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# US animal health: Advancing security and sustainability

A summary report produced for the Animal Health Institute (AHI)

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# About this report

Oxford Analytica is providing a quantitatively informed report that analyses economic and environment-related benefits of strong animal health performance in the United States for the Animal Health Institute (AHI). This report presents findings -- examining associations between health, costs and resources-- from three case studies in selected animal species in the United States. This report is intended for the use and assistance of AHI. It should not be regarded as a substitute for the exercise by the recipients of their own judgment. Oxford Analytica Ltd and/ or any person connected with it accepts no liability whatsoever for any direct or consequential loss of any kind arising out of the use of this study or any part of its contents.



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# Contents

<b>About this report</b>	<b>2</b>
<b>Executive summary</b>	<b>4</b>
<b>Introduction</b>	<b>5</b>
<b>Case study 1: Preventive medications in the poultry industry</b>	<b>6</b>
Summary	6
Key findings	7
State of US poultry sector	7
Threat of coccidiosis	8
Costs of untreated disease	8
Disease prevention and control options	9
<b>Case study 2: Vaccinating against respiratory disease in hog farming</b>	<b>10</b>
Summary	10
Key findings	10
Threat of respiratory disease to US swine production	11
Impact of vaccination programs on efficiency	11
Cost burden of disease	12
Coordination and innovation in biosecurity	12
Economic and environmental benefits	13
<b>Case study 3: Cutting new paths in sustainability in the cattle industry</b>	<b>14</b>
Summary	14
Key findings	15
US cattle sector in a global context	15
Role of animal health products	15
Examining productivity tools	16
Meeting new challenges	16
Techniques to target methane release	17
Genetic selection in breeding	17
Disease management	17
Feed additives and dietary changes	18
Incentives for farmer investment to enhance profitability	18
Carbon insetting marketplaces	18
<b>Conclusion</b>	<b>19</b>

## Executive summary

As the world's population continues to grow in both numbers and wealth, demand for animal protein continues to rise. Additional social imperatives placed on farmers and ranchers, including ecological challenges and the need to protect and efficiently use natural resources, will challenge our ability to meet this increased demand.

How farmers and ranchers meet these imperatives has a great impact on both human health and the environment. This interrelatedness is captured in the concept of One Health, which recognizes that the health of animals, people and our shared environment are connected.

The animal health sector, comprised of companies that provide medicines and other healthcare products to protect the health of animals, works at the nexus of this One Health concept. By providing farmers and ranchers with tools needed to protect the health and welfare of farm animals, the sector contributes to food safety and security while helping to minimize environmental impacts of food production.

Production losses -- animal mortality because of compromised or poor health -- create a ripple effect of negative consequences. The economic profit of that animal or herd is lost to the farmer. The inputs the animal received, including feed, up to the point of mortality are wasted, thus expanding the environmental footprint of production. Inefficiency created by lost production places upward pressure on food prices.

Keeping animals healthy is fundamental to sustainable food production. Animal health impacts economic and environmental sustainability, and as this report demonstrates, healthy animals contribute to farmer profitability, reduced environmental impact and a safe, stable and affordable food supply.

This report features three case studies to highlight the important contributions made by animal health solutions to sustainability-driven outcomes in US animal agriculture. Key findings include:



- According to Oxford Analytica scenario modeling of unvaccinated flocks, the US poultry industry would lose an estimated 1.7 billion broiler chickens (young chicken raised for meat) due to coccidiosis, a fatal, significant parasitic disease, in the absence of health interventions or treatment. As a prevented loss determined by the scenario modeling, an additional 1.7 billion broiler chickens could deliver up to 8.5 billion more pounds of poultry to US consumers, or an estimated 39 billion chicken meals to American's plates<sup>1,2</sup>.



- In US hog farming, vaccination programs provide a strong cost incentive to farmers by providing a large return on investment due to the low cost of vaccination and the significant benefit of avoiding economic losses incurred from disease prevalence, such as porcine circovirus associated disease (PCVAD).



- Genetic selection in cattle breeding, disease management to improve health performance and productivity levels, feed additives and dietary changes can reduce methane emissions in dairy cattle by up to 13.6% per pound of milk yielded.

1 National Chicken Council, [nationalchickencouncil.org/policy/nutrition-health/](https://nationalchickencouncil.org/policy/nutrition-health/)

2 University of Wisconsin-Madison, [livestock.extension.wisc.edu/articles/bird-breakdown-exploring-yields-and-cuts-of-poultry/#Dressing-Percentage](https://livestock.extension.wisc.edu/articles/bird-breakdown-exploring-yields-and-cuts-of-poultry/#Dressing-Percentage)

# Introduction

Healthier animals consume fewer natural resources, which enables them to provide more food for less feed, water and land. Accordingly, keeping animals healthy is central to achieving several UN Sustainable Development Goals (SDGs) by 2030. Consider that around the world, 20% of annual global animal production losses are linked to animal disease<sup>3</sup>. These losses represent not only an animal welfare crisis, but also feed, water, and carbon emissions to be spent with little to no benefit to our food supply.

As such, animal health tools are a critical component of food production and safety. They enable farmers, ranchers, and veterinarians to help prevent diseases, treat sick animals, and control outbreaks among livestock and poultry. Keeping food-producing animals healthy also increases the availability and affordability of safe meat and dairy products. And by helping food producers become more efficient, animal health products help improve farm income and strength local economies.

Consider that the share of food as a proportion of overall consumer expenditure has been on the rise in recent years, reaching 12.9% in 2023<sup>4</sup>. Animal disease disrupts the availability and prices of common animal-derived products such as milk, meat, and eggs and in doing so, animal disease impacts food inflation, with implications for consumer inflation and broader impacts on the economy.

Indeed, animal disease threatens not only the US animal agriculture sector, but also the resilience of food supply, both domestically and in international trade. The good news is that research indicates that controlling livestock disease has multiplier benefits for economic, environmental, and social sustainability<sup>5</sup>. This includes reductions in emissions, hunger, malnutrition and poverty in line with the targets established by the SDGs.

The US animal health sector develops medicines, vaccines, biosecurity measures, diagnostics, and innovative digital technologies to treat, prevent, monitor and better predict animal disease. These tools help stabilize farm-level commodity prices and provide economic security for producers. This assurance is vital to the many sectors that comprise the food production system in the United States as well as for populations abroad who rely on US agriculture and livestock for food.

Additionally, as this report finds, the US animal health sector helps sustain societal imperatives to efficiently produce food, decrease food losses and resource waste, and mitigate environmental impact through technological innovation and improvement in medicines and management practices.

The following case studies illustrate the measurable connections between animal health and sustainability.

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3 HealthforAnimals, [healthforanimals.org/reports/animal-health-and-sustainability/#:~:text=Based%20on%20World%20Organisation%20of,lost%20to%20disease%20each%20year](https://healthforanimals.org/reports/animal-health-and-sustainability/#:~:text=Based%20on%20World%20Organisation%20of,lost%20to%20disease%20each%20year)

4 US Department of Labor, [bls.gov/news.release/pdf/cesan.pdf](https://bls.gov/news.release/pdf/cesan.pdf)

5 HealthforAnimals, [healthforanimals.org/resources/publications/publications/animal-health-and-sustainability-a-global-data-analysis-summary/](https://healthforanimals.org/resources/publications/publications/animal-health-and-sustainability-a-global-data-analysis-summary/)



# Case study 1: Preventive medications in the poultry industry

## Summary

Poultry meat is the most consumed animal protein in the United States, and the United States is also the world leader in poultry production<sup>1</sup>. Demand for animal protein, including meat, is expected to continue increasing globally in the coming years. For example, the Organization for Economic Cooperation and Development (OECD) finds that global average per capita meat demand will rise by 2% between the levels seen in 2020-22 and 2032<sup>2</sup>. In this context, the US poultry sector needs to meet growing levels of domestic and export demand, while also mitigating its environmental footprint<sup>3</sup>.

To meet these challenges, US poultry producers rely on the animal health sector to provide preventive care and medications that protect against common diseases, maintaining a consistent poultry population while improving efficiency to increase overall production.

This case study reflects current preventive medications and treatments for a common disease found in poultry: coccidiosis. Controlling coccidiosis sustains production and supports a positive outlook for the sector in its ability to deliver for consumers and provide consistent livelihoods within the poultry economy. This in turn secures the food supply to provide reliable sources of protein to fuel nutritional needs, reduce environmental impacts, maintain competitive exports and support the goal of reducing global hunger.

<sup>1</sup> FAO, [fao.org/poultry-production-products/production/en/](https://www.fao.org/poultry-production-products/production/en/)

<sup>2</sup> OECD, [oecd.org/en/publications/oecd-fao-agricultural-outlook-2023-2032\\_08801ab7-en/full-report/meat\\_7b036d52.html](https://www.oecd.org/en/publications/oecd-fao-agricultural-outlook-2023-2032_08801ab7-en/full-report/meat_7b036d52.html)

<sup>3</sup> USDA Economic Research Service, [ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers](https://www.ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers)

## Key findings

- Coccidiosis poses a persistent challenge to the health of US poultry flocks and affects the industry's ability to meet projected growth in domestic and export demand.
- According to Oxford Analytica scenario modeling of unvaccinated flocks, approximately 1.7 billion broiler chickens (young chicken raised for meat) would have died in 2023 in the United States from coccidiosis in the complete absence of anticoccidial drugs. The loss of life could deliver up to 8.5 billion more pounds of poultry to US consumers, or an estimated 39 billion chicken meals to American's plates<sup>4,5</sup>.
- In 2024, the total number of broilers produced in the United States was 9.33 billion, for a total live weight of 61.1 billion pounds<sup>6</sup>.
- In a scenario where the entire US broiler population (levels as of 2023) experiences prevalent coccidiosis, it is estimated that the industry could have preserved an additional USD 1.8bn in production value through reduced loss of life from coccidiosis, representing the value of mortality prevented by the use of anticoccidial drugs.



## State of US poultry sector

The United States commands a major presence in the international poultry meat commodity market as the world's second largest exporter of poultry meat<sup>7</sup>. In terms of its production processes, the poultry industry is a major employer: meat and poultry plants collectively employ the largest percentage (30.6%) of food and beverage manufacturing workers, as recorded in 2021<sup>8</sup>. Broiler chickens and turkeys supply nearly half of the total volume (46%) of meat consumed in the United States each year<sup>9</sup>.

Chicken eggs are also critical to the poultry sector economically, comprising nearly a quarter of the total combined production value on average per year. Eggs contribute to the growing scale of domestic poultry product consumption and historically represent one of the most affordable sources of protein available to US consumers.

The US Department of Agriculture (USDA) Economic Research Service measures the availability of meat in the country on an average of 'pounds per person' annual basis. The poultry sector produces 68.1 pounds of chicken per person, as recorded in 2021. This average is more than double the amount that was available in 1980, at 32.7 pounds per person<sup>10</sup> with the same number of birds.

The USDA projects that current levels of US poultry meat production will rise nearly 15% within the next decade, from 45.7 billion pounds in 2022 to 52.5 billion pounds in 2033<sup>11</sup>. This projection is estimated on the assumption of no outbreaks of animal disease.

<sup>4</sup> National Chicken Council, [nationalchickencouncil.org/policy/nutrition-health/](https://nationalchickencouncil.org/policy/nutrition-health/)

<sup>5</sup> University of Wisconsin-Madison, [livestock.extension.wisc.edu/articles/bird-breakdown-exploring-yields-and-cuts-of-poultry/#Dressing-Percentage](https://livestock.extension.wisc.edu/articles/bird-breakdown-exploring-yields-and-cuts-of-poultry/#Dressing-Percentage)

<sup>6</sup> USDA National Agricultural Statistics Service, [downloads.usda.library.cornell.edu/usda-esmis/files/m039k491c/ws85cd48j/q524mm00n/plva0425.pdf](https://downloads.usda.library.cornell.edu/usda-esmis/files/m039k491c/ws85cd48j/q524mm00n/plva0425.pdf)

<sup>7</sup> USDA Economic Research Service, [ers.usda.gov/topics/animal-products/poultry-eggs/sector-at-a-glance](https://ers.usda.gov/topics/animal-products/poultry-eggs/sector-at-a-glance)

<sup>8</sup> USDA Economic Research Service, [ers.usda.gov/data-products/chart-gallery/chart-detail?chartId=58286](https://ers.usda.gov/data-products/chart-gallery/chart-detail?chartId=58286)

<sup>9</sup> USDA Economic Research Service, [ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers](https://ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers)

<sup>10</sup> USDA Economic Research Service, [ers.usda.gov/data-products/charts-of-note/chart-detail?chartId=105929](https://ers.usda.gov/data-products/charts-of-note/chart-detail?chartId=105929)

<sup>11</sup> USDA Economic Research Service, [ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers](https://ers.usda.gov/amber-waves/2024/august/long-term-growth-projected-as-u-s-poultry-and-egg-sector-recovers)

## Threat of coccidiosis

Among diseases found in poultry, coccidiosis ranks as one of the most significant diseases affecting the species. Coccidiosis is a protozoan parasite that can affect the intestines of domestic chicken and can lead to flock mortality and morbidity for the poultry meat and egg industry.

Morbidity (i.e., the rate of illness) can affect entire flocks while mortality rates can reach as high as 50%<sup>12</sup>. Symptomatic cases include displays of anemia, depression and weight loss, causing reduced efficiency. Sub-clinical (non-symptomatic) cases also can lead to reduced feed conversion ratios or efficiency (the amount of feed it takes to produce meat) and diminished egg production. There are seven species of coccidia that infect poultry, meaning that while a chicken may be infected and develop immunity from one species, it can remain susceptible to infection by another coccidia species at a later time.

## Costs of untreated disease

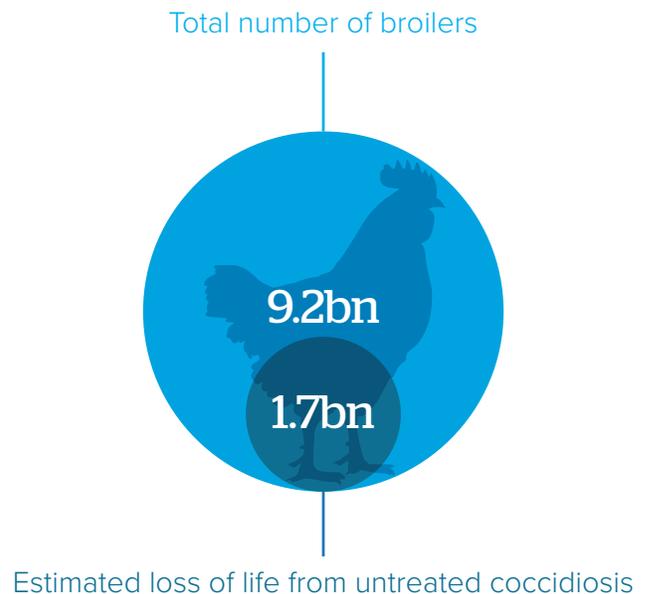
Anti-coccidiosis treatments are a necessary intervention to reduce death loss and enhance animal welfare. The consequences of disease span the entire supply chain, with economically damaging losses for producers, wasted feed, and loss of returns on land used and resources spent on producing and using that feed.

The disease poses a significant economic risk to US poultry production, which generated USD30bn in total revenue in 2024, with an additional USD15bn in revenue for egg producers. These figures are projected to rise, following increased production estimates, over the next decade.

Figure 1 estimates an annual loss of 1.7 billion broiler chickens in the United States and contrasts this number with the total numbers of broiler chickens livestock, to show how anticoccidial drugs could save on production losses from otherwise healthy poultry.

An additional 1.7 billion broiler chickens could deliver up to 8.5 billion more pounds of poultry to US consumers, or an estimated 39 billion chicken meals to American plates.

Figure 1. Estimated broiler chickens loss from untreated coccidiosis in the United States, 2023



<sup>12</sup> Poultry World, [poultryworld.net/topic/coccidiosis/](https://poultryworld.net/topic/coccidiosis/)

By way of example, feed is the largest expense item in poultry and egg production in the United States. It accounted for 59% of total production costs in 2022 at USD28bn, according to the US Census of Agriculture<sup>13</sup>. For this reason, the ability for chickens to retain nutrients and convert feed efficiently is paramount to farmers' bottom line.

Infected or weakened chickens do not convert feed consumed into growth or egg production effectively and, in some cases, may not survive to market or laying age. This results in greater feed use to reach the same level of production or, in the case of mortality, a loss of the value of the feed consumed.

In addition to increasing the price of production, greater demand on resources like feed leaves a greater ecological footprint. The animal feed supply chain, comprised of corn and soy in the case of chickens, is a contributor to GHG emissions -- from soil manipulation, applications of fertilizers and land-use conversion, to manufacturing and transportation.

Figure 2 shows the estimated savings from reduced loss of life in production value terms when treating coccidiosis. This number shows the scale of the challenge to poultry producers and the incentive to invest in treatment options. Estimated savings refers to the total production value preserved by preventing coccidiosis-related mortality through the use of anticoccidial drugs, calculated as the number of deaths averted multiplied by the market value of a single broiler.

Figure 2. Estimated savings from using anticoccidial medications, from data available in 2023

# \$8.1bn

Estimated total production savings  
if using anticoccidial drugs

## Disease prevention and control options

Anti-coccidiosis treatments have been in use for over 80 years and have taken on different forms: synthetic drugs, ionophores and vaccines. Therapeutic drugs for coccidiosis are categorized into coccidiostats, which inhibit parasite growth, and coccidiocides, which kill parasites outright. The majority are now used as treatments administered via feed to prevent and control disease.

Growing demand for fewer antibiotics and increased resistance to synthetic drugs have led to needs for alternative approaches, with vaccines providing a new tool for disease control. Current vaccines are often live infectious versions of the parasite to trigger an immune response. Vaccines can be applied by spray, on chicks in the hatchery, or either into the egg (in ovo) or through feed.

In addition to vaccines and medications, a holistic approach to controlling coccidiosis through farm management, sanitation and immune-boosting supplements has been used among producers. Such approaches align with the animal health industry goal of reducing the need for antibiotics and minimizing the ecological footprint of poultry production.

<sup>13</sup> USDA National Agricultural Statistics Service, [nass.usda.gov/Publications/Highlights/2024/Census22\\_HL\\_Poultry.pdf](https://nass.usda.gov/Publications/Highlights/2024/Census22_HL_Poultry.pdf)



## Case study 2: Vaccinating against respiratory disease in hog farming

### Summary

Respiratory infections are a significant cause of mortality in pigs and as they grow into hogs. Development and implementation of vaccination programs against common viruses such as porcine circovirus type 2 (PCV2) can mitigate disease pressure on the farm. This case study examines the value of vaccination in preventing respiratory disease.

### Key findings

- According to Oxford Analytica scenario modeling, PCV2 vaccines may reduce mortality from between an estimated 8–10% in non-vaccinated pigs to 1–2% in vaccinated pigs. Vaccination programs, as observed among farms post-implementation, can increase herd-level immunity and lessen mortality risks by as much as 90%<sup>1</sup>.
- Three-quarters of swine farms in the United States have large operations (5,000 pigs or more), suggesting the importance of herd-level disease management<sup>2</sup>.
- Scenario modeling for the US pig population estimates that vaccination against PCV2 likely results in production value savings of USD 2.7bn in 2030. This estimated saving reflects reduced loss of life and is expressed in terms of preserved production value.



<sup>1</sup> Gillespie J., Opriessnig T., Meng X.J., Pelzer K., Buechner-Maxwell V. — Porcine circovirus type 2 and porcine circovirus-associated disease, *Journal of Veterinary Internal Medicine* (2009), [pmc.ncbi.nlm.nih.gov/articles/PMC7166794/](https://pubmed.ncbi.nlm.nih.gov/articles/PMC7166794/)

<sup>2</sup> USDA Economic Research Service, [ers.usda.gov/data-products/charts-of-note/chart-detail?chartId=105372](https://ers.usda.gov/data-products/charts-of-note/chart-detail?chartId=105372)



- Trials encompassing the entire production cycle for immunized pigs against PCV2 indicate a potential 12% reduction in carbon dioxide (CO<sub>2</sub>) emissions<sup>3</sup>. This efficiency comes from the reduced amount of feed (which requires land, water and fertilizer use) needed for pigs to grow to target weight.

## Threat of respiratory disease to US swine production

PCV2 is a virus that can cause respiratory infection and lead to high fatality rates in pig herds. The National Animal Health Monitoring System, part of the USDA's Animal and Plant Health Inspection Service, finds that respiratory infections are the main cause of mortality in young pigs (47.3%) and in later development phases (75.1%), as of 2012<sup>4</sup>. The most common viral pathogens include porcine reproductive and respiratory syndrome virus (PRRSV), PCV2 and swine influenza virus (SIV).

PCV2 is transmitted by direct pig-to-pig contact. Highly resistant to inactivation, the virus can be maintained within farms continuously, which increases the risk of different variants emerging. It is prevalent around the world, with some herds showing 100% exposure to the virus, and a variation of 5-30% of pigs and hogs developing clinical disease from this exposure<sup>5</sup>.

Infected pigs, either with or without visible symptoms, have a reduction in average daily gain in weight – though this impact is less pronounced in asymptomatic animals. Infected pigs require extra days to market due to infection to reach target weight. The feed needed during those extra days negatively impacts the efficiency of the individual pig's growth as well as the farm's productivity.

Indeed, feed is the largest expense item in US hog farming, accounting for approximately half of all production costs (48%), or totaling USD13.5bn in 2022, according to the US Census of Agriculture<sup>6</sup>.

Efficiency is a vital consideration given that pork may overtake poultry as the United States' most exported meat by weight by 2033, according to the USDA Economic Research Service<sup>7</sup>.

## Impact of vaccination programs on efficiency

Field studies in the United States from the earliest vaccines against PCV2 available, introduced in 2006, indicate a sharp drop in mortality rates from 8–10% in non-vaccinated pigs to 1–2% in vaccinated pigs<sup>8</sup>. Vaccination programs, as observed among hog farms post-implementation, can increase herd-level immunity and lessen mortality risks by as much as 90%<sup>9</sup>.

A 2012 study examined 73 sites in the United States where PCV2 vaccines were implemented in 2006<sup>10</sup>. It found that vaccines had reduced the prevalence of the virus in 75% of all pigs, as detected in 2006, to

- Gickel, J., Hartung, C.B., El-Wahab, A.A., Hankel, J., Visscher, C. — Influence of vaccination against infectious diseases on the carbon footprint of fattening pigs: a systematic review, *Frontiers in Veterinary Science* (2024), [frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1487742/full](https://frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1487742/full)
- USDA Animal and Plant Health Inspection Service, [aphis.usda.gov/sites/default/files/swine2012-dr-parti.pdf](https://aphis.usda.gov/sites/default/files/swine2012-dr-parti.pdf)
- Xiang-Jin Meng — Spread like a wildfire: the omnipresence of porcine circovirus type 2 (PCV2) and its ever-expanding association with diseases in pigs, *Virus Research* (2012), [sciencedirect.com/science/article/abs/pii/S016817021100493X?via%3Dihub](https://sciencedirect.com/science/article/abs/pii/S016817021100493X?via%3Dihub)
- USDA National Agricultural Statistics Service Information, [nass.usda.gov/Publications/Highlights/2024/Census22\\_HL\\_Hogs\\_Pigs.pdf](https://nass.usda.gov/Publications/Highlights/2024/Census22_HL_Hogs_Pigs.pdf)
- USDA Economic Research Service, [ers.usda.gov/amber-waves/2024/february/u-s-pork-exports-projected-to-surpass-chicken-in-the-next-decade](https://ers.usda.gov/amber-waves/2024/february/u-s-pork-exports-projected-to-surpass-chicken-in-the-next-decade)
- Gillespie J., Opriessnig T., Meng X.J., Pelzer K., Buechner-Maxwell V. — Porcine circovirus type 2 and porcine circovirus-associated disease, *Journal of Veterinary Internal Medicine* (2009), [pubmed.ncbi.nlm.nih.gov/articles/PMC7166794/](https://pubmed.ncbi.nlm.nih.gov/articles/PMC7166794/)
- Gillespie J., Opriessnig T., Meng X.J., Pelzer K., Buechner-Maxwell V. — Porcine circovirus type 2 and porcine circovirus-associated disease, *Journal of Veterinary Internal Medicine* (2009), [pubmed.ncbi.nlm.nih.gov/articles/PMC7166794/](https://pubmed.ncbi.nlm.nih.gov/articles/PMC7166794/)
- Dvorak, Cheryl M.T., Yang, Yan, Haley, Charles, Sharma, Nikita, Murtaugh, Michael P. — National reduction in porcine circovirus type 2 prevalence following introduction of vaccination, *Veterinary Microbiology* (2016), [sciencedirect.com/science/article/abs/pii/S0378113516301183](https://sciencedirect.com/science/article/abs/pii/S0378113516301183)

only 27% of pigs in 2012. Further, detection of the virus in porcine bloodstreams were observed in only 17.2% of finisher pigs (those closest to slaughter) in 2012, compared to 82.6% in 2006.

Most salient from the study, vaccination programs prevent the development of new strains of PCV2 from the potential recombination of multiple strains existing in animals. For example, in the same study, no site showed 100% positivity compared to 2006, when 17% of the sites saw its herds test positive for common porcine viruses.

The study observed that the introduction of vaccination programs greatly reduced the prevalence of PCV2 nationwide and that currently available vaccines continue to offer cross-protection across variants that have arisen.

### Cost burden of disease

The cost burden of PCV2 and porcine circovirus associated disease (PCVAD) for hog farmers ranges from USD3–20 per pig on average<sup>11</sup>.

The projected estimated cost of mortality, as determined by multiplying the number of pigs lost to the disease per head by the upper end of this range, could soar to over USD280mn by 2030.

Figure 3 estimates savings (USD) reflected as the total production value preserved by preventing mortality from PCV2 through vaccination, calculated as the number of deaths averted, expressed in production value terms. This figure underscores the importance of vaccination programs as a useful tool for US pig and hog farmers in terms of the estimated cost savings from avoided economic losses incurred from unvaccinated herds.

Figure 3. Estimated savings on costs related to treating PCV2 with vaccinations by 2030



\$2.7bn

Estimated savings from reduced production losses due to lower mortality

This amount does not include production inefficiencies, such as increased feed requirements and the slower growth rates of asymptomatic infected pigs.

### Coordination and innovation in biosecurity

Animal health, as an innovative and technologically advanced sector, is continuing to develop new responses to the threat of evolving viruses. Surveillance in the field, development of next-generation vaccines and vaccine compliance will remain important to control animal disease.

<sup>11</sup> Alarcon, P., Rushton, J., Wieland, B. — Cost of post-weaning multi-systemic wasting syndrome and porcine circovirus type-2 subclinical infection in England: an economic disease model, Preventive Veterinary Medicine (2013), [sciencedirect.com/science/article/pii/S01675871300041X](https://www.sciencedirect.com/science/article/pii/S01675871300041X)

For example, tracking antibodies can help to prevent PCV2 from spreading or inducing hyper-immunization (presence of high levels of antibodies), which would require vaccination in weaning pigs to be delayed.

## Economic and environmental benefits

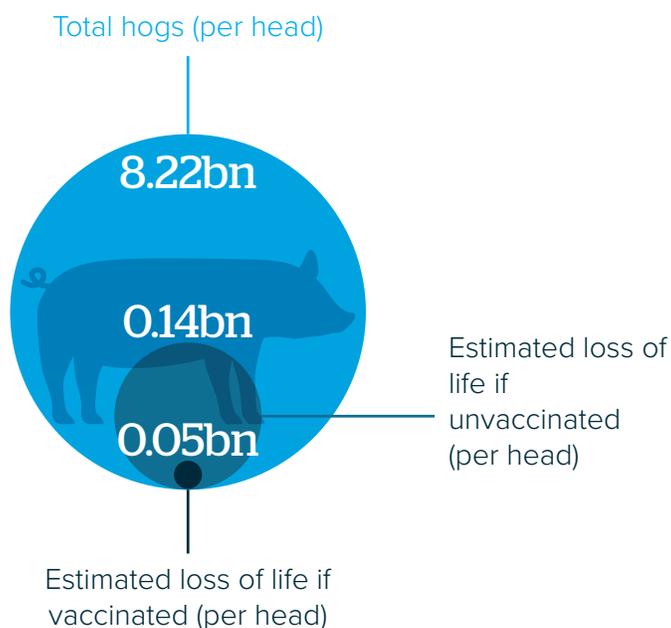
Vaccination programs are inherently cost effective, typically costing only one quarter of the economic losses associated with clinical disease in the absence of vaccines<sup>12</sup>.

For example, when extrapolating from findings in the United Kingdom and applying to herds in the United States, a 500-sow herd with a modest 5% mortality rate alone could cost pig and hog farmers USD34,000 annually, with an additional USD61,000 in extended feed costs and medications. In severely affected farms, where mortality rates can reach 25–30% of weaned pigs, losses can multiply, with costs of USD61 or more per pig in older growth stages (as hogs)<sup>13</sup>.

Figure 4 visualizes the extent to which PCV2 vaccination programs lowers mortality rates. This number captures the loss of animal life and otherwise healthy hogs brought to market as available pork meat. In this example, animal health interventions prevent food loss and waste.

Advancing efficiency in operations of large-scale commercial hog farming has measurable implications for the climate and for resource use, as well as for the management of ecological systems. Trials encompassing the entire production cycle in hog farming among healthy, vaccinated herds indicate a potential 12% reduction in CO<sub>2</sub> emissions<sup>14</sup>.

Figure 4. Estimated US pig livestock loss in 2025 with and without PCV2 vaccination programs



<sup>12</sup> National Animal Disease Information Service (NADIS), [nadis.org.uk/disease-a-z/pigs/pmws-circovirus-disease-and-pdns/](https://nadis.org.uk/disease-a-z/pigs/pmws-circovirus-disease-and-pdns/)

<sup>13</sup> National Animal Disease Information Service (NADIS), [nadis.org.uk/disease-a-z/pigs/pmws-circovirus-disease-and-pdns/](https://nadis.org.uk/disease-a-z/pigs/pmws-circovirus-disease-and-pdns/)

<sup>14</sup> Gickel, J., Hartung, C.B., El-Wahab, A.A., Hankel, J., Visscher, C. — Influence of vaccination against infectious diseases on the carbon footprint of fattening pigs: a systematic review, *Frontiers in Veterinary Science* (2024), [frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1487742/full](https://frontiersin.org/journals/veterinary-science/articles/10.3389/fvets.2024.1487742/full)



## Case study 3: Cutting new paths in sustainability in the cattle industry

### Summary

Cattle production is the largest single source of farm cash receipt in the United States<sup>1</sup>, home to the world's largest fed-cattle industry<sup>2</sup>. Despite a beef supply chain that is among the most complex food production systems in the world, decades of improvements to operations have made the US cattle industry the global sustainability leader in production<sup>3</sup>.

In US dairy production, a gallon of milk produced in 2017 required 30% less water, 21% less land and led to CO<sub>2</sub> emissions that were 19% lower than ten years prior<sup>4</sup>. Meanwhile, between 1977 and 2007, the US beef industry reduced its feed intake by 19%, water use by 12%, and land use by 33%, and cut its CO<sub>2</sub> emissions by 16% for every 2.2 billion pounds of beef produced<sup>5</sup>.

Today, the United States produces one-fifth of the global beef supply with less than 11% of the world's cattle herd, according to the global cattle stock as calculated in 2022<sup>6,7</sup>.

<sup>1</sup> USDA Economic Research Service, [ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income](https://ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income)

<sup>2</sup> USDA Economic Research Service, [ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance](https://ers.usda.gov/topics/animal-products/cattle-beef/sector-at-a-glance)

<sup>3</sup> USDA Agricultural Research Service, [ars.usda.gov/news-events/news/research-news/2019/study-clarifies-us-beefs-resource-use-and-greenhouse-gas-emissions/](https://ars.usda.gov/news-events/news/research-news/2019/study-clarifies-us-beefs-resource-use-and-greenhouse-gas-emissions/)

<sup>4</sup> Dairy Management Inc., [usdairy.com/sustainability/environmental-sustainability](https://usdairy.com/sustainability/environmental-sustainability)

<sup>5</sup> Capper, J.L. — The environmental impact of beef production in the United States: 1977 compared with 2007, Journal of Animal Science (2011), [academic.oup.com/jas/article/89/12/4249/4772093?login=false](https://academic.oup.com/jas/article/89/12/4249/4772093?login=false)

<sup>6</sup> UNFAO, [openknowledge.fao.org/server/api/core/bitstreams/522c9fe3-0fe2-47ea-8aac-f85bb6507776/content](https://openknowledge.fao.org/server/api/core/bitstreams/522c9fe3-0fe2-47ea-8aac-f85bb6507776/content)

<sup>7</sup> USDA Foreign Agricultural Service, [fas.usda.gov/data/production/commodity/0111000](https://fas.usda.gov/data/production/commodity/0111000)

Cattle producers rely on scientific advancements in animal health, genetics and production practices to achieve this success -- enabling higher efficiency in cattle raising for beef and dairy products.

Animal health sector-wide research and development, combined with technological innovation, creates immense opportunity for the United States to advance best practices in sustainable development globally as a model of efficiency.

## Key findings

- Productivity tools, such as hormones, promote target weight in cattle for US beef production. Without interventions, Oxford Analytica scenario modeling finds that the additional land required for the same level of beef production as currently seen would be 655 thousand acres, or the equivalent of nearly the size of the state of Rhode Island.
- Similarly, 5.3 million additional gallons of water would be required, or the equivalent of eight Olympic swimming pools, as converted to the resources required for the additional feed to reach target weight, according to the scenario modeling.
- Genetic selection in breeding, disease management to improve health performance and productivity levels, feed additives and dietary changes can reduce methane emission in dairy cattle by up to 30% per unit of milk yielded<sup>8</sup>.



## US cattle sector in a global context

Livestock raising for beef and dairy products is essential to global food production systems and especially to the North American diet. The UN Food and Agriculture Organization (FAO) estimates that 43% of the total caloric supply in the region comes from animal products like meat, milk and eggs -- compared to a global average of 21%<sup>9</sup>.

Global food availability depends on sustainable practices in food production to ensure supply can keep up with population growth. The FAO projects that population growth and prosperity in greater parts of the world will drive a 20% increase in the global demand for animal products by 2050, relative to 2020<sup>10</sup>.

## Role of animal health products

A range of animal health technologies, including ionophores, implants and hormones are critical to increasing efficiencies in cattle raising. In the absence of productivity tools, the projected costs of US beef production would rise by 8.2% -- due to the additional feed required and pressure on operating costs<sup>11</sup>. This would translate into higher prices for consumers, as well as lower exports and competitiveness for US producers.

<sup>8</sup> Knapp, J.R., Laur, G.L., Vadas, P.A., Weiss, W.P., Tricarico, J.M. — Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions, *Journal of Dairy Science* (2014), [journalofdairyscience.org/article/S0022-0302\(14\)00289-6/fulltext](https://doi.org/10.3168/jds.S0022-0302(14)00289-6)

<sup>9</sup> UNFAO — Contribution of terrestrial animal source food to healthy diets for improved nutrition and health outcomes (2023), [openknowledge.fao.org/server/api/core/bitstreams/0c1bfa99-18d4-42e4-b94f-27160126f826/content](https://openknowledge.fao.org/server/api/core/bitstreams/0c1bfa99-18d4-42e4-b94f-27160126f826/content)

<sup>10</sup> UNFAO, [openknowledge.fao.org/server/api/core/bitstreams/a06a30d3-6e9d-4e9c-b4b7-29a6cc307208/content](https://openknowledge.fao.org/server/api/core/bitstreams/a06a30d3-6e9d-4e9c-b4b7-29a6cc307208/content)

<sup>11</sup> Capper, J.L., Hayes, D.J. — The environmental and economic impact of removing growth-enhancing technologies from U.S. beef production, *Journal of Animal Science* (2012), [academic.oup.com/jas/article/90/10/3527/4717884?login=false](https://academic.oup.com/jas/article/90/10/3527/4717884?login=false)

## Examining productivity tools

These tools can improve productivity among beef cattle, as measured by growth rate and slaughter weight, and reduce resource input and waste output per pound of beef produced. As quantification of the environmental and economic impacts of the US beef production system shows, productivity tools like ionophores and hormones enhance sustainability objectives through reducing nutrient requirements -- a measure of efficient resource use and waste output -- in cattle populations to reach target growth weight<sup>12</sup>. As a class of antibiotics, ionophores aid digestive fermentation processes, while hormones help cattle grow faster, thus reducing the amount of feed required.

Without interventions, the additional land required for US cattle to reach target weight for the same level of beef production as currently seen would be 655 thousand acres, or the equivalent of nearly the size of the state of Rhode Island.

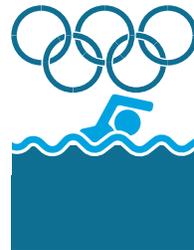
Figure 5.1. Additional land required for US cattle to reach target weight, without interventions, for the same level of beef production



**655,000 acres** are required to support get beef production - an area the size of Rhode Island state

Similarly, 5.3 million additional gallons of water would be required, or the equivalent of eight Olympic swimming pools, as converted to the resources required for the additional feed without these animal health interventions, according to currently available research and Oxford Analytica modeling<sup>13</sup>.

Figure 5.2. Additional water required for US cattle to reach target weight, without interventions, for the same level of beef production



**5.3mn gallons** of water are required to support get beef production - equivalent to eight Olympic swimming pools

As approved for current use by the US Federal Drug Administration (FDA), and adopted by industry, productivity tools contribute to overall cattle population health, and help to sustain the positive relationship between improved productivity and environmental benefits.

## Meeting new challenges

In recent years, it has become clearer that efforts to move the global economy towards net-zero GHG will need the active participation of livestock producers. Moreover, there have been growing calls for farmers to place their focus on methane (CH<sub>4</sub>) emissions.

<sup>12</sup> Capper, J.L, Hayes, D.J. — The environmental and economic impact of removing growth-enhancing technologies from U.S. beef production, Journal of Animal Science (2012), [academic.oup.com/jas/article/90/10/3527/4717884?login=false](https://academic.oup.com/jas/article/90/10/3527/4717884?login=false)

<sup>13</sup> Capper, J.L, Hayes, D.J. — The environmental and economic impact of removing growth-enhancing technologies from U.S. beef production, Journal of Animal Science (2012), [academic.oup.com/jas/article/90/10/3527/4717884?login=false](https://academic.oup.com/jas/article/90/10/3527/4717884?login=false)

Methane has 27 times the warming potency as CO<sub>2</sub> and in 2023 accounted for 18.9% of global GHG emissions<sup>14,15</sup>. In a digestive process known as enteric fermentation, cattle and other ruminant livestock produce methane (CH<sub>4</sub>) as a byproduct. This process comprises a significant contribution of methane from livestock<sup>16</sup>.

## Techniques to target methane release

Targeting methane as a potent driver of emissions in livestock production is critical to minimizing GHG output in the United States. Adopting and implementing innovative techniques -- genetic selection in breeding, disease management to improve health performance and productivity levels, feed additives and dietary changes -- can lead to GHG reductions of between 15% and 30% of methane emissions per unit of milk yielded, or energy-corrected milk (ECM)<sup>17</sup>.

## Genetic selection in breeding

One technique to reduce methane emissions is breeding low methane-emitting dairy cows.

Current research supported by the USDA is investigating how selective genetics could alter the fermentation profile for dairy cows, to naturally decrease methane while retaining production performance. Low methane-emitting dairy cows produce approximately 21% less methane than their high-emitting counterparts, while showing no differences in food intake or composition or production levels of milk per unit of milk production<sup>18</sup>.

In these instances, genetic selection considers traits such as health, feed intake, fertility and productivity, in particular, to boost efficiency in production.

## Disease management

Disease management approaches are also critical to farms' ability to increase milk yields while reducing the number of animals needed to achieve the same productivity. This both reduces methane emissions and increases herd performance.

Higher mortality levels are associated not only with productivity losses, but also with higher GHG emissions<sup>19</sup>. Thus, effectively lowering the prevalence of disease in livestock -- and therefore diminishing mortality -- can lead to improvement in both areas.

Further quantification efforts can help elucidate to what extent controlling vaccine-preventable diseases in global livestock systems impact the ability to reduce GHG emissions.

<sup>14</sup> GHG Protocol, [ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20%28August%202024%29.pdf](https://ghgprotocol.org/sites/default/files/2024-08/Global-Warming-Potential-Values%20%28August%202024%29.pdf)

<sup>15</sup> European Commission, [edgar.jrc.ec.europa.eu/report\\_2024](https://edgar.jrc.ec.europa.eu/report_2024)

<sup>16</sup> UNFAO, [fao.org/in-action/enteric-methane/background/en](https://fao.org/in-action/enteric-methane/background/en)

<sup>17</sup> Knapp, J.R., Laur, G.L., Vadas, P.A., Weiss, W.P., Tricarico, J.M. — Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions, *Journal of Dairy Science* (2014), [journalofdairyscience.org/article/S0022-0302\(14\)00289-6/fulltext](https://doi.org/10.3168/jds.2022-23190)

<sup>18</sup> Stepanchenko, N., Stefenoni, H., Hennessy, M., Nagaraju, I., Wasson, D. E., Cueva, S. F., Räisänen, S. E., Dechow, C. D., Pitta, D. W., & Hristov, A. N. (2023). Microbial composition, rumen fermentation parameters, enteric methane emissions, and lactational performance of phenotypically high and low methane-emitting dairy cows. *Journal of Dairy Science*, 106(9), 6146–6170, <https://doi.org/10.3168/jds.2022-23190>

<sup>19</sup> Capper, J.L. — The impact of controlling diseases of significant global importance on greenhouse gas emissions from livestock production, *One Health Outlook* (2023), [onehealthoutlook.biomedcentral.com/articles/10.1186/s42522-023-00089-y](https://onehealthoutlook.biomedcentral.com/articles/10.1186/s42522-023-00089-y)

## Feed additives and dietary changes

Changes in diet can also reduce direct emissions, helping cows to produce less flatulence and burps that release methane. Methane that builds up requires a metabolic response to release the excess, which is energy inefficient for the animals. This energy could instead contribute to other activities to promote growth and milk production in the case of dairy cows.

The use of feed additives to suppress methane release can also be applied at the final stage of beef cattle production at feedlots.

## Incentives for farmer investment to enhance profitability

New pathways can provide economic incentives for farmers' investment in profitability technologies in the US agricultural production system. Further research is still needed to better understand the impact of innovations on animal health to enable economic incentives for farmers, such as the creation of carbon insetting marketplaces.

## Carbon insetting marketplaces

Carbon insetting involves farmers investing in sustainability solutions within their own production processes and supply chain to mitigate GHG emissions directly.

Marketplaces allow farmers to trade in credits within their supply chains, keeping the overall emissions under a given boundary, and benefitting participants that are able to slash their own emissions. These marketplaces are part of the USDA's broader vision of voluntary and regulatory carbon markets to incentivize carbon sequestration and GHG emissions mitigation in the agricultural sector<sup>20</sup>.

These projects present crucial market-driven opportunities to advance sustainability performance. The USDA considers carbon markets to be a powerful mechanism to achieve net-zero emissions. In recent years, the USDA's Agricultural Research Service has led life-cycle analysis to determine resource use and GHG emissions of US beef cattle production<sup>21</sup>.

The Agricultural Research Service identified water use and reactive nitrogen losses as areas for improvements in sustainability. Manure management practices, for example, can target reactive forms of nitrogen such as ammonia from manure and urine.

A good example of how carbon insetting marketplaces can help comes from the US cattle economy. In 2024, Dairy Farmers of America (DFA) initiated a marketplace trading in enteric methane reduction carbon credits. Such credits allow US dairy farmers to profit from reducing their GHG emissions and advance the dairy sector's sustainable development goal towards carbon neutrality by 2050.

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<sup>20</sup> USDA, [usda.gov/about-usda/general-information/staff-offices/office-chief-economist/office-energy-and-environmental-policy/environmental-markets/carbon](https://www.usda.gov/about-usda/general-information/staff-offices/office-chief-economist/office-energy-and-environmental-policy/environmental-markets/carbon)

<sup>21</sup> USDA Agricultural Research Service, [ars.usda.gov/news-events/news/research-news/2019/study-clarifies-us-beefes-resource-use-and-greenhouse-gas-emissions/](https://www.ars.usda.gov/news-events/news/research-news/2019/study-clarifies-us-beefes-resource-use-and-greenhouse-gas-emissions/)

# Conclusion

The US agricultural economy has built a global competitive advantage through efficient livestock management processes that keep prices of animal commodities accessible to meet consumer demand. Maintaining a safe and sustainable food supply is a matter of public health, economic strength, and environmental responsibility. To protect and enable the safety and sustainability of the food supply, farmers, ranchers, and veterinarians rely on therapies and tools developed by the animal health industry to strengthen immunity, improve prevention, enable earlier and more specific diagnosis, and facilitate more accurate, effective treatment.

Specifically, animal health products that reduce the threat of disease are proven to improve animal welfare and save money. For example, when used as a preventative measure, anticoccidials saved the US poultry sector more than USD1.2bn in 2023 compared to the cost of treating the disease, according to Oxford Analytica scenario modeling. The total amount in production savings from anticoccidial use throughout the value chain was found to be over USD8.1bn during that same year.

Also, vaccination programs that address high fatality viruses like porcine circovirus type 2 (PCV2) have far-reaching effects on animal health, farm management, and farm output. These vaccination programs prevent the development of new strains of PCV2, which have been known to infect 100 percent of pigs on a given farm. And the programs are inherently cost effective, typically costing only one quarter of the economic losses associated with clinical disease in the absence of vaccines.

Furthermore, animal health innovations lead to lower emissions and reduced natural resource use. For dairy cows, genetic selection in breeding and disease management improves health performance and productivity levels, and feed additives and dietary changes can reduce methane emissions by up to 13.6% per pound of milk yielded.<sup>1</sup>

Looking ahead, sustainable development that uses health management tools, techniques, and technology will help to secure a productive agricultural future. In this sense, animal health products are essential to addressing both the rising global need for animal proteins and pressing environmental challenges.

Continued improvement of animal health practices can help the US maintain and further modernize our world-leading capabilities to provide a healthy and nutritious diet for consumers while minimizing the environmental footprint and maximizing animal health and wellbeing.

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<sup>1</sup> Knapp, J.R., Laur, G.L., Vadas, P.A., Weiss, W.P., Tricarico, J.M. — Invited review: Enteric methane in dairy cattle production: Quantifying the opportunities and impact of reducing emissions, *Journal of Dairy Science* (2014), [journalofdairyscience.org/article/S0022-0302\(14\)00289-6/fulltext](https://doi.org/10.3168/jds.S0022-0302(14)00289-6)