2025 VERIFICATION STANDARD

FOR CERTIFIED SUSTAINABLE BEEF

Introduction

This verification standard from Low Carbon Technologies, LLC is designed to help you understand what Certified Sustainable means and what distinguishes certified cattle and their products. It's certification you can trust — created to help you feel empowered to make informed choices that benefit your family, your community, and the planet. We believe sustainability should be simple, so you can choose with confidence.

Beef products with the Certified Sustainable seal have met the cattle raising, traceability and quality standards consistent with the science-based methodology of Low Carbon Technologies' first-of-its-kind Process Verified Program (PVP). Based on a comprehensive life cycle assessment (LCA), the impacts of cattle raising practices on greenhouse gas (GHG) emissions are evaluated throughout an animal's lifetime. For cattle to be recognized as raised with reduced emissions, they must meet the criteria below and demonstrate a carbon footprint at least 10% lower than the U.S. industry average.

The Certified Sustainable verification standard first evaluates cattle against 10 criteria where credit toward certification is given for scientifically proven interventions that strategically reduce GHG emissions. The LCA model incorporates a variety of reduced carbon management strategies and cattle performance parameters to calculate total emissions per carcass weight. In addition, traceability of animals from conception to harvest and package is confirmed to ensure products from only authorized animals are labeled as Certified Sustainable. The scoring process empowers farmers, ranchers, processors, and packaging brands to see how their current cattle-raising practices and management systems align with a reduced carbon, more sustainable path — supporting informed decisions, continuous improvement and alignment.

Questions or Comments

For questions or clarification, please contact the Certified Sustainable standards team at **info@lowcarbontech.com**.

This standard was last updated on November 5, 2025.

Certification Process and Requirements

Beef cattle are eligible for Low Carbon Technologies' PVP certification if they achieve at least a 10% reduction in GHG emissions compared to the U.S. industry baseline. Additionally, products derived from certified cattle must meet traceability standards to qualify for the Certified Sustainable designation.

Low Carbon Technologies certifies both grain- and grass-fed cattle using a proprietary scoring system that includes interventions from three categories: fertilizer, feed and function. Low Carbon Technologies serves as the verification body for both cattle and processed products, ensuring operational and cattle compliance.

Certified Sustainable Farm/Ranch Plan Requirements for Cattle Evaluation:

Information is collected from the life cycle of candidate cattle to calculate emissions scores within 60 days of processing for Low Carbon Technologies' PVP certification, which is the cattle evaluation process requirement of the Certified Sustainable certification. This involves gathering data from cow-calf ranches, backgrounding operations and feed yards, where relevant.

1. **Candidate Identification**

   A unique identification number must be assigned to each candidate animal by the farmer or rancher. The name(s) of the owner(s) associated with each candidate animal are recorded. Low Carbon Technologies determines and assigns a production pathway score to the group depending on the raising method. See below for more information regarding recognized production pathways.

2. **Document and Records Submission**

   Cattle producers must complete a comprehensive cattle records questionnaire and affidavit. Submitted documentation must include detailed information about cattle management practices, performance records and verification of all raising locations.

3. Emissions Scoring

Low Carbon Technologies processes the data, and an emissions score for the group of candidate animals is determined using the Low Carbon Technologies PVP Scoring Table. See page six for more information regarding scoring interventions.

4. Supplier Audit Requirements

All suppliers must undergo an initial on-site audit. Annual surveillance audits are also required for all suppliers and may be conducted either on-site or via video conference. For the purposes of the Low Carbon Technologies PVP certification, a "supplier" is defined as any source of materials (including animals), services, or information input relevant to the PVP. This includes, but is not limited to, cow-calf producers, backgrounders, feedyards, meat packers, dairies and calf ranches.

Each supplier must maintain documented procedures and records appropriate to the operation and necessary to provide evidence of conformance. Suppliers must meet the following requirements:

Control of Documents. Documents related to Low Carbon Technologies' PVP certification are controlled and retained at the operation. Cow-calf, dairy, calf ranch, backgrounder, or feedlot suppliers must also control and retain the Producers' Guide for Low Carbon Beef (PVP) Certification. Meat packers must control and retain documents for cattle identification and traceability procedures

Control of Records. Records related to cattle performance are retained.

Representative. The operation has a representative with authority to act on behalf of the operation at all locations where the program is conducted and to ensure processes are properly executed. Cow-calf, dairy, calf ranch, backgrounder, and feedlot suppliers must specify an operation representative to interact with Low Carbon Technologies. Meat packers must designate an operation representative responsible for administering the Certified Sustainable label program within their operation.

Training. Personnel with responsibilities regarding PVP or Certified Sustainable activities must be trained. Cow-calf producers are not required to be trained by Low Carbon Technologies staff, but it is encouraged.

Purchasing Process. The operation ensures that products purchased or received and used conform to program requirements.

ID and Traceability. The operation can ID and trace candidate cattle.

Preservation of Product. All suppliers must preserve the product during internal processing and delivery to the intended destination in order to maintain conformity to requirements. As applicable, preservation must include identification, handling, packaging, storage, and protection. Preservation must also apply to the constituent parts of product. Additionally, suppliers must have a documented shipping procedure and shipping records. Records must include the date, the number of animals in the shipment, animal identification, the name of the shipper and the name of the receiver.

Control of Non-Conforming Product. Animal IDs are used to manage conformity.

5. Scoring and Certification Status Determination

Cattle are evaluated based on PVP scoring interventions, and records were reviewed to determine compliance. Two possible outcomes resulted from this evaluation.

> *Qualified:* Candidate cattle with an emissions score of 10 points or higher will be issued a Low Carbon Technologies PVP Certificate of Conformance.
>
> *Disqualified:* Candidate cattle receiving an emissions score of less than 10 points, or for which no score is assigned, will not qualify for certification. Low Carbon Technologies will collaborate with the producer to identify and implement targeted interventions aimed at improving production practices toward a more regenerative, reduced carbon approach.

Certified Sustainable Packer/Processor Requirements:

1. **Document Submission**

   A. All beef ingredients that may be derived from certified cattle must be listed as a "raw material" by the provider in the affidavit. Standards for beef cattle and their products to receive the Certified Sustainable label are consistent with Low Carbon Technologies' PVP certification. Raw beef ingredients have met the PVP certification standards, verifying that cattle demonstrated at least a 10% reduction of GHG emissions below the U.S. industry baseline.

   B. Appropriate segregation protocols are in place to ensure only certified beef ingredients will be included in the "New Items" or existing products.

2. **Audit Requirements**

   All downstream entities must undergo an initial on-site audit to confirm processes and affidavit.

Cattle Calculation Methodology and Scoring

Beef cattle are evaluated considering 10 possible mitigation interventions for the Certified Sustainable certification. Cattle from both traditional and grass-fed systems are eligible. For certain interventions such as manure management, inorganic nitrogen fertilizer use, and fat added to the diet, animals may receive multiple scores within that category depending on the life stage during which the intervention applies. Cattle will certify if they have at least a 10% reduction in GHG emissions compared to the U.S. baseline.

Evaluation Process:

The Certified Sustainable certification doesn't apply a one-size-fits-all checklist. Instead, Low Carbon Technologies takes a collaborative, hands-on approach, working directly with cattle producers as partners to identify the most effective, operation-specific interventions. While our scoring framework is built on consistently applied, science-based calculations, we recognize that the impact of each intervention depends on how each operation implements the interventions.

The Certified Sustainable certification recognizes that many producers have already implemented strategies to reduce the carbon footprint of their cattle. We provide credit for these existing efforts and identify additional opportunities for further reductions.

The Certified Sustainable certification assesses each operation individually to determine where improvements or optional interventions can deliver the greatest carbon reduction. This prescriptive, data-informed model ensures that certification outcomes reflect real-world performance — not just compliance — and support continuous progress over time.

Unlike standardized animal-raising claims, our approach is grounded in measurable science and tailored to the complex realities of beef production.

Evaluation Table:

If interventions are not applicable nor applied for, the candidate animal will receive a score of 0 for that section. Cattle will certify if they have at least a 10% reduction in GHG emissions compared to the U.S. baseline. Certification results from reducing

CRITERIA	NOTES/REQUIREMENTS
PRODUCTION PATHWAY	PRODUCER AFFIDAVIT
MANURE MANAGEMENT	ONSITE VERIFICATION
INORGANIC NITROGEN FERTILIZER	PRODUCER RECORDS/RECEIPTS
DIETARY FAT CONTENT	PRODUCER RECORDS/RECEIPTS
ANTI-METHANE FEED ADDITIVES	PRODUCER RECORDS/RECEIPTS
IONOPHORES SUPPLEMENTATION	PRODUCER RECORDS/RECEIPTS
CATTLE FEED EFFICIENCY	PRODUCER RECORDS/RECEIPTS
ANIMAL AGE AND WEIGHT	PRODUCER RECORDS
MATERNAL COW WEIGHTS	PRODUCER RECORDS
HARVEST RATIO	PRODUCER RECORDS/CLOSEOUTS

Interventions:

The factors below are major determinants of GHG emissions associated with raising beef cattle. The Certified Sustainable scoring system accounts for the known GHG emissions associated with variations in each factor.

1. Production Pathway refers to four different management systems used to raise beef cattle in the U.S. Cattle may be born on farms or ranches and stay there until they enter a feedlot. Alternatively, they may be "backgrounded" in an intermediate feedlot where they're fed a high forage diet. Grass-fed cattle will spend most of their time in a grazing environment. Dairy-beef crossbred cattle are born on a dairy farm and spend four to six months on a calf ranch before entering the feedlot. Most beef cattle will finish their life in a feedlot, with the exception of grass-fed cattle. Cattle must also be source and age verified (SAV) regardless of management system.

Each pathway receives a pathway score in the Scoring Table. The pathway score represents the difference in emissions between the pathways when each pathway is operated with baseline conditions, where the Backgrounding pathway is considered the industry baseline. Direct-Entry-to-Feedlot, Grass-Fed and Dairy-Beef pathway emissions are 4-8% lower, 17-23% higher, and 25-35% lower, respectively, than the Backgrounding pathway.

Beef cattle in the U.S. are raised using a range of production methods that reflect the diversity of the industry, regional resources and management practices. Each pathway represents a distinct combination of animal care, feeding strategies and production timelines. The following outlines four common beef production pathways recognized across the U.S. supply chain.

> **Backgrounding Pathway:** beef cattle that are born and raised on a cow-calf operation until weaning, are backgrounded on forage after weaning and finished at a feedlot
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> To qualify for this pathway, cattle:
>
> - can be raised with their mothers for up to 10 months;
> - must spend at least three months at a backgrounding location; and
> - are required to be finished at a feedlot for two months.

Direct-Entry-to-Feedlot Pathway: beef cattle that are born and raised on a cow-calf operation until weaning and finished at a feedlot

To qualify for this pathway, cattle:

- can be raised with their mothers for up to 10 months;
- must spend less than three months at a backgrounding location; and
- are required to be finished at a feedlot for two months.

Grass-Fed Pathway*: beef cattle that are born and raised at a cow-calf operation until weaning, raised on forage after weaning and finished on forage

To qualify for this pathway, cattle:

- can be raised with their mothers for up to 10 months; and
- may be backgrounded and finished for any length of time with 100% of their diet consisting of forage and no grain products.

Dairy-Beef Pathway: cattle born from dairy cows raised at a calf ranch until weaning and finished at a feedlot

To qualify for this pathway, cattle:

- must be separated from their mothers within seven days of birth and weaned off milk, or milk replacer, by five months of age;
- must be fed a feeder ration within four months of weaning; and are required to be finished at a feedlot for two months.

*LCT's classification for Grass-Fed is consistent with the definition provided by the USDA Food, Safety and Inspection Service (FSIS).

Comparing the carbon footprints for beef production pathways

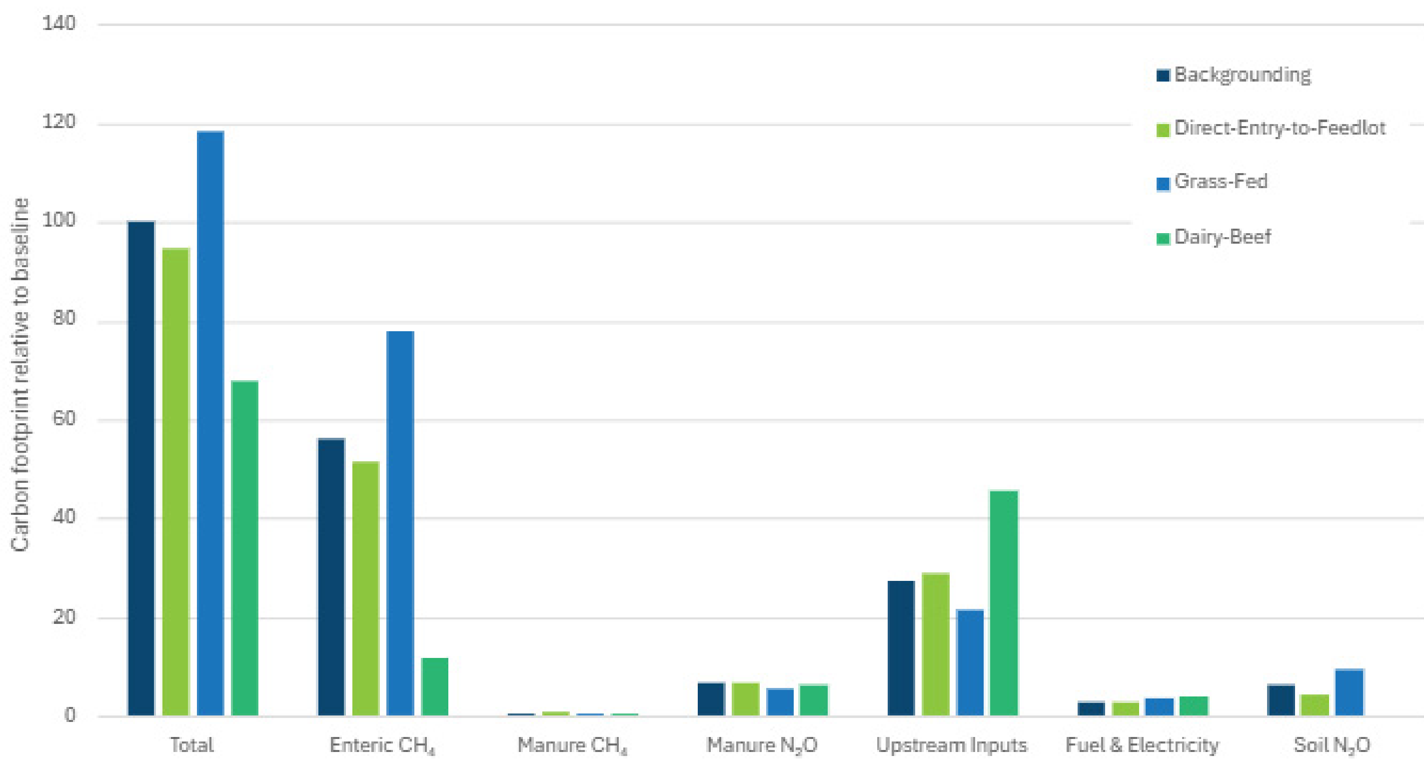

Figure 1. Comparison of the carbon footprints of the four different management systems used to raise beef cattle in the U.S.

2. Manure Management includes the various practices used for storing and disposing of manure across different management systems. When grazing, cattle naturally distribute manure on the range or pasture. On calf ranches and feedlots, manure is mechanically scraped from the pens and stored in dry piles before being spread on fields as fertilizer. On dairy farms, manure is typically stored in tanks or lagoons, and may be processed with an anaerobic digester to capture methane and generate electricity or renewable natural gas.

Cow-Calf Manure Management: it is presumed livestock waste is left on pasture with minimal methane emissions

Backgrounding Manure Management: it is presumed livestock waste is left on pasture or decomposes in post-weaning pens with minimal methane emissions

Finishing Manure Management: manure management methods will be defined and verified during an onsite audit

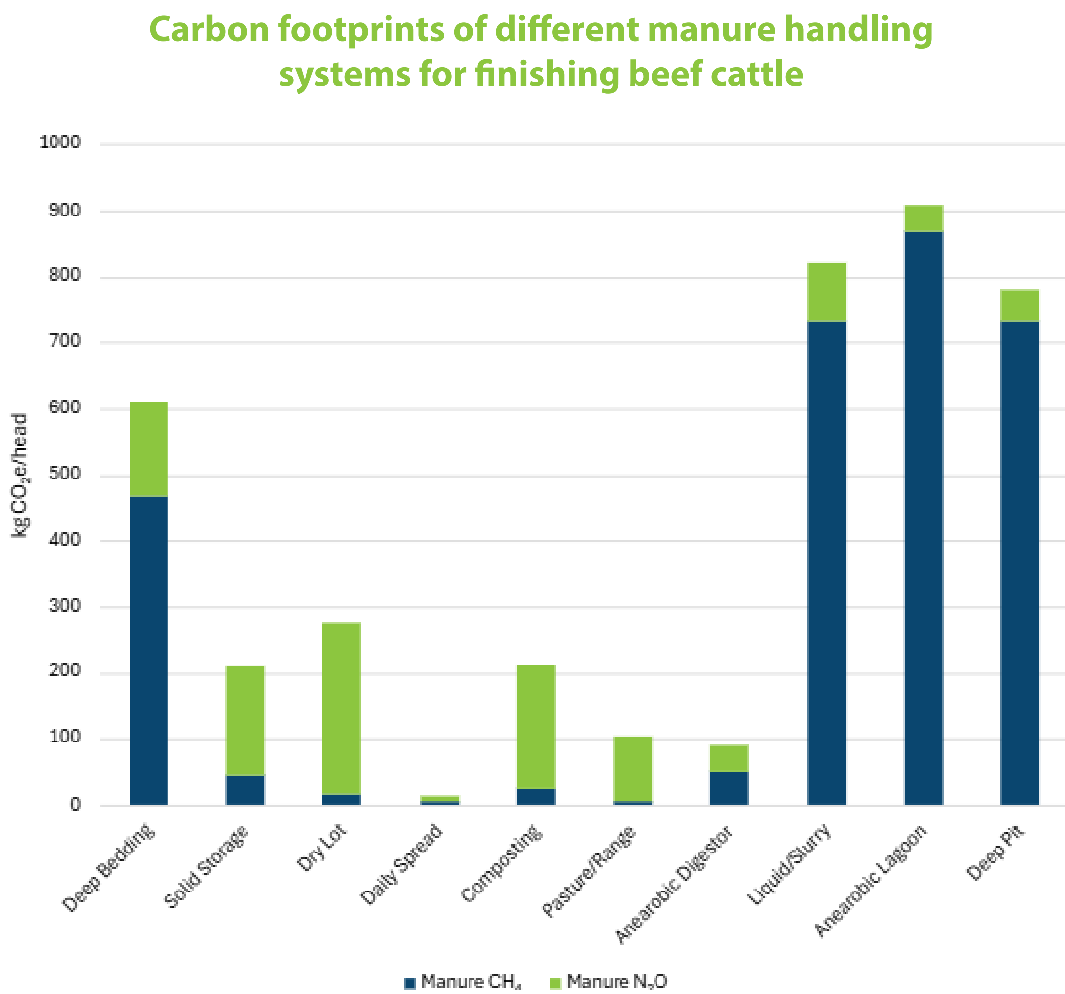

Figure 2. Manure carbon footprints for beef cattle in the finishing stage vary among handling systems. Carbon equivalents from methane and nitrous oxide shown in blue and green, respectively. Manure handling systems defined according to the U.S. Environmental Protection Agency (EPA): https://www.epa.gov/sites/default/files/2015-07/documents/tsd_manure_020409.pdf

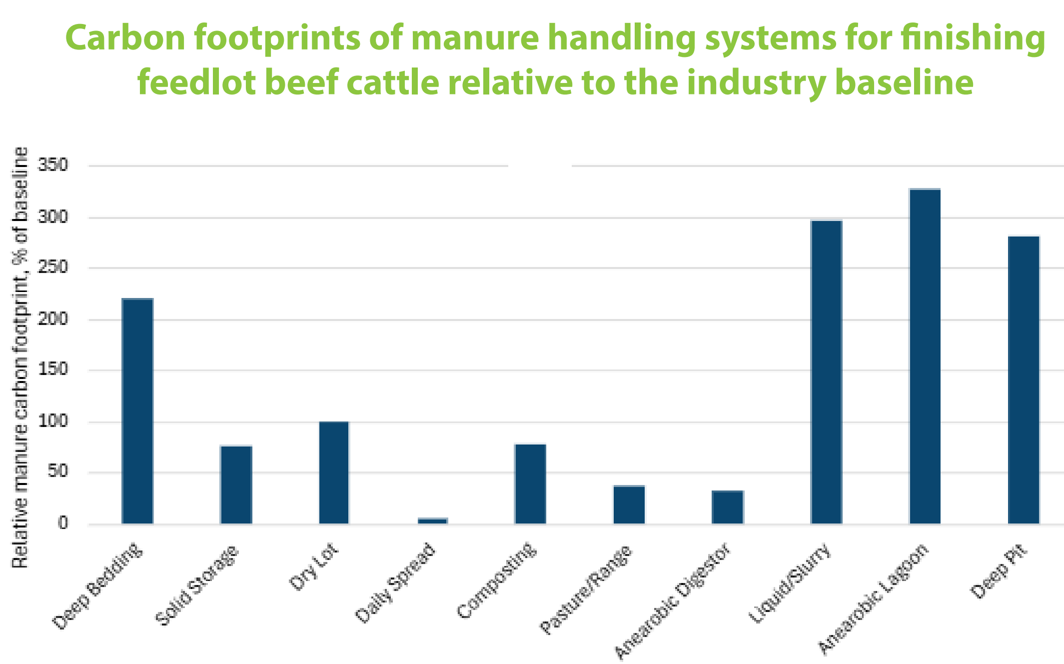

Figure 3. Carbon footrpints of manure handling systems for finishing feedlot beef cattle compared to the industry baseline. The baseline is dry lots.

3. Inorganic Nitrogen fertilizer is applied to boost yields in grass pastures and crops used as cattle feed. However, it also produces the GHG nitrous oxide in proportion to the application rate. By tracking the amount of inorganic nitrogen fertilizer used in each production pathway, we can account for its contribution to the feed-related carbon footprint of the animal.

The inorganic nitrogen value is determined by dividing the amount of inorganic elemental nitrogen applied to a production system per year by the number of mature cows or stockers in that system. The amount of elemental nitrogen is calculated as the total amount of fertilizer applied, multiplied by the amount of nitrogen present in the fertilizer type.

If organic or inorganic fertilizer has been purchased, receipts will be examined to validate fertilizer application claims. If inorganic nitrogen is applied to land used for other purposes, such as grazing by multiple groups of cattle or crop land that is grazed after harvest, the amount allocated to feeder cattle will be determined by standard LCA methods.

> **Cow-Calf Inorganic Nitrogen Fertilizer**: applies to the Backgrounding, Direct-Entry-to-Feedlot and Grass-Fed pathways
>
> **Backgrounding Inorganic Nitrogen Fertilizer:** applies to the Backgrounding and Grass-Fed pathways
>
> It is assumed dairy-beef calves are backgrounded in corrals, pens or pasture where inorganic nitrogen fertilizer is not applied.
>
> **Finishing Inorganic Nitrogen Fertilizer:** only applies to the Grass-Fed pathway
>
> It is assumed feedlots do not apply inorganic nitrogen fertilizer.

4. Dietary Fat Content or added fat to cattle rations is a simple approach to reducing enteric methane. Fat also increases the energy content of cattle diets to help them grow more quickly.

The percentage of fat in cattle diets is calculated as the sum of the mass of each ingredient and the percentage of fat in that ingredient, divided by the total dry matter intake (DMI) for that segment.

Receipts for purchased feeds containing fat must be provided to justify claims of the total fat in the diet. If ingredients containing fat are produced onsite, evidence of crop yields and ration formulations must be presented. Low Carbon Technologies can estimate animal DMI from cattle body weights or calculate from feed records and bills of full rations.

Cow-Calf Fat in Diet: applies to the Backgrounding, Direct-Entry-to-Feedlot and Grass-Fed pathways

Backgrounding Fat in Diet: applies to the Backgrounding and Grass-Fed pathways.

Finishing Fat in Diet

5. Anti-Methane Feed Additives are a proven solution for reducing enteric methane in cattle at feedlots and calf ranches. The Certified Sustainable scoring system credits only those additives with Generally Recognized as Safe (GRAS) status or U.S. Food and Drug Administration approval. Additives like Rumensin®, essential oil blends such as Agolin®, and products from Mootra®, have been scientifically shown to effectively reduce enteric methane emissions.

Cow-Calf Anti-Methane Feed Additives: applies to the Backgrounding, Direct-Entry-to-Feedlot and Grass-Fed pathways

Backgrounding Anti-Methane Feed Additives: applies to the Backgrounding and Grass-Fed pathways

Finishing Anti-Methane Feed Additives

6. Ionophore Supplementation from products like Rumensin and Bovatec® helps reduce coccidia, an intestinal parasite in cattle, promoting faster growth and better overall health. As a result, cattle grow more quickly and produce fewer GHG emissions over their lifetime. Rumensin or Bovatec purchase receipts will be needed to verify additive application.

Cow-Calf Ionophores in Diet: applies to the Backgrounding, Direct-Entry-to-Feedlot and Grass-Fed pathways

Points are awarded based on the duration of feeding.

Backgrounding Ionophores in Diet: applies to the Backgrounding and Grass-Fed pathways

Points are awarded based on the duration of feeding.

Finishing Diet Ionophores in Diet: only applies to the Grass-Fed pathway

7. Cattle Feed Efficiency is influenced by genetics, diet composition, feed additives and overall health. More feed-efficient cattle require less feed and water, resulting in lower GHG emissions. This is where producers can have a large impact on the carbon footprint of candidate cattle.

8. Animal Age and Weight are used to determine efficiency. Cattle that reach their target weight more quickly will produce less GHG emissions over their lifetime than animals that take longer.

Animal age and weight is determined from actual cattle live weights at processing, calculated from hot carcass weights recorded by a packer or projected from a commercially proven feedlot management system within 60 days of harvest. Age verification and harvest weight data such as closeout reports will need to be submitted to receive an emissions score for this criteria.

Carbon footprint compared to cattle finishng weight and age

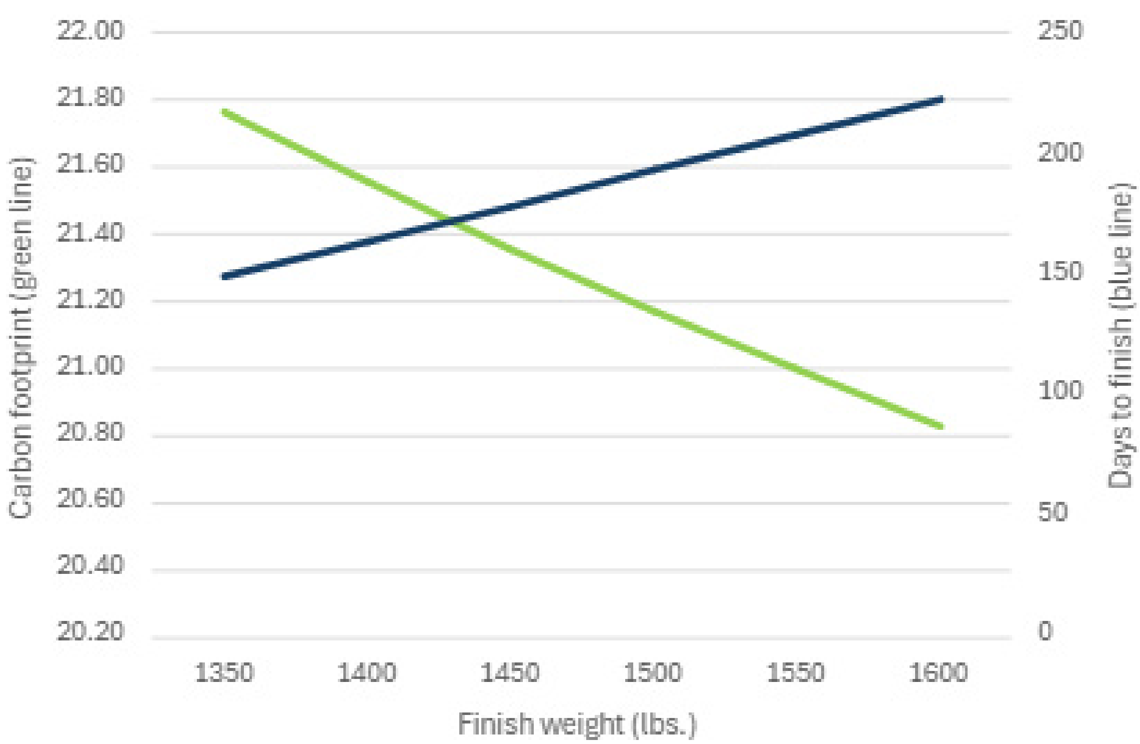

Figure 4. Beef carbon footprint decreases with increasing animal age and finish weight.

Maternal Cow Weights in Low Carbon Technologies' LCA for beef also account for the emissions associated with maintaining the dams of beef cattle. In conventional beef production, each cow typically produces one calf per year, and her annual GHG emissions significantly contribute to her offspring's carbon footprint. Larger dam cows require more feed and water, resulting in higher GHG emissions compared to smaller cattle.

Maternal cow weights are calculated as the average weight of a group of mature cows that represent at least 10% of candidate cattle dams.

Producer records are required to verify mature cow weights which will be reviewed during an annual audit. Cow weights must be measured between calving and pregnancy checking at the end of the breeding season that candidate cattle were born. Weight measurements during that same time period in the preceding or following year are also acceptable. Cow weights will need to be collected via a scale, a commercially available three-dimensional camera system, or by Schaeffer's method.

The maternal cow weights criterion does not apply to the Dairy-Beef pathway.

Harvest Ratio is a key measure of herd efficiency, representing the ratio of harvested cattle to maternal cows. It reflects how effectively resources are utilized in beef production and the associated GHG emissions. An ideal harvest ratio is 1, meaning each mother cow produces one calf per year that reaches maturity. Factors such as low fertility, disease and animal loss can reduce the harvest ratio. This is where producers can have a large impact on the carbon footprint of candidate cattle.

Backgrounding, Direct-Entry-to-Feedlot, Grass-Fed Pathways Harvest Ratio: the number of candidate cattle harvested divided by the number of mature cows at the beginning of the calving season, adjusted for a constant herd size.

Dairy-Beef Pathway Harvest Ratio: the number of candidate cattle harvested divided by the number of dairy-beef calves purchased in the candidate cattle group. Producer cattle records will be reviewed during an annual audit to verify herd size.

The calculation methodology and supporting scientific references are detailed in U.S. Patent No. US-11209419-B2 Lifecycle Assessment Systems and Methods for Determining Emissions from Animal Production.

Low Carbon Technologies, LLC Life Cycle Assessment Model

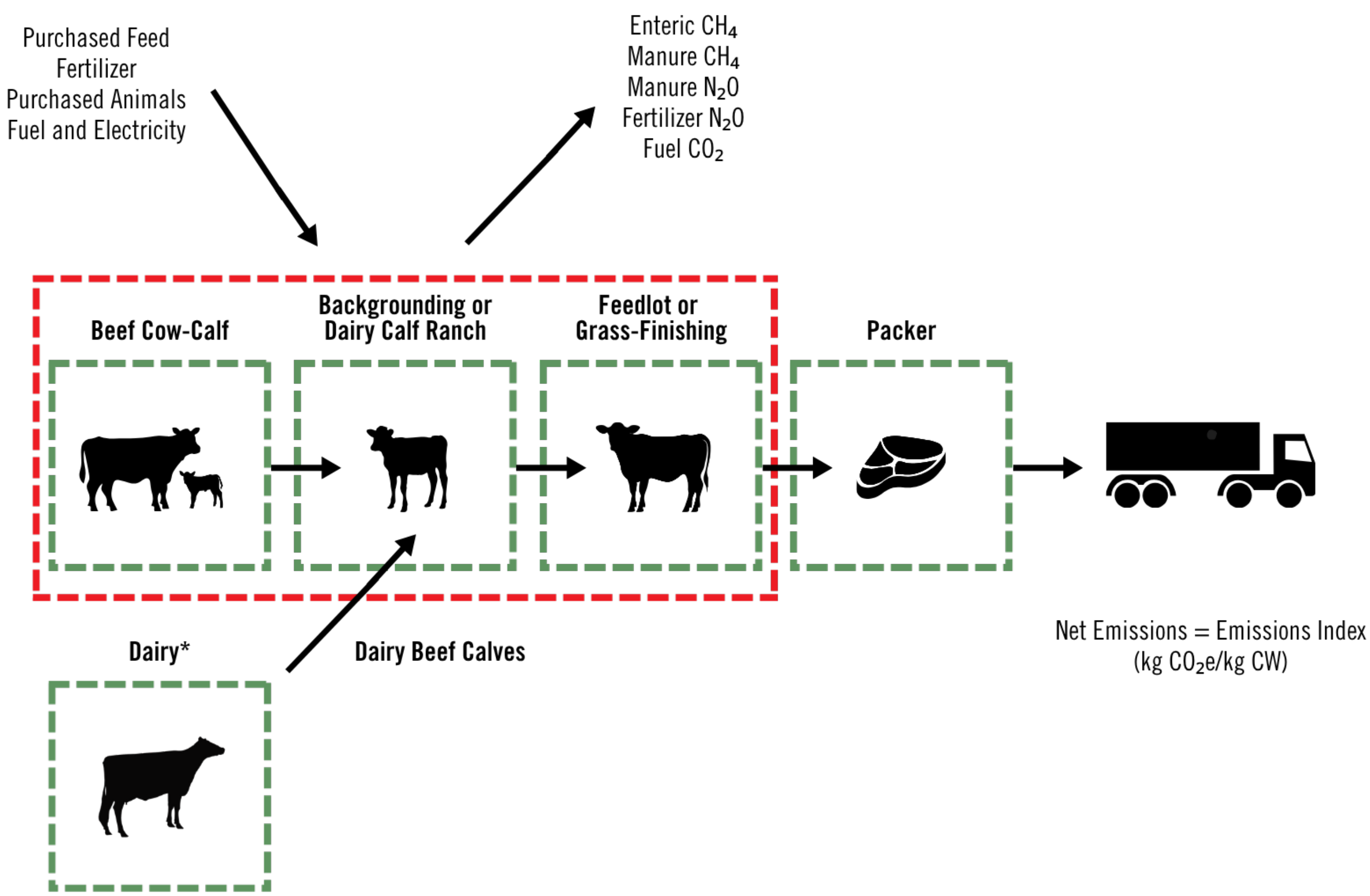

*Figure 5. A life cycle assessment model uses a variety of parameters to quantitatively estimate total emissions per carcass weight. Those cattle with life cycle emissions at least 10% lower than industry baseline qualify for certification. *Dairy operations are outside the system boundary (red dashed line), however dairy beef calves carry upstream emissions (also called embedded emissions) into the analysis.*

The major GHG contributing to conventional beef's carbon footprint is carbon dioxide (CO_2) from fossil fuel use and electric generation from non-renewable sources, methane (CH_4) and nitrous oxide (NO_2) generated in cattle raising operations. The carbon footprint includes GHG emissions associated with feed production, fertilizer use on grazing land and in crop production, purchased cattle, fuel use in transportation and on farms and ranches, and their manure storage and handling systems.

CO_2 that cattle exhale is not included since it comes from CO_2 that was fixed by plants in feed production and is part of the biogenic carbon cycle with a net zero balance. Only CO_2 from fossil fuel use is included. Methane arises from microbial fermentation during digestion (enteric) and from manure storage. Nitrous oxide arises from manure storage and handling as well as the use of synthetic nitrogen fertilizer in crop production.

Baseline Determination:

This standard isn't arbitrary, it's the threshold established in the Low Carbon Technologies PVP that serves as a trusted indicator when identifying practices that contribute meaningfully to lower GHG emissions in cattle production. This baseline of GHG emissions for conventional beef cattle production in Low Carbon Technologies' PVP was developed using the LCA model and national average data for U.S. cattle that considered the following metrics:

- beef cattle pregnancy rate
- replacement rate of cows with heifers
- weaned cattle rate
- mortality in the brood cow, stocker, and finishing cattle populations
- body size of brood cows
- finishing cattle ages and weights
- upstream emissions of typical feed ingredients used in rations for all phases
- manure handling systems are defined as pasture for cow-calf operations and drylot for stocker and finishing feedlots using the Intergovernmental Panel on Climate Change's (IPCC) guidelines (2019)
- fuel and electricity usage in each phase

This average was determined considering that conventional beef cattle production typically involves maintaining beef brood cows on a ranch or farm, where each cow produces one calf per year. After weaning, the calves enter a stocker feeding phase before moving to a feedlot for finishing, usually reaching market weight between 18 and 24 months of age. The number of brood cows is assumed to be constant, i.e. no herd expansion or reduction.

This baseline undergoes periodic reevaluation every few years to ensure it reflects the most current industry standards and insights.