

UK Climate Adaptation Consultation

This document outlines AMI's response to the UK Climate Adaptation Consultation, highlighting the importance of integrating microbiology and One Health approaches into national adaptation strategies. Key climate-related risks are identified, including the spread of infectious diseases, antimicrobial resistance (AMR), emerging plant pathogens, food safety threats and disruption to beneficial microbial communities. It emphasises the essential role of microorganisms in maintaining soil health, agricultural productivity and ecosystem resilience. AMI calls for greater investment in microbial surveillance, genomic monitoring, climate-resilient crop development and research into beneficial microorganisms. The response stresses that recognising microbial processes and risks is essential to building a more resilient, sustainable and climate-prepared UK.

1. UK preparedness for climate change

a. What are the most significant climate risks facing the UK over the next 10, 20 and 50 years?

Climate adaptation planning should explicitly consider **microbial and One Health risks**.

Disease spread and AMR: Antimicrobial resistance (AMR) as a climate sensitive One Health risk should be explicitly considered. Environmental changes may influence microbial communities, pathogen transmission, and the persistence and dissemination of resistant organisms and resistance genes. UKHSA has identified the effects of warming weather on AMR. Adaptation strategies should consider how climate change may alter AMR risks across interconnected human, animal, wildlife and environmental systems. Changes in temperature, precipitation, water quality, and land use can alter the distribution and transmission of infectious diseases, including food- and water-borne pathogens and vector-borne diseases. UKHSA highlighted these risks, and the Climate Change Committee's 2026 UK Climate Risk Assessment identifies climate-sensitive infectious diseases as a risk for which more action is needed.

Plant health: Climate change will alter which crops can thrive in the UK, potentially threatening traditional staples while creating opportunities for new varieties. Greater reliance on climate-resilient crops could reduce genetic diversity and increase vulnerability to pests and diseases. Maintaining production may require adapted farming practices, resilient crop varieties and protection of beneficial soil microbial communities.

A further significant and under recognised risk is the climate driven shift in crop pests and pathogens. Milder winters, wetter springs and longer growing seasons are expected to favour the survival, establishment and spread of fungal, bacterial and viral plant pathogens and their insect vectors, including organisms not yet established in the UK. For instance, *Xylella fastidiosa*, a bacterial pathogen that has caused severe losses to olive and other trees in southern Europe and is not currently known to be present in the

UK¹, illustrates the kind of significant threat whose likelihood of establishment may rise as conditions warm. Climate change can also erode the effectiveness of disease resistance bred into current crop varieties: some plant immune responses are weakened at higher temperatures, and new or more aggressive pathogen strains can overcome widely deployed resistance genes.

Extreme Heat: threatens agriculture, food manufacturing, workers and the cold chain. Much of the UK's refrigeration equipment is relatively old and not designed to cope with temperatures above 32C.² This impacts chilled food manufacture and retail. The "last mile" to consumer homes is a risk factor, and storage of food must be at correct temperatures in the home to maintain safety and quality throughout shelf life, and to avoid waste.

Alternating waterlogging and drought can stress crops and beneficial soil microbes, reduce yields and increasing reliance on chemical inputs. Dry spells following wet periods can also increase nitrogen loss from soils through greenhouse gas emissions.

Rising temperatures may promote soil-borne pathogens, increasing root diseases, fungicide use and crop losses. Warmer conditions can also favour foodborne and marine pathogens, while heavy rainfall can overwhelm sewage systems and contaminate water supplies. Warming aquatic ecosystems may encourage toxin-producing cyanobacterial blooms.

Prolonged droughts and increasing temperatures can lower water tables, exposing previously waterlogged peat to oxygen and accelerating microbial decomposition. Healthy peatlands accumulate and preserve carbon over thousands of years. This can transform peatlands from long-term carbon sinks into sources of greenhouse gas emissions. Drier conditions also increase wildfire risks, potentially releasing carbon accumulated over centuries or millennia in a matter of days. This is particularly concerning because around 80% of UK peatlands have been modified or degraded, making them more vulnerable to environmental disturbances. Their degradation also affects biodiversity, water quality and hydrological functioning, potentially exacerbating the consequences of extreme rainfall and flooding.

Risks to food production: Droughts, flooding, and emerging pests and diseases will affect UK crop yields and livestock production. There may be visual impacts on fresh produce such as size reduction (without affecting food safety & quality). Recent issues with aphids on lettuce crops – Autumn has been warm and provided conditions for aphids: [Millions of heads of lettuce ruined by aphid outbreak - BBC News](#)

¹ <https://www.efsa.europa.eu/en/topics/topic/xylella-fastidiosa>

² <https://www.ukclimaterisk.org/publications/resilience-of-cold-supply-chains-to-future-heat-risk/>

b. Does the Government adequately assess current and future climate risks, including risks to vulnerable environments and potential ecosystem collapse?

The government has made significant efforts to assess current and future climate risks; however, it seems to focus more on macro-level climate threats, while giving minimal attention to microbiological risks and ecosystem collapse dynamics. Current national adaptation strategies fail to adequately assess how climate extremes trigger systemic microbial tipping points.

Projected warming and hydrological shifts threaten to permanently disrupt soil microbiome integrity, impairing nitrogen fixation, nutrient cycling, and agricultural productivity. Furthermore, policy frameworks undercount compounding biological risks, such as warmer ambient temperatures driving rapid bacterial mutation, accelerated horizontal gene transfer of antimicrobial resistance (AMR), and thermal adaptation of opportunistic fungal pathogens. The Climate Change Committee (CCC) says that the national adaptation plans do not have meaningful, measurable targets, and that adaptation needs the same focus as geopolitical security threats; it says the UK is already one of Europe's most nature-depleted countries³, and at 2°C of warming by 2050 there is a risk of widespread ecosystem loss that could make current restoration targets impossible.

This highlights an opportunity, and necessity, to more explicitly incorporate the microbial dimension of ecosystem resilience into climate-risk assessment. Microbial communities underpin processes including nutrient cycling, organic matter transformation, plant health and broader ecosystem functioning, yet these components can be much less visible than changes in plant or animal biodiversity when ecosystem vulnerability is assessed.

The Government's assessment of climate risk would benefit from routine use of genomic and metagenomic monitoring. Environmental DNA and metagenomic sequencing of soils, waters, air samples and plant material can detect shifts in microbial communities, the arrival of plant pathogens and invasive species, and declines in key functional groups (for example, nitrogen-cycling or mycorrhizal organisms) before visible ecosystem damage occurs. Such tools could provide an early warning of ecosystem stress and support the detection of tipping points that conventional biodiversity surveys may miss. A related food-safety risk is mycotoxin contamination. Fungi such as *Fusarium* and *Aspergillus* produce toxins that contaminate cereals, animal feed and other crops. Modelling for the European Food Safety Authority projected that aflatoxin B1 contamination of maize could become a food-safety concern in parts of Europe under a +2 °C warming scenario.⁴ Climate change may therefore alter the mycotoxin risk profile

³ <https://policy.friendsoftheearth.uk/insight/how-britain-became-one-most-nature-depleted-countries-world>

⁴ [Aflatoxin B₁ contamination in maize in Europe increases due to climate change](#)

of both UK-grown and imported cereals and feeds, with consequences for human and animal health and for trade.

From a One Health perspective, environmental and wildlife systems should also be considered not simply as recipients of human impacts but as dynamic components of disease ecology. Wildlife and environmental microbial communities can harbour resistant microorganisms and resistance genes, while wildlife may also serve as a useful sentinel for environmental AMR. Environmental change can also alter interactions among microbes, wildlife, domestic animals, and people. The Environment Agency has already explored the use of wild flora and fauna for environmental AMR surveillance, which could provide a useful model for incorporating microbial indicators into broader assessments of environmental change.

c. How might poorly planned adaptation create new vulnerabilities?

Poorly planned adaptation can create long-term negative effects on a community or shift avoided risk to other communities or ecosystems. For instance, building hard defences like seawalls can encourage unsafe development in flood-prone zones, which in the long term can create more severe consequences when extreme storms arise; upstream flood barriers can increase water flow into downstream communities; mass air conditioning strains energy grids and increases greenhouse emissions; deep groundwater drilling to safeguard crop irrigation during drought can deplete aquifers and damage soil microbiomes.

Specifically, regarding agriculture, increasing irrigation to protect crops from drought may become unsustainable if it places excessive pressure on rivers and groundwater. Intensive irrigation, increased fertiliser application or greater reliance on crop varieties may provide short-term protection against climate stress but could create longer-term problems such as soil degradation, nutrient losses, water depletion or reduced agricultural biodiversity.

Microbial products such as biofertilisers, biostimulants and microbial inoculants have been noted as potential tools to help address these issues, however, they should only be adopted on the basis of robust, independent field evidence. Products that perform inconsistently across different UK soils and climates could create a false sense of resilience.

Moreover, adaptation measures that increase the use of manures, slurry, sewage sludge or treated wastewater for soil improvement and irrigation could, without adequate treatment and monitoring, increase the spread of pathogens, antimicrobial resistant bacteria and resistance genes into soils, crops and waters. Similarly, deploying a single new resistance gene or a single 'climate-ready' variety across very large areas could reduce genetic diversity, so diversity in deployment should be built into breeding and variety strategies.

Focus should be on maintaining healthy and biologically active soils, improving water-use efficiency, increasing crop diversity and strengthening natural soil processes. Research on soil microbiology, plant–microbe interactions and biological nutrient management could contribute to adaptation strategies that improve resilience without creating additional environmental pressures.

2. Agriculture, water and the natural environment

a. How should climate adaptation be integrated with agricultural policy and food security?

Climate adaptation should be fully integrated into agricultural policy and food-security planning. Agriculture is directly exposed to increasing temperatures, drought, flooding, changing rainfall patterns, pests and diseases, meanwhile the food system is vulnerable to climate impacts occurring outside the UK. Food-security policy should consequently combine resilient domestic production with diversified international sourcing and stronger monitoring of climate-related risks to global supply chains.

Greater use of climate-resilient crop varieties, crop diversification, rotations, agroecological approaches and integrated farming systems could reduce exposure to individual climate hazards. The UK should encourage greater agricultural diversity and resilience. Dependence on a narrow range of crops, varieties, production systems or supply chains can increase vulnerability when climatic conditions change. Agricultural research and extension services should help farmers identify combinations of practices that are appropriate for local soil, climate and production conditions rather than promoting a single adaptation model across all regions. Flexibility is needed for specific regional food production such as horticulture.

The role of soil and plant microbiology deserves greater recognition within this agenda. Beneficial soil microorganisms and plant–microbe interactions have been shown to contribute to nutrient cycling, soil structure, plant growth and tolerance to environmental stresses.⁵ Research into microbial inoculants, biological fertilisers, plant-growth-promoting microorganisms and microbial approaches to improving soil health could provide additional tools for climate-resilient agriculture. Further investment in research, field validation and translation would meaningfully contribute to adaptation. Plant genetics and breeding should be recognised as a core component of agricultural adaptation and therefore policy. Developing a new variety with improved tolerance to heat, drought, waterlogging or new disease pressures commonly takes ten years or more using conventional methods, so research and breeding decisions made now will determine which varieties are available to UK farmers in the 2030s and 2040s. Modern tools, including genomic selection, marker-assisted breeding, speed breeding, high-throughput phenotyping and gene editing, can shorten these timescales and allow breeders to combine several adaptive traits in one variety. The Genetic Technology

⁵ <https://academic.oup.com/sumbio/article/1/1/qvae026/7829347>

(Precision Breeding) Regulations 2025, in force in England since 13 November 2025, create a proportionate route for gene-edited plants whose changes could have arisen through traditional breeding. To realise their adaptation potential, the Government should ensure the regime is workable and affordable for the public sector, university and smaller breeders as well as large companies, and should give breeders early clarity on how it will interact with any future UK–EU sanitary and phytosanitary (SPS) agreement, so that long-term breeding programmes can be planned with confidence.

There is also an important opportunity to connect plant genetics and microbiology more directly. Plant genotype influences which beneficial microbes colonise roots and leaves, and breeding under high-fertiliser conditions may have reduced the capacity of some modern varieties to form beneficial associations, for example with arbuscular mycorrhizal fungi and plant-growth-promoting bacteria. Breeding programmes could therefore include traits relating to root architecture and beneficial plant–microbe interactions, so that new varieties perform well under lower-input and more variable conditions. Combining resilient crop genetics with healthy, biologically active soils is likely to deliver more durable adaptation than either approach alone.

Beyond crop resilience, water availability is likely to become a major constraint on food production. Adaptation policies should therefore support:

- Catchment-scale water planning
- Efficient irrigation technologies
- Drought contingency planning
- Collaborative water sharing arrangements

Food security extends beyond farms. Climate adaptation policy should cover not just agriculture but consider the broader impact across the wider supply chain including:

- Food manufacturing
- Chilled and frozen storage
- Transport infrastructure
- Ports and logistics systems
- Retail distribution networks
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Any policy development and design must include input from the relevant parties and experts to avoid any unintended consequences and reduce the risk of policy adaptations needed post implementation from not having their input from the outset. The risk of not doing so in AMI's response to the UK government Sustainable Farming Incentive which omitted important microbiological considerations.⁶

⁶ <https://www.the-microbiologist.com/news/ami-experts-issue-warning-over-uks-sustainable-farming-initiative/2642.article>

b. How can nature-based solutions contribute to adaptation, including flood management, water security and urban cooling?

Nature-based solutions can strengthen climate adaptation by restoring ecosystems to reduce flooding, drought and heat risks. Restoring wetlands, floodplains and riverbank vegetation can absorb excess rainfall, reduce erosion, filter pollutants and improve water quality, limiting flood-related health risks. The choice of trees and vegetation requires consideration and nuance because for example, poorly selected tree species may have high water requirements during drought, while poorly designed vegetation schemes may provide limited cooling or flood benefits.

Protecting watersheds, restoring peatlands and improving soil organic matter can increase water retention and resilience to drought. In urban areas, trees, parks, green roofs and permeable surfaces can reduce heat and surface runoff, lowering heat-related health risks.⁷ Healthy soils, wetlands and vegetation also support beneficial microorganisms that recycle nutrients, break down organic matter and remove pollutants, contributing to healthier ecosystems.

Many solutions to address unsustainable land management and agricultural practices are being explored within the microbiology research community and should be explored as viable options. This would require sustained policy, financial and advisory support.⁸

3. Other questions

a. What indicators should Government use to measure progress on adaptation?

Alongside physical, ecological, and socioeconomic indicators, the inclusion of **microbial and One Health indicators** should be integrated where appropriate. These could include trends in the incidence and geographic or seasonal distribution of climate-sensitive infections; vector distribution and seasonality; indicators of microbial water quality following flooding or other extreme events; and environmental surveillance for pathogens and AMR in wastewater, surface waters, and other relevant environmental compartments.

Where feasible, wildlife can also serve as a sentinel for environmental microbial risks, including AMR. Importantly, this would not necessarily require building entirely new surveillance systems. The UK already has relevant surveillance programs and pilot work to build on: the Environment Agency has piloted AMR surveillance in river catchments and assessed wildlife surveillance approaches, while the UK's 2024–2029 AMR National Action Plan calls for strengthened surveillance to understand how resistant microorganisms and resistance genes evolve and spread across and between human, animal, agricultural and environmental sectors. Climate-adaptation monitoring could build on and integrate these existing One Health surveillance efforts.

⁷ <https://climate-adapt.eea.europa.eu/en>

⁸ [Policy Report: Improving Soil Health in the UK](#)

Soil-health indicators should also be included, because soils underpin agricultural resilience, flood regulation and water quality. Possible indicators include soil organic carbon, soil structure and aggregate stability, infiltration capacity, erosion rates, and measures of soil biological activity such as microbial biomass. Soil health indicators are further discussed in a recent soil health policy report by AMI.⁹ Indicators relating to plant health and crop genetic resources would also be valuable. Examples include the genetic diversity of varieties grown across the UK; the proportion of gene bank accessions characterised for climate relevant traits; the time taken to detect and respond to new plant-pest and pathogen incursions; the incidence of major crop diseases and of mycotoxin exceedances in UK cereals; and the number of new varieties reaching the market with improved tolerance to heat, drought or waterlogging.

Long-term field experiments and monitoring programmes would be particularly valuable for determining which interventions improve resilience under real-world conditions.

b. Are there any lessons that can be learnt from international best practice on climate adaptation?

International best practice demonstrates that successful adaptation is generally not based on a single intervention. Instead, it combines long-term planning, scientific evidence, local knowledge, ecosystem-based approaches, resilient infrastructure, effective governance and sustained investment. For example,

- **The Netherlands has demonstrated the value of long-term adaptation planning based on future climate scenarios rather than historical climate conditions.** They have developed approaches that consider future sea-level rise, flooding and changing hydrological conditions when planning infrastructure and spatial development.¹⁰ The Dutch experience demonstrates the importance of designing systems that can be modified as risks evolve. For the UK, this suggests that infrastructure, housing, coastal planning and water management should be designed with sufficient flexibility to accommodate changing climate conditions.
- **Australia¹¹ and Israel¹², both countries facing chronic water scarcity, have invested in water-use efficiency, desalination plants, drought planning, wastewater reuse, improved irrigation technologies, water monitoring and diversification of water supplies.** While the UK has different climate and water systems, these experiences demonstrate the importance of managing water demand as well as increasing supply. The UK could apply this principle through improved agricultural water efficiency, leakage reduction, water recycling,

⁹ [Policy Report: Improving Soil Health in the UK](#)

¹⁰ [Government of the Netherlands: Delta Programme: flood safety, freshwater and spatial adaptation](#)

¹¹ [Making Every Drop Count: How Australia is Securing its Water Future](#)

¹² [Israel's Water Technology and Innovation Lead to Resilience and Surplus](#)

catchment-scale planning and stronger integration of agricultural and environmental water requirements.

c. Additional comments

Early warning systems, designed to provide timely and actionable warnings of impending hazards such as floods, wildfires and droughts, are one of the most cost-effective adaptation measures according to the UNDP, providing up to tenfold return of investment.¹³ The UK should prioritise investing in a comprehensive multi-hazard warning system.

The potential contribution of microbial biotechnology and biological approaches to agricultural adaptation should be considered and funded. Research from different climatic regions has demonstrated the potential of beneficial microorganisms, plant-growth-promoting bacteria and fungi, microbial inoculants and biological nutrient-management approaches to improve plant performance under environmental stress. Further investment in research and field validation of these approaches could complement conventional crop breeding, water management and soil-conservation strategies. Importantly, these technologies should be assessed under realistic field conditions and different soil and climatic environments before being widely scaled.

Finally, the UK should strengthen international knowledge exchange and research collaboration as part of its adaptation strategy. International research partnerships can help the UK identify effective interventions more quickly, test whether they are transferable to UK conditions and avoid repeating approaches that have produced unintended consequences elsewhere. The UN Framework Convention on Climate Change provides international resources, case studies and adaptation approaches that countries can use to improve their own strategies.¹⁴

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¹³ [UNDP: What are early warning systems and why do they matter for climate action?](#)

¹⁴ [UN Climate Change - Adaptation Knowledge Portal](#)

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About Applied Microbiology International

[Applied Microbiology International](http://www.appliedmicrobiology.org) is a charitable, membership-based organisation for those interested in or working in microbiology.

We aim to demonstrate how microbiology can help address global challenges, and our policy work focuses on bringing microbiological evidence and expertise into policy conversations. AMI is solving some of the world's greatest challenges by bringing the applied microbiology community together, across borders and disciplines, to enable meaningful collaboration that delivers scientific impact. With a strong focus on influencing international policy, we are organised around six core UN Sustainable Development Goals and encourage partnership between academia and industry to increase our impact.

This consultation response is the amalgamation of seven member responses. If you have questions on specific points raised, please get in touch and we will put you in touch with the relevant individual/s.