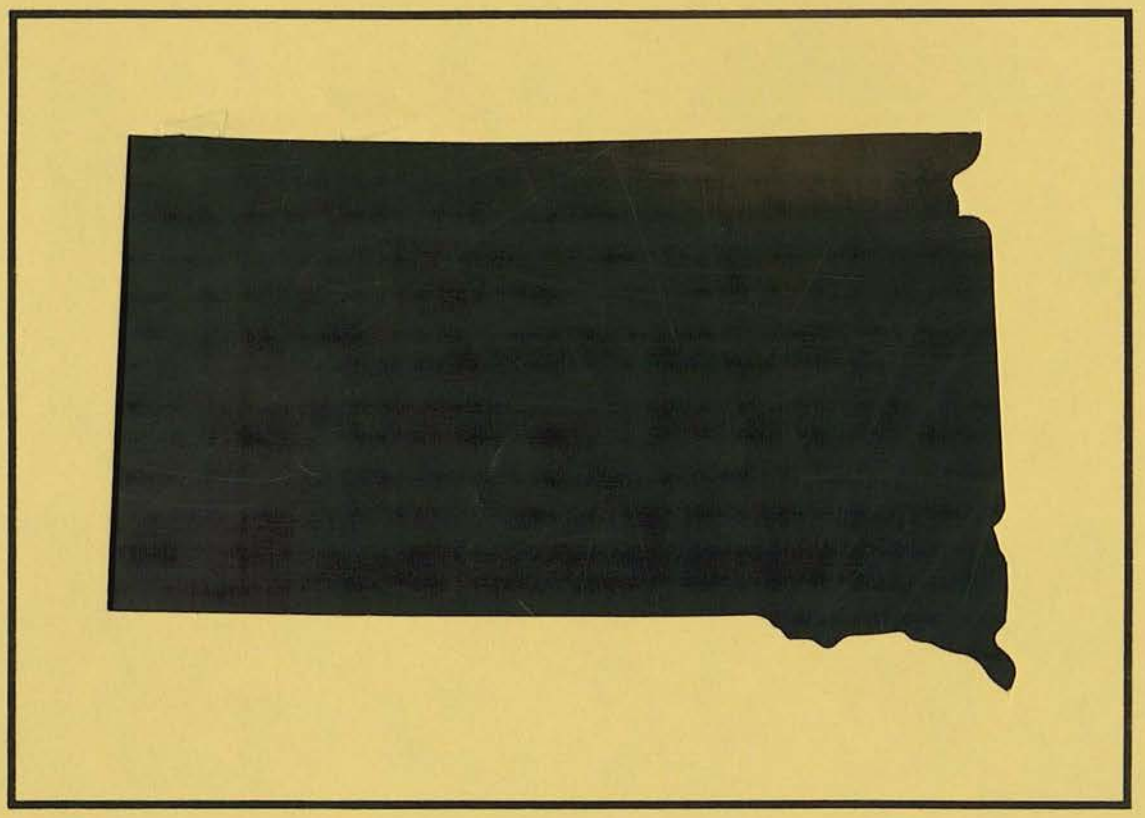

ECONOMICS DEPARTMENT

South Dakota State University
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BEEF CATTLE PRODUCER "SUSTAINABILITY" AND "ORGANIC" INDICES

by

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Because of the somewhat controversial nature of the material covered in this paper, the usual disclaimer of reviewer responsibility for any of the final content of the paper is especially applicable to this paper.

Donald C. Taylor
Dillon M. Feuz

BEEF CATTLE PRODUCER "SUSTAINABILITY" AND "ORGANIC" INDICES

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INTRODUCTION

This paper covers one component of a research project aimed at exploring the sustainability of beef cattle production in South Dakota. In this exploratory research, farmers/ranchers who follow alternative "near-organic" production practices are being studied in relation to farmers/ranchers who follow "mainstream" production practices. The study is being accomplished through comparisons of four "matching" pairs of "near-organic" and "mainstream" case study farms/ranches, with the members of each pair being as similar as possible in size-of-operation, types of cattle, natural and economic resources, and overall farm management levels. The comparisons involve both physical and economic measures of production.

To determine farmers/ranchers who follow production practices most consistent with "organic" certification standards, we developed a **producer organic index (POI)** system intended to reflect in single composite numbers the degree to which each cow-calf operator and each cattle feeder being studied follows "organic" beef cattle standards. We also developed **producer sustainability indices (PSIs)** to reflect the degree to which the same producers follow more broadly defined "sustainable" beef cattle production practices. The indices are being operationalized with information provided by South Dakota cow-calf producers and cattle feeders who responded to recent mail surveys covering production management practices [see Taylor and Feuz (1992 and 1993) for reports of the overall survey findings].

In this paper, we first describe the conceptual basis underlying development of the sustainability/organic index number systems and the procedures followed in developing the systems. We then present the four index number systems developed: a **PSI** and a **POI** for each of cow-calf producers and cattle feeders. Finally, we conclude with a brief indication of plans for future research. In that connection, we solicit reactions of readers that can be considered in further development of the index measures.

CONCEPTUAL FRAMEWORK UNDERLYING DEVELOPMENT OF INDICES

"Sustainable" production

In general, "sustainable development" involves philosophies and courses of action to help insure the long-term ecological/environmental, social/institutional, and economic "staying power" of various geographical entities in the world. Applied to livestock production, "sustainability" is judged in terms of the joint short- and long-term implications of various production practices to productivity, profitability (both level and year-to-year variability), environmental quality (water and soil resources), animal health/welfare, and human health/safety.

We envision that different beef cattle producers in South Dakota range from being apparently "very sustainable" to apparently "very unsustainable" in their production practices. The modifier "apparently" is used in this sentence because no one can know with 100% confidence exactly which production practices adopted today will, in fact, turn out over the longer-term to be genuinely "sustainable" and which ones will not.

In concept, we attempted to assign plus scores to practices contributing to **"sustainable"** production, zeroes to practices that are neutral, and minus scores to practices detracting from sustainable production. In soundly-based extension programs, we can consider production practices with plus scores as those that would be **generally recommended** to producers and those with negative scores as those **generally recommended to not be followed** by producers.

While the prior para describes underlying intentions in assigning scores to individual practices, our ability to actually achieve these intentions was constrained by inadequate scientific evidence on the full range of implications to sustainability of various production practices. Even if the scientific community could agree 100% on precisely (1) which practices contribute to, which detract from, and which are neutral with respect to long-term sustainability and (2) the reasons why, limitations in capacity for communication and analysis preclude our being able to fully capture the essence of sustainability in empirical research. From the standpoint of communication, the challenges are very considerable for a researcher to elicit from farmers, with complete accuracy, the nature and rationale of farmers' production practices relative to the potentially well-established "sustainability" criteria. In the follow-up phase of personal interviews to be conducted with case study farmers/ranchers, some of the communication limitations represented in the mail survey approach followed in the study phase reported in this paper should be overcome.[1] From the standpoint of analysis, human limitations preclude researchers from being able to capture the full essence of managerial decision-making in any one measurement device.

"Organic" production

We also envision different producers to fall at various points on an "organic"-to-"non-organic" continuum, with no one being completely "organic" nor anyone completely "non-organic." The general principles for assigning scores on the degree to which producers follow **"organic"** production practices are similar to those for the **PSI,** except that only those practices for which the following eight "organic" organizations show standards are included in the **POI:**[2]

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[1]The Masters graduate students involved with these respective phases are Ming Guan and Scott Docken.

[2]Under the Organic Food Production Act of 1990, a National Organic Standards Board was created to establish national standards for "organic" crop and livestock production. A National Organic Livestock Committee is currently working on establishment of the national standards for livestock (New Farm, 1993). In the absence of already-established national "organic" livestock standards, we have gathered information on current livestock standards from

* CCOF = California Certified Organic Farmers, as reflected in their 1993 Certification Handbook;

* IFOAM = International Federation of Organic Agriculture Movements, (a) "1989 standards" and (b) minutes from January 30-February 2, 1991 Animal Standards Sub-Committee, chaired by Francis Blake, Technical Director, Soil Association, Bristol, U.K.;

* NOLC = National Organic Livestock Committee, as reflected in a March 1992 report to the National Organic Standards Board (NOSB) of the results of a mail survey of 252 organic livestock producers;

* NOSBLC = NOSB Livestock Committee, as reflected in a statement covering "national standards for organic production" distributed on March 17, 1993 for response by the public;

* NPSAS = Northern Plains Sustainable Agriculture Society, as reflected in NPSAS's "guiding philosophy" for organic livestock production received in 1992;

* OCIA = Organic Crop Improvement Association, as reflected in their 1993 certification standards;

* OFPA = Organic Food Production Act of 1990; and

* OFPANA = Organic Food Producers Association of North America, as reflected in draft statements "written by committees of OFPANA and Organic Farmers Association Council (OFAC) members," which bear the date of June 1, 1992.

In general, the practices covered by "organic" organizations appear to be those with relatively direct implications to animal health/welfare and human health and those which involve natural rather than synthetic inputs.[3] Practices covered in the **PSI** but not the **POI**, on the other hand, appear to reflect relatively greater concerns for environment and the economic use of resources.

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several private "organic" certifying organizations. Since there is some "organizational" ambiguity/overlap between and among certain of the eight indicated standards-sources, the terminology adopted in the paper of information representing "eight organizations" with "organic" standards should not be taken literally. The organizations are referenced by acronym and year in the **POI** sections below.

[3]Many of the production practices covered in "organic" standards are intended to ultimately result in production of a differentiated "organically certified" beef which some consumers will perceive to be healthier/tastier and for which they may be willing to pay a premium.

Weighting various practices and types of practices

The various production practices covered in the questionnaires were grouped into the following types of management practices:

* Grazing/feeding;
* Drinking water access/quality;
* Herd health management;
* Overall farm/ranch management;
* Breeding management;
* Calf management; and
* Manure management.[4]

The first four cluster groups of practices pertain to both cow-calf operators and cattle feeders. The fifth and sixth apply only to cow-calf operators. The seventh potentially applies to both cow-calf operators[5] and cattle feeders, but in this phase of the study it is limited to cattle feeders.

In weighting (1) individual practices within each type-of-practice cluster group and (2) the various cluster groups relative to each other for the **PSIs**, we attempted to give attention to the relative importance of the practice (group of practices) in impacting jointly productivity, profitability, environment, animal health/welfare, and human health/safety. We did reduce such weights, however, if a practice:

* Was not covered explicitly/comprehensively/clearly in the mail survey questionnaires (e.g., overall strategies for preventing/treating cattle sickness and injury, various characteristics of cattle drinking water sources);[6] or

* Involved conflicting implications for sustainability (e.g., in respect to debt management, taking advantage of possibilities for lower per-unit production costs associated with economies-of-scale versus becoming vulnerable to default with larger credit repayment obligations).

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[4]In instances in which a certain practice has implications to more than one type-of-practice cluster group, it was included as a component of the cluster group for which we judged its implications to be greatest.

[5]To the extent that cow herds are concentrated geographically over winter and during calving, issues of manure management are relevant to cow-calf operators.

[6]Issues that will be explored in subsequent personal interviews with producers to more clearly establish the sustainability of production practices are shown at various points in the scoring system under the heading of "subsequent research."

Our presupposition is that the **relative importance of individual practices (groups of practices)** is reflected by the "maximum range" of possible scores i.e., by the difference between the largest possible plus score that could be earned by a "perfectly sustainable" producer and the largest possible minus score that would be earned by a producer totally insensitive/unresponsive to issues of sustainability.[7] For example, with the cow-calf operator **PSI**, using antibiotics appropriately is considered more important (a maximum possible range of 8 points) than using insecticides/fumigants appropriately (maximum range of 4 points). Similarly, of the various type-of-practice cluster groups, the "grazing/feeding" cluster group is considered as more important than the "calf management" cluster group[8] (ranges of 68 versus 35 points).

In weighting individual practices within each type-of-practice cluster group and the various cluster groups relative to each other for the **POI**, primary attention was given to the extent to which (1) **all eight** (rather than only some) of the various referenced "organic" organizations have established standards in respect to particular practices and (2) the standards of the various organizations in regard to a particular practice are pointed clearly in one **common direction**. For example, since all eight organizations require the exclusive feeding of "organically" produced feedstuffs, a large weight is given to this practice in the **POI**. Since only four of the eight organizations have explicit standards on drinking water, practices concerning drinking water access and quality receive a lesser weight in the **POI**. Seven of the eight organizations state a position on use of parasiticides; all express caution in the use of parasiticides; since some of the organizations provide greater latitude than others on the possible use of parasiticides, however, producers who "regularly" use parasiticides receive a negative but only relatively modest score in the **POI**.

PROCEDURES FOLLOWED IN DEVELOPING THE INDICES

The initial inspiration for development of the indices in this beef cattle study was the senior author's involvement, during a 1991-92 sabbatical study leave, in creating a "farmer sustainability index" (FSI) for cabbage production in Malaysia (Taylor, et al., 1993). In that exercise, each of 33 cabbage production practices was first scored individually for sustainability. The sums of scores for the 33 practices followed by each of 85 farmers in producing cabbage then came to represent the FSI values for the respective farmers.

In the phase of research reported in this paper, information from 70 cow-calf operators and 102 cattle feeders in South Dakota who responded to 1991-92 winter mail survey questionnaires (see Annexes A and B for copies of the questionnaires) was utilized. Data on the

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[7]In contrasting the scoring for the four index number systems, however, attention should be given to differences in the relative importance of different type-of-practice cluster groups, not differences in the absolute scores.

[8]Steps to help ensure the birth and survival of live calves are included under "herd health management," not "calf management," in the cow-calf index number systems.

following numbers of production practices reported through the mail surveys were included in development of the respective indices:

* Cow-calf **PSI**: 38 practices;
* Cow-calf **POI**: 20 practices;
* Cattle feeder **PSI**: 35 practices; and
* Cattle feeder **POI**: 32 practices.[9]

The assigning of scores and the weighting of scores involved an iterative process. Individual practices were initially scored one-by-one. We then altered the magnitude of scores for individual practices so that the weighting of various practices within each type-of-practice cluster group became consistent with the degree to which we judged the individual practices to reflect sustainability.

We then determined the resulting maximum possible range of scores for each type-of-practice cluster group. If we judged the relative sums of scores for various cluster groups to be inconsistent with the overall importance to sustainability of particular cluster groups, we adjusted the scale of scoring for individual practices to overcome the inconsistency. Ultimately, through this iterative process, we adjusted scores of cluster groups of practices and individual practices until we were satisfied that the relative weights to (1) individual cluster groups of practices comprising the overall indices and (2) individual practices comprising particular cluster groups were consistent with the respective contributions to sustainability of the cluster groups of practices and individual practices.

At two stages in the above-described development of the index number systems, reactions were solicited from various types of professionals, e.g., beef cattle producers; beef cattle production, soil/water, and livestock waste management specialists; veterinarians; natural resource economists; and members of various "organic" certifying organizations. Reactions to both (1) the overall conceptualization of the index number systems and (2) the scoring of individual production practices and cluster groups of practices were solicited. These reactions, while quite diverse, were very insightful.

A flavor of the reactions to the overall conceptualization of the index number systems is conveyed through the excerpted comments of reviewers reported in Annex C. In some cases, reviewers were skeptical about the limited breadth of applicability of the index number systems to various diverse farms/ranches, indicating that individual differences among various farms/ranches require individualized managerial responses that cannot be satisfactorily captured through one standard index number system for all producers. These comments--reflecting the appropriateness for recommendations to be tailor-made for individual producers rather than to be prescribed more generally for groups of producers--are acknowledged to reflect a limitation

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[9]In the next major section, the practices are listed in relation to the individual questions from the respective questionnaires.

COW-CALF PRODUCER SUSTAINABILITY INDEX (PSI)

Summary of maximum ranges, scoring sub-totals, by type of practice

Grazing/feeding practices:	- 19 to + 49 = 68	(24%)
Herd health management practices:	- 23.5 to + 31.5 = 55	(19%)
Breeding management practices:	- 14 to + 40 = 54	(19%)
Drinking water access/quality:	- 49 to + 5 = 54	(19%)
Calf management practices:	- 33 to + 2 = 35	(12%)
Overall farm/ranch management:	- 10 to + 10 = 20	(7%)
Total		286 (100%)

Grazing/feeding practices

Q 28, Grazed versus harvested forages: percentage of dry matter from:

* Grazed pasture, 70% or more = + **15**, 40-69% = + **8**, 10-39% = **0**, < 10% = - **5**

* Grazed crop residues, 15% or more = + **5**, < 15% = **0**

Rationale: The greater the role of grazed versus harvested forages in the diets of cattle, the less the amounts of fossil fuel energy and out-of-pocket expenditure on machine-related inputs required in production. The former contributes to long-term environmental/ecological sustainability; the latter reduces the vulnerability of producers to subsequent potential difficulties in honoring debt obligations. In addition, if crops do not need to be mechanically harvested, less labor is required and farm workers experience less exposure to risks of potential injury from operating farm machinery. Whether the welfare of cattle feeding on grazed rather than harvested forage is possibly greater has not been established scientifically as far as we know.[10]

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[10]One reviewer wrote, "This is the most important of all factors." Another wrote, "I agree. According to the Standardized Performance Analysis (SPA), the two most important aspects affecting a ranch's profitability are (1) winter feed cost and (2) reproductive efficiency. The more we can get away from harvested forages, the cheaper the feed cost. The old saying, 'silage is an expensive way to haul water to your cows' is true."

in this index number exercise. It is hoped, however, that the more aggregate conceptual insights enabled through use of the index number systems may more than counterbalance the inherent limitations of the systems in necessarily being completely accurate in reflecting the "true" sustainability of each individual farm/ranch.

In cases in which several reviewers agreed on needed changes to the scoring of individual practices, we responded rather fully to the suggestions. In cases in which the judgments of various reviewers were not completely consistent with one another, we exercised our best judgment in refining the scoring systems.

Reactions by first-round reviewers were incorporated into the scoring systems circulated to the second-round reviewers. The scoring systems presented in this paper reflect revisions based on the second round of reviews. Most second-round reviewer comments are included as footnotes in the index number sections of the paper.

The outcome, until now, of this iterative process of index number development is reported herein. As we embark on the next phase of the research, we would very much welcome learning additional reactions of readers to the overall conceptualization and specific substance of the scoring systems presented in this paper.

PRODUCER SUSTAINABILITY AND ORGANIC INDICES

In this section, we present (1) the summary statement of points assigned to each type-of-practice cluster group and (2) the scoring system for individual production practices, by type-of-practice cluster group, for each of the four index number systems.

Immediately following the scoring of each individual practice in the **PSIs** is an indication of the "rationale" underlying assignment of the scores. The selected "subsequent research" comments reflect issues that we intend to explore in more depth in the next phase of research which will involve personal interviews, rather than mail surveys, of producers.

Following the scoring of each individual practice in the **POIs** is an indication of the standards required by the various "organic" certifying organizations.

Q 32, Grazing management system

* One or more of rest-rotation, deferred rotation, and complimentary use = + **15** (no penalty for "fewer acres than the SCS recommendation" under Q 31); if not = **0.***

* Cell or strip grazing = + **5** (no penalty for "fewer acres than the SCS recommendation" under Q 31); if not = **0**.

* Continuous grazing = - **5**; if not = **0**.

Rationale: By appropriately following some type of pasture rotation (rather than continuous grazing), producers can realize greater productivity--from the various grass species having intermittent opportunities for undisturbed natural re-seeding and re-growth--from their pasture resources. The differential scores for various rotational systems are intended to reflect range specialists' judgments on the relative suitability of the various systems. Since SCS recommendations are based on continuous grazing practices, no penalties were assessed against producers who rotationally graze but allow fewer acres per cow-calf unit than recommended by SCS.[11]

Subsequent research: Determine how rotation systems are implemented. For example, is the timing of the rotational movement of cattle on pastures well-synchronized with critical growth stages of main plant species in the pastures? What interrelationships are there between grazing system and stocking rates?

Q 27, Home-raising of feed for cattle: percentage home-raised dry grain, alfalfa hay, grass/native hay, corn silage, and mixed hay

In scoring this question, divide the points below by the number of different feedstuffs fed. For example, if Producer A feeds two feedstuffs and 100% of each are home-raised, Producer A would receive a + 5 for each of the two feedstuffs. If Producer B is the same as Producer A except that he feeds three feedstuffs, all of which are home-raised, he would receive + 3.33 for each of the three feedstuffs.

* 95-100% = + **10**
* 50-94% = + **5**
* 20-49% = **0**
* Less than 20% = - **5**

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* If producers followed cell or strip grazing, in addition to one of the above rotations methods, they received no additional points for the cell or strip grazing.

[11]One reviewer inquired about the possible differentiation of scores between East and West River. Another wrote, "I agree, we have seen some tremendous success with clients using intensive rotational grazing programs. They have been able to increase cow stocking densities and weaning weights (while) improving their pastures."

Rationale: The greater the role of home-raised versus purchased feedstuffs, (a) the less the amounts of fossil fuel energy and out-of-pocket expenditure required for transporting feedstuffs and (b) the less producers are exposed to possible difficulties in purchasing feedstuffs that may occasionally come into short supply and become high priced. Thus, producers who home-raise large proportions of feedstuffs are likely to have longer term "staying power" than those who routinely depend heavily on purchased feedstuffs. Home-raising rather than purchasing feedstuffs can also give producers greater assurance that their cattle are being fed uniformly high quality feedstuffs. On the other hand, it is conceivable that some otherwise sustainable producers might find the prices of certain purchased feedstuffs to be less than their own costs for producing the feedstuffs.[12]

Subsequent research: Determine whether producers purchase feedstuffs routinely year-to-year, or only when they experience production shortfalls. Determine roughly the amounts of purchased feedstuffs involved and from what distances the feedstuffs are transported. Explore producers' awareness of their costs for home-raising versus purchasing feedstuffs and their strategies for stockpiling feedstuffs as insurance against possible production shortfalls. The scoring for situations involving locally purchased versus "imported" feedstuffs, routine versus occasional purchases of feedstuffs, and large versus small quantities of feedstuffs would then be differentiated. Scores may also be assigned--relative to the perceived soundness of their feedstuff stockpiling strategies.

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[12]Various reviewers wrote as follows:

* "Grazing and home-raised feed are the backbone for both profitability and sustainability."

* "This question is not an easy one. The last several years have seen grain prices reach a point where it is more economically sound for a great many producers to buy rather than raise their own grains. For example, do producers whose cow herds have increased to the point at which they need more corn to feed buy more land and equipment, (or do they purchase the extra feed)? There are many cases where purchasing--depending on year-to-year prices--is more financially sound than buying feed."

* "IRM data suggest that many producers can buy feed cheaper than they can raise it."

* "Producers being flexible from year to year in switching back and forth between complete home-raising of feedstuffs and purchasing some feedstuffs may be most positive."

Another reviewer indicated that some producers who home-raise their feedstuffs may incur greater energy costs than would have been involved if they had purchased and transported feedstuffs for their cattle. He also indicated that some producers have inflated views about the quality of their feedstuffs compared to feedstuffs purchased from others.

Q 31, Pasture stocking rates vs SCS recommendations

* Close to SCS recommendation = + 4.

* More acres than SCS recommendation = + 1

* "Do not know" SCS recommendation = 0

* Fewer acres than SCS recommendation = - 4 if continuous grazing (Q 32); otherwise = 0.

Rationale: Farmers who know and follow SCS-prescribed pasture stocking rate recommendations are presumed to be making sustainable use of their pasture resources. Because producers may base their pasture stocking rates on soundly-established criteria other than SCS recommendations, however, they were not penalized for not knowing SCS recommendations. Although allowing more acres per cow-calf unit than recommended by SCS may reduce short-term pasture productivity, the greater opportunity for species survival thereby enabled was considered as more than offsetting (especially in years of below-average precipitation). Farmers who knowingly allow fewer acres per cow-calf unit than recommended by SCS were penalized for "over-grazing."[13]

Subsequent research: Explore strategies that producers use in determining their pasture stocking rates, with particular attention to how stocking rates vary with the grazing management system. Do producers base their stocking rates on such criteria as percent residue or degree of pasture use? To what extent do considerations on stocking rates and grazing system seem to reflect short- versus long-term resource management and profit goals?

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[13]Various reviewers wrote as follows:

* "A sustainable grass-stock farmer probably knows more than SCS about stocking rates, particularly on his/her own farm."

* "Good cattlemen may know their grass better than SCS."

Two reviewers, on the other hand, indicated that producers' stocking rates should be evaluated in close relation to SCS recommended grazing rates.

Herd health management practices

Q 20, Vaccinations, insecticides/fumigants, and parasiticides

* Brucellosis vaccination[14]

  - Regularly = + 3
  - Sometimes = - 3
  - Never = - 3

* Blackleg and IBR-BVD-PI_3 vaccinations[15]

  - Regularly = + 2 for each type of vaccination
  - Sometimes = - 2 for each type of vaccination
  - Never = - 1 for each type of vaccination

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[14]Veterinarian reviewers indicated the following:

* "This area is quite subjective. Brucellosis currently only exists in one buffalo herd in South Dakota. The main reason for vaccinating (unless the producer would happen to be in proximity to the infected herd) is for breeding stock sales. This make this relatively expensive input optional, depending on circumstances."

* "South Dakota and all surrounding states will soon be free of brucellosis. Once this happens, Brucellosis vaccinations will be greatly decreased."

Dr. D.K. Thorpe, South Dakota State Veterinarian, indicates that South Dakota has had no incidence of brucellosis since 1987 (except for "the bison herd") and that generally in the U.S. the incidence of brucellosis is definitely decreasing (currently, 300 herds out of 1.5 million herds are infected). There are moves in the U.S. to reduce the strictness of regulations concerning brucellosis for cattle which are sold. About 2 years ago, South Dakota dropped its requirement for brucellosis vaccinations for cattle sold within state; cattle coming into the state, however, must be vaccinated for brucellosis. Once the disease is eliminated, the need for vaccinating against it will of course also be eliminated. For the present, however, beef cattle producers should continue to vaccinate against brucellosis (telephone conversation on September 9, 1993).

[15]A veterinarian writes, "In our area, it is extremely critical ... to have a very well individually designed vaccination program for these diseases."

* Calf scours vaccination[16]

  - Regularly = + 3
  - Sometimes = + 3
  - Never = - 1

* Insecticides/fumigants and parasiticides[17]

  - Regularly = - 2 for each type of treatment
  - Sometimes = + 2 for each type of treatment
  - Never = - 1 for each type of treatment

Rationale: The practices above to which plus scores are assigned are intended to represent those which are generally recommended to producers, with the magnitude of plus score reflecting the degree to which the recommended practices are believed to be important. Producers who only sometimes vaccinate for brucellosis, blackleg, and IBR-BVD-PI_3 are penalized because animals

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[16]Veterinarians wrote as follows:

*"It is impossible to predict whether this is a year when we can skip scours shots. You never know if it will be a snowy, wet, cold, blizzardy spring or not. Don't take the chance with your calf crop. It's not that expensive. Vaccinate every year for this one!"

* "I consider calf scours vaccination to be an expensive input that can usually be eliminated under good management (**E. coli** vaccination may be the exception)."

[17]Reactions of various reviewers were as follows:

* "Use of parasiticides is an important indicator of the balance and sustainability of a system. The best run operations will be using none--as their rotation system, health promotion program, and general management will be so well-honed that they do not need them. Regular use indicates that there is a breakdown in the system, i.e., it is not sustainable 'biologically...' So although many operations may use some, particularly as their systems settle down and achieve balance, I would suggest that regular use should be accorded a high negative score and no use a high positive score." (Official in an "organic" certifying organization)

* "Don't even think about a minus value for a rancher who regularly worms and 'pours' his cows! It has been shown in trial after trial that regular worming and lice control is a **very** good and profitable practice. Give a + 2 for regular use, a **0** for sometimes, and a - 2 for never." (Veterinarian)

* "I like the approach given, as it allows for use when necessary. It reflects producers thinking about what they do rather than just doing it because everyone else does or a salesperson recommends it." (Veterinarian)

not vaccinated may lack the natural antibody immunity to withstand possible infection from animals which receive the live virus through vaccination. Producers who **never** vaccinate their animals are presumed to be flirting with major possible trouble if these diseases would ever invade their herds.

In some herds, calf scours can cause rather major setbacks in productivity and profits through calf growth impairment and, in the extreme, through death. Depending on the herd situation, the regular or occasional use of calf scours vaccinations is presumed to be well-advised. Regularly using insecticides/fumigants and parasiticides may result in animals building up resistance to the agricultural chemicals used and may involve greater costs than benefits. On the other hand, the productivity and welfare of animals never receiving insecticides/fumigants or parasiticides is expected to at least occasionally be sacrificed if a producer follows a "blanket" policy of **never** using these production tools.

Subsequent research: Visit with producers to determine the rationale for their use or non-use of various vaccinations, insecticides/fumigants, and parasiticides. Also, determine the specific nature of calf scour problems experienced and treated (e.g., bacterial or viral?).

Q 19, Antibiotic use

* Uses antibiotics to treat specific sicknesses/injuries = + 4
* Subtherapeutic use of antibiotics in creep feed = - 2
* Uses antibiotics for group prevention = + 2
* Never uses antibiotics = - 4

Rationale: Producers who uses no antibiotics because they follow herd management practices that completely prevent animals from becoming sick or injured would represent a "sustainability" health ideal and therefore would be deserving of a maximum plus score. Because some types of sickness and/or injury are likely with most herds, however, we chose to assign (a) positive scores to those who use antibiotics to treat specific sicknesses/injuries and (b) negative scores to those who never use antibiotics. The underlying rationale is that animal productivity and welfare will, on occasion, be sacrificed if a producer follows a "blanket" policy of **never** using antibiotics.[18]

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[18]One veterinarian wrote, "I strongly dislike subtherapeutic use of antibiotics as it encourages resistance. Such a practice should have a minus value... Specific treatment of individuals and hard and fast treatments of pens of cattle that are breaking with a respiratory problem are definitely best."

The authors recognize that some producers would disagree with the scoring of this practice because they believe that properly selected homeopathic (non-Western medicinal) approaches can restore health to sick/injured animals.

From the standpoints of cattle developing resistance to antibiotics from continued use over time and economics (prospective benefits are likely to be less than prospective costs), we assigned a mildly negative score to producers who regularly include subtherapeutic doses of antibiotics in their creep feed. On the other hand, producers who use antibiotics to protect groups of animals (e.g., administered to cows who have been through a tough calving season prior to their being bred) were assigned mildly positive scores. The underlying rationale is a presupposition that the judicious, prophylactic use of antibiotics in response to specific extenuating circumstances can contribute positively to cattle herd productivity and profitability.

Subsequent research: Determine producers' strategies for preventing/treating sickness and injury to animals. Determine whether decisions on use of the above production tools are made independent of particular circumstances (e.g., weather, localized health environment, season of the year, type of cattle). If not, what seems to determine whether particular tools are used. Do they try various other means to treat sickness/injury, reserving antibiotics as a last resort, or do they "automatically" use antibiotics at the first sign of sickness? Determine the extent to which producers rely on themselves versus on veterinarians to make decisions on animal treatment. To gain some idea on the appropriateness of drug levels used, perhaps create a hypothetical case sickness (e.g., newborn calf with scours or a respiratory problem) and inquire on how they would treat the animal.

Q 36, Special protection of cows from snow, mud, wind, and heat: Yes = **+ 2.5**, No = **- 2.5**

Q 38, Facilities to segregate sick or injured animals: Yes = **+ 2.5**, No = **- 2.5**

Rationale: Provision to cows of these types of protection/facilities can be expected to contribute positively to the health, welfare, and productivity of the cows.[19]

Q 22, Extent of effort to minimize stress

* Scores of 2-5 = **0**
* Scores of 6-8 = **+ 2**
* Scores of more than 8 = **+ 4**

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[19]One veterinarian indicated that the protection and facilities covered in these two questions can be very costly. Producers must be reasonable in determining the level such care to provide; they should also "use genetics."

Another veterinarian wrote, "I agree (with the proposed scoring). Sometimes an inexpensive windbreak protection can save a lot of dollars in ... winter feed costs. The nutritional requirements of a cow in a 30 mph windchill are much greater than for a cow out of the wind. A good sick pen can save a producer a great deal of expense in treatment cost and lost animals."

Rationale: Producers were asked to reflect the weight--on a scale from 0 to 10--that they exert in minimizing stress on their cattle. Because of the inherent subjectivity in responding to the question, the maximum plus score for this question was only + 4.

Q 37, Special care/facilities for cows when they calve

* "Separate pasture for heavy springing cows," "special covered maternity areas," and/or "other" care/facilities: Yes = + **2.5**, No = **0**

* Individual maternity pens: Yes = + **1**, No = **0**[20]

* No special care/facilities = - **2.5**

Rationale: Providing special care to (e.g., intensified observation of heavy springing cows) and facilities for cows when they calve can increase the percentage of live calves that are born and survive, which in turn has a major influence on herd productivity and profitability. Lower plus scores are assigned to individual maternity pens than the other types of care/facilities because of their perceived higher relative incremental cost versus benefit.[21]

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[20]If producers provided another special care/facility for cows when they calve, no additional plus score was given to the producers for their also having individual maternity pens.

[21]The following reactions were in relation to earlier proposed scores of + **2** and + **1** for the two types of special care/facilities, and a **0** for no special care/facilities.

* "Here is another very important aspect. Your total future is determined by the survival of the calf. More weight should be assigned to the calving phase." (Beef cattle producer)

* "Live calves are extremely important to sustainability." (Beef cattle production specialist)

* "I think the plus for having such facilities should be higher and the penalty for not having these type of facilities more severe. My reasoning ... (arises from the fact) that a live calf represents the majority of income for most cow-calf producers. Calving time losses ... due to poor facilities greatly influence profits." (Beef cattle production specialist)

* "The protection and facilities covered in these two questions can be very costly. Producers must be reasonable in determining the level of such care to provide; they should also 'use genetics.'" (Veterinarian)

* "This one might deserve higher values. I see over and over every year where ranchers could easily afford to build or design better calving facilities that would dramatically improve their calving percentages. This is a very often overlooked very critical area... Individual maternity pens are needed, but only to the point to hold close up calvers during a blizzard or

Breeding management practices

Q 14, Herd bull-brood cow management

* Fertility test bulls, Yes = + 7, No = 0

* Pregnancy check cows, Yes = + 6, No = 0

* Production test cows, Yes = + 4, No = 0

* Use hormones to control breeding seasons, Yes = + 2, No = 0

Rationale: Fertility testing bulls and pregnancy checking cows are relatively low effort/cost practices that provide critical information for decisions regarding possible disposal of animals from the herd; such decisions can have significant implications to herd productivity and profitability. Producers who production test individual cows in their herds can assess rather directly the productivity and profitability of the cows. However, the implications of having that information are less directly related to herd profitability than are the implications of determining that herd bulls are infertile or that cows may be open (not pregnant). The practice of synchronizing heifers to obtain a short calving interval with carefully-selected A.I. sires can add to herd productivity and profitability.[22]

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other extremely adverse conditions... I think this one is worth more by a long ways than just + 2!" (Veterinarian)

[22]The following reactions were in relation to earlier proposed scores for producers who follow these practices of + 5, + 5, + 3, and - 3, respectively.

* "You are very insightful." (Beef cattle producer)

* "Some sharp producers may do well without the inputs of pregnancy checking and fertility testing." (Veterinarian)

* "Most of (your proposed scores) are right on target. The reproductive efficiency of the cow herd was one of SPA's top two findings on the profitability of ranches... But, do **not** give a - 3 to producers who use hormones. We are in a very intense A.I. area and can give a tremendous genetic boost to a herd without outlaying $5-10,000 for a bull to breed 30 head that might get injured in natural service. The practice of synchronizing heifers to obtain a short calving interval and to A.I. with top sires is **extremely** beneficial and should **not** "anyway, anyhow" be given a **minus value**." (Veterinarian)

* "The plus score for fertility testing bulls should be higher. I disagree (with a minus being assigned to the use of hormones to control breeding seasons). This is a highly recommended practice, especially for heifers." (Beef cattle production specialist)

Subsequent research: If producers use hormones to control their breeding seasons, determine if they do so with replacement heifers only or all cows in the herd. Inquire about the manner of physically handling cows with the estrus-synchronization.

Q 10, Criteria in herd bull selection

* Sound feet and legs, scores of 8-10 = + **5**, 4-7 = + **2.5**, and < 4 = **0**

* Reproductive performance, scores of 8-10 = + **5**, 4-7 = + **2.5**, and < 4 = **0**

* Transmit milk production to daughters, scores of 8-10 = + **3**, 4-7 = + **1.5**, and < 4 = **0**

* Disease resistance, scores of 8-10 = + **2**, 4-7, + **1**, and < 4 = **0**

* "Correct" body conformation = **0**

* High calf weaning weights = **0**

Rationale: The long-term sustainability of cow herds depends very importantly on the structural soundness of brood cows and herd sires. We, therefore, assign highest points to the herd sire selection criteria of "sound feet and legs" and "reproductive performance."

Because (a) heavier weaning weights can be linked with higher profitability and (b) milk production is relatively heritable, a plus score is assigned to producers who select bulls with particular ability to transmit milk production to their daughters. The plus score is smaller than for the structural characteristics because resource/economic limitations may preclude the full meeting of nutritional needs of cows that have "too great" a milk production potential.

Because the capacity to genetically transmit disease resistance is relatively limited with beef cattle, this otherwise very sound "sustainability" trait is accorded a relatively small plus score. Except as "correct" body conformation reflects structural soundness and sometimes may

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* "I would have to disagree with the scoring of hormone use to control breeding seasons. I believe that in many instances the use of such efforts would greatly improve the more efficient use of labor and other resources. It would also help in the production of a more uniform product that can be beneficial at marketing. All of these add profitability which is part of the formula for sustainability. At best, I would suggest a **O** for a yes answer to this question, possibly even a + **1** or + **2**." (Beef cattle production specialist)

* "(Synchronizing reproductive cycles can be a way of) keeping calves from being dropped at the 'wrong' time and of helping insure that batches of calves placed in the feedlot are uniform in size." (Natural resource economist)

impact marketing, this selection criterion is viewed to have relatively little connection with long-term cattle sustainability.

Calves that are heavy at one particular time in their growth process (time of weaning) are not likely to be more productive and profitable to the cattle industry than calves that grow rapidly and efficiently throughout their entire growing period. Further, apparent positive evidence for rapid calf growth arising from genetics can be masked if calves receive intensive, long-term creep feeding. Thus, the "heavy calf weaning weight" herd sire selection criterion was viewed as neutral to sustainability.[23]

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[23]A beef cattle producer suggested evaluating producers' herd bull selection on the basis of their use of EPDs (expected progeny differences) with respect to "sire evaluation" and "carcass data" criteria.

Reactions of other reviewers were as follows:

* "I would like to see genetic selection based on survivability and production relative to the specific environment and feeding systems present on particular farms." (Veterinarian)

* "I very strongly agree to all except the transmission of milk production to daughters (earlier proposed scoring of + 3 to producers who indicated priority scores of 8-10). 'This is great,' except in instances where a producer buys all his replacement heifers or uses a Charlois or other exotic bull as a terminal cross. In this instance, a fast high growth EPD bull is needed, and the milk EPD means nothing. We have a great many ranches that utilize terminal cross bulls on certain crossbred sets of cows not intending to keep any of the heifers for replacements; milk transmission is insignificant in this case. But milk is very important for replacement heifers, **but** only to the point that it **matches** a ranch's resources. We can very definitely get too much milk for the feed situation on some ranches." (Veterinarian)

* "If resources are limited, too much milk production is more detrimental than too little milk production." (Beef cattle production specialist)

* "Please consider:

- Fertility testing of bulls. A large scrotal size in relation to age is directly related to early onset of puberty of a bull's daughters.

- Pelvimetery of yearling bulls and virgin heifers. A large pelvic area of a sire is directly related to pelvic size of daughters and a tendency toward early puberty and calving ease of daughters. First-calf heifers with large pelvic areas can produce larger calves at birth and yet calve without assistance. Larger birthweight is usually directly correlated with higher weaning weights. Absence of calving difficulty leads to timely breeding back of cows. Heifers with small pelvic areas should be culled when pregnancy checking.

Subsequent research: Determine if producers use sire evaluation and carcass EPDs in selecting sires. If so, which EPDs do they consider to be most important? Also, inquire whether producers are raising replacement heifers. If not, their priority to transmission of milk should be zero.

Q 15, Average target weights of females at breeding and calving

* Ratio of (a) yearling heifer weight at breeding to (b) mature brood cow weight

  - Less than 0.60 = **- 4**
  - 0.60 - 0.67 = **0**
  - More than 0.67 = **-2**

* Ratio of (a) two-year old cow weight at calving to (b) mature brood cow weight

  - Less than 0.85 = **- 2**
  - 0.85 or more = **0**

Rationale: Proper bodily development of replacement beef heifers prior to first breeding and calving is very important to subsequent reproductive performance and economic value. If heifers are bred when they are too small, the heifers' conception rates may be reduced (irregular estrus cycling) and the heifers may be too small to produce and/or deliver "full-size," healthy baby calves. If they are bred when they are unnecessarily big, the delayed productivity will deter from herd profitability.[24]

- Performance testing in herd and within breed where available. For example, Angus Herd Improvement Records (AHIRs) and breed EPDs can help producers to ... select sires well suited to shoring up areas of weakness (and generally improving cattle efficiency).

- Yearling weight EPDs. These indicate a calf's ability to 'finish' at an early age.

- Carcass EPDs where available; until now they have been little used.

- Frame scores: the ability of bulls to sire moderate framed, efficient cattle." (Beef cattle producer)

[24]Reactions of various reviewers were as follows:

* "I agree. It is very important to not necessarily pick the biggest heifer, but the most efficient heifer for the feedstuffs available." (Veterinarian)

* "Hitting the target weight at breeding and calving should be rewarded--as the importance of hitting those weights at those times is becoming increasingly apparent. I would suggest a + 2 score for both the 0.60-0.67 and > 0.85 categories. In my opinion, these

Q 11, Flush brood cows

* Farmers who flush with pasture = + 3
* Farmers who flush with concentrates = - 3
* Farmers who do not flush = 0

Rationale: Flushing cows with fresh pasture can be a relatively low-cost way of enhancing conception rates for cows; thus, a plus score was assigned to this practice. Since we judged the added costs of using concentrates (or harvested hay) to flush cows to be greater than the value of potential increased conception rates, a negative score was assigned to this practice.[25]

Q 12, Length of breeding season

* Less than 45 days = - 5
* 45-90 days = 0
* More than 90 days = - 5

Rationale: Producers with "too short" and "too long" breeding seasons were penalized for the following reasons. Producers with "too short" a breeding season may forego opportunities for retaining in their herds otherwise productive and profitable cows. If "too many" cows calve in too short a period, producers may be unable to provide adequate attention to individual mothers and newborn calves. On the other hand, if breeding seasons are "too long," providing differentiated management and care to calves of widely varying ages may prove to be problematic. To counteract this limitation, cows bred at either extreme of the breeding season could be sold (rather than retained in the herd), but only at the expense of a higher heifer replacement rate.

Q 9, Natural service or artificial insemination (A.I.)

* Small herds (< 100 cows) = + 3 for some artificial insemination and 0 for 100% natural service

* Large herds = + 2 for some artificial insemination and 0 for 100% natural service

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represent the two most important times in a cow's productive life that determine her longevity in the herd and contribution to profitability." (Beef cattle production specialist)

[25]Reactions of two reviewers are as follows:

* "I would feel more comfortable if this was 'condition of cows' not just at breeding but at calving also. This is very critical for reproductive efficiency."

* "For the last 5 years, grain has been the most economical source of TDN. I do not agree with a penalty for farmers who flush cows with concentrates."

Rationale: Use of artificial insemination in small herds can enable producers to upgrade herd efficiency through the mating of cows to bulls particularly well-suited for them. In larger herds, (a) the extra effort/disturbance required in handling many cows with artificial insemination may not be feasible/desirable and (b) herd bulls with differing characteristics can be matched with individual groups of cows having rather common characteristics. However, even in large herds, estrus-synchronization and A.I. breeding of replacement heifers can contribute toward higher birth and survival rates of calves from first-calf heifers.[26]

Subsequent research: Inquire if A.I. is used with replacement heifers versus with mature brood cows and the reasons why producers use A.I.

Drinking water access/quality

Q 39, Water sources. If more than 50% of cattle drinking water is from groundwater = **- 3**; otherwise = **0**

Rationale: Pumping water for cattle can require considerable fossil fuel energy and out-of-pocket expenditure. Thus, farmers known to pump high proportions of their cattle drinking water with conventional energy sources and from great depths should be assigned strongly negative scores. Since we have data on the proportion of cattle drinking water from groundwater sources, but not on the lift of water or the energy source for pumping the water, we assign modestly negative scores to producers who rely primarily on groundwater.[27]

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[26]The following comments were made in response to an earlier version of the scoring system, in which we showed the above scoring system for small herds (< 100 head of cows), but **0**'s for large herds regardless of whether they used some or no artificial insemination.

* "Large herds can definitely benefit from A.I. to heifers. Cow A.I. is more labor intensive, but heifer A.I. is a tremendous opportunity for any producer... I would give large herds a + 3 also." (Veterinarian)

* "I think the benefits of artificial insemination apply to all sizes of operation, not just the small. While the ability to utilize A.I. on the entire or largest percentage of the herd may apply more to a small herd, the same benefits are realized in large herds. Scoring should be relative to whether or not A.I. is used, regardless of herd size." (Beef cattle production specialist]

* "A.I. is being used quite extensively and efficiently in many large herds. This is especially true on estrus-synchronized replacement heifers..." (Beef cattle production specialist]

* "There can be exceptions either way on this." (Veterinarian)

[27]Various reviewers wrote as follows:

* "Pumping groundwater may cost less than buying water from the 'rural water system.'"

Subsequent research: Obtain information not only on the source of water, but also on the amount of lift for pumped water (under some circumstances, surface water--as well as groundwater--may have to be lifted). Scores will then be assigned in relation to pumping lift and whether energy sources are renewable or non-renewable. If groundwater is pumped, inquire whether the quality of it is superior to possible alternative surface water sources. Include attention also to whether springs have been "developed" (producers take steps to uncover and collect water from formerly natural slow-flowing water sources) and, if rural water systems are involved, the cost of such water.

Q 40, Water access

* If groundwater is the main water source

  - Unlimited access = **+ 5**
  - Limited access = **0**
  - Water moved from source to access point = **- 10**

* If man-made ponds, natural ponds, rivers/creeks, and/or springs/artesian wells are the main water source

  - Unlimited access or limited access = **0**
  - Water moved from source to access point = **- 10**[28]

Rationale: The productivity and welfare implications of cattle having unlimited access to water sources can be expected to be positive, other things the same. However, cattle having direct access to ponds, rivers/creeks, and springs/artesian wells (versus groundwater) may damage water source embankments and cause drinking water to become contaminated. These potential negative effects for these water sources were judged to offset the otherwise positive implications of cattle having unlimited access to drinking water.[29]

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* "Not all groundwater is expensive to use. I think you need more information."

* "Many producers in Northeast South Dakota 'develop' springs as a water source which not only does not require pumping but requires no energy to keep open in winter. These should receive positive scores."

Several reviewers drew attention to the possible use of windmills for pumping groundwater. One indicated potential for solar energy. One also indicated that water quality may be higher with groundwater than surface water.

[28]When producers indicated this response, we assumed they were reporting transportation of water to a pasture from a source outside the pasture, i.e., we assumed that cattle drinking water was moved a substantial distance.

[29]One reviewer indicated that, in the future, cattle may not be allowed direct access to rivers/creeks. Another indicated that "hauling water is expensive and time-consuming."

If water must be moved from its source to an access point for cattle, a penalty was imposed to cover (a) likely fossil fuel energy and out-of-pocket costs for transporting the water and (b) the possibility of reduced cattle productivity and welfare from unexpected interruptions in transportation of water from the access point.

Subsequent research: Determine and reflect in the scoring system on-farm observations and discussion with producers concerning (a) the physical implications of cattle having direct access to various water sources; (b) the distance, gradient (uphill or downhill), and mode of transport required in moving the water from its source to cattle access points; and (c) the existence of possible surface storage for transported water. Also, inquire into whether water naturally flows throughout the winter, or whether the producer has to open the ice during the winter (the latter would be less sustainable).

Q 41, Cattle drinking water quantity problems

* In an average year of precipitation and water run-off: Yes = **- 15**, No = **0**

* In years of below-average precipitation and water run-off: Yes = **- 5**, No = **0**

Rationale: If producers experience cattle drinking water quantity problems, we judge the longer-term sustainability of their operation to be in question. Experiencing inadequate quantities of water during average years of precipitation and water run-off (not just in years of below-average water availability) is particularly damaging.

Q 42, Cattle drinking water quality problems

* Bacteria, nitrate, salinity, and sodium problems: Yes = **- 2** for each of the four possible problems, No = **0**

Rationale: The health, welfare, and productivity of cattle is negatively affected if the cattle have to drink poor quality drinking water. The long-term sustainability of such cattle operations is seriously open to question.

Subsequent research: Also include mention of possible sulfate problems.

Q 42b, Steps taken to overcome bacteria, nitrate, salinity, or sodium cattle drinking water problems: Yes = **0**; No = **- 2** for any of the four existing problems; otherwise (including producers with no drinking water quality problems) = **0**

Rationale: Producers who do not take steps to overcome existing water quality problems are viewed to be detracting from realization of cattle health, welfare, and productivity goals. For

example, with respect to bacteria, producers can limit build-up of fecal coliform through appropriate manure management practices. With nitrates, they have some latitude to (a) limit amounts of feedstuffs rich in nitrates when formulating rations and (b) limit non-point nitrate water pollution through appropriate management of manure and purchased fertilizer applications. Since correcting salinity and sodium problems may be quite costly, farmers may be forced to find and incur the expense of using water from other sources.

Calf management practices

Q 4b, Weaning age: < 3 mo = **- 9**, 4 mo = **- 6**, 5 mo. = **- 3**, 6-8 mo = **0**, 9 mo = **-10**, > 9 mo = **- 15**

Rationale: Since most breed organizations have a 205 day standard for performance testing, we chose to assign a neutral sustainability score to producers who wean calves at 6-8 months of age. If calves are generally weaned at earlier ages, producers fail to take advantage of the natural milk production and nurturing of their brood cows; calf welfare may be negatively impacted. During periods of unusual feed shortage, however, early weaning may be advisable.

If calves are weaned at later ages, (a) cows may not be able to provide adequate nutrition to their newly developing calf-embryos during the critical final pregnancy trimester and to otherwise rebuild themselves for subsequent lactation and/or (b) year-to-year calving intervals may exceed 12 months. Both possible repercussions of late weaning are likely to negatively impact overall herd productivity and profitability.[30]

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[30]The following comments were made in response to an earlier version of the scoring system, in which we showed a **- 15** for weaning at < 3 months:

* "Compared to grazing and use of home-raised feedstuffs, the penalty for early weaning is too great. In years of a short feed supply, early weaning may be advisable." (Beef cattle producer)

* "I agree for most cases. I like the strong penalty for late weaning. A poor practice." (Veterinarian)

* "This may depend on the year (feed supply) or specific marketing/management practices on a particular farm." (Veterinarian)

* "My feeling is that the penalty for early weaning is too severe. I believe there are situations (e.g., drought) that warrant early weaning... In my mind, the more severe penalty should occur after 6-8 months, with a less severe penalty for < 6-8 months. I think a little more flexibility is needed to allow for the many conditions that can warrant earlier weaning (especially in the South Dakota environment) to allow for 'sustaining' a cow herd." (Beef cattle production specialist)

Subsequent research: Inquire into the weaning age under typical conditions and whether (if so, how) extenuating circumstances may cause a producer to alter that weaning age.

Q 17, Dehorning, castrating, and branding

* Performed at 3 mo or less = **0** (for each of the three "events")

* Performed at > 3 mo = **- 4** (for each of the three "events")

* Castrating with injectable chemicals = **- 2**

* Other means of castrating and all means of dehorning and branding = **0**

* Do not dehorn, castrate, and/or brand = **0**

Rationale: Since dehorning, castrating, and/or branding calves at older ages can result in significant setbacks in calf productivity and welfare, negative scores were assigned to producers who dehorn, castrate, and/or brand their calves at ages of more than 3 months. Because of possible negative effects on productivity and calf welfare from castrating with injectable chemicals, this practice received a mild penalty.

While some recent commentators express the view that the effects of hot iron branding on animal welfare and hide value are more negative than with freeze branding, this view is sufficiently untested/unsupported at this time that we decided not to penalize producers for using hot iron branding.[31]

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[31]Reactions of various reviewers were as follows:

* "I agree, with some comment. Dehorning is the hardest procedure you can to a calf. Today's genetics are good enough we don't have to put up with horns. We have made great steps in improving our polled cattle. I hate dehorning a calf--it's very stressful. If you don't castrate your bulls, you will definitely receive a lower price when you sell, and therefore producers who chose to not castrate should receive a minus score. If we get to the point where bulls sell equally well with steers, not castrating may no longer require a minus score." (Veterinarian)

* "It would be my contention that (a) dehorning and castrating at < 3 months should not be scored equally to (b) not performing these tasks at all. Advantages to management, production, and marketing exist when these tasks are performed; stress is less when the calves are young. The same probably cannot be said about hot iron branding, due primarily to damage done to the hide, but not necessarily to a reduction in productivity." (Beef cattle production specialist)

Subsequent research: Determine if these practices are done "at birth" versus during the first month of their lives; consider assigning plus scores if done at birth. Also, determine if producers have naturally polled (hornless) calves. If so, possibly assign them plus scores. If they do not have naturally polled calves and do not dehorn, or if they do not castrate, assign them negative scores.

Q 13, Creep feeding practices

* Always creep feed = - 2
* Never creep feed = 0
* Sometimes creep feed = + 2

Rationale: In general, the prospective extra effort/costs for regular long-term creep feeding of calves may not completely offset short-term increases in daily rate of gain. Further, calves with high weaning weights affected by long-term creep feeding will not necessarily continue to show improved performance throughout the duration of their growing period. However, under extenuating circumstances, e.g., drought, we judge that (a) creep feeding benefits can often be expected to exceed creep feeding effort/costs and (b) potential stresses on both calves and mothers from inadequate feed supplies can be reduced through judiciously timed creep feeding. An additional argument for creep feeding prior to weaning is to facilitate the transition of calves to dry feed following weaning.[32]

Subsequent research: For producers that regularly creep feed, determine the timing and duration of creep feeding and whether purchased or home-raised creep feeds are used.

Q 16, Calf identification: does not identify calves = - 2; otherwise = 0

Rationale: Producers who do not identify their calves forego opportunity to at least informally assess the performance of the calves' respective mothers. Herds managed in this way may not be sufficiently productive and profitable to be sustainable over the long-run.[33]

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* "Some producers retain horns for predator control." (Natural resource economist)

* "Branding is looked on unfavorably by animal welfare people and the hide industry. Dehorning and castrating are necessary for longer term viability." (Beef cattle producer)

[32]A veterinarian wrote, "Good! Creep feeding's only real advantage is to get a calf used to eating grain out of a bunk. If you have to creep feed to maintain a calf's weight on pasture (say due to poor condition), he should be weaned. Most creep feed too much and too long; it is expensive."

[33]One reviewer wrote, "I agree. It is very, very critical to have accurate records. This is impossible without individual identification. Very important!"

Manure management

Subsequent research: Because cattle on many ranches are geographically concentrated over winter and during calving, manure management for cow-calf operators will receive attention in the next phase of research (see the manure management section for finishing cattle on pp 44-45).

Overall farm management

Q 44, Debt-to-asset ratio

* More than 0.60 = **- 10**
* 0.40 - 0.60 = **- 5**
* Less than 0.40 = **0**

Rationale: Producers with debt-to-asset ratios greater than 0.60 are generally considered to be in financial difficulty. Because such producers are especially vulnerable to bankruptcy, they were assigned a large negative score. Producers with 0.40-0.60 debt-to-asset ratios were viewed as potentially vulnerable to financial difficulty. On the other hand, any producer with a less than 0.40 debt-to-asset ratio was viewed as being neutral in "sustainability." The rationale for this decision is the following. "Sustainable" producers need to consider how most appropriately to balance (a) low per-unit costs arising from possible economies-to-scale that may require some debt financing against (b) reduced financial vulnerability represented by debt-to-asset ratios approaching zero. A high degree of personal preference is involved in individual producers determining the debt-asset structure most suitable for them.

Subsequent research: Possibly try to obtain data on the farm's/ranch's total assets which could be used along with data on gross sales and net revenue to more fully appraise the longer-term financial sustainability of the farm/ranch. That appraisal would involve determining and interpreting "net return on equity" and its three financial ratio "determinants."

Q 45, Percentage family labor

* 100% = + **10**
* 80-99% = + **5**
* Less than 80% = **0**

Rationale: Producers who farm exclusively with family labor do not face (a) possible uncertainties in finding adequately qualified and motivated hired laborers and (b) possibly "burdensome" out-of-pocket expenditures for meeting wage bills. These factors were considered to substantially outweigh possible advantages from economies-to-scale that could arise from an expansion in the labor force represented by hired laborers.[34]

Subsequent research: Inquire about percentage of family labor, not only at present, but at earlier times when families might have been at a different family cycle stage.

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[34]One reviewer indicated that family labor involvement with cattle production is not sustainable unless families themselves are sustainable. Another commented that the life cycle stage of particular families can complicate interpretation of responses to this question.

COW-CALF PRODUCER "ORGANIC' INDEX (POI)[35]

Summary of maximum ranges, scoring sub-totals, by type of practice

Grazing/feeding practices:	- 8 to + 50 = 58 (31%)
Herd health management practices	- 28.5 to + 29.5 = 58 (31%)
Calf management practices	- 22 to + 4 = 26 (14%)
Breeding management practices	- 10 to + 14 = 24 (12%)
Drinking water access/quality	- 21 to + 3 = 24 (12%)
Total	190 (100%)

Grazing/feeding practices

Q 33, Feeding of "organically" produced feedstuffs

* Grains: 100% = + **11**, 50-99% = + **7**, 1-49% = = + **3**, 0% = **0**
* Harvested forages: 100% = + **11**, 50-99% = + **7**, 1-49% = + **3**, 0% = **0**
* Grazed forages: 100% = + **11**, 50-99% = + **7**, 1-49% = + **3**, 0% = **0**

* Organizational statements

- CCOF (1993, p 20) states that organically grown feeds are required for organic livestock. For slaughter animals, their position is that "animals intended for slaughter must be raised on a balanced diets of 100% organic feed from birth..."

- IFOAM (1989, p 26) states "organically grown feedstuffs fed in correct proportions are the basis of 'Symbol Standard' requirements"

- IFOAM Animal Standards Sub-Committee (1991, p 1) states that the maximum percentages of non-organic feed that may be fed are 10% in 1992, 5% in 1994, and 0% in 1996

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[35]One reviewer (not associated with an "organic" certifying organization) wrote, "I will not make any specific comments on the cattle feeder indices. By nature, most feedlots are quite unsustainable... If a truly sustainable feedlot is possible, I can only guess it would involve mostly forages and by-products as I saw when visiting England."

- NOLC (1992 survey) reports 75% of producers to support requiring 100% organic feeds

- NOSBLC (1993, p 11) states that "all certified organically produced livestock must be fed 100% certified organically produced feeds and feedstuffs, ..."

- NPSAS (1992, p 1) states that feedstuffs for livestock consumption should be organically produced and rations should be nutritionally balanced.

- OCIA (1993, p 4) states that slaughter animals must be fed OCIA certified organically grown feed

- OFPA (1990, p 21-6) states that livestock shall be fed organically produced feed

- OFPANA (1992, p 1) states that "100% organic feeds must be fed, ..."

Q 28, Grazed versus harvested forages: percentage of dry matter from:

* Grazed pasture, 70% or more = + **7**, 40-69% = + **4**, 10-39% = **0**, < 10% = - **4**

* Grazed crop residues, 15% or more = + **4**, < 15% = **0**

* Organizational statements

- CCOF (1993, p 20) states that "CCOF livestock producers are encouraged to provide all animals with access to pasture or outside runs..."

- IFOAM (1989, p 25) states that "all stock should have access to pasture during the grazing season unless ..."

- NOSBLC (1993, p 14) states that "year-round confinement of livestock to an outdoor drylot without seasonal access to pasture or grazing land shall be prohibited"

- NPSAS (1992, p 1) states that "stock should have access to outdoor range"

- OFPANA (1992, p 3) states that organic livestock shall have "access to pasture and sunshine when seasonally and ecologically sound"

Q 32, Grazing management system

* One or more of rest-rotation, deferred rotation, cell/strip grazing, and/or complimentary use = + **6**; if not = **0**

* Continuous grazing = - **4**; if not = **0**

* Organizational statements

- OCIA (1993, p 5) states that the first line of herd health defense "must be control of environmental problems through pasture rotation, disinfection, etc."

- OFPANA (1992, p 7) states that pasture rotation is to be undertaken to interrupt life cycles of parasites

Herd health management practices

Q 19, Antibiotics

* Uses antibiotics to treat specific illnesses = + **12**
* Subtherapeutic use of antibiotics = - **10**
* Uses antibiotics for group prevention = - **5**
* Never uses antibiotics = **0**

* Organizational statements

- CCOF (1993, pp 20, 21, 29) states that (a) "subtherapeutic feeding" and "routine" ("automatic") use of antibiotics are prohibited and (b) "livestock producers must never deny treatment to an ill animal so that its products may be labeled 'organic'."

- IFOAM (1989, pp 28, 29) says that "the aim should be to reduce the use of antibiotics to a minimum or, if possible, eliminate their use altogether... For conditions requiring treatment and where effective alternative treatments are not available, conventional drugs should be used, in particular to save life, to prevent unnecessary suffering, or to provide the only way to restore the animal to full health. Treatment should never be withheld where an animal is suffering. Withdrawal periods must be observed. Treatment of healthy animals and the routine use of prophylactic drugs is prohibited, except in cases of a known farm disease problem."

- NOLC (1992 survey) reports controversy around whether animals treated with antibiotics "should be removed from the certified herd or if some extended withdrawal time is acceptable." Of all respondents, 32% supported prohibition of all antibiotic use; 65% of them supported allowing restricted use of antibiotics with extended withdrawal periods.

- NOSBLC (1993, p 8) states that "antibiotics--systemic and topical" are excluded from the National List of exempted synthetics. On p 13, they state "the action of a producer to withhold treatment to maintain the organic status of an individual livestock animal which results in the otherwise avoidable suffering or death of the animal shall be grounds for decertification"

- NPSAS (1992, p 1) states that rations containing "antibiotics of any kind" and the regular use of antibiotics as preventative treatments are not acceptable.

- OCIA (1993, p 5) states that antibiotics to stimulate growth are prohibited

- OFPA (1990, p 21-6) states that producers shall not "use subtherapeutic doses of antibiotics"

- OFPANA (1992, pp 1, 3, 4) state that antibiotics to stimulate growth or production are prohibited; the use of antibiotics is prohibited except "restricted use of topical antibiotics" and for emergency medical treatment, with provision for an adequate withdrawal time thereafter; "withholding treatment resulting in otherwise avoidable suffering of livestock" may be grounds for denial of organic certification.

Q 20, Vaccinations, insecticides/fumigants, and parasiticides

*** Brucellosis, blackleg, and IBR-BVD-PI_3 vaccinations**

- Regularly = + **2** for each type of vaccination

- Sometimes = - **2** for each type of vaccination

- Never = - **2** for brucellosis and = - **1** for the other two vaccinations

- Organizational statements

CCOF (1993, p 21) states that "producers may vaccinate stock for endemic diseases..."

IFOAM (1989, p 29) says that "vaccines may only be used where a known disease problem exists on a farm or neighboring land which threatens stock health, and which cannot be effectively controlled by other management means"

NOLC (1992 survey) reports that over 90% of respondents support use of vaccinations

NOSBLC (1993, p 7) states that "vaccines are restricted to use for the prevention of infectious diseases"

NPSAS (1992, p 1) states that "vaccinations, etc. for legal sale and/or transportation" and "bacterial immunizations" are acceptable.

OCIA (1993, p 5) states that "vaccinations (including vaccination to stimulate production of maternal antibodies)" are permitted

OFPA (1990, p 21-6) states that producers shall not "administer medication, other than vaccinations, in the absence of illness"

OFPANA (1992, p 3) says that vaccinations are "accepted" practices

*** Parasiticides**

- Regularly = - **2**
- Sometimes = + **2**
- Never = **0**

- Organizational statements

CCOF (1993, p 21) states that "CCOF livestock producers are required to minimize the use of parasiticides"

IFOAM (1989, p 29) states that "appropriate stocking rates, mixed stocking, and clean grazing systems are recommended to prevent the buildup of unacceptable worm burdens... Specific treatments may be administered where stock are known to be carrying unacceptable worm burdens. In these circumstances, strict identification procedures and withdrawal periods must be observed."

NOLC (1992 survey) reports controversy around whether animals treated with parasiticides "should be removed from the certified herd or if some extended withdrawal time is acceptable." Of those surveyed, 64% did not support a complete prohibition on all use of parasiticides, with 54% of these respondents supporting restricted use of parasiticides with breeding stock

NOSBLC (1993, p 8) states that parasiticides are excluded from the National List of exempted synthetics

NPSAS (1992, p 1) states that the regular use of "worming medications" as preventative treatments are not acceptable.

OFPA (1990, p 21-6) states that producers shall not "use synthetic internal parasiticides on a routine basis"

OFPANA (1992, p 3) states that organic livestock shall receive "parasite and disease control ... to insure and protect the health and well-being of the livestock;" however, on p 4 they say that "synthetic parasiticides, both internal and external, are prohibited," except they may have restricted use with breeding stock

Q 36, Special protection of cows from snow, mud, wind, & heat: Yes = **+ 1.5** , No = **- 1.5**

Q 37, Special care/facilities for cows when they calve: Yes = **+ 1.5**, No = **- 1.5**

Q 38, Facilities to segregate sick or injured animals: Yes = **+ 2.5**, No = **- 2.5**

Q 22, Extent of effort to minimize stress

* Scores of 2-5 = **0**
* Scores of 6-8 = **+ 2**
* Scores of > 8 = **+ 4**

* Organizational statements (re. Q's 36-38 and 22)

- CCOF (1993, p 20) states that "the livestock standards emphasize stress reduction ... to maximize animal health... CCOF livestock producers are required to provide their animals with uncrowded living conditions, with maximum fresh air, daylight and shelter from inclement weather. Each animal must have enough room to comfortably get up, lie down, groom, turn around, and stretch its limbs... Livestock producers are encouraged to ... promptly recognize and isolate ill individuals."

- IFOAM (1989, pp 25, 35) states that "prolonged confining of animals is prohibited." ... "Buildings for housing livestock must have adequate natural ventilation and lighting and allow sufficient room for the free movement of stock..." ... "Outdoor calving is recommended when weather conditions allow. Facilities for indoor calving during severe weather or for winter housed herds must be adequate." ... "Extensive systems with shelter available" are recommended. "Out-wintering, provided windbreaks are available" and "in-wintering" are permitted.

- IFOAM Animal Standards Sub-Com (1991, p 1) states that "all animals must have access to open air and grazing when this applies to the type of animal and season..."

- NOSBLC (1993, pp 13, 14) states that "a production environment which minimizes livestock stress and maximizes livestock health shall be provided; it must include the following factors: (a) access to shade, shelter, natural air, and daylight suitable to the species, the stage of production, the climate, and the environment; ... (c) housing design which allows for the conduction of natural maintenance and comfort behaviors and for exercise; and (d) housing design which provides a temperature level, ventilation, and air circulation suitable to the species. Year-round confinement of livestock to an indoor housing facility without daily

exercise and access to the outdoors ... shall be prohibited... Year-round confinement of livestock to an outdoor drylot without seasonal access to pasture or grazing land shall be prohibited."

- NPSAS (1992, p 1) states that "housing should be light, well ventilated, and uncrowded; stock should have access to outdoor range."

- OCIA (1993, p 4) states that "livestock must be provided with living conditions which respect their needs: reasonable liberty, lack of crowding, kindness, etc. Livestock should have access, when seasonally appropriate, to sunshine, fresh air, soil, fresh plants, etc."

- OFPANA (1992, p 3) says that (a) organic livestock shall be in a situation in which they receive adequate exercise, have adequate shelter, and receive natural light and air to insure and protect the health and well-being of the livestock and (b) organic livestock producers are encouraged to minimize livestock diseases through ... "reduction of livestock stress, proper pasture management, isolation of ill individuals ... and other sound health management practices."

Calf management practices

Q 16, Calf identification

* Does not identify calves = - **11**; otherwise = **0**
* Uses ear tags and tattoos = + **2**
* Uses ear tags, tattoos, and freeze brands = + **4**[36]
* Ear notching = - **2**

* Organizational statements

- CCOF (1993, p 21) states that "livestock producers are required to ear-tag or individually mark in some way all livestock..."

- IFOAM (1989, p 25, 30) states that animals must be clearly identified and that "mutilation of ears is prohibited. Only tags and tattoos are permitted."

- NOSBLC (1993, pp 14) states that "an identification system must ensure the identity of organic livestock"

- OCIA (1993, pp 5,6) states that "... if animals are not individually identified by numbered tags, each animal that is treated with an active material must be clearly identified with a tag specifying the material and date of treatment. Each animal must be traced from birth to slaughter."

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[36]Multiple calf identification helps to insure maintenance of the audit trail on cattle.

- OFPA (1990, p 21-7) states that organic certified farms "shall keep adequate records and maintain a detailed, verifiable audit trail so that each animal ... can be traced back to such farm"

- OFPANA (1992, p 2) requires an identification system that insures identity of organic livestock

Q 4b, Weaning age: < 3 mo = **- 11**, otherwise = 0

* Organizational statements

- IFOAM (1989, p 35) states that "natural weaning" is recommended... Weaning of calves before 10 weeks is prohibited."

- OCIA (1993, p 4) states that weaning beef calves under 3 months is prohibited

Breeding management practices

Q 10, Criteria in herd bull selection

* Sound feet and legs, scores of 8-10 = **+ 4**, 4-7 = **+ 2**, and < 4 = **0**
* Reproductive performance, scores of 8-10 = **+ 4**, 4-7 = **+ 2**, and < 4 = **0**
* Disease resistance, scores of 8-10 = **+ 3**, 4-7 = **+ 1.5**, and < 4 = **0**

* Organizational statements

- CCOF (1993, p 25) states that "livestock breeding selects for disease resistance"

- IFOAM (1989, p 25) states that "attention should be paid to the choice of sire and dam to avoid problems at birth"

- OFPANA (1992, p 1) recommends selective breeding practices that "strive to maintain livestock structural integrity; produce healthy, marketable livestock; and minimize obstetrical and genetic related problems"

Q 14, Herd bull-brood cow management

* Use hormones to control breeding seasons, Yes = **- 10**, No = **0**

* Organizational statements

- IFOAM (1989, p 29) says that hormones for heat synchronization are prohibited

- NPSAS (1992, p 1) states that rations containing "estrus inhibitors" are not acceptable

- OFPANA (1992, p 3) says hormones to control the reproductive cycle are prohibited

Q 9, Natural service or artificial insemination

* 90-100% natural service = **+ 3**

* Otherwise = **0**

* Organizational statements

- IFOAM (1989, p 25) states that "attention should be paid to the choice of sire and dam to avoid problems at birth." IFOAM Animal Standards Sub-Com (1991, p 1) states that "artificial insemination is not recommended but can be allowed... Own sires should be kept."

- NOLC (1992 survey) reports 92% of respondents to support allowing artificial insemination

- NOSBLC (1993, p 11) states that "artificial insemination is allowed. Semen from conventional breeder stock is allowed until semen from organic breeder stock is commercially available."

- OCIA (1993, p 5) states that "natural service is the ideal. Since breeding methods have minimal effect on the quality of the meat produced, various other methods are tolerated, provided they do not unduly restrict the gene pool."

- OFPANA (1992, p 1): "artificial insemination is allowed, although natural service is preferred. ... Selective breeding practices are recommended that strive to maintain livestock structural integrity; produce healthy, marketable livestock; and minimize obstetrical and genetic related problems"

Drinking water access/quality

Q 40, Water access

* If groundwater is the main water source

- Unlimited access = + 3
- Limited access = 0
- Water moved from source to access point = - 3

* If man-made ponds, natural ponds, rivers/creeks, and/or springs/artesian wells are the main water source

- Unlimited access or limited access = 0
- Water moved from source to access point = - 3

Q 41, Cattle drinking water quantity problems

* In an average year of precipitation and water run-off: Yes = - 2, No = 0

Q 42, Cattle drinking water quality problems

* Bacteria, nitrate, salinity, and sodium problems: Yes = - 2 for each of the four possible problems, No = 0

Q 42b, Steps taken to overcome bacteria, nitrate, salinity, or sodium cattle drinking water problems: Yes = 0, No = - 2 for any of the four existing problems; otherwise (including producers with no drinking water quality problems) = 0

* Organizational statements, re. overall drinking water access/quality

- IFOAM (1989, pp 25, 28) states that "stock must have access to fresh water at all times;" "care should be taken to ensure that water used by stock for drinking should be free from contamination"

- NOSBLC (1993, p 12) states that "water for livestock must be free of contamination by hazardous substances ..."

- NPSAS (1992, p 1) states that cattle should have "access to clean, fresh water at all times."

- OFPANA (1992, pp 2, 3) states that "water quality should not compromise the health of livestock" and organic livestock shall have access to clean water

CATTLE FEEDER PRODUCER SUSTAINABILITY INDEX (PSI)

Feeding practices:	- 36 to + 14 = 50 (23%)
Cattle health management practices:	- 22 to + 27.5 = 49.5 (23%)
Drinking water access/quality:	- 49 to 0 = 49 (23%)
Manure management practices:	- 6 to + 20 = 26 (12%)[37]
Overall farm/ranch management:	- 14 to + 26 = 40 (19%)
Total	214.5 (100%)

Feeding practices:

Q 17, Percentage of grain to total dry matter intake fed to backgrounded steers (500-750 lb), early finishing steers (750-950 lb), and late finishing steers (950+ lb)

* Backgrounded steers: > 40% = - 8; 40% or less = **0**
* Early finishing steers: > 70% = - 8; 70% or less = **0**
* Late finishing steers: > 80% = - 8; 80% or less = **0**

Q 8, Feeding system

* Confinement feeding during entire feeding period = - 2; otherwise = **0**

Rationale: Beef cattle, as ruminants, are uniquely designed to make effective use of roughages. In many regions, beef cattle can make more effective use of pasture/grazing land and forages included in crop rotations than other livestock species. Thus, feeding beef cattle high proportions of concentrates can detract from overall efficient and profitable natural resource use. Including "excessively" high proportions of concentrates in finishing cattle diets may detract from cattle health/welfare and may result in production of meat with levels of fat harmful to human health.[38]

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[37]One reviewer indicates that manure management practices "may be more important in the future, depending on how regulation of manure runoff changes."

[38]A beef production specialist indicated a judgment that the most sustainable mix of grains and roughages in cattle diets depends to some extent on the price of energy from grain versus from roughage. He went on to write, "Most of today's fast growth genetic feeder calves cannot realize their potential on grass. We have calves that are ready for slaughter at 12 months of age with good lean meat. Most of the calves that go to grass as yearlings are late, poor 'tail-end'

If current government policies that provide incentives for producers to limit their production of food and feed grains were to be eliminated, an additional area of concern with high concentrate cattle finishing diets could be cattle competing with people (especially the poor with limited purchasing power for meat and meat-related products) for limited food/feed production resources.

Q 18, Home-raising of feed for cattle: percentage home-raised dry grain, hay, high moisture grain, and corn silage

In scoring this question, divide the points below by the number of different feedstuffs fed. For example, if Producer A feeds two feedstuffs and 100% of each is home-raised, Producer A would receive a + 4 for each of the two feedstuffs. If Producer B is the same as Producer A except that he feeds three feedstuffs, all of which he home-raises, he would receive + 2.67 for each of the three feedstuffs.

* 100% = + 8
* 50-99% = + 4
* 20-49% = 0
* 0-19% = - 4

Rationale and subsequent research: The discussion on the home-raising of feed by cow-calf operators on p 10 also applies here.

Q 11, Feeding management practices

* Feeds are tested for nutrient composition at least once a year = + 2; if not = - 2

* Feed records are kept for separate pens of cattle = + 2; if not = - 2

* Feed scales are used to monitor and control feeding rates = + 2; if not = - 2

Rationale: Producers who periodically test various diet components for nutrient composition can help insure that their cattle receive adequate nutrition and, thus, that their cattle are healthy,

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calves. The good calves are usually too big to go to grass. They need to go to the feedlot instead... Feeding them in confinement from weaning to slaughter is not a disadvantage. A calf ready to slaughter at 12 months is much more profitable than one fed for 6 months on grass and another 90-120 days in the feedlot."

An official from an "organic" certifying organization wrote, "Too high a ratio of grains-to-forage goes against the principle that cattle are ruminants and should primarily be consumers of roughage. It has implications for cattle welfare and health and sustainability more generally."

productive, and profitable.[39] Maintaining feed records for separate pens of cattle can enable producers to evaluate the health and overall efficiency of feed use by various batches of cattle, and thus to make more well-informed decisions concerning sources of purchased feeder cattle in subsequent feeding periods. Using feed scales to monitor and control feeding rates can help insure that producers are making available to their cattle quantities of feed commensurate with their cattle's nutritional needs and conducive to profit-making.

Cattle health management practices:

Q 16, Features of cattle finishing operation

* Confinement barn: mechanical ventilation = **- 3**; if not = **0**

    - If < 20 sq ft per head = **- 3**; if not = **0**

* Confinement barn: natural ventilation = **0**

    - If < 25 sq ft per head = **- 3**

* Have mounds = **+ 2**; if not = **0**
* Have fence windbreak = **+ 2**; if not = **0**
* Have shelter-belt windbreak = **+ 2**; if not = **0**
* Feedlot partially paved with concrete = **+ 2**; if not = **0**
* Have covered protection from wind and snow = **+ 1**; if not = **0**
* Use bedding = **+ 1**; if not = **0**
* Feedlot completely paved with concrete = **- 2**; if not = **0**

Q 28, Facilities to segregate sick or injured animals: Yes = **+ 2**, No = **- 2**

Rationale: Provision for feeder cattle of the types of housing/shelter/facilities scored positively can be expected to contribute to the health, welfare, and productivity of the cattle. On the other hand, the welfare, health, and productivity of cattle which are "excessively" confined or which must remain continuously on concrete can be impaired. Further, investments in tightly constructed confinement barns and/or completely paved feedlots may not be economic.

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[39]One reviewer indicated the advisability of testing for feedstuff nutrient composition quarterly rather than simply once a year.

Q 23, Antibiotic use

* Using antibiotics to treat specific illnesses = + 4; if no = 0

* Subtherapeutic use of antibiotics = - 2; if no = 0

* Newly purchased cattle upon arrival at the feedlot = + 2; if no = 0[40]

* Never use antibiotics = - 4

Rationale: Producers who use no antibiotics because they follow cattle feeding management practices that completely prevent animals from becoming sick or injured would represent a "sustainability" health ideal and therefore would be deserving of a maximum plus score. Because some types of sickness and/or injury are likely with most feedlots, however, we chose to assign (a) positive scores to producers who use antibiotics to treat specific sicknesses/injuries and (b) negative scores to those who never use antibiotics. The underlying rationale is that animal productivity and welfare will at least occasionally be sacrificed if a producer follows a "blanket" policy of **never** using antibiotics.[41]

From the standpoints of cattle developing resistance to antibiotics from continued use over time and economics (prospective benefits are likely to be less than prospective costs), we assigned a negative score to producers who regularly include subtherapeutic doses of antibiotics in their feed. On the other hand, producers who use antibiotics with newly purchased feeder cattle were assigned mildly positive scores. The underlying rationale is a presupposition that the judicious, prophylactic use of antibiotics at this time of likely rather acute calf-stress can result in feeder cattle maintaining their health and ultimately being more productive and profitable.

Subsequent research: Determine producers' strategies for preventing/treating sickness and injury to animals: To what extent do they take preventative measures? Do they try various other means to treat sickness/injury, reserving antibiotics as a last resort, or do they "automatically" use antibiotics at the first sign of sickness? Do they use antibiotics differently with different types of feeder cattle? Determine the extent to which producers rely on themselves versus on veterinarians to make decisions on animal treatment. To gain some idea on the appropriateness of drug levels used, perhaps create a hypothetical case sickness (e.g., 600 lb calf coughing...) and inquire about how they would treat the animal.

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[40]A veterinarian reviewer indicated that he would consider administering antibiotics to groups of certain stale or long-haul cattle, but not to all cattle.

[41]The authors recognize that some producers would disagree with this approach because they believe that properly selected homeopathic (non-Western medicinal) approaches can restore health to sick/injured animals.

Q 24, Other "production tools"

* Growth promotants: All cattle = + **2**, some cattle = + **1**, no cattle = - **1**

* Ionophores: All cattle = + **1**, some cattle = + **0.5**, no cattle = - **1**

* Coccidiosis control: All cattle = - **0.5**, some cattle = + **1**, no cattle = **0**

* Parasiticides: All cattle = - **1**, some cattle = + **1**, no cattle = - **0.5**

* Insecticides/fumigants: All cattle = - **1**, some cattle = + **1**, no cattle = - **0.5**

* Vaccinations

- 7-way clostridial bacterin: All cattle = + **1**, some cattle = - **1**, no cattle = - **1**

- IBR, BVD, PI_3, BRSV, and Haemophilus somnus: For each, all cattle = + **0.5**, some cattle = - **0.5**, no cattle = - **0.5**

Rationale: Single component animal production research shows cattle receiving growth promotants to have improved daily weight gain, feed conversion efficiency, and lean meat development. Similarly, ionophores have been shown to contribute to improved feed conversion and general animal health. Whether continued use over time of such production tools is commensurate with long-term sustainable livestock production, on the other hand, may be somewhat open to question.

Regularly using coccidiosis control, parasiticides, and insecticides/fumigants may result in cattle developing resistance to the agricultural chemicals and may involve greater costs than benefits. On the other hand, the productivity and welfare of animals never receiving these production tools is expected to at least occasionally be sacrificed if a producer follows a "blanket" policy of **never** using these tools.

We judge that producers are well-advised to use the various vaccinations with all cattle. Producers who only sometimes vaccinate are penalized because animals not vaccinated may lack the natural antibody immunity to withstand possible infection from animals which receive the live virus through vaccination.

Subsequent research: Determine producers' overall strategies for preventing/treating sickness and injury to animals. Determine whether decisions on use of these production tools are made independent of particular circumstances (e.g., weather, localized health environment, season of the year, weight of cattle). If not, what seems to determine whether particular tools are used. Also, examine "some" cattle from both of the following standpoints: (a) part of the cattle in a feedlot at one point in time and (b) part of the cattle placed in a feedlot at different points of time within the period of a year.

Q 14, Percentage feedlot utilization, by quarter

* For feedlots with a design capacity of 500 head or more of cattle, + 2 for each quarter in which the utilization > 75%; otherwise = 0

* Feedlots with a design capacity of < 500 head of cattle = 0

Rationale: To offset relatively high fixed costs in larger feedlots, feeders commonly have economic incentive to insure high feedlot utilization rates throughout the year. With smaller feedlots in which crop and livestock production are often both relatively important and in which feeder calves are commonly home-raised, single batches of feeder cattle tend to be placed in the feedlot after weaning in late fall, or are sold, depending importantly on the opportunity cost of home-raised feed. During peak periods of labor demand for crops, smaller feedlot managers may prefer to have empty feedlots. Thus, the direct linkage between economic sustainability and continuous high feedlot utilization rates assumed for large feedlots may not apply to farms/ranches with small feedlots.

Q 6a, Percentage of cattle placed on feed that were home-raised

* 100% = + 4
* 50-99% = + 2
* 20-49% = 0
* 0-19% = - 2

Rationale: The greater the percentage of cattle placed on feed that are home raised, the less cattle feeders are exposed to possible difficulties in purchasing cattle that may occasionally come into short supply and become high priced. Home-raising rather than purchasing feeder cattle can also give producers greater assurance of avoiding sickness and being able to feed uniformly high quality cattle. On the other hand, it is conceivable that producers who feed more cattle than they can raise from their own cow herds may realize economies-of-scale in production and associated reduced per-unit production costs.

Q 11, Cattle weight monitoring

* Cattle weights are checked periodically to track cattle performance = + 2; if not = - 2

Rationale: Producers who periodically check cattle weights can help insure diagnosis of production problems that may arise with their cattle and can make more well-informed decisions on when to market their cattle--thereby enhancing feedlot productivity and profitability.[42]

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[42]One reviewer writes, "Cattle scales are very important. Feed costs make it critical to monitor cost of gain and average daily gain of cattle."

Q 11, Feed purchase-storage practices[43]

* Have grain storage facilities to take advantage of price drops in purchased feed grains = + 2; if not = 0

Rationale: Producers with grain storage facilities should be able to buy feed on the average at a somewhat lower cost and with less risk of being forced to have to buy feed at times when feed prices are "abnormally" high compared to producers with no grain storage facilities--thereby enhancing feedlot profitability.

Subsequent research: Inquire into other approaches that feeders take to help guard against "emergency" purchases of "high priced" feed. Or, have they never experienced such situations?

[43]One reviewer comments, "Not all producers have the cash flow necessary to retain ownership."

CATTLE FEEDER PRODUCER ORGANIC INDEX (POI)

Feeding practices:	- 49 to + 37 = 86 (39%)
Cattle health management practices:	- 49 to + 32 = 81 (37%)
Manure management practices:	- 6 to + 24 = 30 (14%)
Drinking water access/quality:	- 22 to 0 = 22 (10%)
Total	219 (100%)

Feeding practices:

Q 19, Feeding of "organically" produced feedstuffs

* Grains: 100% = + **11**, 50-99% = + **7**, 1-49% = = + **3**, 0% = **0**
* Harvested forages: 100% = + **11**, 50-99% = + **7**, 1-49% = + **3**, 0% = **0**
* Grazed forages: 100% = + **11**, 50-99% = + **7**, 1-49% = + **3**, 0% = **0**

* Organizational statements

- CCOF (1993, p 20) states that organically grown feeds are required for organic livestock. For slaughter animals, their position is that "animals intended for slaughter must be raised on a balanced diets of 100% organic feed from birth..."

- IFOAM (1989, p 26) states "organically grown feedstuffs fed in correct proportions are the basis of 'Symbol Standard' requirements"

- IFOAM Animal Standards Sub-Committee (1991, p 1) states that the maximum percentages of non-organic feed that may be fed are 10% in 1992, 5% in 1994, and 0% in 1996

- NOLC (1992 survey) reports 75% of producers to support requiring 100% organic feeds

- NOSBLC (1993, p 11) states that "all certified organically produced livestock must be fed 100% certified organically produced feeds and feedstuffs, ..."

- NPSAS (1992, p 1) states that feedstuffs for livestock consumption should be organically produced and rations should be nutritionally balanced.

- OCIA (1993, p 4) states that slaughter animals must be fed OCIA certified organically grown feed

- OFPA (1990, p 21-6) states that livestock shall be fed organically produced feed

- OFPANA (1992, p 1) states that "100% organic feeds must be fed, ..."

Q 22, "Alternative" feeds fed (organizations which prohibit the use of these alternative feeds are shown following the respective feeds)

* Plastic pellets for roughage (CCOF, 1993, p 20; NOSBLC, 1993, p 12; OCIA, 1993, p 4; OFPA, 1990, p 21-6; OFPANA, 1992, p 1) Yes = **- 5**, No = **0**

* "Recycled" manure; "droppings, dung, and other manures" (CCOF, 1993, p 20; IFOAM, 1989, p 27; IFOAM Standards Sub-Com, 1991, p 2; NOSBLC, 1993, p 12; NPSAS, 1992, p 1; OCIA, 1993, p 4; OFPA, 1990, p 21-6; OFPANA, 1992, p 1) Yes = **- 7**, No = **0**

* Feed formulas containing urea and/or anhydrous ammonia (CCOF, 1993, p 20, 36; IFOAM Standards Sub-Com, 1991, p 2; NOSBLC, 1993, p 12; NPSAS, 1992, p 1; OCIA, 1993, pp 3, 4; OFPA, 1990, p 21-6; OFPANA, 1992, p 1) Yes = **- 7**, No = **0**

* Animal by-products (e.g., meat, bone, offal, feather, fish meals) (IFOAM, 1989, p 27; IFOAM Standards Com, 1991, p 2) Yes = **- 1**, No = **0**

- However, NOSBLC (1993, p 12) states that fish meal from "certified 100% organic sources" is an acceptable feed supplement

- However, OCIA (1993, p 3) states that bonemeal, fishmeal, and other similar natural products are authorized

* Preservatives (IFOAM Standards Sub-Com, 1991, p 2; NPSAS, 1992, p 1) Yes = **- 2**, No = **0**

* Solvent-extracted feeds (IFOAM, 1989, p 27; IFOAM Standards Sub-Com, 1991, p 2; NOSBLC, 1993, p 12) Yes = **- 2**, No = **0**

* Sawdust and other non-food ingredients (IFOAM, 1989, p 27; NOLSC, 1992, p 1; OFPANA, 1992, p 1) Yes = **- 3**, No = **0**

Q 17, Percentage of grain to total dry matter intake fed to backgrounded steers (500-750 lb), early finishing steers (750-950 lb), and late finishing steers (950+ lb)

* Backgrounded steers: > 40% = **- 8**
* Early finishing steers: > 40% = **- 6**
* Late finishing steers: > 40% = **- 4**

* Organizations

- IFOAM (1989, pp 26, 38) says that "For ruminants, forage should constitute no less than 60% of the total daily dry matter intake" ... "High energy, low fiber rations and those with more than 40% dry matter concentrate feeds" are prohibited.

Q 8, Feeding system

* Confinement feeding during entire feeding period = - 4

* Grazing during part of backgrounding period, confinement feeding thereafter = - 2

* Grazing during all the backgrounding period, confinement feeding thereafter = + 2

* Grazing, followed by a period of confinement feeding for < 100 days = + 4

* Organizational statements

- CCOF (1993, p 20) states that "CCOF livestock producers are encouraged to provide all animals with access to pasture or outside runs..."

- IFOAM (1989, p 25) states that "all stock should have access to pasture during the grazing season unless ..."

- NOSBLC (1993, p 14) states that "year-round confinement of livestock to an outdoor drylot without seasonal access to pasture or grazing land shall be prohibited"

- NPSAS (1992, p 1) states that "stock should have access to outdoor range"

- OFPANA (1992, p 3) states that organic livestock shall have "access to pasture and sunshine when seasonally and ecologically sound"

Drinking water access/quality:

Q 20, Cattle drinking water quantity problems

* In an average year of precipitation and water run-off: Yes = - 6, No = 0

Q 21a, Cattle drinking water quality problems

* Bacteria, nitrate, salinity, and sodium problems: Yes = - 2 for each of the four possible problems, No = 0

Q 21b, Steps taken to overcome bacteria, nitrate, salinity, or sodium cattle drinking water problems: Yes = 0; No = - 2 for any of the four existing problems; otherwise (including producers with no drinking water quality problems) = 0

* Organizational statements, re. drinking water (Q's 20 and 21)

- IFOAM (1989, pp 25, 28) states that "stock must have access to fresh water at all times;" "care should be taken to ensure that water used by stock for drinking should be free from contamination"

- NOSBLC (1993, p 12) states that "water for livestock must be free of contamination by hazardous substances ..."

- NPSAS (1992, p 1) states that cattle should have "access to clean, fresh water at all times."

- OFPANA (1992, pp 2, 3) states that "water quality should not compromise the health of livestock" and organic livestock shall have access to clean water

<u>Cattle health management practices:</u>

Q 16, Features of cattle finishing operation

* Confinement barn: mechanical ventilation = **- 3**; if not = **0**

- If < 20 sq ft per head = **- 3**; if not = **0**

* Confinement barn: natural ventilation = **0**

- If < 25 sq ft per head = **- 3**

* Have mounds = **+ 2**; if not = **0**
* Use bedding = **+ 1**; if not = **0**
* Have covered protection from wind and snow = **+ 1**; if not = **0**
* Have fence windbreak = **+ 2**; if not = **0**
* Have shelter-belt windbreak = **+ 2**; if not = **0**
* Feedlot completely paved with concrete = **- 1**; if not = **0**
* Feedlot partially paved with concrete = **+ 2**; if not = **0**

Q 28, Facilities to segregate sick or injured animals: Yes = **+ 2**, No = **- 2**

* Organizational statements (re. Q's 16, 28)

- CCOF (1993, p 20) states that "the livestock standards emphasize stress reduction ... to maximize animal health... CCOF livestock producers are required to provide their animals with uncrowded living conditions, with maximum fresh air, daylight and shelter from inclement weather. Each animal must have enough room to comfortably get up, lie down, groom, turn around, and stretch its limbs... Livestock producers are encouraged to ... promptly recognize and isolate ill individuals."

- IFOAM (1989, pp 25, 35) states that "prolonged confining of animals is prohibited." ... "Buildings for housing livestock must have adequate natural ventilation and lighting and allow sufficient room for the free movement of stock..." ... "Outdoor calving is recommended when weather conditions allow. Facilities for indoor calving during severe weather or for winter housed herds must be adequate." ... "Extensive systems with shelter available" are recommended. "Out-wintering, provided windbreaks are available" and "in-wintering" are permitted.

- IFOAM Animal Standards Sub-Com (1991, p 1) states that "all animals must have access to open air and grazing when this applies to the type of animal and season..."

- NOSBLC (1993, pp 13, 14) states that "a production environment which minimizes livestock stress and maximizes livestock health shall be provided; it must include the following factors: (a) access to shade, shelter, natural air, and daylight suitable to the species, the stage of production, the climate, and the environment; ... (c) housing design which allows for the conduction of natural maintenance and comfort behaviors and for exercise; and (d) housing design which provides a temperature level, ventilation, and air circulation suitable to the species. Year-round confinement of livestock to an indoor housing facility without daily exercise and access to the outdoors ... shall be prohibited... Year-round confinement of livestock to an outdoor drylot without seasonal access to pasture or grazing land shall be prohibited."

- NPSAS (1992, p 1) states that "housing should be light, well ventilated, and uncrowded; stock should have access to outdoor range."

- OCIA (1993, p 4) states that "livestock must be provided with living conditions which respect their needs: reasonable liberty, lack of crowding, kindness, etc. Livestock should have access, when seasonally appropriate, to sunshine, fresh air, soil, fresh plants, etc."

- OFPANA (1992, p 3) says that (a) organic livestock shall be in a situation in which they receive adequate exercise, have adequate shelter, and receive natural light and air to insure and protect the health and well-being of the livestock and (b) organic livestock producers are encouraged to minimize livestock diseases through ... "reduction of livestock stress, proper pasture management, isolation of ill individuals ... and other sound health management practices."

Q 23, Antibiotic use

* Uses antibiotics to treat specific illnesses = + 8
* Subtherapeutic use of antibiotics = - 8
* Newly purchased cattle upon arrival at the feedlot = - 4
* Never uses antibiotics = - 4

* Organizational statements

- CCOF (1993, pp 20, 21, 29) states that (a) "subtherapeutic feeding" and "routine" ("automatic") use of antibiotics are prohibited and (b) "livestock producers must never deny treatment to an ill animal so that its products may be labeled 'organic'."

- IFOAM (1989, pp 28, 29) says that "the aim should be to reduce the use of antibiotics to a minimum or, if possible, eliminate their use altogether... For conditions requiring treatment and where effective alternative treatments are not available, conventional drugs should be used, in particular to save life, to prevent unnecessary suffering, or to provide the only way to restore the animal to full health. Treatment should never be withheld where an animal is suffering. Withdrawal periods must be observed. Treatment of healthy animals and the routine use of prophylactic drugs is prohibited, except in cases of a known farm disease problem."

- NOLC (1992 survey) reports controversy around whether animals treated with antibiotics "should be removed from the certified herd or if some extended withdrawal time is acceptable." Of all respondents, 32% supported prohibition of all antibiotic use; 65% of them supported allowing restricted use of antibiotics with extended withdrawal periods.

- NOSBLC (1993, p 8) states that "antibiotics--systemic and topical" are excluded from the National List of exempted synthetics. On p 13, they state "the action of a producer to withhold treatment to maintain the organic status of an individual livestock animal which results in the otherwise avoidable suffering or death of the animal shall be grounds for decertification"

- NPSAS (1992, p 1) states that rations containing "antibiotics of any kind" and the regular use of antibiotics as preventative treatments are not acceptable.

- OCIA (1993, p 5) states that antibiotics to stimulate growth are prohibited

- OFPA (1990, p 21-6) states that producers shall not "use subtherapeutic doses of antibiotics"

- OFPANA (1992, pp 1, 3, 4) state that antibiotics to stimulate growth or production are prohibited; the use of antibiotics is prohibited except "restricted use of topical antibiotics" and for emergency medical treatment, with provision for an adequate withdrawal time thereafter; "withholding treatment resulting in otherwise avoidable suffering of livestock" may be grounds for denial of organic certification.

Q 24a, Use of growth promotants

* No cattle = **0**
* Some cattle = **- 8**
* All cattle = **- 16**

* Organizational statements

- CCOF (1993, p 20) states that "hormones and/or growth promoters are prohibited whether implanted, ingested, or injected"

- IFOAM (1989, 29) states "all growth promoters and hormones for ... suppression of natural growth controls are prohibited."

- IFOAM Standards Sub-Com (1991, p 2) states that "growth promoters may not be added to feed or in any other way be given to livestock"

- NOLC (1992 survey) reports 93% of respondents to support prohibition of growth promoters and hormones

- NPSAS (1992, p 1) states that rations containing "glandular stimulants" and hormones and the regular use of drugs as preventative treatments are not acceptable.

- OCIA (1993, p 4) states that "synthetic growth promoters ... implanted, injected, or ingested" to stimulate growth are prohibited

- OFPA (1990, p 1-26) states that organic livestock producers "shall not use growth promoters and hormones on such livestock whether implanted, ingested, or injected..."

- OFPANA (1992, p 1) prohibits "growth promoters and hormones, whether implanted, ingested, or injected, ... used to stimulate growth or production of such livestock"

Q 24f, Use of vaccinations

* 7-way clostridial bacterin: All cattle = + **2**, some cattle = - **2**, no cattle = - **1**

* IBR, BVD, PI_3, BRSV, and Haemophilus somnus: For each, all cattle = + **1**, some cattle = - **1**, no cattle = - **0.5**

* Organizational statements

- CCOF (1993, p 21) states that "producers may vaccinate stock for endemic diseases..."

- IFOAM (1989, p 29) says that "vaccines may only be used where a known disease problem exists on a farm or neighboring land which threatens stock health, and which cannot be effectively controlled by other management means"

- NOLC (1992 survey) reports that over 90% of respondents support use of vaccinations

- NOSBLC (1993, p 7) states that "vaccines are restricted to use for the prevention of infectious diseases"

- NPSAS (1992, p 1) states that "vaccinations, etc. for legal sale and/or transportation" and "bacterial immunizations" are acceptable.

- OCIA (1993, p 5) states that "vaccinations (including vaccination to stimulate production of maternal antibodies)" are permitted

- OFPA (1990, p 21-6) states that producers shall not "administer medication, other than vaccinations, in the absence of illness"

- OFPANA (1992, p 3) says that vaccinations are "accepted" practices

Q 24d, Use of parasiticides:

* All cattle = - **3**
* Some cattle = + **3**
* No cattle = **0**

* Organizational statements

- CCOF (1993, p 21) states that "CCOF livestock producers are required to minimize the use of parasiticides"

- IFOAM (1989, p 29) states that "appropriate stocking rates, mixed stocking, and clean grazing systems are recommended to prevent the buildup of unacceptable worm burdens... Specific treatments may be administered where stock are known to be carrying unacceptable worm burdens. In these circumstances, strict identification procedures and withdrawal periods must be observed."

- NOLC (1992 survey) reports controversy around whether animals treated with parasiticides "should be removed from the certified herd or if some extended withdrawal time is acceptable." Of those surveyed, 64% did not support a complete prohibition on all use of parasiticides, with 54% of these respondents supporting restricted use of parasiticides with breeding stock

- NOSBLC (1993, p 8) states that parasiticides are excluded from the National List of exempted synthetics

- NPSAS (1992, p 1) states that the regular use of "worming medications" as preventative treatments are not acceptable.

- OFPA (1990, p 21-6) states that producers shall not "use synthetic internal parasiticides on a routine basis"

- OFPANA (1992, p 3) states that organic livestock shall receive "parasite and disease control ... to insure and protect the health and well-being of the livestock;" however, on p 4 they say that "synthetic parasiticides, both internal and external, are prohibited," except they may have restricted use with breeding stock

Q 11, Health record practices

* Records on the amounts and sources of medications administered to individual animals are maintained: Yes = + 2, No = - 2

Manure management practices

Q 29, Manure disposition

* Composted manure as a percent of total manure from finishing cattle

- 100% = + 12
- 51-99% = + 9
- 26-50% = + 6
- 1-25% = + 3
- 0 = 0

Q 30c, Intensity of manure application

* Estimated amounts of N and P/acre actually applied to cropland (to be computed) versus amounts that can "safely" be applied

- X_1 = + 6
- X_2 = + 12
- X_3 = - 6

* Organizational statements

- CCOF (1993, 25, 32) states that "composted animal manures" are recommended. Animal manures "must be aerobically composted, preferably by turning and keeping moist and warm until well broken down. Raw manures are considered restricted materials... Raw manures can be harmful to soil life and cause unhealthful levels of nitrates in produce and salt buildup in soils. Can also contain pesticide residues depending on what the animal has been eating... Fresh and "sheet composted" manures are allowable only in moderate amounts and as a supplement to other soil-building practices..."

- OCIA (1993, p 2) states that the following types of manure are authorized: "(i) composted manure, (ii) uncomposted manure that has been turned and free of internal frost for at least six months prior to application, and (iii) fresh, aerated, anaerobic, or 'sheet composted' manures on perennials or crops not for human consumption..."

- OFPA (1990, p 21-9) states that "an organic plan shall contain terms and conditions that regulate the application of manure to crops... Such organic plan may provide for the application of raw manure only to (i) any green manure crop, (ii) any perennial crop, (iii) any crop not for human consumption, and (iv) any crop for human consumption, if such crop is harvested after ... Such organic plan shall prohibit raw manure from being applied to any crop in a way that significantly contributes to water contamination by nitrates or bacteria."

RESEARCH PLANS FOR THE FUTURE

Future research involves two main thrusts. The first involves the 70 cow-calf operators and 102 cattle feeders who responded to mail surveys and for whom we are computing **PSIs** and **POIs** based on the scoring systems presented in this paper.

* Comparisons and contrasts in the relative "sustainability" versus "organic" rankings of the 70 cow-calf operators and 102 cattle feeders, as reflected by **POI** scores versus **PSI** scores, will be determined and analyzed.

* The strengths and weaknesses of the producers studied in following "sustainable"/"organic" production practices--relative to the various cluster groups of management practices--will be identified.

* The degree to which the **PSI** values and **POI** values correlate with various measures of production performance will be determined.

The second thrust involves comparative analysis of four matching pairs of "near-organic" and "mainstream" case study farms/ranches in South Dakota. Part of the comparative analysis will involve further development of the "sustainability" and "organic" indices (based on operationalization of the ideas under the heading of "subsequent research") presented in this paper. With data gained through personal interviews, each of the case units will be characterized via the improved indices.

The main part of the subsequent analysis, however, will involve collection and analysis of detailed data on (1) various crop and livestock enterprises and (2) resources available for production on each case unit. The overall objective of this analysis will be to determine the comparative physical and economic performance of the four matching pairs of farms/ranches.

Because of the small number of case units and extreme complexity of the issues being studied, we recognize that findings from this analysis will be only indicative. Attempting to determine more definitive conclusions would require far more financial resources and professional person-months than are available at this time for the research.

If you would be interested to be placed on the mailing list for results from the subsequent analysis, please send your name and mailing address to the authors (SDSU Economics Department, Box 504A, Brookings, S.D. 57007-0895) along with the phrase "sustainable beef cattle study."

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COW-CALF QUESTIONNAIRE

1. Do you have a beef cow herd on your farm/ranch?

___ No. If no, please stop now and return the questionnaire in the enclosed envelope.
___ Yes. If yes, please proceed to complete the questionnaire.

Beef cow herd inventory and production practices

2a. How many beef cows, 2 years and older, were exposed to a bull or artificially inseminated in 1990? ____

b. How many were kept and calved in 1991? ____

3a. How many yearling replacement heifers were exposed to a bull or artificially inseminated in 1990? ____

b. How many were kept and calved in 1991? ____

4a. How many total calves were weaned in 1991? ____

b. What was the average weaning age (in months)? ____

c. What was the average weaning weight for steers _____
heifers _____

5. Relative to the number of cows determined (believed) to be pregnant in the fall, what percentage calf crop do you typically wean? ____%

6. For each category of cattle shown below, please indicate your typical average percentage death loss.

____% Baby calves from birth to weaning
____% Replacement heifers from weaning to first calving
____% Brood cows per year
____% Bulls per year

7. What main types of cattle do you have in your cow herd? (please check those categories that comprise at least 25% of the cows in your herd)

___ Purebred exotic European breeds
___ "Commercial" exotic European breeds
___ Purebred English beef breeds
___ "Commercial" English beef breeds

Exotic European-English crosses
___ Exotic European breeds dominant
___ English breeds dominant
___ About 50-50 European-English

___ Other (specify: _____)

8. For every 100 cows in your herd, how many heifer calves would you typically retain as replacements? ____

9. In a typical year, approximately what percentage of your brood cows are bred:

____% With herd bull? ____% Artificially?

10. In choosing herd sires for mating to mature cows, what weight (on a scale from 0 to 10) do you give to each of the following selection criteria?

____ Transmitting milk production to daughters
____ High calf weaning weights
____ Sound feet and legs
____ "Correct" body confirmation
____ Disease resistance
____ Reproductive performance
____ Other (specify: _____)

11. Do you flush cows before the breeding system? Yes ___ No ___. If yes, how do you flush them? (check as many as apply)

___ Place them on improved pastures
___ Feed them concentrate
___ Other (specify: _____)

12. What are the dates for your typical breeding season?

	Start	End
Cows	_____	_____
Replacement Heifers	_____	_____

13. Do you creep feed your calves? (check all that apply)

___ Never
___ Sometimes, if pastures are unusually short
___ Sometimes, if (specify: _____)
___ Always

14. Please place a check before each practice that you follow:

___ Pregnancy check cows
___ Fertility test bulls
___ Use hormones to control breeding seasons
___ Production test cows

15. What average target weights (nearest 25 lb) do you have for:

_____lb. Yearling heifers at breeding
_____lb. Two-year old heifers at first calving
_____lb. Mature brood cows
_____lb. Mature herd sires

16. Which of the following types of animal identification do you use? (please check as many as apply)

___ Ear tagging
___ Horn branding
___ Neck chains or straps
___ Other (specify: _____)
___ Hide branding
___ Tattooing
___ Ear notching

17. Do you follow each of the following practices? If so, (a) at what age are most of your calves when you perform the practice and (b) how do you perform the practice?

	Practice performed? Y=yes or N=no?	If yes, at how many months?	How performed Please check as many as apply
Dehorning	___	___	___ Chemicals ___ Saws, clippers ___ Hot iron ___ Dehorning spoon ___ Other (_____)
Castration	___	___	___ Cutting ___ Injectable chem. ___ Burdizzo pincers ___ Elastrator ___ Scrotum shortening ___ Other (_____)
Branding	___	___	___ Branding fluid ___ Freeze branding ___ Hot iron ___ Other (_____)

18. In a typical year, what percentages of cows would you physically help to calve?

____% Two-year old heifers at first calving
____% Mature cows

31. How would you characterize your stocking rates relative to SCS recommendations? (please check one)

___ More acres than SCS recommendations
___ Close to SCS recommendations
___ Fewer acres than SCS recommendations
___ Do not know

32. Which term describes most closely your grazing management system? (please check one)

___ Continuous grazing
___ Deferred rotation
___ Complimentary (use of improved pasture and native range)
___ Rest-rotation
___ Cell or strip grazing
___ Other (specify: _____)

33. Do you feed any organically produced (with no synthetic fertilizers or pesticides) feedstuffs to your beef cows and calves? Yes ___ No ___. If yes, what approximate percentages of the following total feedstuffs fed to your cows and calves are organically produced?

___% Grains
___% Harvested forages
___% Grazed forages

Physical facilities

34. Please check the following description that most accurately describes your cow calf operation.

___ Outdoor
___ Outdoor, with natural shelter (please describe the natural shelter: _____)
___ Outdoor/indoor, including open-front sheds/winter housing
___ Indoor confinement
___ Other (specify: _____)

35. Which of the following cattle handling facilities do you have? (check as many as apply)

___ Permanent corral/holding pen
___ Portable corral/holding pen
___ Cattle squeeze
___ Salt-mineral feeder
___ Loading shoot
___ Scales
___ Dipping vat
___ Calf creep feeder

36. Do you provide special protection to your beef cows from snow, mud, wind, heat, and other potential climatic-related problems? Yes ___ No ___. If yes, indicate what you consider to be your 2-3 most important types of protection.

37. Do you provide special care/facilities for your cows when they calve? Yes ___ No ___. If yes, what type of care/facilities do you provide? (check as many as apply)

___ Separate pasture for heavy springing cows
___ Special covered maternity areas for groups of heavy springing cows
___ Individual maternity pens/box stalls
___ Other (specify: _____)

38. Do you have facilities for segregating ill or injured animals? Yes ___ No ___. If yes, please briefly describe the facilities.

Water supply

39. About what percentage of your beef cow herd's annual water needs is met from each of the following sources?

___ Natural pond
___ River, creek
___ Other (specify: _____)
___ Man-made pond
___ Pumped ground water
___ Springs
100% Total

40. What access does your beef cow herd have to its main water source? (please check only one)

___ Unlimited in place and time
___ Limited, e.g., during only certain seasons or only in certain areas
___ None, water is moved from the source to an access point such as a tank or containment pond

41. Do you experience drinking water quantity problems with your beef operation? (please answer yes or no for each)

___ In an average year of precipitation and water run-off?
___ In years of below-average (e.g., worst 2 of 10 years) precipitation and water run-off?

42. Do you commonly experience any water quality problems with your beef cow herd? Yes ___ No ___.

a. If yes, please check which one(s)?

___ Salinity ___ Nitrate ___ Sodium ___ Bacteria
___ Other (specify: _____)

b. Have you taken steps to try to overcome the problem(s)? Yes ___ No ___. If yes, please describe them below.

Financial and other

43. Approximately what percent of your gross farm income over the past 5 years has typically been from the sale of all types of livestock? (please check one)

___ less than 25%
___ 25% to 49%
___ 50% to 75%
___ more than 75%

44. What is your approximate overall farm/ranch debt-to-asset ratio? (please check one)

___ Zero
___ 0.01-0.09
___ 0.10-0.19
___ 0.20-0.29
___ 0.30-0.39
___ 0.40-0.49
___ 0.50-0.59
___ 0.60 or higher

45. Approximately what percentage of the labor required for your beef cow herd is provided by family members?
___%

46. Do you have off-farm employment? Yes ___ No ___ Do you do custom work for other farmers? Yes ___ No ___

47. Are you married? Yes ___ No ___ If yes, does your spouse have off-farm employment? yes ___ No ___. If yes, is the employment full-time ___ or part-time ___?

48. How would you classify your production methods? (please check one)

___ I am a "mainstream" (conventional) beef producer.
___ I am an "organic" beef producer.
___ In some respects, I am "organic," but in others I am "mainstream" (conventional). If so, please indicate the steps would you need to take before you could become "organic?"

CATTLE FEEDING QUESTIONNAIRE

1. Do you finish cattle to slaughter on your farm/ranch?

___ No. If no, please stop and return the questionnaire in the enclosed envelope.
___ Yes. If yes, please proceed to complete the questionnaire and then return it in the enclosed envelope.

Overall farm operation

2. In what county is your farmstead located? _____

3. How many acres of farmland, by type of tenure, did you operate in 1991? (please show 0's for any category of land that you do not have)

Type of farmland	Acres (to the nearest 10) Owned	Rented	Total
Cropland, including row crops, small grains, set-aside, fallow, and hay in rotation	___	___	___
Conservation Reserve Program	___	___	___
Improved permanent pasture and hay	___	___	___
Native permanent pasture and hay	___	___	___
Other (e.g., woodland, farmstead)	___	___	___
Total	___	___	___

4. In addition to finishing cattle, do you have other livestock on your farm/ranch. Yes ___ No ___. If yes

a. About how many animals would you market in a typical year?

___ Feeder calves
___ Stocker cattle
___ Feeder pigs
___ Slaughter pigs
___ Feeder lambs
___ Slaughter lambs
___ Poultry
___ Other _____

b. About how many breeding animals would you maintain each year?

___ Dairy cows ___ Beef cows ___ Poultry
___ Sows ___ Ewes ___ Other _____

5. Approximately what percent of your gross farm income over the past 5 years has typically been from the sale of livestock? (please check one)

___ less than 25%
___ 25% to 49%
___ 50% to 75%
___ more than 75%

Cattle management

6. Approximately what percentage of the cattle that you placed on feed in 1991 were:

a. Raised on your own farm/ranch? ___%

b. Backgrounded and sold rather than finished for slaughter? ___%

7. Approximately what percentage of the cattle you fed in 1991 were placed on feed during each of the following quarters?

___% Jan-Mar ___% Apr-Jun
___% July-Sept ___% Oct-Dec

8. Which of the following best describes the system for feeding the majority of your cattle? (please check one)

___ Confinement feeding during entire feeding period
___ Grazing during part of backgrounding period, confinement feeding thereafter
___ Grazing during all the backgrounding period, confinement feeding thereafter
___ Grazing, followed by a period of confinement feeding for < 100 days.
___ Other (specify: _____)

9. To what targeted daily rates of gain (nearest 0.1 lb/day) do you most commonly feed the following types of cattle? (please show "n/a" if you do not have the indicated type of cattle)

___ Backgrounded steers (roughly 500-750 lb)
___ Early finishing steers (roughly 750-950 lb)
___ Late finishing steers (950+ lb)

10. To what targeted final finishing weight (nearest 25 lb) do you most commonly feed:

slaughter steers? _____ lb.
slaughter heifers? _____ lb.

11. Please place a check before each practice that you follow:

___ Feeds are tested for nutrient composition at least once a year
___ Have grain storage facilities to take advantage of price drops in purchased feed grains
___ Feed records are kept for separate pens of cattle
___ Cattle weights are checked periodically to track performance
___ Feed scales are used to monitor and control feeding rates
___ Records on the amounts and sources of medications administered to individual animals are maintained

12. What do you estimate to be your average out-of-pocket expenditure for purchased (versus raised) inputs? For example, protein supplement, minerals, production tools, other supplies and veterinary expense, power and fuel, building & equipment repair--per head finished in your feedlot? $ _____ per head.

Physical facilities

13. This question concerns the capacity of your feedlot. About how many feet (to the nearest 25) of feed bunks do you have at 100% feedlot utilization? _____ feet. Of this total footage, how many feet are designed for feeding from:

___ One side (fenceline) _____ feet

___ Two sides (portable) _____ feet

14. On average during each quarter of 1991, about what percent of this design capacity was actually used?

___% Jan-Mar ___% Apr-Jun
___% July-Sept ___% Oct-Dec

15. Which of the following cattle handling facilities do you have? (check as many as apply)

___ Permanent corral/holding pen
___ Portable corral/holding pen
___ Cattle squeeze
___ Salt-mineral feeder
___ Loading shoot
___ Scales
___ Dipping vat
___ Calf creep feeder

25. For each of the production tools listed in question 24, please show the number(s) from below of your most important reason(s) for use or non-use.

	Use	Non-use
a. Growth promotants	_____	_____
b. Ionophores	_____	_____
c. Coccidiosis controls	_____	_____
d. Parasiticides	_____	_____
e. Insecticides	_____	_____
f. Vaccinations	_____	_____

Possible reasons for using the production tool

1. Improve my cattle's physical production performance (e.g., feed conversion)
2. Reduces cost per pound of gain in my cattle
3. Professional consultants advise me to use the production tool
4. Neighbors use the production tool
5. Others have advised me to use the production tool
6. Other reasons: please specify in question 25

Possible reasons for <u>not</u> using the production tool

1. Cost of production tool exceeds increased production value from using it
2. Prefer to avoid extra handling of cattle to administer the production tool
3. Prefer to follow natural production methods to the maximum extent possible
4. Concern over possible negative impacts of production tool on consumers' health
5. Other reasons: please specify in question 25

26. Briefly discuss any additional factors or philosophies that contribute to your use or non-use of the previously mentioned production tools.

27. What do you consider to be your 2-3 most important precautions for keeping your finishing cattle healthy, i.e., for them to resist infection, parasitic attacks, and metabolic disorders and overcome injury by rapid healing?

28. Do you have facilities for segregating ill or injured animals? Yes ___ No ___. If yes, please briefly describe the facilities.

Manure handling and management

29. Approximately what percentage of the total manure from your finishing cattle in a typical year do you manage in each of the following ways?

____% Solid raw manure applied directly to the land
____% Composted manure applied to the land
____% Runoff holding pond disposed of by land application
____% Runoff holding pond disposed of by irrigation
____% Falls on grazing land
____% Other (specify: _____)
100%

30. The following questions pertain to the manure produced by all livestock on your farm, including your finishing cattle.

a. Of the total acreages of the following types of land that you operate, what percentages would typically receive applications of spread manure (versus manure dropped while grazing) over a 15-year period?

____% Cropland following row crops/grains
____% Cropland following sod
____% Improved hay land ____% Native hay land
____% Improved rangeland ____% Native rangeland

b. Of that land receiving spread manure applications, approximately how many times during a 15 year period would typical individual fields receive manure applications?

____ Cropland following row crops/grains
____ Cropland following sod
____ Improved hay land ____ Native hay land
____ Improved rangeland ____ Native rangeland

c. About how much manure per acre (tons of solid raw manure or gallons of liquid manure) would you typically apply each time that you spread manure on a particular field? Please indicate "d/k" if you don't know.

Ton/acre	or Gal/acre	
_____	_____	Cropland following row crops/grains
_____	_____	Cropland following sod
_____	_____	Improved hay/rangeland
_____	_____	Native hay/rangeland

Other

31. Approximately what percentage of the labor required in your cattle finishing operation is provided by family members? ____%

32. Do you have off-farm employment? Yes ___ No ___ Do you do custom work for other farmers? Yes ___ No ___

33. Are you married? Yes ___ No ___ If yes, does your spouse have off-farm employment? yes ___ No ___. If yes, is the employment full-time ___ or part-time ___?

34. How old are you? ____ years

35. What is your approximate overall farm/ranch debt-to-asset ratio? (please check one)

___ Zero
___ 0.01-0.09
___ 0.10-0.19
___ 0.20-0.29
___ 0.30-0.39
___ 0.40-0.49
___ 0.50-0.59
___ 0.60 or higher

ANNEX C

REVIEWER REACTIONS: OVERALL CONCEPT OF PRODUCER "SUSTAINABILITY" AND "ORGANIC" INDICES

"In general, I think it (beef cattle sustainability index) is an interesting concept--in that livestock production has not historically been dealt with or associated with the concept of 'sustainable agriculture.' (However,) ... I wonder if such an index can be accurately applied to all ranching or feedlot operations since any operation certainly is unique from others. Each producer or manager may apply different management techniques to address problems that are common to other operations, but require different means to solve the problem. While the different management techniques answer the same problems found on different operations, they may not receive the same scoring or consideration in the index, yet all may lead to 'sustainability' for each case." (Beef cattle production specialist)

"Overall, I think it will be very difficult to come up with an accurate scoring system due to the variable nature of farming. On most farms on which I have worked there are special circumstances and exceptions to the rules present. When I was going through the (draft manuscript), I constantly kept thinking of one large cow-calf/feeder... I know that he would score as being very unsustainable in (your) study, yet he is one of the most innovative producers I have worked with. His farm is extremely profitable and quite sustainable." (Veterinarian)

"Overall, I think this (beef cattle sustainability index) has some good promise and potential. (However,) ranching is such a tremendously diverse operation, (using the index number system) is going to be extremely difficult to do. In my practice alone, (differences) in the resources available to individual ranchers ... are tremendously different... (with a result) that health, water sanitation, grazing, and feeding practices are very different even over short distances." (Veterinarian)

"I do have some concerns about the overall concept. My feeling is that most of the true 'sustainability factors' are more or less independent culling factors that are not necessarily adapted to an index format. For example, if a producer is doing an outstanding job in one area but an unacceptable job in another area, the index portrays them as an average producer, when in actuality they are not highly sustainable. As an alternative, I offer the following suggestion. Classify each producer's performance for each of your factors as 'acceptable,' 'questionable/marginal,' or 'unacceptable.' Then the farms/ranches could be ranked for sustainability according to their percentage of 'acceptable' or percentage of 'unacceptable' management practices. I feel that if you tell producers that they are utilizing 80% 'acceptable,' 15% 'questionable,' and 5% 'unacceptable' practices as opposed to 50% 'acceptable,' 30% 'questionable,' and 20% 'unacceptable' practices they will have a better idea of their '[sustainability' than they will with an index number. My other suggestion is to try to incorporate more financial information into the survey. 'Do you do an annual enterprise analysis?' would be an example of the type of financial management questions I am referring to." (Beef cattle production specialist)

"The material (on the beef cattle sustainability index) was interesting and mirrors very much our own experience with beef feeder cattle... I think it is very important that you have called out the differences between 'sustainable' and 'organic' beef production. As you have surmised, they are not interchangeable terms... I think your work is 'right on the money' and appreciated seeing it." (Beef cattle producer)

"Well done! These are a few of our thoughts... Hope to hear from you soon." (Beef cattle producer)

"I think you are on the right track!" (Livestock waste management specialist)

"It (beef cattle sustainability and organic index conceptualization) is an interesting exercise and I look forward to seeing the results you come up with, particularly the differences that may emerge with the sustainable and organic comparisons." ("Organic" certifying organization)