



ON INDUSTRIES: AGRICULTURE

**Industry insight
with impact**

ON Industries is a five-part series analyzing key industries through the lens of our ON Climate solution, providing commercial bankers with a detailed and powerful forward-looking view of the industry's drivers and performance.

Climate change **WILL**
impact your loan book.

Are you prepared?

Can you...

- Identify climate risk in your portfolio early?
- Calculate and report on emissions?
- Discover green lending opportunities?

It's a
 **\$145B**
RISK¹

And a
 **\$9.2T**
OPPORTUNITY²

¹In 2021 alone, extreme weather events cost the US economy \$145 billion. National Centers for Environmental Information.

²McKinsey estimates that the investment in new infrastructure and systems needed to meet international climate goals could be as much as \$9.2 trillion, annually. The net-zero transition: What it would cost, what it could bring.

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QUICK ON-BOARDING AND NEXT STEPS

You need to be looking at your loan book in a completely different way

The effects of climate change are being felt in almost every sector as business and government work to reduce carbon emissions and mitigate the environmental consequences that we are already experiencing.

The SEC and OCC have both raised the prospect of regulations that will compel lenders to account for the likely material impact of climate-related risk on their portfolio, as well as the related greenhouse gas emissions associated with lending.

How equipped is your bank to evaluate the risks to your borrowers and identify new lending opportunities?

The traditional approach to analysis is based on a historical view that can't possibly predict the potential impact of climate change. The lack of a standardized framework makes it almost impossible to comply with climate policy, report the carbon emissions in your loan book, increase green lending, and identify decarbonizing ventures to lower the emissions you finance.

There is also lack of relevant borrower data to evaluate such impacts. And even if you have the necessary information within your current systems, it's likely that they are outdated and held in multiple data sets that are impossible to turn into actionable intelligence.

It's time for a new approach.

A solution for future lending

ON Climate gives you a real-time view of climate transition risk applicable to your loan book so you can act to either de-risk or grow. It allows you to understand the impact that climate risk might have on each borrower. This empowers relationship managers, credit officers, and risk managers to make better, faster, and more informed decisions on which borrowers or industries in their portfolio are most likely to be vulnerable, or to benefit, from climate change.

It shows you:

- An overview of your climate risk and distributed exposure across top sectors and borrowers.
- Total financed emissions by sector and borrower level (Scope 1 and Scope 2).
- A list of borrowers that should be prioritized for climate reviews.
- Borrowers with high climate risk that you might be able to coach to help avoid future risk.
- Borrowers with lower projected climate risk, even though they are in sectors that are rated to have inherently high climate risk.
- Lending opportunities in sectors that are projected to have lower climate risk in the future.



ON Climate uses agreed, recognized industry and accounting standards (including PCAF, CFRF and NGFS Climate Scenarios) and a reliable, extensive data set to build and run climate scenario and financed emissions modeling.

The smaller the detail, the greater the value

At the moment most credit analyses work at a broad sector level, looking no deeper than the sub-sector level. This does provide some indication of your exposure, but such a broad view lacks the insight needed to really understand the impact and trends at the individual borrower level.

Take, for example, the agricultural sector. It's an area facing multiple pressures, from the impact of energy costs throughout the supply chain, the rising price of materials such as fertilizer and the need to accommodate the loss of grain capacity resulting from the war in Ukraine...to name just a handful.

How do you analyze and plan for the impact of these multiple drivers across a diverse sector? The truth is that many solutions miss crucial detail buried within your data, which can lead to the under or over-stating of risk. ON Climate goes into much greater detail. We dig down five levels, to NAICS 6-digit industry code to uncover crucial details buried within your data, providing you the information needed to report, recommend, and act with confidence.

This sample analysis of the potential impact of climate across the agricultural value chain reveals areas of risk and opportunity, and how they may change over time.

Granular analysis across the supply chain

THE AGRICULTURE VALUE CHAIN



- FERTILIZERS
- CROP PRODUCTION
- BEEF CATTLE RANCHING & FARMING
- MEAT MANUFACTURING & PROCESSING
- RESTAURANTS



FERTILIZERS

CROP PRODUCTION

BEEF CATTLE RANCHING & FARMING

MEAT MANUFACTURING/

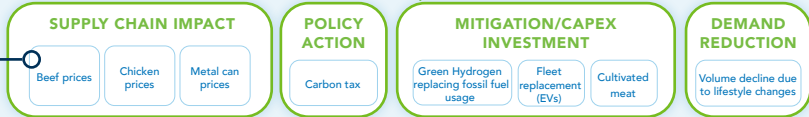
RESTAURANTS

We dig down five levels, to NAICS 6-digit industry code to uncover crucial details buried within your data, providing you with the information needed to report, recommend, and react with confidence.

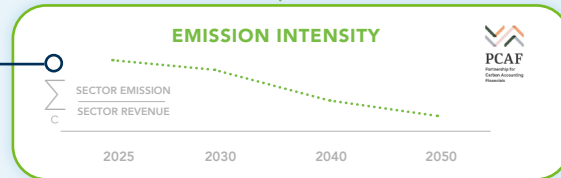
L1 TO L5 NAICS

MEAT PROCESSED FROM CARCASSES

Emission intensity along with NGFS intensity reduction target are used to identify the financial impact drivers needed to reach the target and weightage of each driver. Some drivers (such as policy action) are derived from NGFS, while others are discovered through extensive sector research by ON.



Emission intensity for the industry is calculated by dividing the aggregated amount of carbon emissions for the industry with the total industry revenue. The data used are from: US census data | EPA/market data | USGS | CDP | Census inventory | Borrower sustainability reports and other disclosures.



The impact drivers and the climate scenarios are overlaid on borrower data points to identify borrower level impact metrics including revenue, debt service coverage, leverage and profitability, and provides forecast financials and credit metrics for the borrowers, thus assigning them a transition risk score.



ON transition risk score can be compared with bank's existing risk rating models to derive a climate adjusted risk rating.



Sector trend

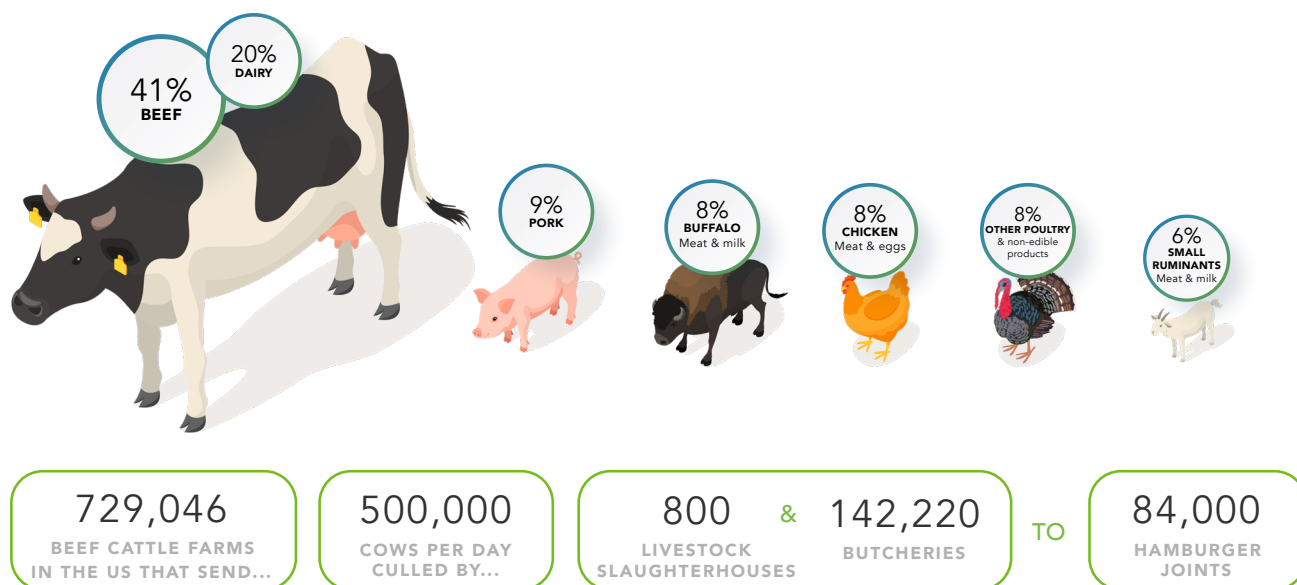
Agriculture, food and related industries are a vital part of our economy, contributing 5% of US GDP and 10% of total US employment. But this sector is also responsible for 25% of the total greenhouse gas (GHG) emissions in the US. The vast majority of pollutants come from three sources: agricultural soils (from the use of nitrogen fertilizers); enteric fermentation of feed in the stomach of livestock (particularly cattle); and livestock manure decomposition (Source: USDA, IPCC, breakthrough energy).

Slowing and reversing the rise of agricultural emissions while still meeting growing global demand for food will require significant innovations in agricultural practices. On the supply side, new technologies, practices, and policies will be needed to improve efficiency, reduce the use of fertilizers, increase carbon sequestration through soil management, and

lower methane emissions from livestock. At the same time, demand-side measures can reduce the consumption and waste of GHG-intensive foods.

Changing consumer preferences, use of technology and policy risks will all impact the entire agricultural value chain, affecting both upstream and downstream sectors / activities. This includes the vast cattle sector that generated \$66B for the US economy in 2021 and supported the 660,000 downstream businesses in the food service industry. Banks need a loan-level understanding of how risk cascades down the value chain and the ripple effects that a carbon mitigation lever (such as technological disruption) could have throughout the entire sector.

ANIMAL METHANE EMISSION SOURCES | Consider the carbon cost of your hamburger



The US is the world's largest producer of beef, with 729,046 beef cattle farms that send 500,000 cows a day to be culled by 800 livestock slaughterhouses and 142,220 butcheries, before being sold to consumers or restaurants, including the nation's 84,000 hamburger joints (Source: USDA).

All the businesses in this supply chain are potential borrowers that could be impacted by transition risks such as carbon taxes or changing consumer demands for meat-free alternatives.

The green premium

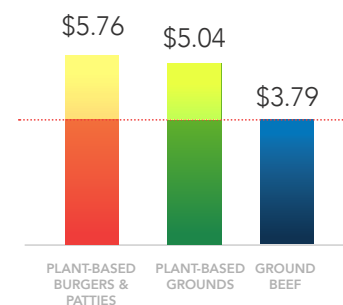
The green premium is the additional cost of choosing a clean technology over one that emits a greater amount of greenhouse gases. Right now, clean solutions are usually more expensive than high-emission ones, in part because we don't factor the true economic and environmental costs of existing energy options, such as fossil fuels, into the price we pay for them.

Take meat for example. The average retail price of ground beef is \$3.79 per pound, while a plant-based burger is \$5.76 per pound. The green premium for a zero-carbon burger is the difference in cost between the two - i.e. \$1.97 (Source: Rhodium group). However, the regular burger price doesn't reflect the true cost of methane which is emitted by all

livestock and is a more potent greenhouse gas than carbon dioxide. In fact, if cows were their own country, they'd be the third-largest greenhouse gas emitter in the world.

Moving our immense energy economy from inputs and products that emit greenhouse gases to ones that don't will, of course, incur significant cost. However, with the right policies and focus, we can lower the green premium. Ultimately, we need the premiums to be so low that every country and industry in the world can choose the clean alternative.

The green premium for low-GHG meat



ON Climate

ON Climate uses agreed, recognized industry and accounting standards (including PCAF, CFRF and NGFS Climate Scenarios) and a reliable, extensive, and audited data set to build and run climate scenario and financed emission modeling.

Identifying carbon mitigation levers for the industry

Carbon emission intensity is a key metric when determining the carbon mitigation levers that would need to be applied to reduce the emissions. Emission intensity is calculated as a ratio of the aggregated amount of carbon emissions at the industry level and the total revenue for that industry. We follow PCAF Score 3 and Score 4 methodologies for this calculation.

This calculated emission intensity along with NGFS intensity reduction target is used to identify the emission reduction levers needed to reach the target and the weightage of each lever. We also identify the limit to which a certain technology can reduce emissions in a particular industry. For example, process efficiencies / improvements or recycling processes can only reduce emissions to a certain extent. The levers are identified through NGFS (e.g., most policy actions like carbon tax, change in electricity prices, change in fossil fuel prices) and our ON sector research team. These also consist of supply chain impacts such as raw material pass-on, and emissions reduction technologies like green hydrogen, transition to EVs, etc.

Continuously updated

These levers are constantly changing and updated in our climate models to reflect the latest market trends. ON Climate solution then aggregates the mitigation levers into eight categories which customers can easily use to view and evaluate carbon emission for certain scenarios like carbon tax and carbon reduction efforts.

Data sources

The data used in these calculations are from public sources, such as US census data, EPA/market data, USGS, CDP, census inventory, borrower sustainability reports and other disclosures. For new technologies we refer to research reports, technical documents, journals, and publications from various sources to validate their operational feasibility. We also check for government subsidies currently in process for the available carbon reduction technologies, such as 45Q tax credit for CCS.

In the above illustration on pg. 6, we can see that for a 6-digit NAICS industry (Meat Processed from Carcass) we have identified several levers needed to reach the emission target:

- **SUPPLY CHAIN CONSTRAINTS** from higher raw material prices, which result from upstream industries moving towards a low carbon economy. Companies are likely to pass-on a significant portion of the incremental climate-related costs to end users, given the sector's high importance for the economy.
- **DEMAND REDUCTION** due to lifestyle changes.
 - Meat and dairy remain the most GHG-intensive foods on our plates. But compared to their meat counterparts, plant-based pork and chicken could reduce emissions by 30-35% and plant-based hamburgers could reduce emissions by 80-90% (Source: breakthrough energy).
 - Cell-based or lab-cultivated beef could reduce the impact of livestock on land use by more than 95% and bring down GHG emissions by 80% compared to conventional beef. The production of cultivated meat takes around 6-8 weeks, far faster than the time required to raise an animal for slaughter.
- **CARBON MITIGATION EFFORTS** such as replacing fossil fuels with green hydrogen or transitioning an entire fleet of vehicles to EV requires significant additional operating and capital expenditure.
- **GOVERNMENT POLICY ACTIONS** that will have major repercussions for business financials. For example:
 - **Carbon tax** which is a government imposed fine (\$ per tonne of CO₂) will likely go up as borrowers try to reduce their carbon emissions – with an aim to reach net zero by 2050 (if not sooner).
 - **Agricultural methane abatement:** Both livestock and decaying plant matter emit methane, which is as much as thirty times more harmful than CO₂. Policies to reduce agricultural methane include adjusting feeding practices, implementing methane-recovery technologies at landfills, and increasing rates of recycling and composting.
 - In 2020 The European Commission published a **“Farm to Fork Strategy”** which supports and advocates a move to a more plant-based diet through meat-free alternatives. These best practices are also seeing adoption in US's Farm to Table strategy.

ON CLIMATE IS BUILT ON A RICH REPOSITORY OF CLIMATE DATA

CLIMATE & WEATHER DATA



BORROWER & SECTOR DATA



GLOBAL TRADE, ECONOMIC & REGULATORY DATA



- **Buy Clean California Act:** companies whose products exceed the embodied-carbon limit are not eligible to respond to a call for public work tenders. Currently the limit is applicable on four materials, but it could also be extended to other materials soon.

These levers will affect margins which are likely to decline due to a dip in volume, an increase in raw material cost pass-on, carbon price rises and growing energy costs. Revenue decline reflects the 85% pass through of the additional emission costs and a drop in sales volume.

Projection of borrower financial performance and generation of climate risk score

Our transition risk climate model ingests 14 borrower data points which can be readily extracted from spreading and core banking systems, and then apply the NGFS climate scenarios on each borrower's data to determine the impact climate might have on their future financial performance, across:

- Operating costs, which can be impacted by changes in policy and supply chain
- Potential capex for clean technology
- Revenue changes driven by shifts in demand or disrupted operations
- Debt service coverage, leverage, and profitability to arrive at a final transition risk rating.

Borrower-level financial projections are used to provide a climate risk score from low priority (least vulnerable) to high (most vulnerable) for each individual borrower. The score helps banks in identifying:

- Borrower with lower projected climate risk, in sectors that are rated to have inherently high climate risk
- Borrowers with high climate risk that you might be able to coach to help avoid future risk

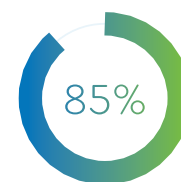
Financed carbon emissions reporting

ON Climate helps banks calculate and report on Scope 3 financed emissions across their commercial loan portfolio. This allows banks to view the total financed emissions in their loan book at the portfolio and individual borrower levels.

Taking a holistic view of financed emissions – together with carbon pathways under the various NGFS scenarios – enables banks to evaluate and set overall emission goals (e.g., net zero by 2050), and understand the levers available to manage a transition of their commercial portfolio.

Coverage

We have identified more than 300 direct and indirect impact industries (when categorized at the 6-digit NAICS level) that collectively account for 85% of the gross scope 1 emissions for C&I industries in the US. EU Emissions Trading System, US EPA TSCA Inventory, and IPCC research documents have been used to identify these industries. These industries are mapped to OakNorth's 85 unique transition risk climate models.



ON Climate covers 85% of the gross Scope 1 emissions for C&I industries in the US



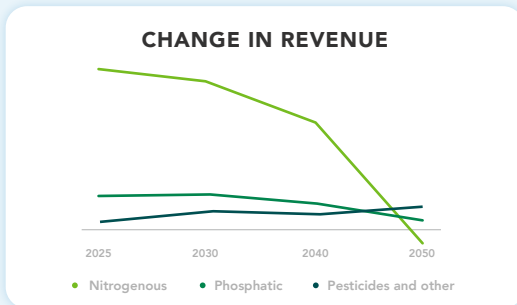
“We’re trying to look forward and think about what the implications might be on a borrower-by-borrower basis because each obligor will have very different adaptive capability.”

ON CLIMATE CONSORTIUM MEMBER

Climate impact in agriculture

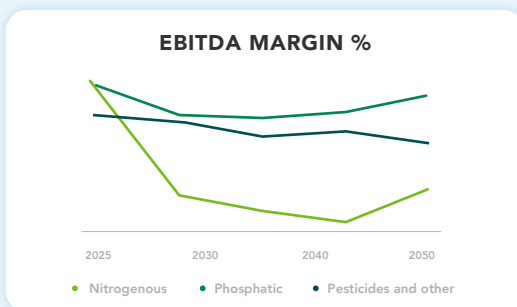
Let's look at the trends we anticipate for borrowers in the agriculture economy. The graphic shows various climate risk impact models for the agricultural sector and the resultant change in the revenue and margins of borrowers in this industry. We are continuously updating these models with the latest carbon mitigation technologies, government policies and global market outlook/trends.

Climate models for crop cultivation



NITROGENOUS FERTILIZER

- Use of emission reduction measures such as green ammonia and carbon capture and storage (CCS) will impact margins of nitrogenous fertilizers
- Decline in volume of nitrogenous fertilizer is due to growing trend towards sustainable farming practices
- Revenue increase reflects significant cost pass on as the sector is highly concentrated with no direct substitutes



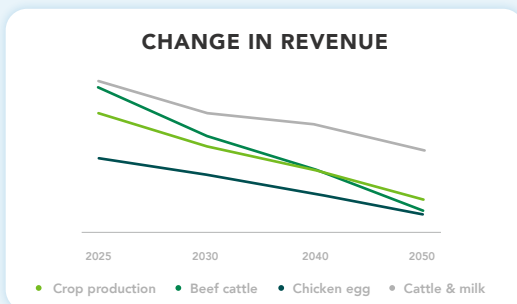
PHOSPHATIC FERTILIZER

- Use of emission reduction levers such as CCS and fuel efficiency improvement will suppress margins
- Revenue increases due to significant cost pass on as the sector is highly concentrated with no direct substitutes

PESTICIDES & OTHER AGRICULTURAL

- Increase in input cost is due to increase in oil price and emission reduction measures including CCS and fuel efficiency improvement will result in lower margins
- Revenue increases due to significant cost pass on as the sector is consolidated with limited substitutability

Climate models for crop cultivation, animal breeding & rearing



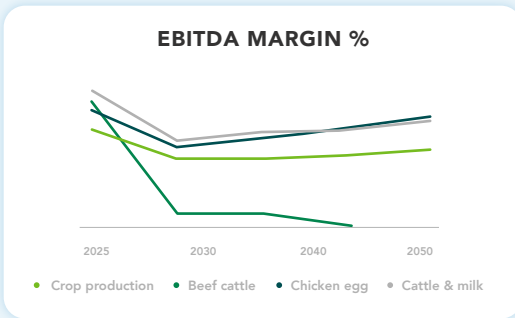
CROP PRODUCTION

- Use of emission reduction levers such reduced tillage intensity, reduced fertilizer application, inhibitor application, and variable rate technology is expected to suppress margins in the medium term
- Decline in yield is expected due to reduced tillage intensity and lower fertilizer application

BEEF CATTLE RANCHING & FARMING

- Volume decline is expected in this industry due to changing consumer preference
- High input cost due to increase in prices of upstream industries such as crop production and use of emission reduction measures such as adding seaweed to cattle feed and installing manure-based biogas plants will impact margins
- Revenue increases reflects significant pass on of the additional emission costs

Climate models for crop cultivation, animal breeding & rearing continued



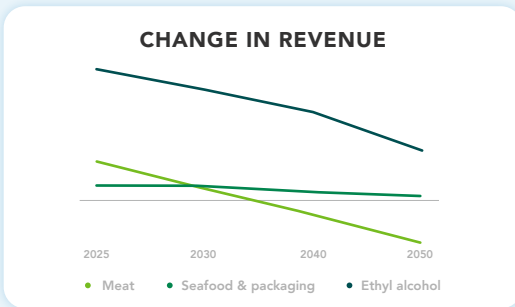
CHICKEN EGG PRODUCTION

- Implementation of emission reduction technologies such as setting up biogas plants to capture methane and changing from fossil fuel to green hydrogen, along with increase in raw material costs is expected to impact margins
- Revenue increase due to significant cost pass on because of steady demand in this industry and no direct substitutes

DAIRY CATTLE & MILK PRODUCTION

- Increase in price of feed is in line with increase in crop prices and use of emission reduction measures such as adding seaweed to cattle feed and installing manure-based biogas plants will result in lower margins
- Revenue increases due to significant pass on of the additional emission costs

Climate models for meat manufacturing/processing

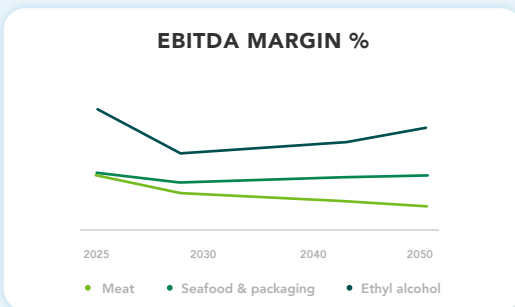


MEAT PRODUCT MANUFACTURING

- Implementation of emission reduction measures such as green hydrogen will impact margins of the industry
- Volume decline is expected in meat production which is driven by anticipated shift towards lower emitting options such as cultivated meat

SEAFOOD PRODUCT PREPARATION & PACKAGING

- Application of emission reduction measures such as green ammonia fueled ships and change from fossil fuel to green hydrogen will result in decline in margins
- Higher input prices from upstream industries like crop production and meat manufacturing will further shrink the margins
- Revenue increase reflects significant cost pass on as the industry is highly concentrated with stable demand and no availability of direct substitutes



ETHYL ALCOHOL MANUFACTURING

- Use of emission reduction measures such as CCS, changing from fossil fuel to green hydrogen and higher input price from upstream industries like crop production will impact margins
- Revenue increase reflects significant cost pass on due to negligible risk of substitution

A proven model with a massive data set

ON Climate was developed by our team of credit scientists and engineers, in close collaboration with 10 US banks and 27 climate experts. We have one of the largest commercial lending data sets in the USA, representing \$420B of lending across automotive, agriculture, energy, industrial, manufacturing, and buildings and construction. We also draw information from industry experts, media sources, research and multiple third parties to create a comprehensive and continuously evolving rich data source. The data is proprietary data which we've collected as a function of providing software to our customers. Additionally, we pipe in over 400 million external third party and alternative data sources which help provide an overall perspective of what the "now" looks like.



Quick ON-boarding and next steps

You could implement ON Climate in just a few weeks time, moving rapidly from initial briefing through exploratory workshops, an executive readout, and then go live. To discover what it could deliver for your bank, we offer a rapid onboarding that is completely customizable to your needs.

Schedule a demo to learn how the ON Climate can help your institution better evaluate and manage climate-related risks in your portfolios.

[Request a demo](#)