

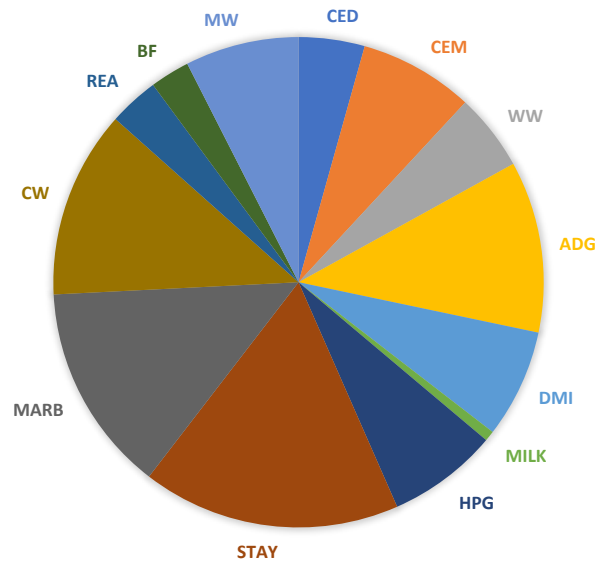
What is the Profitability and Sustainability (ProS) selection index?

The profitability and sustainability selection index is an all-purpose index that covers economically relevant traits across all aspects of the beef supply chain from conception to carcass. This updated index will be a combination of HerdBuilder, which includes traits from conception to weaning, and GridMaster, which includes postweaning through harvest traits. This index is expressed in \$ per head born.

Under the model assumptions for the pre-weaning phase of production, each bull will sire 100 head of calves. A portion of the female calves will be retained as replacements within the herd, and the non-replacement females and male calves will enter into the feedlot where they are grown, finished, and sold on a grid. Within the herd structure of the model, both Red Angus and terminal sires are used. In terms of the replacements, a higher percentage of those replacements will come from the animals that are sired by Red Angus bulls versus the other sires used in the system. These females will then be dams of calves in the future. To account for the continued influence of the bull's genetics in the herd a methodology known as Discounted Genetic Expressions is used. This methodology accounts for when different traits are expressed, as well as, how many times a trait is expressed in an animal's life. By incorporating discounted genetic expressions, the model is better able to account for long term differences in profitability that a set of genetics will have on a commercial operation.

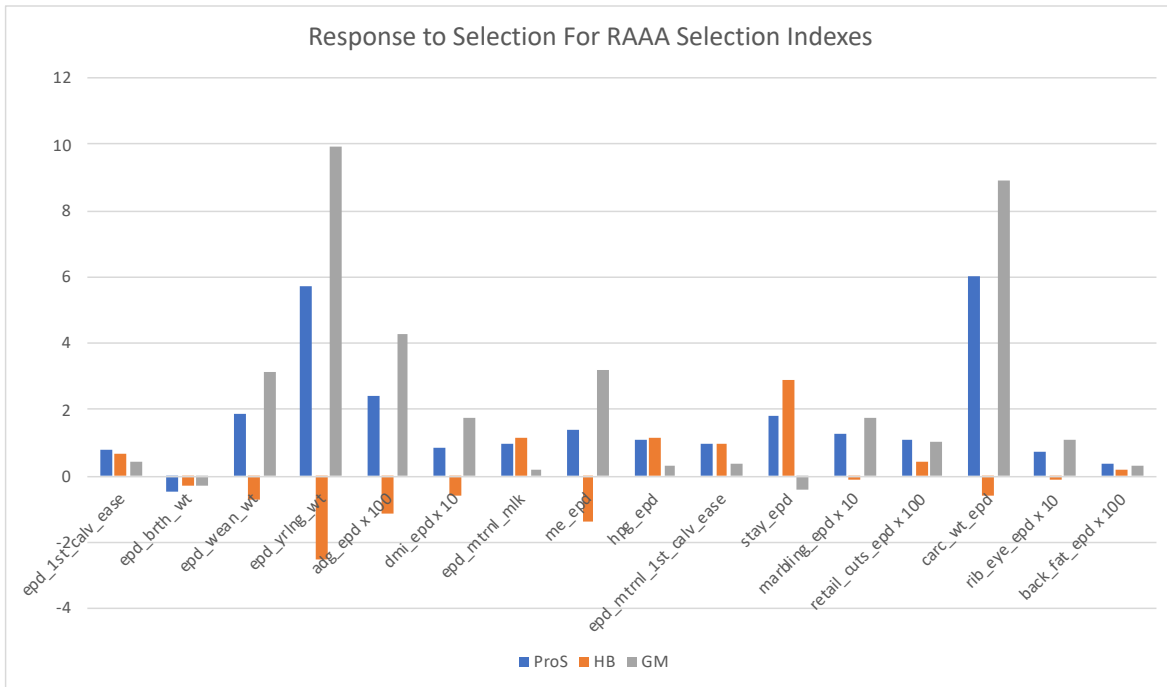
There are many economically relevant traits in beef cattle production. Since the ProS index covers from conception to harvest, the traits that are included in the index are as follows: Calving Ease Direct, Calving Ease Maternal, Weaning Weight, Milk, Mature Weight, Heifer Pregnancy, Stayability, Average Daily Gain, Carcass Weight, Dry Matter Intake, Marbling, Back Fat, and Rib Eye Area. Each trait in the model is weighted based on the effect that the trait has in terms of increasing profitability. Using the 500 most used sires over the last 5 years the following chart provides an illustration of the general weighting of traits within the ProS index.

PROFITABILITY AND SUSTAINABILITY INDEX IMPORTANCE



Within the updated selection index there are many traits that have meaningful impact on the resulting index value. What this means is that in order for an animal to be high in the ProS index the animal must have favorable values for many traits. Drilling down a bit further, the traits that have the highest importance value in the index include Stability, Marbling, Carcass Weight, and Average Daily Gain. While ProS does look to increase revenues through additional weight and carcass quality, the index is also built to include costs associated with additional weight gain. Mature Weight and Dry Matter Intake EPDs are included in the index calculations as costs. This prevents the revenue traits from becoming overly influential in the index.

Another method to evaluate the updated indexes is a response to selection graph (as seen below). This graph provides the expected result and direction of EPD change that would occur if multi-generation selection was carried out based solely on the selection indexes. The resulting change would be shown after one standard deviation of improvement of the indexes was achieved. In the graph, the blue bars represent the ProS index, the orange bars represent the HB index, and the grey bars represent the GM index. The results for these indexes were included on the same chart to better identify the selection pressure that each of the indexes are placing on different traits.



With the ProS index being a combination of the breeding objectives from the HerdBuilder and GridMaster indexes, the resulting selection response is frequently intermediate to that of the sub-indexes. Having results such as this allows for multiple trait improvement across economically relevant traits. The indexes seek to improve important maternal traits such as STAY, HPG and CEM, while increasing the revenue of marketed calves by increasing growth and carcass traits, without excessive mature size and dry matter intake.

How is the ProS index different than the previous HerdBuilder Index?

Many of the traits that are included in the previous HerdBuilder index and ProS index are the same. The only trait that was added to the updated ProS index that was not previously incorporated in the HerdBuilder index is carcass weight. While many of the traits included in the index are similar, the weightings of the traits did change as the models were updated. Below is a graph that represents the difference in the importance values of traits that occur from conception to weaning, and those that occur after weaning, for the ProS index and the previous HerdBuilder index.

PREVIOUS HERDBUILDER IMPORTANCE

■ Traits From Conception to Weaning ■ Post Weaning and Harvest Traits



PROS IMPORTANCE

■ Traits From Conception to Weaning ■ Post Weaning and Harvest Traits



In the previous HerdBuilder index roughly $\frac{2}{3}$ of the emphasis in that index was put on traits occurring from conception to weaning. With the ProS index the distribution of the importance put on traits pre and post weaning is closer to 50/50. The largest difference

between the two is the importance of Stayability. In the previous HerdBuilder index Stayability was by far the largest driver of the resulting index values. Whereas, in ProS it is still the highest in terms of importance but not to the degree that it was previously.

Some of the additional differences that may arise between these two indexes are due to the updating of the market assumptions used within the mathematical models. For the updated indexes, 5-year industry rolling averages are used. Data for these economic inputs were compiled using trusted data sources such as USDA and CattleFax. The following table lists economic inputs that are included in the model for calculation of the economic weights for the ProS index.

Trait	Price
Cow/heifer mix	78/22
Percent of calves born unassisted	93%
Weaned Steer Price	\$191.95
Weaned Heifer Price	\$168.81
Breeding Heifer	\$1733.68
Cull Cow Carcass Price	\$70.38
Carcass Price	\$196.45
Calf Fed/Yearling Fed%	15/85
Average Carcass Weight	860.88
Prime Premium	\$14.27
Upper 2/3 rd choice Premium	\$2.05
Select Discount	-\$12.79
Standard Discount	-\$31.16
Yield Grade 1 Premium	\$3.70
Yield Grade 2 Premium	\$1.76
Yield Grade 4 Discount	-\$11.40
Yield Grade 5 Discount	-\$25.00
Heavy Weight Discount 950-1000	-\$1.57
Heavy Weight Discount 1000-1050	-\$7.29
Heavy Weight Discount >1050	-\$22.84
Grass Hay	\$139.95
Alfalfa	\$164.15
Grain	\$137.56
Silage	\$51.92
Mixed Ration	\$260.62

Another improvement that was included in the updated index was the inclusion of non-linear coefficients for several of the traits. Within the ProS index, the following traits include non-linear economic parameters: Calving Ease Direct, Calving Ease Maternal, Milk, Marbling, Carcass Weight, Rib Eye Area, and Back Fat. For more detailed descriptions about the non-linear

parameters, examples have been compiled in information about the updated HerdBuilder and GridMaster indexes for those traits.

Such scientifically sound changes will lead to differences in results of the indexes. The goal of these updates is to provide members and commercial customers information that allows for a better description of the economic differences of different EPD profiles. These updated indexes have numerous advantages over the previous indexes that were available to members since 2014. To verify that point, an example was pulled together that shows the amount of improvement that would have been made over the past 10 years in each index. Genetic trend data from the RAAA database was pulled on all registered and compute animals from 2009 to 2019. For this time frame, an average change in index values in standard deviation units was calculated. Next, if the amount of genetic progress was consistent in the future the amount of time to make one standard deviation of improvement in the index was calculated. The results of this analysis are included in the table below.

	Slope	SD of Index	SD improvement per Year	Time to make 1 SD of improvement
ProS	2.11	24.76	0.09	11.73
Old_HB	0.81	27.40	0.03	33.85

These results suggest that the updated ProS index much more closely aligns with the market signals. This should better support RAAA breeders by allowing them to make selection and mating decisions that result in faster progress for their operation's genetic goals.