

Preliminary release of Suri EPDs – Classification Traits

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Introduction

The preliminary run of the classification EPDs for the Suri Network are now available. Remember, these are preliminary estimates of EPDs based on what would be considered a small data sample, and as such are subject to change with additional data inclusion. However, the results are promising with respect to creating a selection program on visual classification scores.

Data Summary

In the fall of 2012, there was a large addition of classification scores added to the database. This allowed for an increase in the database of greater than 20%. As a result of such a large increase in data, the variance components were re-estimated. Depending on the breed registry or genetic company, variance components are not re-estimated on an extremely regular, but in those situations the addition of data is fairly constant. As data continues to be added, there will likely be a need to re-estimate variance components fairly regularly until the database reaches a level robust enough to not be greatly affected by additional data. The phenotypic attributes of the data are provided in Table 1 and the attached histogram for each of the respective traits. Generally speaking, the traits are fairly similar in the distribution.

Table 1. Phenotypic description of the data.

Trait	# of Animals	Mean	St. Dev.	Min.	Max.
Natural Luster	1146	3.69	0.86	1	5
Fleece Fineness	1146	3.72	0.79	1	5
Smooth Cool Hand of Fleece	1146	3.70	0.80	1	5
Uniform Micron	1145	3.63	0.76	1	5
Fore & Rear Legs	1144	3.72	0.71	1.5	5

Genetic Analysis

Within the initial genetic analysis there are 5 classification traits being evaluated, 4 describe fleece traits, while 1 involves leg structure. From a biological standpoint it would be expected the 4 fleece traits would be related; however, the leg structure would not be expected to have a genetic relationship to fleece characteristics. With that said, because these were subject visual scores and the data set is small, there is the potential for there to be statistically significant genetic correlations that may in fact not be relevant. As a result, to avoid artificial bias, two genetic models were used: 1) 4-trait fleece classification, and 2) single-trait leg structure.

Table 2, provides the heritability and genetic correlation for the 4 classification scores of fleece traits. All of the traits are moderately heritable and would offer real possibility for genetic improvement to be made. One item to note is the genetic correlation amongst the 4 traits. There is certain to be some biological relationship amongst the 4 traits, but it would seem with the visual scoring it might be a little more challenging to differentiate the 4 traits from one another

or possibly a high quality fleece is high quality in most visual measures. Also in Table 2 is the heritability estimate used in the single-trait model for fore & rear leg score. This trait is lowly heritable and would be in line with other estimates for structure traits. In other species, confirmation heritability has been shown to be somewhat higher in some situations, but typically for a more specific trait. For instance, front leg structure or mobility; with this trait involving both front and rear legs, there is the potential to create more non-genetic variation due to the confirmation of the front leg being influenced by different genes than the confirmation of the rear leg.

Table 2. Heritabilities (diagonals) and genetic correlations (off-diagonals) used in the preliminary EPD calculations for two different models; 4-trait fleece classification and single-trait leg confirmation classification.

Traits ¹	Luster	Fine	Hand	Uni Mic	Legs
Luster	0.292	<i>0.904</i>	<i>0.898</i>	<i>0.923</i>	
Fine		0.228	<i>0.934</i>	<i>0.920</i>	
Hand			0.294	<i>0.912</i>	
Uni Mic				0.221	
Legs					0.078

¹Luster: Natural Luster; Fine: Fleece Fineness; Hand: Smooth Cool Hand of Fleece; Uni Mic: Uniform Micron; Legs: Fore & Rear Legs.

Table 3 describes the EPDs and their respective accuracies of animals in the current Suri database for fleece classification scores from the 4-trait model and the leg scores from the single-trait model. These EPDs are calculated using all the phenotypic data and pedigree information for the 4-trait model and single-trait model with the heritabilities and genetic correlations provided in Table 2. The accuracies for each specific animal are affected by the amount of data within an animal's pedigree (individual record, siblings, parents, grandparents, etc.), the heritability of the given traits and correlations with other traits in the model. The accuracy is measured on a scale from 0 to 1 that gives insight into the confidence one should have in the EPDs of a given animal. The closer the value is to 1, the more confident one can be in the accuracy of the animal's EPD for a given trait.

Currently, there are 2,815 animals within the Suri pedigree that have EPDs calculated for them. This number includes the approximately 1150 animals with individual classifications scores and any animals related within the pedigree that do not have data themselves. Those with individual scores and/or data on a large number of relatives will have a greater accuracy.

Table 3. Means, minimums, maximums for the EPDs and accuracies with the Suri database.

Trait¹	Expected Progeny Differences			Accuracy		
	Mean	Min	Max	Mean	Min	Max
Luster	0.042	-0.407	0.645	0.268	0.0	0.784
Fine	0.034	-0.337	0.575	0.258	0.0	0.759
Hand	0.039	-0.399	0.651	0.265	0.0	0.780
Uni Mic	0.035	-0.339	0.491	0.263	0.0	0.766
Legs	0.006	-0.088	0.117	0.087	0.0	0.479

¹Luster: Natural Luster; Fine: Fleece Fineness; Hand: Smooth Cool Hand of Fleece; Uni Mic: Uniform Micron; Legs: Fore & Rear Legs.

Table 4. Percentile rankings for EPDs within the Suri database.

Percentile	Luster¹	Fineness¹	Hand¹	Uni Mic¹	Legs¹
99	0.32	0.28	0.32	0.27	0.08
95	0.23	0.20	0.23	0.19	0.05
90	0.19	0.16	0.18	0.16	0.04
75	0.11	0.09	0.11	0.09	0.02
50	0.03	0.02	0.03	0.02	0.00

¹Luster: Natural Luster; Fine: Fleece Fineness; Hand: Smooth Cool Hand of Fleece; Uni Mic: Uniform Micron; Legs: Fore & Rear Legs.

Future Work:

With continued data capture there will likely be some rather large fluctuations in EPDs, depending on the relatedness and number of animals coming into the dataset. There is not a set level or known number of animals with observations to determine when the entire dataset of EPDs will stabilize. However, if data additions occur in a similar ratio of added animals to current, such as what occurred in the fall of 2012 (~20% more numbers), there will be large fluctuations. As the dataset begins to stabilize and a consistent flow of data occurs, individual animals might change, but as a whole the population EPDs should remain fairly consistent.

The current Suri dataset is very much in a preliminary format. There is much that can be gained with further data collection and submission of visual classification, but the results to this point are promising for the ability to place genetic selection pressure on visual scores to see progress in these traits.

Careful attention needs to be paid to the contemporary group structure of animals being scored. Realizing there are different farms sizes and number of animals at a given location, it will be challenging to get accurate genetic values for animals within groups with limited numbers of animals scored.

Consideration should be given to a study to determine the repeatability of the scoring system. Because of the format of it being a lifetime trait that may or may not fluctuate over time, but also could fluctuate due to the scorer involved. As a result, there might be some benefit to multiple scorings over an animal's lifetime that could increase the heritability of the traits. At this time, there are animals with multiple scores, but not enough or in a format to evaluate the data with a repeatability model. In a very simple description, repeatability involves measuring or scoring the same trait multiple times. Variation between measures could be due to biological changes or accuracy of the measure/score itself. It is not definitive that a benefit would occur, but it is a possibility.

Additional Documents:

- 1) Histogram JPGs of Phenotypic Traits:
 - a. FINE.jpeg
 - b. HAND.jpeg
 - c. LEGS.jpeg
 - d. LUSTER.jpeg
 - e. UNIF_MIC.jpeg
- 2) EPDSummary.xlsx – 4-trait fleece classification data
 - a. Animal ID
 - b. 5 Traits
 - i. Trait EPD (Mean, Min, Max)
 - ii. Trait Accuracy (Mean, Min Max)
 - iii. Actual Classification Score