acknowledges, "but sometimes there is no choice."



6



7

> "We are more at the mercy of nature than people in the south. They have fields; we have snow."
>
> – Lars Aslak, Sami reindeer herder.



8

Icy rain and unstable snow make it harder for the herds to find food or even stay upright. “They slip, they fall,” Lars Aslak says. “Some calves are orphaned when their mothers wander away.”

Reindeer may starve in such challenging climate conditions unless fed by hand, a costly effort for small herding families. “In Norway and Sweden, the government helps with feeding costs,” Lars Aslak explains. “In Finland, it’s different. We try to get the same system, but politics always gets in the way.”

The PPGIS survey confirmed that this is no isolated problem: respondents across Lapland reported difficulties for herders, declining grazing areas, and a general sense that “nothing grows in the swamps anymore.”

Lars Aslak, representing a younger generation of herders, says technology has changed their way of life. “My grandfather lived in the forest all winter,” he says. “Now we go home every day. GPS and snowmobiles make that possible.” But he adds that modern tools can’t preserve tradition alone. “People don’t know what reindeer herding means anymore. It’s not a job. It’s who we are.”

Changing forests, drying lands

The PPGIS data also reveal broader ecological shifts that are reshaping Lapland’s environment. As snowmelt accelerates, the tundra is developing palsa mires, waterlogged hollows where the ground used to stay frozen. These “wet holes” make pastures unstable and change the migration routes of reindeer.

At the same time, forestation is advancing into areas once too cold for trees, with hardy birch species beginning to grow where only mosses once survived. The expansion alters the tundra’s fragile ecosystem, forcing both wildlife and herders to adapt.

Forest lines are moving north, as pine and aspen gradually spread into formerly treeless fell areas. This brings new pressures for reindeer herding, tourism, and biodiversity. Warmer winters have allowed moth outbreaks to survive and expand, damaging mountain birches and altering habitats for birds and insects.

Meanwhile, residents report drought conditions that have lowered river levels, reduced salmon runs, and dried up traditional fishing and berry-picking areas. “There is no groundwater – the well dried up,” one participant noted. These patterns align with scientific data from Kilpisjärvi, where warming and drying trends have intensified over the past decade.

Together, these findings paint a picture of a landscape under stress but also of communities observing and responding in real time.

For Lindell, these steps show that adaptation is as much institutional as environmental. “It’s about making sure that climate considerations aren’t a side project,” she says. “They have to be part of how municipalities plan, budget, and communicate.”

Living with change

By connecting local voices, scientific data, and municipal planning, MountResilience is turning Lapland into a living laboratory for adaptation. It’s not a story of crisis, but of experimentation – of communities testing what works and adjusting what doesn’t.

“Adaptation is proactive, not reactive,” Lindell says. “It’s cheaper and more effective to plan ahead.”

In practice, that means building partnerships across sectors – scientists and herders, hoteliers and government officials – and developing shared ownership over the process. “The most powerful thing,” Autto reflects, “is seeing science, local wisdom, and entrepreneurship sitting at the same table.”

As the Arctic light softens over Kilpisjärvi and the Saana fell glows orange in the evening, it’s clear that adaptation here is not a distant policy goal but a daily act of resilience.

“Here,” says Margit Eskonen, “we learn to live with change, not fight it.”

Lapland’s communities are demonstrating that even in a rapidly warming landscape, hope lies not in permanence, but in participation. In that sense, adaptation is less about surviving the future, and more about shaping it together.

1. A view of Lake Kilpisjärvi.
2. Saana mountain, near the village of Kilpisjärvi, in the far northwest corner of Finnish Lapland, surrounded by fall foliage.
3. The MountResilience-developed PPGIS mobile application being used in the field.
4. A view of the Kilpisjärvi Biological Centre and its employee friendly sauna.
5. Margit Eskonen outside her Cahkal Hotel in Kilpisjärvi.
6. A general view over Lake Tsahkal.
7. Reindeer herder Lars-Aslak Tornensis feeding their reindeer at their farm, a tourist attraction showcasing traditional Sámi life.
8. A herd of reindeer watched over by their herder.
9. A detailed view of tundra plantlife.
10. Peat mounds or palsa mires, typical landscapes of the Arctic region.

> “Here, we learn to live with change, not fight it.”
>
> – Margit Eskonen, owner of Cahkal Hotel.



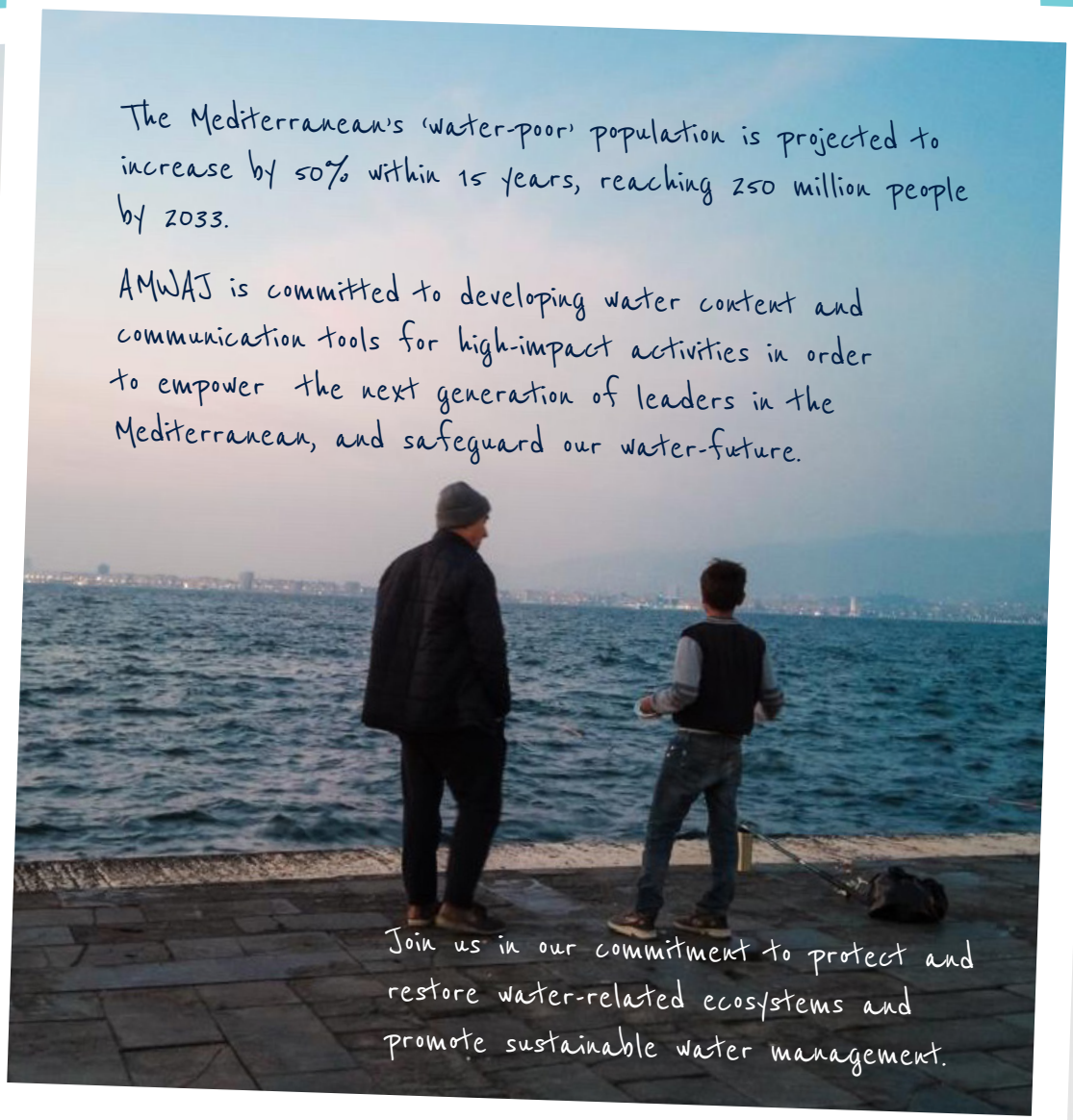
9



10

AMWAJ أمـــواج

Valuing Mediterranean Ecosystems



A view of the Aegean Sea in Izmir, Türkiye.

Photo: Emin Yigit Koyuncuoglu/ REVOLVE

Follow @AMWAJAlliance on

an initiative by

REVOLVE



VIEWS

The Price of Roses

WORDS: **GIOVANNY JARAMILLO ROJAS, BERNAT MARRÈ COSTA, AND SANTIAGO ROSERO**
PHOTOGRAPHY: **BERNAT MARRÈ COSTA, IRINA DAMBRUASKAS, BERTA VICENTE SALAS, AND DAHIAN CIFUENTES**

How offshoring and inequality sustain the global trade

Each morning, Royal FloraHolland wakes like a transit station. Millions of flowers arrive from all corners of the world, claimed by intermediaries who set their price without ever handling them. In this kingdom of fleeting beauty, roses still reign. But the Dutch no longer grow what they sell. Since 2000, the area dedicated to rose cultivation has shrunk by over 80%, and more than 90% of growers have disappeared. The Netherlands has become a logistical hub. An invisible link between the hands that cut and the hands that celebrate. The profit stays in Europe; the labour is outsourced.

On the shores of Lake Naivasha, under the equatorial sun and behind fences guarded by private security, Kenya blooms year-round. An endless patchwork of greenhouses stretches along the water. The altitude, the light, the water, everything is perfect. But so are the conditions for something else: cheap labor, weak protections, and silence. Here, floriculture is both a promise and a trap. Temporary contracts, low wages, exposure to toxic agrochemicals. “Modern slavery,” a local activist calls it. “The narrative of European aid,” warns Africa Justice Tax, “can become a façade – Europe captures the value, while countries like Kenya are left absorbing the costs.”

Catalonia once grew its own roses. Today, the last remaining grower, Joan Pons, harvests just a fraction of the millions of stems sold during Sant Jordi, a national holiday now dominated by imports from Ecuador and Colombia. In Tabacundo (Ecuador), workers handle up to five million stems a day. They earn less than the cost of the basic food basket, while chronic exposure to pesticides has been linked to respiratory and reproductive disorders, skin damage, and various forms of cancer. “It’s a hidden slavery,” says Marcia, a former supervisor turned labour organiser after suffering a stroke.

In Colombia, the second-largest flower exporter after the Netherlands, the situation echoes: exhausting shifts, chemical burns, and outsourcing practices that reduce labor protections. Over 65% of workers are women, many of them with temporary contracts that limit access to healthcare or pensions. During peak seasons like Valentine’s Day, companies bring in hundreds of workers – including Indigenous Wayuu migrants – who are housed in overcrowded shipping containers. A bouquet sold for €300 in Paris may cost less than €3 to produce in Cundinamarca. The difference is absorbed by the workers’ bodies and communities ●

This VIEWS has been adapted from an in-depth report by Revista Late, featuring writing by Giovanny Jaramillo Rojas, Bernat Marrè Costa, and Santiago Rosero.

This investigation was made possible thanks to the support of Journalismfund Europe. It was carried out in collaboration with journalists Oyunga Pala (Netherlands) and Darius Okolla (Kenya).

Journalismfund Europe
Strengthening democracy

Cover: Segundo Fernández arranges roses grown on his land in San Juan Loma, near Tabacundo, Ecuador. Since the COVID-19 pandemic he and his wife have dedicated themselves to growing flowers. Photo: Irina Dambrauskas

Above: Electric carts loaded with flowers traverse the corridors of Royal FloraHolland in Aalsmeer, the world's largest cut flower market. Photo: Bernat Marrè Costa
Below: The hands of Segundo Fernández hold a bouquet of freshly harvested roses at his San Juan Loma plantation, Ecuador. Photo: Irina Dambrauskas



View of Marjoland's greenhouses in Waddinxveen: a continuous 20-hectare complex that makes it the largest rose nursery in Europe. Photo: Bernat Marrè Costa







Above: Joan Pons, third-generation farmer in Santa Susanna, keeps Catalonia's last rose nursery alive. Photo: Berta Vicente Salas **Below:** In the 1970s, Catalonia produced 80% of roses for the traditional Sant Jordi festival in the region; Flors Pons supplied 20,000 of the roughly seven million stems sold during the holiday in April 2025, with most coming from Colombia, Ecuador, and the Netherlands. Photo: Berta Vicente Salas





Above: A woman carries roses to her street stall in downtown Bogotá. At the end of the floriculture chain, informal workers survive by reselling flowers that never reach international markets. A symbol of inequality stretching from the greenhouses to the city streets. Bogotá, Colombia. Photo: Dahian Cifuentes. **Below:** Aerial view of rose crops in the Western Savannah. Puente de Piedra village, Madrid, Cundinamarca, Colombia. Photo: Dahian Cifuentes





In front of the gates of one of the largest rose farms in Tabacundo, a fumigator poses with his protective gear. Constant exposure to pesticides in the floriculture sector is linked to respiratory diseases, cancer and neurological disorders, according to scientific studies. Photo: Irina Dambrauskas

Above: Clara, 51, has been packing roses for sale in Bogotá for 12 years. Chía, Cundinamarca, Colombia. Photo: Dahian Cifuentes
Below: Rosa Vera (who requested anonymity) holds a rose grown in the western savannah of Bogotá, Colombia. She says she suffers physically after 30 years of uninterrupted work. Photo: Dahian Cifuentes



Above: Alba Gallego, 58, is former rose farm worker in the western savannah of Bogotá who suffers physical ill health from working in the flower industry and faced paramilitary threats for her union activity. Photo: Dahian Cifuentes
Below: A bouquet of 24 stems grown in the Bogotá savannah can cost around Col$50,000 (11€) on the local market. A pittance compared to cities such as New York, Madrid or Paris, where stems can sell for as much as 15€ each. Photo: Dahian Cifuentes







Marcia Lema, 58, founded Pichincha Flower Workers Association (ASOTFLORPI) after witnessing the poor working conditions in the growing industry, turning her experience as a flower worker into a fight for labor rights in Tabacundo. At 50 she earned a law degree to defend her colleagues. Photo: Irina Dambrauskas



Daniel van den Nouweland, head of Marjoland in Waddinxveen, continues the family tradition begun in 1978. Floriculture is an important industry in the Netherlands, despite the shift towards overseas cultivation.
Photo: Bernat Marrè Costa





A bouquet of Explorer roses, one of the most-sought after in the Russian market, in Tabacundo, Ecuador. Photo: Irina Dambrauskas

8TH - 9TH JANUARY 2026

OXFORD REAL FARMING CONFERENCE

Scan to find out more!

JOIN US IN-PERSON OR ONLINE FOR TWO FULL DAYS OF TALKS AND WORKSHOPS, FEATURING 150+ SESSIONS INCLUDING TOPICS SUCH AS:

INDIGENOUS WISDOM • PLASTIC-FREE AGRICULTURE • SEED SOVEREIGNTY • COUNTERING INDUSTRIAL AGRICULTURE • CLIMATE CHANGE CROPS • THE GREAT GLYPHOSATE DEBATE • SAVING POISONED WATERWAYS • ANTI-FASCIST FARMING • LANDWORKER SOLIDARITY • FOSSIL-FUEL-FREE FARMING • NEW ECONOMIES FOR AGROECOLOGY • FOOD SYSTEMS DECOLONISATION • RIGHTS OF NATURE • CULTIVATING HEALTHY, LIVING SOILS

LET'S TRANSFORM OUR FOOD AND FARMING SYSTEM TOGETHER

WITH SPEAKERS INCLUDING:

ALI ANDERSON • AMY-JANE BEER • ANNA LAPPÉ • CHRIS SMAJE • FUAD ABU SAIF • JENNIFER CLAPP • JYOTI FERNANDES • KAPKA KASSABOVA • KATE RAWORTH • LYLA JUNE • MICHAEL ANTONIOU • PANIA NEWTON • ROSINAH MBENYA • RUPA MARYA • SATISH KUMAR

BOOK NOW: ORFC.ORG.UK



Bubbles to Biofuel: Decarbonising Road Transport

WRITER: **TOM LOVETT**



1

Decarbonising road transport requires collaboration, diversified solutions, and innovation for a fair and effective transition across Europe.

Picture the scene: it's an early winter evening and you're settling in for a cosy night at home. You grab a bottle of Rioja from the shop to pair with your nut roast. Just because you're treating yourself doesn't mean you can't be sustainable, right? You've chosen wine from an ecological vineyard in Spain, and most of your meal is made from locally sourced produce.

But all this food and drink had to reach you somehow – and that journey was almost certainly by road. Most of our everyday necessities, whether from the supermarket or the local deli, spend part of their journey on a Heavy-Duty Vehicle (HDV). Road freight transport alone is responsible for around one-fifth of Europe's transport-related greenhouse gas emissions (GHGs), according to the Smart Freight Centre in a 2021 report. To meet the EU's ambitious net-zero target by 2050, this sector needs to move away from fossil fuels, and fast.

The good news? That same wine you're enjoying is part of a small but growing group of innovations helping to transform how we fuel road transport. Through collaboration and circular thinking, wineries are turning their own fermentation CO_2 into clean, renewable fuel – closing the loop between what we drink and how we deliver it.

EU's decarbonisation ambition off track for transport

The European Union has pledged to achieve climate neutrality by 2050, in line with the 2015 Paris Agreement. In some areas, progress is encouraging. The energy sector – which, according to the European Commission accounts for more than 75% of the EU's total greenhouse gas emissions – is undergoing rapid transformation. The bloc aims to raise the share of renewables to at least 42.5% by 2030, and State of the Energy Union Report 2025 published by the European Commission in November shows the clean energy transition gaining pace, with emissions falling 2.5% in 2024 compared to 2023.



2



3

Yet one major sector remains stubbornly reliant on fossil fuels: road transport. HDVs carry about 75% of all freight transported over land in the EU, according to the European Automobile Manufacturers' Association (ACEA), and they run almost entirely on high-energy fossil fuels such as diesel, petrol, and gas. In 2023, 96.4% of all EU trucks used diesel, while only 0.1% were zero-emission.

The Renewable Energy Directive III (RED III) is part of the EU's Fit for 55 package – a set of policies designed to cut greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. RED III requires each EU country to either cut the greenhouse gas intensity of transport fuels by 14.5% or ensure that 29% of energy used in transport comes from renewable sources by 2030.

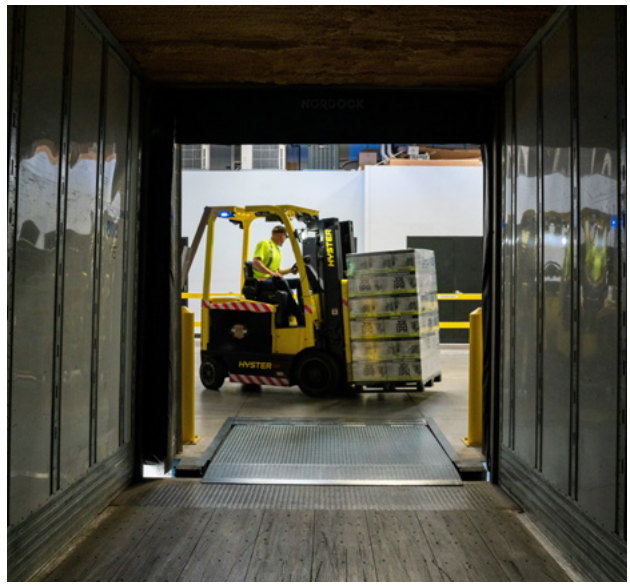
Biofuels, produced from organic materials such as corn, sugar beet, or soy, offer another alternative to fossil fuels. Their key advantage is compatibility – blends of bioethanol and biodiesel (such as E10 or B20) can run in most existing engines, pipelines, and fuel stations without major modifications. However, these so-called first-generation biofuels have been capped at 7% of the energy used in transport under RED III, due to concerns over competition with food production and land-use change. An investigation in Brazil by Reuters revealed cases of deforestation directly linked to corn-ethanol production.

So-called first-generation biofuels have been capped at 7% of the energy used in transport under RED III, due to concerns over competition with food production and land-use change.

RED III stipulates that at least 5.5% of transport energy must come from advanced biofuels – fuels made from waste and residue feedstocks rather than food crops – and renewable fuels of non-biological origin (RFNBOs), such as hydrogen-based fuels produced using renewable electricity, with at least 1% specifically from the latter.



4



5

Road transport's heavy reliance on fossil fuels makes it a "hard-to-abate" sector – one of several industries, along with aviation, shipping, steel, and cement, that according to a 2024 report from the International Renewable Energy Agency (IRENA), none of these sectors are currently on track to reach net-zero emissions by 2050.

Transport vehicles moving goods across Europe and globally account for nearly one-quarter of all transport-related CO_2. To meet the EU's 2030 climate targets, the region would need to have around 400,000 zero-emission trucks on the road by the end of the decade – meaning one in three new trucks sold each year must be zero-emission, according to the ACEA.

But with freight demand expected to grow 47% between 2015 and 2050, transforming this sector is proving to be one of Europe's toughest challenges.

Can't we just electrify?

In theory, electrifying heavy-duty road transport promises cleaner air and lower operating costs. The EU's 2035 ban on internal combustion engines for cars and vans is a major step towards encouraging electrification across road transport. Some countries have gone further to incentivise freight electrification. The Netherlands, for example, will introduce a Heavy Goods Vehicles charge in 2026 that gives electric trucks a significantly lower rate than diesel trucks, creating a clear incentive to switch to cleaner vehicles.

But opponents say that the move towards electrification is going too fast, too quickly. Dariusz Joński, Polish MEP and a member of the European Parliament's Committee on Transport and Tourism, put to an audience at the June 2025 event Decarbonising EU Road Transport: Solutions for 2030 and Beyond, organised by the International Road Transport Union: "The infrastructure isn't ready right now. How can we push for electrification when large parts of Europe don't even have basic charging infrastructure?"

ACEA data supports this concern: Europe currently has only about 1,100 public charging points powerful enough (350 kW or above) for heavy-duty trucks. Meeting 2030 needs would require around 50,000 chargers, including 35,000 Megawatt Charging System units.

To overcome this, EU Commissioner for Transport and Tourism Apostolos Tzitzikostas unveiled the Clean Transport Corridor Initiative in September 2025, aimed at speeding up the rollout of recharging infrastructure for heavy-duty vehicles along major freight routes, including the Scandinavian–Mediterranean and North Sea–Baltic corridors.

Combined with the EU Greening Corporate Fleets initiative, which targets the decarbonisation of company-owned vehicles – including freight vehicles – these measures form a coordinated effort to build the backbone of Europe's clean transport network and drive the transition toward zero-emission mobility.

Hydrogen fuel cells offer another route to decarbonisation. Vehicles can cover long distances and refuel in minutes, making them ideal for heavy-duty freight

where battery-electric options struggle with range and charging time. However, high renewable hydrogen costs, limited refuelling infrastructure, and costly fleet overhauls remain major challenges.

Critics caution that the deployment for decarbonisation remains uneven across member states: “We’re going to fight hard against the EU proposal for one-size-fits all rules on green corporate fleets,” stated Joński. “This may work in Rotterdam, maybe in Copenhagen, but not in Białystok, my city in Poland”.

In an October 2025 letter to EU leaders, European Commission President Ursula von der Leyen sought to reassure industry by pledging to accelerate the review of vehicle CO_2 standards and emphasising technological neutrality. She specifically noted that the Commission was assessing the role of zero-emission and low-carbon fuels, including advanced biofuels, in the transition to zero-emission road transport beyond 2030. Von der Leyen stressed that the EU’s shift toward climate neutrality and circularity requires “a combination of ambition, speed, pragmatism and flexibility.”

Such pragmatism is essential in a sector as fragmented as road freight: Europe has more than half a million haulage operators, 99% employing fewer than 50 people, according to the Smart Freight Centre. For these businesses, the upfront cost of new technologies, new maintenance skills, and uncertainties around charging or refuelling availability pose real operational risks.

The challenge is to develop fuels that are renewable, truly sustainable, and compatible with existing infrastructure – bridging the road toward full decarbonisation of the transport sector.

From bubbles to alternative biofuels

Stepping inside the Viñas del Vero bodega feels like entering any modern winery at harvest time. Tall stainless-steel tanks line the hall, each quietly alive with fermenting grape must. The air is rich with the scent of yeast and fruit. But here, unlike most wineries – where the CO_2 produced during fermentation simply escapes into the air – a network of pipes weaves between tanks, capturing it instead.

Set in the foothills of the Pyrenees in Huesca, Spain, Viñas del Vero is part of González Byass, a fifth-generation family company with nearly two centuries of winemaking history. The multinational group operates in Spain, Chile, and Mexico, managing around 2,000 hectares of vineyards, with the



6

same amount cultivated by associated growers. González Byass sells its wines in more than 120 countries.

Since 2013, the winery has measured its carbon and water footprint across all scopes. Based on those results, it has set ambitious targets: a 55% emissions reduction by 2030 and net-zero by 2050. To reach these goals, Viñas del Vero is investing in renewable energy, sustainable mobility, efficient water use, sensor-based monitoring, and regenerative viticulture.

"After studying our carbon footprint, we found that nearly 60% of our direct emissions are biogenic, meaning they come from fermenting grapes." José María Ayuso Rodríguez, Manager of Vineyards and Projects at González Byass, told REVOLVE. "We quickly realised we could turn this problem into an opportunity."

The process starts by capturing the CO_2 that naturally bubbles out as grapes ferment. The gas is then cleaned, compressed, and stored safely for reuse. Around 30% of the captured biogenic CO_2 is put straight back to work within the winery – filling tanks and pipes to keep oxygen from spoiling the wine, moving grape juice between vessels, cooling grapes during processing, cleaning equipment, balancing water acidity, and even fine-tuning alcohol levels. It's a closed loop that makes the winemaking process more efficient and circular.

The remaining 70% is being transformed into a feedstock for renewable fuels of non-biological origin (RFNBOs) under the EU-funded FUELPHORIA project. Here, CO_2 from fermentation is combined with green hydrogen to create synthetic methane – a carbon-neutral gas that could eventually fuel freight vehicles in the form of compressed natural gas (CNG) or even heat buildings.



7

FUELPHORIA brings together demonstration projects across Europe to produce advanced biofuels and RFNBOs from a range of feedstocks. In one case, organic urban waste is converted into ethanol and methanol for use in road transport. In another, a biogas plant uses microorganisms such as algae to produce biodiesel. The overarching goal is to build sustainable value chains for advanced biofuels and RFNBOs by connecting feedstock suppliers, technology providers, and end-users.

"Each demonstration faces its own challenges – from feedstock quality to hydrogen availability," Kostis Atsonios, FUELPHORIA's Project Coordinator told REVOLVE. "The biggest barrier is making these processes both technically feasible and economically viable at full scale."

For González Byass, this work builds on a decade of clean-energy innovation. Since 2014, the company has been producing green hydrogen – hydrogen made through the electrolysis of water powered by renewable electricity – as part of a LIFE Rewind Project, which installed Spain's first privately owned hydrogen refuelling station.

One of the greatest challenges for advanced biofuels and RNFBOs is consistency. "Working with waste means working with uncertainty," said Atsonios. "You never get the same composition twice – different branches, different prunings, different plants. Stability in feedstock quality is one of the toughest technical hurdles."

This year, Viñas del Vero captured around 17 tonnes of CO_2, purified it to 99.95% purity, and compressed and stored 40,000 litres at high pressure – ready for reuse or conversion into methane. The project is done in close collaboration with the University of Rovira i Virgili, Tarragona, and CIRCE, a Zaragoza-based technology centre developing sustainable energy solutions.



8

1. Reaching Europe's Net-Zero goals while keeping heavy-duty vehicles on the road is a complex challenge that requires collaboration and innovation. Photo: Tima Ilasov / Unsplash
2. Most everyday goods spend part of their journey on a heavy-duty vehicle, making road transport essential to modern life. But the sector is lagging far behind net zero targets. Photo: Lucas van Oort / Unsplash
3. Biofuels produced by crops such as corn have been capped due to concerns over competition with food production and land-use change. Photo: Wolfgang Weiser / Unsplash
4. Decarbonising transport remains challenging due to limited charging infrastructure across Europe and the high costs of replacing existing trucks. Photo: Fiona Frommelt / Unsplash
5. The vast majority of road freight companies are small operators, and the challenges of adopting new technologies pose significant operational risks. Photo: Elevate / Unsplash
6. Viñas del Vero is a Spanish winery committed to sustainability and a pioneer in circular energy production. Photo: Viñas del Vero
7. The CO_2 released during grape fermentation is being used onsite and transformed into a feedstock for renewable fuels of non-biological origin as part of the FUELPHORIA project. Photo: FUELPHORIA
8. Spain is home to more than 4,000 wineries, offering vast potential to scale this technology across the country. Photo: Helena Lopes / Pexels

The first production of methane is set to begin soon, and José María is optimistic. "We are just one winery – there are 4,000 in Spain. If we manage to encourage some of those other 4,000 to join in because they see that it's possible, then that would be a major achievement."

Road transport is an industry that affects all of us, and progress will depend on collaboration. Producers, policymakers, industries, and communities must work together to scale what works, share what is learned, and bring all of Europe along in a fair transition of decarbonisation. As José María told REVOLVE, "if you want to go fast, go alone; but if you want to go far, go together."

The tricky road to decarbonisation

The road transport sector is complex – and so is decarbonising it. There is no single pathway to clean mobility. Electrification, hydrogen, and renewable fuels each have a role to play, complementing one another across regions, vehicle types, and infrastructure realities. Renewable methane made from grape fermentation will not replace fossil fuels overnight, or alone, but it offers a glimpse of what is possible: turning waste into energy, cutting emissions, and providing practical, transitional solutions that work with the systems we already have.

> "If you want to go fast, go alone; but if you want to go far, go together."
>
> José María Ayuso Rodríguez, Manager of Vineyards and Projects at González Byass.



Redefining Beauty in the Built Environment

WRITER: **ASYA AL MARHUBI**



1

A sustainable economy depends on an aesthetic revolution valuing resilience and beautiful imperfection over pristine newness.

Despite the dominance of the "make-take-dispose" culture embedded in our global economy, society has a long history of making do with what we have. In traditional Japanese culture, the necessity of extending an object's life is elevated through *Wabi-Sabi*, a philosophy that finds beauty in imperfection, impermanence, and age, brought to life by the practice of *Kintsugi*. Literally translated to gold joinery, the practice takes broken pottery and doesn't just repair the item, it transforms it using a special lacquer mixed with gold dust. By drawing attention to the mend with this precious material, creates beauty out of an apparent imperfection, instead of concealing it: turning something into beautiful because of its flaws instead of despite them.

This mindset, common before the age of mass production, is now a philosophical blueprint for circular design. Historically, objects were built to last: furniture relied on durable, separable joints (dowels or dovetail joints instead of glue) ensuring the components could be repaired or maintained by a local craftsman. Consumers expected objects to last and to be repaired.

Today's linear take-make-dispose model is a stark contrast to the philosophy of *Wabi-Sabi*: when something shows signs of age or imperfection, it's time for it to be replaced with something new, driving a continuous demand for virgin resources. According to the 2024 Global Resource Outlook, an annual report developed by the United Nations Environmental Programme and International Resources Panel, the extraction of the Earth's natural resources has tripled over the last 50 years.

Linear economy versus planet(ary limits)

This endless demand for new resources comes with a complementary waste problem. Beyond the sheer tonnage of material waste – which, according to a study published in 2022, could reach up to 49 billion tonnes by 2050 under a business-as-usual scenario – the hidden environmental costs are immense.



2

In terms of land use, the true scale of the problem is hard to define, with estimates for the total number of landfills worldwide ranging between 10,000-100,000. When it comes to scale, the Fresh Kills Landfill in Staten Island, New York, takes home the dubious honour of being the Guiness World Record holder for the largest refuse tip, covering 12 km^2 – the equivalent of over 2,200 American football fields. From there, we need to also consider to the methane emissions, which have become the third largest source of methane emissions globally, according to a 2025 study published in Nature Climate Change, as well as water and soil pollution and the global ocean plastic pollution crisis.

Rethinking value, and rebranding waste

The circular economy is an alternative model designed to decouple economic growth economic growth from resource consumption by finding ways to keep products and materials at their highest value for a as long as possible. In doing so, it reduces pressure on natural resources and reduces waste by turning it into new materials instead of pollution and emissions.

The concept of material circularity is not new: industrial researchers began discussing turning waste or by-products into resources in the 1940s. However, it's only now gaining real momentum. A 2024 study from UNIDO and Chatham House shows just how fast things are moving: out of the 75 national circular economy roadmaps/calls to action/strategies that have been launched since 1999, a staggering 71 of them since 2016.

What is the 9R framework?

Despite its name, the framework includes a total of ten Rs (R0-R9), with R0 calling for the refusal of unnecessary consumption. The following nine Rs offer a hierarchy that ensures materials are maintained at their highest value for as long as possible, prioritising actions with the highest value retention.

R0 **Refuse**
R1 **Rethink**
R2 **Reduce**
R9 **Recover**
R3 **Reuse**
R8 **Recycle**
R4 **Repair**
R7 **Repurpose**
R6 **Remanufacture**
R5 **Refurbish**

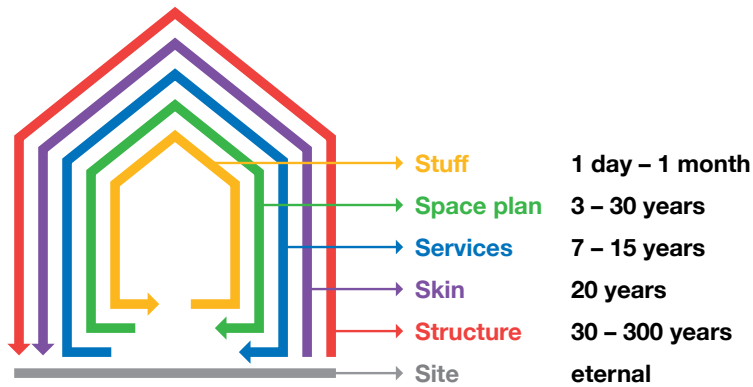
The technical roadmap: the 9R framework for a circular economy

To put circular economy into action, the 9Rs framework, proposed by Potting et al. in 2017, offers a clear roadmap, albeit not an easy one. The framework proposes a hierarchy that ensures materials are maintained at their highest value, with R0 representing maximum value retention, and R9 the lowest.

The framework begins with the most impactful actions: Refuse (R0), Rethink (R1), and Reduce (R2), which focus on smarter product use and manufacture. R0 is about rejecting unnecessary consumption entirely, while R1proposes a complete rethink of the need for outright ownership in favour of sharing or leasing in a Product-as-a-Service (PaaS) models. PaaS models incentivise designing for durability and repair as the manufacturer retains ownership and responsibility for the product throughout its life (e.g. leasing lighting systems, or appliances). R2, refers use fewer resources to make a given product, or replacing them with non-virgin materials.

In the middle tiers (R3 through R7), we have actions that extend a product or material's lifespan, through reuse, repair, refurbishment, remanufacturing, and repurposing. The final two, Recycle (R8) and Recover (R9), are concerned with the useful application of materials, with energy recovery through incineration as the last resort.

However, for the most impactful suite R - first two tiers of this technical framework - a massive cultural change is required. R0 and R1 challenge our relationship with consumption, and for key middle tier R-steps to succeed we have to move away from the linear aesthetic to a circular one, in which a seamless pristine condition is not a prerequisite to beauty.



3

A new aesthetic of permanence and change

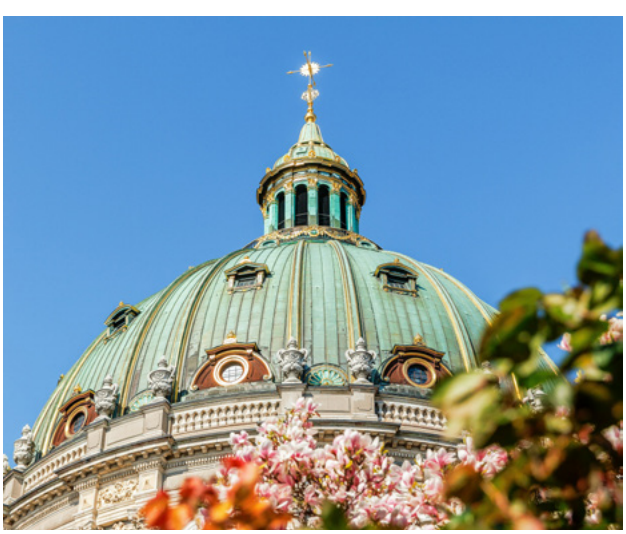
In the field of architecture and construction, this aesthetic change is essential. The global built area is expected to double by 2060, according to Architecture 360, and given our annual extraction rate is already well above what the planet can safely provide us, we need to find ways to build that do not require new resources.

Technical innovations in circular materials are providing opportunities to replace virgin materials with high quality Secondary Resource Materials (SRMs), such as the EU-funded ICARUS project which is piloting new recycling and upcycling methods for construction. However, taking the 9R framework to heart means we also need to aim higher on the ladder to and rethink how we build in the first place.

Designing for disassembly

Designing for Disassembly (DfD) is a core principle for operationalising material circularity in the construction sector. DfD changes how we view our buildings, from a structure destined for demolition after its useful life is over, to flexible "material banks" - a concept popularised by the EU-Project Building's as Material Banks - full of valuable components that can be easily accessed and removed.

DfD is rooted in the understanding that not all parts of a building age equally. Architect Frank Duffy first introduced the concept of "Shearing Layers", which separates a building into different layers characterised by their longevity. The concept was later elaborated upon by Stewart Brand in his popular book "How Building's Learn: What Happens After They're Built," to define six layers: site, structure, skin, services, space plan, and stuff.



4



5

In viewing building through this lens, we can see exactly why DfD is necessary. Maintaining the maximum material value requires fast-changing layers be easily detachable and replaceable without compromising the slow-changing ones. This means favouring non-destructive reversible mechanical connections so that the structure to adapt to changing needs, be it updating the "skin" to optimise for energy efficiency, or removing the space plan to repurpose a commercial building for residential use.

DfD works by relying on modularity and reversibility favouring mechanical connections (dovetail joints, bolts, clips, demountable footings) instead of permanent ones (welding, glue, poured concrete, glue). In doing so, it ensures both that the components can be accessed and taken apart easily as well as preventing damage to the materials and preserving their quality so that they may enter the next stage of their 9R journey.

The circular aesthetic

This technical necessity creates a whole new aesthetic, one of resilience and adaptability. It means embracing patina, the natural changes that materials undergo over time such as copper turning green or wood weathering grey, as well as the markers of a structure's adaptability, like visible steel connectors. The beauty lies not in the fixed form, but in its potential for change, to be reconfigured, or disassembled its components used in novel ways elsewhere.

This aesthetic flies in the face of the modern pursuit of flawless, pristine surfaces and the linear economy's perpetual demand for newness. Instead, it champions an aesthetic rooted in *Wabi-Sabi* – in finding beauty in impermanence and imperfection. The building's beauty is in its proven longevity and visible history of adaptation, not it's immaculate condition.

The beauty lies not in the fixed form, but in its potential for change, to be reconfigured, or disassembled its components used in novel ways elsewhere.

Examples of this can be seen in projects across the globe: using weathering steel which oxidises to a stable protective layer or featuring reclaimed timber and exposed connectors to make the structures modularity and material history a central feature of the design.

Much like Kintsugi, these design approaches proudly share the history of an object, celebrating the visible changes and joints, and the meaning behind them. Beautiful because, not because despite.

The golden seam: beauty in resilience

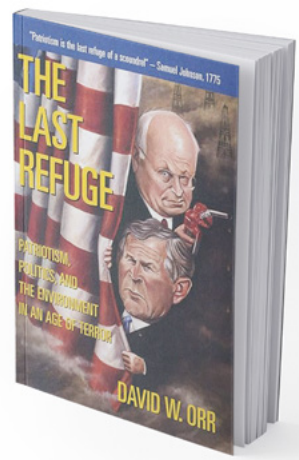
Ultimately, the success of a truly circular economy for the construction section depends on simultaneous cultivating a compelling circular aesthetic that celebrates a material's life story and longevity.

And here lies the opportunity: objects that use reused materials have a unique, traceable history that new materials simply lack. When designers highlight the origins and journey of these materials, they elevate "reused" (or any of the Rs for that matter) into a premium design feature that appeals directly to consumers desires for something unique and meaningful.

The circular economy is an invitation to architects, designers and consumer alike to embrace a new form of beauty. In a world where every patch of patina, visible bolt serves as a gold-lined symbol of adaptation, affirming that beauty is not found in the seamless and new, but in the story of resilience and endurance.

1. Kintsugi is a traditional Japanese practice that uses a special lacquer mixed with gold dust to repair broken pottery. Photo: Riho Kitagawa / Unsplash
2. Dovetail joints are a type of reversible wood joinery known for interlocking sections that start narrow and fan out, like a dovetail. Photo: Walter Frehner / Unsplash
3. The Shearing Layers concept divides a building into six layers based on their lifespans. Source: Davis, Annette. 2022. "Design for disassembly in housing: the need to adapt LCA to shearing layers."
4. Patina refers to the natural changes to a material due to age, weather, or chemical reactions, such as the brilliant green of oxidised copper. Photo: Heino Eisner
5. Exposed bolts connection steel beams. Photo: Tartezy / Tartezy Images via Canva

Climate Warnings from the Recent Past



REVIEWED BY **HOLLIE FISHER**

The Last Refuge: Patriotism, Politics, and the Environment in an Age of Terror
David W. Orr
Island Press, 2004.
172 pages.

Two decades after its publication, The Last Refuge: Patriotism, Politics, and the Environment in an Age of Terror reads with an unsettling freshness.

It is remarkable that a book written in the early 2000s still speaks so directly to the political and ecological crises of today. In The Last Refuge: Patriotism, Politics, and the Environment in an Age of Terror, David W. Orr warned about governmental neglect, public apathy, and the manipulation of truth in environmental discourse. These concerns have only grown louder in our modern era of polarisation and climate denial.

As a prominent environmentalist and scholar, Orr opens with a sharp critique of American society at the time of its publication. He believed they were entering an era of citizens saturated with media yet strikingly uninformed about politics. It's an observation that feels ripped from today's headlines, as misinformation spreads with viral ease and complex political discourse is reduced to sound bites and outrage.

At the heart of The Last Refuge is Orr's conviction that we do not merely face an environmental crisis – we face a political one. Our democratic institutions have faltered, leaving power concentrated in the hands of a few, often aligned with corporate or ideological interests opposed to environmental progress. The solution to this must be a reconnection of citizens with the political process so they understand their abilities to make a change.

Reading this in 2025, against the backdrop of climate programmes cut under the Trump administration and continuing battles over environmental regulations, it is hard not to see Orr's line of reasoning. The frustrations he voiced then and yet not being heard, echo the despair of climate advocates today. His account of a White House meeting following the attacks of 9/11 where staff listened politely but without interest is painfully familiar to anyone who has tried to advance climate policy in the current hostile political environment.

But there are glimmers of hope throughout the book. Orr frames the work of climate action as "The Great Work." To him, this is a moral, civic, and even patriotic duty akin to the great struggles of past generations, whether against slavery or fascism. He insists that environmentalism must reclaim words like *patriotism* from those who have weaponised them for narrow ends and instead use them to inspire a collective project of building a just and habitable future. "Political reform," he reminds us, "requires an active, engaged, and sometimes enraged citizenry."

The urgency of his call is heightened by his pointed critique of Bjørn Lomborg's The Skeptical Environmentalist, which Orr states as ill-informed and dangerously dismissive of climate science. That book, widely publicised at the time, gave cover to far-right efforts to undermine climate action. Orr's rebuttal remains vital reading, especially in an era when denialism and delay still hold sway in parts of the political establishment. It's

worth asking whether Lomborg's book still circulates widely in American libraries, while, curiously, The Last Refuge itself was stamped as "withdrawn" from the Palo Alto City Library, California, and somehow ended up in a second-hand bookstore in Edinburgh, Scotland, where I picked it up. One cannot help but wonder if such decisions are linked, however indirectly, to the broader roll-back of climate education happening across America thanks to the latest administration.

The Last Refuge is not just a book from the past. It is a summons to the present.

What gives The Last Refuge enduring value is not only its prescience but also its tone. Orr writes with frustration, yes, but also with passion and stubborn hope. His words are less about winning policy arguments than about awakening civic imagination. He acknowledges the difficulty of meaningful change within a system resistant to human progress, but he insists on the necessity of trying.

The vision of "The Great Work" still stands as an invitation. In a fractured environmental movement, in a distracted political culture, and in a world edging closer to climate tipping points, The Last Refuge is not just a book from the past. It is a summons to the present.

revolve.media/between



1. Fridays For Future, 20 September 2019 in Bonn, Germany.
Photo: Mika Baumeister/ Unsplash

1

World Sustainable Energy Days 2026

24 – 27 February 2026
Wels/Austria

ENERGY TRANSITION = ENERGY INDEPENDENCE

Conferences:

- European Energy Efficiency Conference
- European Pellet Conference
- Industrial Energy Transition Conference
- Smart E-Mobility Conference
- Energy Communities Workshop
- Young Energy Researchers Conference

www.wsed.at

OÖ ENERGIESPARVERBAND

upper austria

OÖ Energiesparverband, Linz/Austria, Tel. +43 732-7720-14386, office@esv.or.at, www.wsed.at