Solving the Beef

This competitive game encourages players to think broadly, innovatively, and creatively. This is a game of divergent and innovative thinking, with a bit of luck. The game will be updated regularly by Asombro educators as additional information is published in this study: Novel strategies to increase sustainability of beef production systems in the western United States (a.k.a. Sustainable Southwestern Beef). Scientists involved in this study are focusing on three major topics: Supply Chain Options, Precision Ranching, and Heritage Genetics for Raramuri Criollo (pronounced rare-a-moor-ee cree-yo-yo) cattle.

To learn more about Raramuri Criollo you can watch some videos about them from the Jornada on YouTube at https://bit.ly/2z55ogk

Recommended for players ages 12+.

Minimum of TWO players.

Next Generation Science Standards (NGSS) Alignment:
HS-ETS1-3.
Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, and reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

Science and Engineering Practice: Constructing Explanations and Designing Solutions
Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

Cross Cutting Concept: Systems and System Models
Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions — including energy, matter, and information flows — within and between systems at different scales.

Players:
Two teams of one or more players per team.

Materials:
- 4 Scenario Cards
- 8 Constraint Cards
- Timer (required but not included)
- Paper and Pencil (optional and not included)

Set Up:
PRINT the game contents (pages 3 – 6) two-sided on the Long Edge. For reusability, you can laminate the cards. Scenario cards are shuffled and placed in one pile face down between the teams. Constraint Cards are also shuffled and placed in a separate pile face down. The timer will be used for team play. Teams may use paper and pencil to help them with brainstorming and to keep track of points.

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Game Play and Rules:

1. One player from a team selects the Scenario Card from the top of the pile.
2. One player from the opposite team selects the Constraint Card from top of the pile.
3. The two players read the Scenario Card and Constraint Card to determine if the Constraint Card works for the chosen scenario. If it is a good fit, the round continues; if not, new Constraint Cards are drawn until a good fit is chosen. Each Scenario Card has at least four possible "good fit" constraints. (See *Matching "Correct" Constraints* below)
4. Teams are given six minutes to think of the problem presented by the constraint with that scenario, and then brainstorm as many possible solutions for the constraint within the scenario as possible.
5. Teams alternately suggest possible solutions.
6. When a team comes up with a solution that the other team does not have, that team gets a point.
    a. All valid solutions (that aren't shared by the other team) will receive a point as a single problem can have many solutions, with some possibly being better solutions than others.
7. Teams continue back and forth until they run out of solutions for that scenario and constraint.
8. The opposite teams then have players draw from the Scenario Card and Constraint Card piles.
9. Game play continues until all of the scenarios have been played or until 45 minutes have passed.
10. If the team's solution is unique and not shared by the other team, they win a point for their solution as they've officially "Solved the Beef."
11. The team with the most points at the end of game play wins.

The Scenarios:

Each scenario comes from current, relevant works in reference to Supply Chain Options, Precision Ranching, and Heritage Genetics research for Raramuri Criollo cattle. Asombro utilizes information from peer-reviewed research to design scenario summaries. In addition, the scientists involved in the research project have reviewed the scenarios. There are currently four scenarios for this game: Precision Ranching Tools, Criollo Cattle, Grass Fed Labeling, and Movement & Rangeland.

An Example:

The cards drawn are Precision Ranching Tools and Cost. In thinking of the problem for this card combination, a player could state that the constraint of cost with precision ranching would be that it could be very expensive to set up LoRa and GPS equipment. To "solve the beef," players would then come up with ways to lower cost, increase revenue, or otherwise minimize the impact of the cost on getting these tools for ranching.

The Constraints:

Constraints have been adapted from NGSS as cost, safety, reliability, aesthetics, social, cultural, and environmental impacts. Definitions of each are on the corresponding Constraint Cards.

Matching "Correct" Constraints:

The following constraints are considered to be a good fit or a "correct" match with each of the scenarios as listed.

- Precision Ranching Tools:
    - Social
    - Cost
    - Reliability
    - Environmental
    - Cultural
- Criollo Cattle:
    - Cultural
    - Environmental
    - Reliability
    - Aesthetic
    - Social
- Grass Fed Labeling:
    - Reliability
    - Safety
    - Cost
    - Environmental
    - Aesthetic
- Movement & Rangeland
    - Reliability
    - Cost
    - Environmental
    - Social
    - Cultural
    - Safety

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Grass Fed Labeling

Grass-fed beef has become a popular product in stores. This beef tends to be more lean and therefore considered healthier, though marbling does still occur. The Food Safety Inspection Service, an agency of United States Department of Agriculture (USDA), requires that meat and meat products which are labeled "100% grass-fed" come from cattle that were only fed grass after having stopped drinking their mother's milk. The diet must be 100% grass and shrubs including stalks and stubble, and leaves without seedpods or grains. To be labeled "100% grass-fed," the beef producers must verify that their beef meets the requirements. There are many ways to verify, including through the USDA Process Verified Program (PVP) standard. If food sources change to include seedpods, grains, or other additives due to unfavorable range conditions, this information must be included on the label. For example, if cattle are eating less than 100% grass or shrubs, the label for that beef product might say: "Made from cows fed 85% grass and 15% corn." Consumers may not know that a label of "grass-fed" (as opposed to "100% grass fed") currently does not mean the same as "100% grass-fed."

Source: Food Safety and Inspection Service Labeling Guideline on Documentation Needed to Substantiate Animal Raising Claims for Label Submissions- December 2019

Raramuri Criollo Cattle

The Raramuri Criollo reminds many people of Corriente cattle, which are commonly used as sport cattle in rodeo events such as team roping and bulldogging (steer wrestling). This mistaken identity is brought on by the physical attributes of the Raramuri Criollo and common ancestry. Criollo refers to cattle that were introduced to the new world by Christopher Columbus from southern Spain. They are small, agile, lean animals with heavy horns, long legs, and a gentle disposition. Scientists from the Jornada Experimental Range and New Mexico State University's Department of Animal and Range Science are studying one of the 33 types of Criollo, the Raramuri Criollo. Studies are helping determine if these cattle, which are adapted to harsh desert climates, can help maintain sustainable beef production in the southwest. Criollo have been observed surviving on woody plants and cacti during times of drought. During drought, Criollo cattle have higher pregnancy rates and higher success in calves weaning off of milk and on to grasses and shrubs than the British cattle breeds, such as Angus.

Source: Criollo Cattle: Heritage Genetics for Arid Landscapes; D. Anderson, R.E. Estell, A. Gonzalez, A.F. Cibils, L.A. Torell; 2015

Precision Ranching Tools

Long Range LoRa Wide Area Network (WAN) -Precision Ranching Tools for Western U.S. Ranchers

Population growth, global warming, consumer demands, and pressure on our supply of food and water have led food producers to utilize technology to help in meeting the needs of the population and the environment. For example, with the use of precision tools, ranchers are able to monitor animal well-being more closely, even from miles away. They can collect information on body temperature, consumption of food and water, the reproductive cycle of female cows or dams, disease, and possibly prevent loss or theft of their cattle. Researchers at the Jornada Experimental Range and New Mexico State University use long range LoRa WAN GPS collars to track cattle, monitor grazing patterns, and monitor health issues. Tools include GPS trackers in collars around the necks of cattle and LoRa-enabled water-level sensors placed on water tanks. There is a high cost for initial set-up and purchase of this equipment. Maintenance and upkeep of the equipment and software is critical and can also be expensive.

Source: Jornada Symposium: Long Range LoRa Wide Area Network (WAN) technology to develop Precision ranching tools for US ranchers; 2019

Movement & Rangeland

Typically, young calves can alter grazing patterns of cows because nursing mothers tend to stay in one area. This limits movement of cattle on the rangeland and, in turn, causes cattle to overgraze, or over eat, in an area. Observations of Raramuri Criollo show that the calves will follow their mothers through rugged areas, which scientists believe will prevent overgrazing. Raramuri Criollo cow-calf pairs appear to have higher levels of mobility than the British cattle breeds.

Worldwide interest in heritage breeds, such as the Raramuri Criollo, has increased in recent years. Heritage breeds may offer a way to reduce the environmental footprint of animal agriculture. These cattle have undergone natural selection to be able to endure harsh and variable environments without the need for much additional food or water. Increased movement of Raramuri cow-calf pairs allows ranchers to use a larger area for raising cattle while maintaining a lower environmental impact in any one location.

Source: Do Young Calves Influence Movement Patterns of Nursing Raramuri Criollo Cows on Rangeland; S. Nyamuryekung'e, A.F. Cibils, R.E. Estell, D. VanLeeuwen, C. Steele, O.R. Estrada, F.A. Rodríguez-Almeida, A.L. González, S. Spiegal; 2020

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Sustainable Southwest Beef
knowledge and tools for ranch and rangeland resilience

Scenario Card

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Cost:

A cost constraint refers to an accounting constraint that states the cost of providing something must be measured against the benefit derived from the use of that same thing.

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland*

Safety:

A safety constraint is any constraint that specifies a specific safeguard (e.g., architectural safety mechanism, safety design feature, safety implementation technique).

Scenarios: *Grass Fed Labeling; Movement & Rangeland*

Reliability:

A reliability constraint is the overall consistency of a measure. A measure is said to have a high reliability if it produces similar results under consistent conditions

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland; Criollo Cattle*

Aesthetics:

An aesthetic constraint is when one does not find or is unable to find enjoyment and/or beauty within an object via any measure of enjoyment and/or beauty.

Scenarios: *Grass Fed Labeling; Criollo Cattle*

Social:

We define social constraints as patterns of behavior that provide opportunities for and constraints on implementation of projects. Social constraints can include formal practices such as government regulations or informal norms including cultural preferences.

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland*

Cultural:

The environments and associated cultures that make up our society – home, community, school, and workplace – contribute to the practices and implementations of projects.

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland; Criollo Cattle*

Environmental Impacts

Environmental impacts may result from the addition to the environment of various substances such as chemicals, technological advances, and relation to various environmental issues such as global warming and pollution.

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland; Criollo Cattle*

Wild Card:

Choose a constraint from cost, safety, reliability, aesthetics, social, cultural, and environmental impacts.

Scenarios: *Precision Ranching Tools; Grass Fed Labeling; Movement & Rangeland; Criollo Cattle*

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