Spotlight on Science and Climate: Adaptation, Ecology & Policy

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This curated collection brings together five articles from Science magazine exploring the intersection of climate change, ecology, and human health. As global temperatures rise, the consequences are becoming increasingly visible across interconnected systems: mosquito-borne diseases are expanding into previously unaffected regions of Europe, wetland methane emissions are accelerating feedback loops that scientists are racing to understand and mitigate, and air pollution is now linked to specific neurodegenerative disease pathways. Alongside these environmental pressures, the collection highlights remarkable adaptive strategies in nature — from stinkbugs recruiting fungi to shield their eggs from parasitic wasps, to computational tools redesigning how we target disordered proteins implicated in disease. Together, these articles underscore that navigating climate-driven change demands scientific

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Keywords: Arboviruses; Methanogenesis; Symbiosis; Disordered Proteins; Lewy Body Dementia.

1. Mosquito-borne viruses surge in a warming Europe

By Meredith Wadman

Europe is experiencing a record-breaking season for mosquito-borne diseases, driven largely by an extraordinarily hot summer that has accelerated mosquito propagation and shortened viral incubation periods in insects. France has logged over 300 locally acquired chikungunya cases — a dramatic leap from just 32 cases recorded across the entire 2010–2024 period — with new transmission clusters appearing as far north as Alsace, a region previously considered too cool for such outbreaks. Italy, meanwhile, is grappling with an unprecedented geographic expansion of West Nile virus (WNV), with over 500 cases and 33 deaths reported, concentrated in the densely populated Rome-to-Naples corridor rather than the traditionally affected northern Po Valley. Both developments are attributed to the northward spread of the *Aedes albopictus* mosquito and shifting bird migration patterns linked to climate change. Treatment options remain limited to supportive care, as no approved antivirals exist for either disease and vaccines are either years from approval or clouded by safety concerns. Experts warn that Europe has entered a new phase of endemic mosquito-borne disease risk, and that the U.S., where *Aedes albopictus* has similarly expanded its range, may not be far behind.

This article was previously published in *Science Magazine* on September 11, 2025.

Read the full article here

2. ‘We’re in uncharted waters.’ Hacking swamps could curb methane emissions—but side effects are unclear

By Paul Voosen

This news piece describes how rising global methane emissions, driven in part by warming-fueled increases in wetland methanogenesis, are prompting scientists to explore a cautious form of geoengineering that chemically alters swamps to suppress methane production. The FRAMES (Feedback Research and Action on Methane Emissions) initiative plans to test additives such as sulfate, nitrate, iron, and biochar first in controlled “wetlands in a jar” and then in small field trials, drawing on evidence that sulfate additions in the past (via acid rain and gypsum use in rice paddies) allowed sulfate-reducing microbes to outcompete methanogens and

thereby lowered methane emissions. Researchers emphasize both the potential climate benefits and serious ecological risks, including enhanced methylmercury formation and broader ecosystem disruptions, so proposed interventions would involve intensive baseline characterization and long-term monitoring. Because large-scale chemical treatment of vast wetlands is likely infeasible and undesirable, the article highlights more targeted approaches—such as modifying hydrology, vegetation, or restoration practices—to incorporate methane mitigation into selected, managed wetland projects where additional climate benefits can be realized without compromising wetland conservation goals

This article was previously published in *Science, Volume 389, Issue 6758*, on July 22, 2025.

Read the full article here

3. These stinkbugs coat their eggs in fungi to protect them from parasitic wasps

By Erik Stokstad

The article reports that certain stinkbugs have evolved a defensive symbiosis in which females cultivate fungi on specialized organs in their hind legs and then deliberately smear these fungi onto each newly laid egg, where the fungal hyphae rapidly grow to form a thick physical barrier. Laboratory and field experiments show that parasitic wasps readily attack eggs without this fungal coating but largely avoid or cannot penetrate fungus-covered eggs, indicating that the fungi act as mechanical “bodyguards” rather than producing toxic chemicals. The work reveals that a structure once thought to be a hearing organ is actually a fungal nursery and suggests that this egg-protecting symbiosis likely evolved early in the *Dinidoridae* stinkbug lineage, highlighting an unexpected way insects recruit microbes for defense.

This article was previously published in *Science* on October 16, 2025.

Read the full article here

4. Disorder meets its match

By Alan M. Moses *et al*

This article explains that many key cellular signaling and regulatory processes depend on intrinsically disordered protein regions, whose lack of stable structure has made them very difficult to target with conventional structure-based design. Wu et al. introduce a computational strategy that inverts the usual paradigm: instead of designing ligands to fit preexisting folded pockets, they design small, folded protein "pockets" that are custom-built to recognize specific peptide sequences within disordered regions with nanomolar affinity, without forcing these regions to fold. Using template libraries of backbone-interacting pockets and sequence-specific optimization, they generate binders that work *in vitro* and in cells, including an ultra-tight binder for the disordered neuropeptide dynorphin A that outperforms its natural partners while leaving the peptide in an extended conformation. The article emphasizes that such designed peptide-recognition domains could open new avenues for therapeutics against disordered protein targets, including those in biomolecular condensates, serve as antibody-like research tools, and enable synthetic, orthogonal interaction networks between designed disordered regions and their binders to build novel dynamic assemblies and signaling readouts inside cells.

This article was previously published in *Science, Volume 389, Issue 6757*, on July 17, 2025.

Read the full article here

5. Lewy body dementia promotion by air pollutants

By Xiaodi Zhang *et al*.

Using a multimodal approach spanning epidemiology, molecular biology, and animal models, this study establishes a mechanistic link between chronic fine particulate matter ($PM_{2.5}$) exposure and Lewy body dementia (LBD). Analysis of over 56 million US Medicare beneficiaries revealed that $PM_{2.5}$ exposure was more strongly associated with hospitalization risk for LBD than for Parkinson's disease without dementia, suggesting a disease-specific vulnerability. At the molecular level, $PM_{2.5}$ from multiple global sources was found to generate a distinct, highly pathogenic α-synuclein strain (PM-PFF) with accelerated aggregation, degradation resistance, and enhanced neurotoxicity. In humanized mouse models, PM-PFF preferentially caused cognitive impairment and produced brain gene expression signatures mirroring LBD patients, not Parkinson's without dementia. Mice lacking

the α-synuclein gene were largely protected from $PM_{2.5}$-induced neurological damage, identifying it as a key mediator of this environmental neurotoxicity and a potential therapeutic target.

This article was previously published in *Science* on September 4, 2025.

Read the full article here.

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