Deep Decarbonization Pathways

NDC INSIGHTS

n°3

Can land use deliver on climate and development goals?

In this edition of NDC Insights, we explore a critical sector for climate action and development: the land use sector, including agriculture, forestry and other land use (often referred to as AFOLU). AFOLU encompasses a wide range of activities, with LULUCF (land use, land use change, and forestry) representing a key subcategory focused on the role of land in carbon sequestration and emissions.

The analysis conducted by the DDP in eight countries shows that, in all cases, net-zero pathways require net negative emissions from the LULUCF sector by 2050. This often necessitates either maintaining the negative emissions already occurring at the baseline or implementing proactive measures to transition the sector from being a net emitter to a net sink.

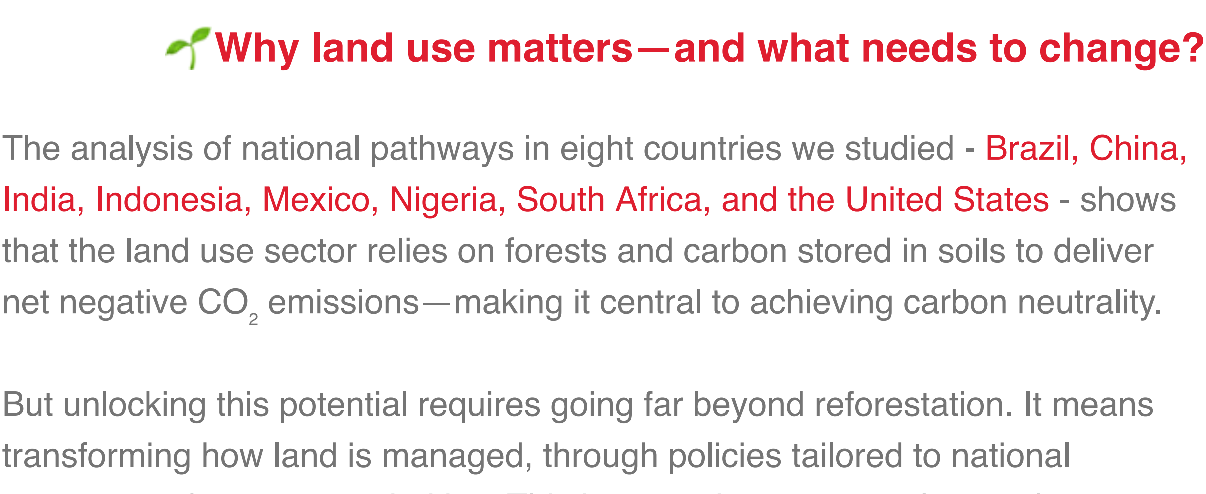


Figure: CO2 emissions from the LULUCF sector in national pathways to net zero

🌱Why land use matters—and what needs to change?

The analysis of national pathways in eight countries we studied - Brazil, China, India, Indonesia, Mexico, Nigeria, South Africa, and the United States - shows that the land use sector relies on forests and carbon stored in soils to deliver net negative CO_2 emissions—making it central to achieving carbon neutrality.

But unlocking this potential requires going far beyond reforestation. It means transforming how land is managed, through policies tailored to national contexts and long-term priorities. This is essential to ensure that land use strategies remain compatible with other core functions—such as food provision, biodiversity protection, and the livelihoods of rural communities.

The land use sector can contribute not only to long-term carbon neutrality, but also to immediate emissions reductions. The DDP analysis shows that action relating to forests and land use can reduce emissions significantly in the short term, making them a vital part of near-term NDC ambition.

Realizing this potential requires more than a single policy—it calls for **smart policy mixes** that integrate climate and development goals. For example:

- Brazil is combining deforestation control with sustainable intensification of agriculture, reducing land pressure while maintaining food exports.
- India is promoting agroforestry, which improves soil quality and provides smallholder farmers with alternative income streams.
- Indonesia is restoring degraded peatlands and mangroves, while supporting community livelihoods through sustainable forest use.

These examples show that climate strategies must be embedded within broader development plans, ensuring that land-based mitigation aligns with food systems, ecosystem resilience, and rural employment.

🌍Country scenarios: land use strategies in action

Brazil

In our analysis of Brazil's national pathway to net zero, the land use sector transitions from emitting over 0.6 $GtCO_2$ in 2020 to absorbing more than 1 $GtCO_2$ by 2050 (not counting non-CO_2 emissions from livestock and crop management). This shift relies on:

Halting deforestation in the Amazon and other biomes

Restoring degraded pasturelands to support agricultural expansion without forest loss

Scaling sustainable practices like integrated crop-livestock-forest systems (ICLFS)

The pathway shows that climate mitigation can align with Brazil's economic reliance on agriculture—if done with local context, strong enforcement of anti-deforestation laws, and support for sustainable intensification.

India

In India's pathway, annual net CO_2 absorption is projected to increase fourfold by 2050, primarily through scaling up agroforestry on croplands.

Agroforestry helps diversify farmer income, enhances soil health, and improves resilience to climate shocks. But enabling this shift will require better market access for products associated with agroforestry systems, technical and knowledge-based support to farmers, and investment in restoring degraded soils—especially for smallholders.

- Agroforestry provides smallholder farmers with diversified income, while also improving soil health and enhancing resilience to climate extremes
- Widespread adoption of agroforestry will depend on addressing market access, capacity building, and soil degradation, especially in vulnerable regions

This scenario shows how climate mitigation in the land sector can be a co-benefit of rural development when supported by the right policy mix. By addressing key challenges in Indian agriculture—such as low productivity, income insecurity for farmers, and poor soil quality —India can achieve meaningful emissions reductions while advancing core development priorities. The pathway underlines that with targeted action, the land use sector can be both a climate solution and a foundation for more resilient, inclusive growth.

Indonesia

In the national pathway developed for Indonesia, the land use sector transitions from a net emitter to a net sink of CO_2 emissions, led by:

Reducing deforestation and the degradation of peatlands and mangroves, which hold significant carbon stocks

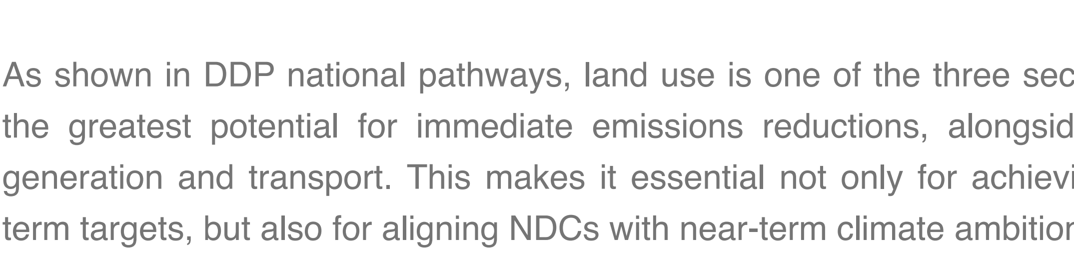
Promoting sustainable forest and agricultural systems, with incentives for communities to adopt practices that balance agricultural and forest production with ecosystem protection

Creating incentives for ecosystem services through both market and non-market mechanisms

Indonesia's pathway illustrates the importance of locally tailored solutions that link climate action with improved livelihoods and land governance. It highlights how land use strategies can not only reverse emissions trends, but also strengthen resilience and support rural development, particularly in forest-dependent regions.

What this means for NDCs

The land use sector can contribute not only to long-term carbon neutrality, but also to immediate emissions reductions. The DDP analysis shows that action relating to forests and land use can reduce emissions significantly in the short term, making them a vital part of near-term NDC ambition.



Agrifood systems in nationally determined contributions: Global analysis

Key findings

The AFOLU sector features prominently in existing NDCs for its capacity to contribute to mitigation and adaptation - which reflects the major mitigation potential by 2030 that our work identifies in the sector. However, the focus lies on forest-related action. Moreover, the AFOLU sector plays other core functions, including for food security, biodiversity protection and rural livelihoods. Most existing NDCs fail to take into account the sector's other core functions, with the risk of proposing a way forward that misses out on potential co-benefits with other objectives.

As shown in DDP national pathways, land use is one of the three sectors with the greatest potential for immediate emissions reductions, alongside power generation and transport. This makes it essential not only for achieving long-term targets, but also for aligning NDCs with near-term climate ambition.

To fully harness the potential co-benefits between mitigation and other objectives, countries should:

- Identify a set of short-term actions to put the sector on track to achieving all key objectives for the transformation of AFOLU, and not only those relating to mitigation. Some countries, including Brazil, are already leading the way toward detailed work on sectoral transformation plans suited to inform short-term measures.
- Adopt a focus that goes beyond mitigation, meaning transformative action in agriculture becomes more important. Countries should better integrate agriculture in upcoming NDCs, for instance by including non-CO_2 emissions from agriculture in mitigation targets.
- Ensure implementation is supported by clear governance and adequate resources.

Recognizing land as more than a carbon sink—but also as a foundation for development, biodiversity, and resilience—will make NDCs not only more ambitious, but more effective.

Next in NDC Insights: Methane and nitrous oxide emissions

In our next edition, we'll focus on **methane and nitrous oxide emissions**, particularly from agriculture—a sector that remains one of the most difficult to decarbonize.

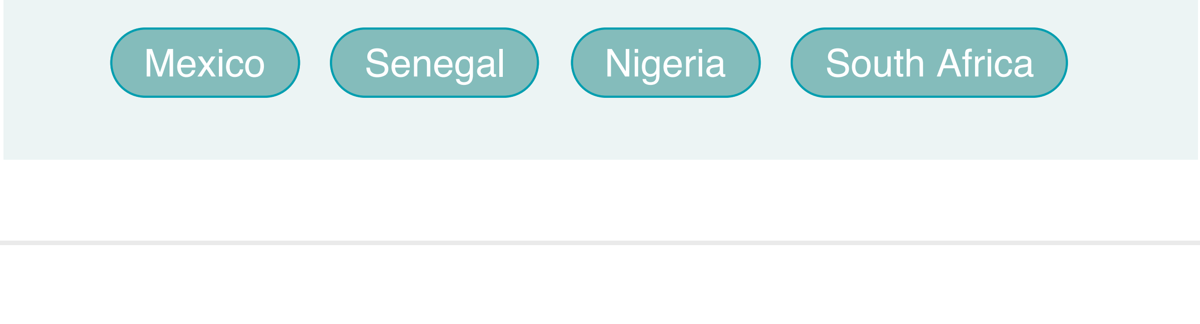
National pathways show that while the energy transition reduces non-CO_2 emissions from fossil fuel production, emissions from agriculture are far more persistent and often overlooked in NDCs. We'll explore how countries are addressing these challenges, and what policies can drive meaningful action while protecting food security and rural livelihoods.

Missed the last newsletters? Download:
"Beyond pledges: Are NDCs addressing the transformations we need?"
"What role for Carbon Capture and Storage?A measured look at its place in the transition"

About the DDP and why this newsletter matters

The Deep Decarbonization Pathways (DDP) initiative supports countries in designing strategies for deep emissions cuts aligned with development goals.

Since 2013, DDP has worked with local experts to build bottom-up, country-driven pathways that turn climate ambition into real, grounded action.



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