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CLIMATE ACROSS SYSTEMS · NO. 11

The farms behind the climate plan

Farms and forests can make the energy transition less costly. New research brings the land, water and agricultural choices behind that promise into focus, from the US Corn Belt to dairy households in Ethiopia.

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Ahmed Nadhir Omar

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The farms behind the climate plan

A farmer offered a long-term biomass contract has more to weigh than the price per tonne. The crop will need water, land and labour already supporting food production and household income. A new global modelling study helps explain why energy buyers and ministries may seek such supplies: in its scenarios, farms and forests contribute to a cheaper energy transition. The agreement still has to work for the people farming the land.

An energy ministry can count on biomass replacing some fossil fuel. A forest programme can count on land storing more carbon. An agricultural policy can count on higher yields keeping food affordable. Each expectation may be reasonable in isolation. Together, they can commit the same hectare, water supply or farmer’s labour more than once. The central question is whether those commitments can coexist, and who has the authority to reconcile them.

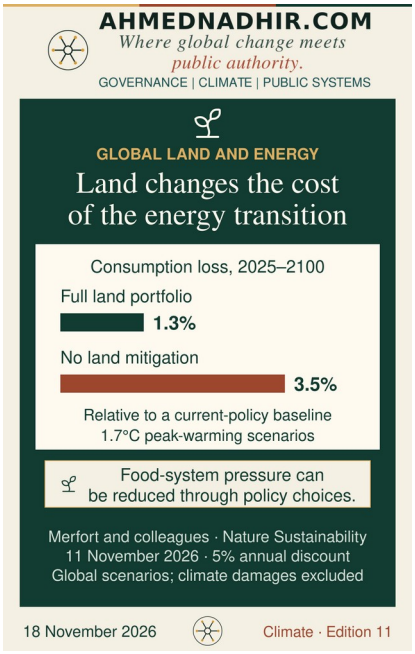
Five publications from 11 to 17 November illuminate different parts of that question. Global land-use scenarios show the value of combining several forms of mitigation. Research in the US Corn Belt examines the fit between maize hybrids and changing growing conditions. An Ethiopian household study challenges a simple ladder from greater technological adoption to greater food security. Two water-policy essays address the physical damage and institutional arrangements beneath all these choices.

Farmers make these commercial and household decisions within rules on water access, seed supply and land use that they cannot change individually. An energy ministry buying biomass, an agricultural agency subsidising seed and a regulator limiting pumping can each influence the same holding. Whether their policies work together will shape both the cost of the transition and the farmer’s ability to stay in business.

A cheaper transition makes a larger claim on land

Global modelling · 11 November 2026

Leon Merfort and colleagues at the Potsdam Institute for Climate Impact Research linked models of energy, the economy and land use in the REMIND–MAgPIE framework to compare alternative climate-policy portfolios. Their Nature Sustainability study, published on 11 November, finds that including land-based mitigation substantially reduces the cost of limiting peak warming to 1.7°C. Discounted cumulative consumption losses over 2025–2100 fall from 3.5% to 1.3% relative to a current-policy baseline. These are global scenario comparisons, using a 5% annual discount rate and excluding climate damages, rather than predicted changes in household incomes.



The mechanism matters more than the headline saving. Protecting and restoring ecosystems, reducing agricultural emissions and supplying bioenergy give the energy system more ways to meet a temperature objective. The authors also find that constraints on bioenergy use and agricultural methane and nitrous oxide pricing can reduce pressure on food production without sacrificing most of the climate benefit. The result supports choosing a combination of policies rather than pursuing every available land-based option at maximum intensity.

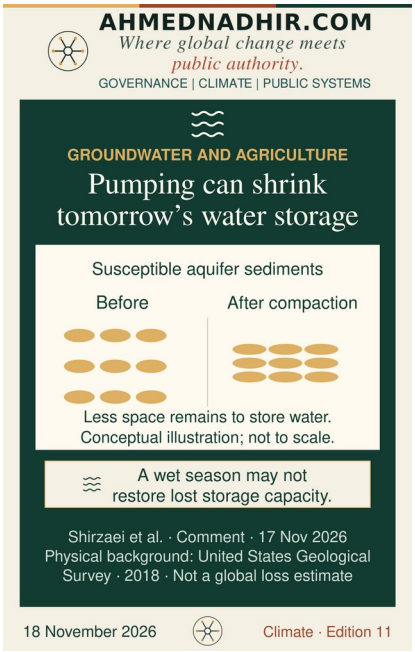
For governments, this creates a bargaining problem between sectors. An energy strategy that assumes a large biomass supply needs to establish where that supply can come from. An agricultural strategy promising stable food prices needs to account for the competing demand. The relevant comparison includes the alternatives available to each sector: faster electrification, different fuels, changes in production, or greater ecosystem protection. A low-cost solution in the combined model does not decide which particular community should change its land use.

Private contracts can settle some of this competition. A biomass buyer can offer growers a long-term market; a carbon buyer can pay for a change in land management. Those agreements become harder to judge when a tenant lacks security, grazing rights are shared, or the contract outlasts the farmer’s access to water. The public choice is which uses can lawfully be committed, for how long, and with whose consent. Clear terms allow genuine opportunities to proceed while preventing an apparently available resource from being promised to several buyers.

The water reserve can shrink with the harvest

Global argument; California background · 17 November 2026

A Comment published on 17 November by Manoochehr Shirzaei and colleagues argues that sinking land should have a more prominent place in groundwater governance. It draws attention to a form of loss that a later wet season may fail to repair: compaction of the material that stores water underground. This is an interpretative essay, not a newly established global estimate of groundwater depletion.



The underlying mechanism is well established. The United States Geological Survey explains that falling groundwater levels can rearrange fine-grained sediments, leaving less space for water. Compaction at historically low water levels can be largely irreversible. In California's San Joaquin Valley, subsidence can also alter canal gradients and reduce the ability to convey water. That account dates from 2018; it supplies physical background to this week's argument. Subsidence has several causes, so ground movement alone cannot diagnose groundwater loss everywhere.

A farmer pumping during a dry spell may be protecting a crop worth far more than the immediate electricity bill. If several users draw on the same vulnerable aquifer, that individually defensible response can erode storage they will all need later. Where compaction damages a canal, it can also weaken the surface-water supply that might otherwise reduce pumping. This is a possible reinforcing cycle, conditional on local geology and water arrangements, rather than a universal description of irrigation.

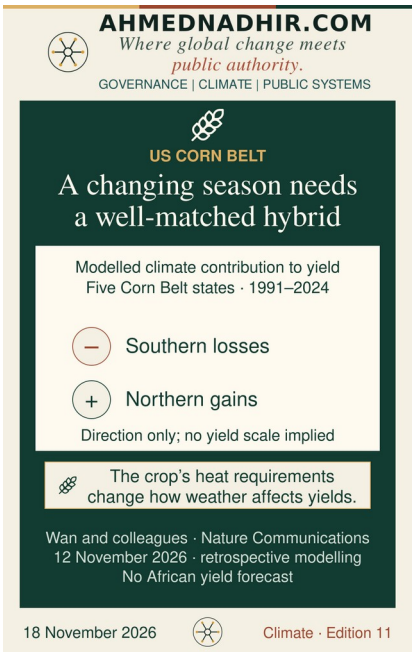
A lending contract or agricultural subsidy can intensify the incentive to preserve this year's output. Restraining extraction without changing those obligations can instead force a grower into default or distress sale. The choices therefore extend beyond setting a pumping limit. Creditors, water users and the competent regulator have to confront the consequences of changing the cropping area or timing of production. Buying a more efficient pump cannot, by itself, settle how much water all users together may take. The storage beneath the farm is part of the productive asset being governed.

US CORN BELT

A changing season rewards a different seed choice

Five US Corn Belt states · 1991–2024 · 12 November 2026

The US maize study brings the argument down to the crop. Nenghan Wan and colleagues used a crop-season framework aligned with plant development and the Hybrid-Maize model across five Corn Belt states for 1991–2024. Their 12 November paper finds that estimated climate contributions to yields shift from losses in the south to gains in the north. The analysis connects that pattern to regional weather trends and the match between available heat and the requirements of the planted hybrids.



The central United States has experienced a summer 'warming hole', including cooling maximum temperatures and increasing rainfall. The authors identify declining thermal matching particularly south of 42° north. A broad expectation that warming should help or harm maize misses the interaction between the growing season and the crop selected for it. These are retrospective model-based findings for the study region. They provide neither an African yield forecast nor a recommendation to move a particular American hybrid elsewhere.

For a seed company, the commercial task is to offer varieties farmers will buy. For a grower, a familiar hybrid may have advantages that a yield simulation does not price: a dependable supplier, known harvest timing or compatibility with equipment and buyers. Public breeding programmes, agricultural extension and independent variety trials can widen the information available without pretending that one simulated optimum settles the choice. The useful comparison concerns performance across plausible seasons as well as the best result under one set of conditions.

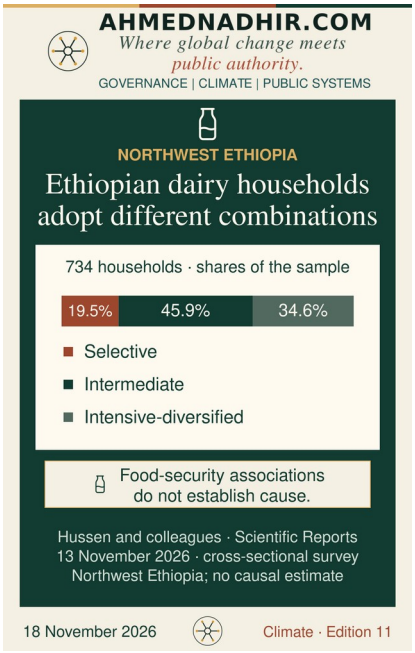
This changes how governments might think about adaptation support. Subsidising an input can lock in an unsuitable choice if the scheme takes the crop's requirements as fixed while the season changes. Conversely, withdrawing a familiar variety too quickly can remove an option that still performs well under particular conditions. A diverse, independently tested seed supply preserves room to respond. The institutional issue is whether farmers can make an informed switch, including access to seed and a buyer, rather than whether officials can prescribe one preferred package.

NORTHWEST ETHIOPIA

Ethiopian dairy support needs room for different choices

734 smallholder dairy households · 13 November 2026

Yemiamirew Zayede Hussen and colleagues examined 734 smallholder dairy households in Northwest Ethiopia. Their 13 November study groups households into selective, intermediate and intensive-diversified adoption profiles for practices described as climate-smart. After statistical adjustment, the intermediate and intensive-diversified groups were associated with less food insecurity than selective adopters. The difference between those two more extensive profiles in the probability of food insecurity was not statistically significant.



The study is cross-sectional. Weighting methods address observed differences between households; unobserved advantages may still influence both adoption and food security. The intermediate group's food-quality comparison was also sensitive to allowing for similarities among households in the same kebele, an Ethiopian local administrative area. A statistically inconclusive difference between profiles does not establish that their outcomes are equivalent. The findings therefore do not establish that giving a household a larger technology bundle will cause a particular benefit. Nor does the climate-smart label demonstrate an emissions reduction or protection against a measured climate shock.

That limited finding has a useful implication for programme design. An apparent progression from selective to intensive adoption need not be a dependable ranking of the support every household should receive. A dairy household has to balance feed, animal care, cash, land and labour with its food needs. A package that looks more comprehensive to a supplier can demand resources the household needs elsewhere. This is a question for further investigation, rather than a mechanism the survey has proved.

Agricultural agencies and private suppliers have different reasons to favour standard packages. Common inputs can simplify training, purchasing and after-sales support. Flexibility can make the offer harder to administer. The public interest lies in whether that convenience excludes households or encourages commitments they cannot maintain. Follow-up research tracking the same households through different seasons would help distinguish a useful combination from the advantages of the households able to adopt it. Until then, the study supports a serious comparison of combinations, including their demands on household resources, rather than a universal prescription for greater intensity.

The rules have to reach the water people use

Institutional analysis · 17 November 2026

Edoardo Borgomeo and Dustin Garrick's 17 November Perspective argues that water institutions deserve treatment as infrastructure. They identify a difficulty with generic prescriptions for integrated management: actual water systems include informal provision, decentralised supplies, interdependence across sectors and unilateral developments across borders. Institutional investment must work with those arrangements, including informal solutions. This is an argument about institutional design, rather than an evaluation showing that a particular reform increased water security.



Its relevance to farmland is direct. A formal right, an irrigation association's rotation and an arrangement with a private supplier can govern different parts of the same user's supply. Changing one can alter the value of the others. Recognition can make an existing arrangement more secure; regulation can protect users from unsafe or abusive provision. A requirement designed around a large utility can also make a smaller provider's service legally impossible before a replacement is available.

Public authority has to distinguish those situations. Treating informal users as absent can understate the demands on a water source. Treating every existing use as untouchable can entrench an unfair allocation. Neither a licence nor a negotiated local arrangement settles the issue by itself. The question is how access can be challenged and revised without making households dependent on an unaccountable intermediary or displacing an effective local solution.

Who can promise the next hectare?

Taken together, the readings suggest a different starting point for agricultural climate policy. The value of a farm's contribution depends on the claims around it. A carbon payment, a biomass contract and a loan secured against future production may each be affordable and enforceable on their own terms. Their combined demands can exceed the land, water or labour available. The institution able to see one contract may have no standing to revise another.

Consider a proposed energy-crop contract in an irrigated district. This is an illustrative case, not a project reported in the studies. The buyer wants a dependable feedstock. The grower wants a dependable price. Other water users need the contract to remain compatible with a dry-year allocation. If the grower bears every supply interruption while the buyer can walk away, the promise of a new market may produce pressure to pump through a shortage. A contract that recognises lawful water restrictions would distribute that pressure differently.

The competing explanation deserves attention. Poor outcomes may arise from insecure markets, weak extension or expensive credit, even where land and water are adequate. Resource limits cannot explain every failed intervention. Equally, better markets and cheaper credit can accelerate depletion when access rules leave it profitable. The relationship works in both directions: institutions affect whether a technology is usable, and successful technologies can change how intensely a shared resource is used.

The geography of that bargain is unequal. The Potsdam Institute for Climate Impact Research's account of the modelling notes that much of the land-based mitigation potential lies in the Global South, alongside pressing food, water and biodiversity concerns. Where an energy or carbon buyer is abroad, a local land-use decision can be shaped by a distant market. Export earnings may make a new use attractive while leaving the host jurisdiction to resolve competing rights. That possibility strengthens the case for negotiating terms before dependence on one buyer becomes entrenched.

This is why the global mitigation opportunity and the farm-level evidence belong in the same discussion. An economy-wide saving creates room to negotiate fairer terms for rural participation. It does not establish that the money saved will reach growers or that their consent can be assumed. Governments can compare alternatives across sectors and defend uses that lack a powerful buyer. Private firms can develop contracts, equipment and seed that make agreed changes workable. Both depend on a credible settlement about what the resource can support.

A climate offer farmers can negotiate

A practical next step would be to test negotiated land-use offers in an existing agricultural programme, under the relevant land and water law. Participants could compare food production, restoration and an energy crop on their actual holdings. The offers would state the water assumptions, changes in labour and income, contract duration and treatment of a dry-year restriction. Tenants and shared-rights holders would need an independent route to representation and dispute resolution. This is a proposition, not an announced programme.

The test would use existing extension, water-management and research institutions, with private buyers paying for the production they want. Public expenditure would have a narrower role: independent trials, access to advice and protection of legitimate rights. There would be no presumption that one use should win everywhere. The first useful result would be evidence of which offers people accept, which they reject and why, followed through several seasons rather than counted at signing.

Three unresolved questions would then become answerable. Do locally feasible land-use combinations retain the gains suggested by global models? Can farmers change crops or practices without surrendering control of future choices? And do water arrangements preserve the productive capacity on which the contracts depend? Evidence of lower yields, insecure access, greater unpaid labour or continued depletion would weaken the case for expansion, even where a carbon account looked attractive.

The energy transition has good reason to seek a contribution from farms and forests. Its durability depends on how that contribution is agreed. Agricultural land is already occupied by decisions, obligations and livelihoods. A climate plan becomes more credible when it gives those who use the land a real choice over the additional work it is being asked to do.

Sources and notes

Reporting period: 11–17 November 2026

The five principal publications appeared during 11–17 November 2026. Underlying data cover different periods, stated in the readings. The water Comment and Perspective are arguments rather than new impact evaluations. Several early articles and water essays were accessible through their publisher abstracts and indexed excerpts, so the analysis avoids unsupported methodological or country-specific detail. The United States Geological Survey's 2018 explanation is labelled background. Connections, illustrative contracts and the closing proposition are this edition's interpretation.

Cost-effective climate change mitigation through land sector contributions
Leon Merfort and colleagues · Nature Sustainability, 11 November 2026.
Global REMIND–MAgPIE scenario analysis. Figure 2 defines discounted cumulative consumption losses at 5% per year over 2025–2100, excluding climate damages. Model and selected methods/figure notes consulted; scenarios were not independently replicated.

Sinking land is the fingerprint of global water bankruptcy
Manoochehr Shirzaei and colleagues · Nature Sustainability · Comment, 17 November 2026.
Read from the publisher's abstract and bibliographic record. An interpretative Comment about groundwater and governance, rather than a new global depletion dataset.

Aquifer Compaction due to Groundwater Pumping
United States Geological Survey · Land Subsidence in California, 18 October 2018.
Background explanation published in 2018, used for the physical mechanism, possible permanent storage loss and California canal example.

Latitude modulates climate-driven maize yield gains across the central U.S. 'warming hole'
Nenghan Wan and colleagues · Nature Communications, 12 November 2026.
Publisher abstract and article-in-press record consulted. Crop-season framework and Hybrid-Maize modelling, 1991–2024, five US Corn Belt states. No transfer of estimated yields to Africa; no claim that maize caused the regional cooling pattern.

Climate-smart dairy technology adoption profiles and multidimensional food security among smallholder dairy households in Northwest Ethiopia
Yemiamirew Zayede Hussen and colleagues · Scientific Reports, 13 November 2026.
Publisher abstract and early accepted-article record consulted. Cross-sectional survey, latent-class profiles and adjusted weighting comparisons. The abstract has an ambiguous repeated outcome label; this edition uses the unambiguous profile comparison. The associations do not establish causation or measured mitigation.

Strengthening water institutions amid interdependence and informality
Edoardo Borgomeo and Dustin Garrick · Nature Sustainability · Perspective, 17 November 2026.
Publisher abstract and publication record consulted. A Perspective on institutional design, rather than an evaluation of an adopted reform. Full-text access was unavailable for this review.

Why land – a scarce resource – is so important for climate protection
Potsdam Institute for Climate Impact Research · Primary institutional research account, 11 November 2026.
The authors' institution describes the policy alternatives and their geographical implications. It reports the land-mitigation study by Merfort and colleagues discussed in this edition.

Ahmed Nadhir Omar (2026), 'The farms behind the climate plan', Climate Across Systems, No. 11, 18 November 2026.