

Sustainable Uses for Animal Hides and Byproducts Brief

This brief describes the the results of a study aimed at identifying market-viable uses for hides and other meat processing byproducts.

Background

In September 2021, the Agricultural Utilization Research Institute (AURI) and the United States Department of Agriculture, Agricultural Marketing Service (USDA-AMS) signed a multi-year cooperative agreement focused on the Upper Midwest's small meat and poultry processors. The project explored opportunities to strengthen industry resiliency and create solutions to position the processors for success.

As part of this project, a needs assessment was conducted that indicated adding value to animal hides and by-products was a critical factor impacting industry resiliency. Very small and small processors note that the cost associated with removing hides from their establishments and finding ways to utilize hides and by-products are consistent challenges. This brief summarizes the results of a study focused on alternative and innovative applications for animal hides and by-products.

Traditionally, hides have been an important source of income for the meat industry. According to [Leather International](#), hides averaged nearly 54% of the drop in credit value of a beef animal (or the value of byproducts) between 1980 and 2011. This represented 8 to 10% of the animal's total value. Fast-forward to 2020, and hides represented a mere 1% of the animal's total value.

This decrease in the value of hides has been driven by declining consumer demand, economic factors, and waste management challenges. With the rise of fast fashion, demand favors synthetic materials (vegan leather or plastic) over their natural counterparts. Customers also have little tolerance for off-specification products --such as imperfections resulting from exposure to the elements or branding marks --despite hides being a natural product prone to variation. Other economic factors include rising processing costs. For instance, having to tan hides makes it less profitable for processors to handle the hides and sell them directly to customers.

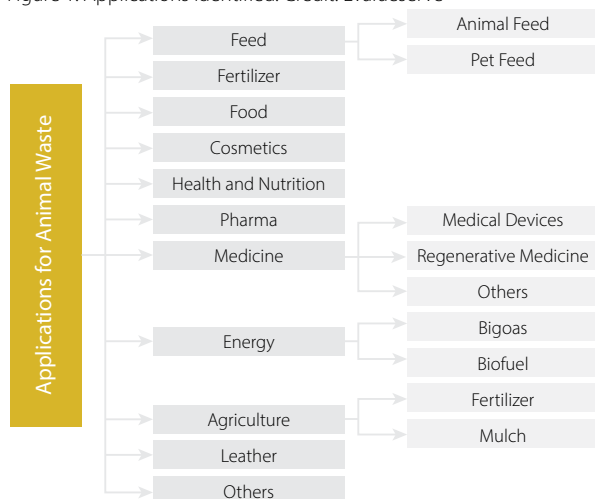
As a result, a large percentage of hides are now considered waste. According to the Leather Hide Council of America, [in 2020](#) the United States processed 33 million head of cattle, resulting in a total of 33 million cattle hides. Of the 33 million hides, 28.2 million were used to make leather, while the remaining 4.8 million hides (14.5%) went to waste (burned or ended up in landfills). Hides are increasingly becoming a liability rather than a source of profit due to disposal costs.

Various techniques are used to prevent hides from decaying. Common types of tanned goods are leather, suede, or nubuck. Leftover pieces after tanning are referred to as rawhide trimmings. Rawhide trimmings can be further treated to produce hide glue, animal feedstuff, biogas, thermal and landfill applications, and keratin-rich materials derived from hair and wool.

Potential Uses of Animal Hides

AURI engaged a third party to conduct research in this space. Research focused on applications and solutions that can be implemented in the United States and Upper Midwest Region (Iowa, Minnesota, North Dakota, South Dakota, and Wisconsin). Data sources included patents, scientific literature, news, press releases, conference literature, and company directories. Solutions identified were required to have a [Technology Readiness Level \(TRL\)](#) of at least four (i.e., validated at lab-scale). TRL is an indication of technology maturity utilized by the federal government. While completing the scouting process, solutions and applications related to leather sustainability were determined to be out of the scope of this research. Figure 1 provides an overview of identified uses for animal hides and other materials extracted from animal byproducts. Eleven core applications were identified, followed by nine sub-applications derived from animal waste.

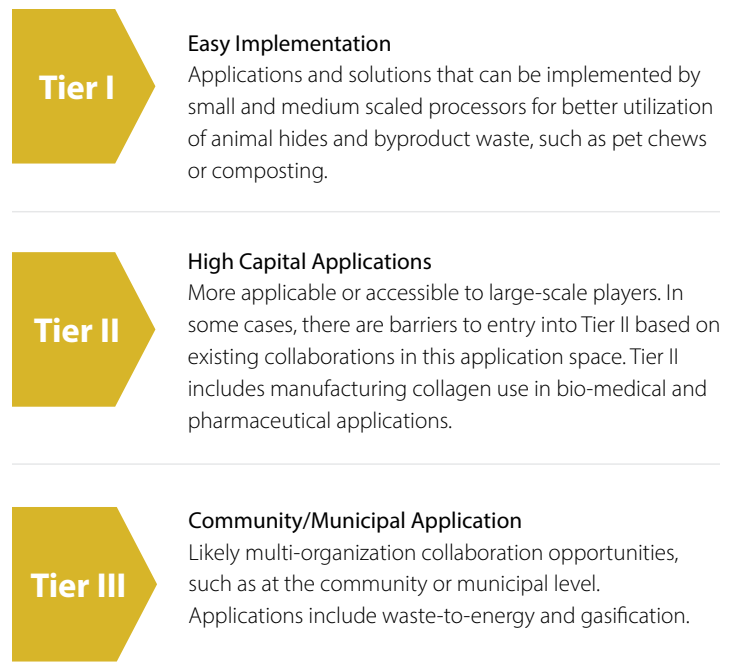
Figure 1. Applications Identified. Credit: Evalueserve



Researchers then categorized solutions into three tiers (Figure 2). This brief focuses on an overview of Tier I solutions, as they are most likely to be implemented by very small and small meat processors. For information about Tiers II and III, please reference the [full report](#). These tiers are most likely to be implemented by renderers or in collaboration with developers or municipalities.

Animal Hide Product Application Solutions for Small Processors

Figure 2. Animal Hide and Byproduct Utilization Tiers



Tier I Applications for Hide Utilization and Other Meat Byproducts

Applications included in this tier have a low degree of technical complexity and capital investment. They can be implemented within small-scale organizations. Three applications are highlighted below that convert an animal hide into an innovative by-product. These include pet chews, beef rinds, parchment, bone broth, casings and compost.

There is increasing demand for locally sourced pet chews. The product is made from dried animal skins. Although already fully commercialized, this application strategy can be explored by small processors.

Pet Chews	
Raw Material	Rawhide Trimmings
Product	Rawhide chews made from dried animal skin
Description	Pet owners purchase pet chews for numerous reasons including mental stimulation and dental health.
Estimated Technology Readiness Level (TRL)	Fully commercialized TRL 9
Data Sources	Company websites, products, news

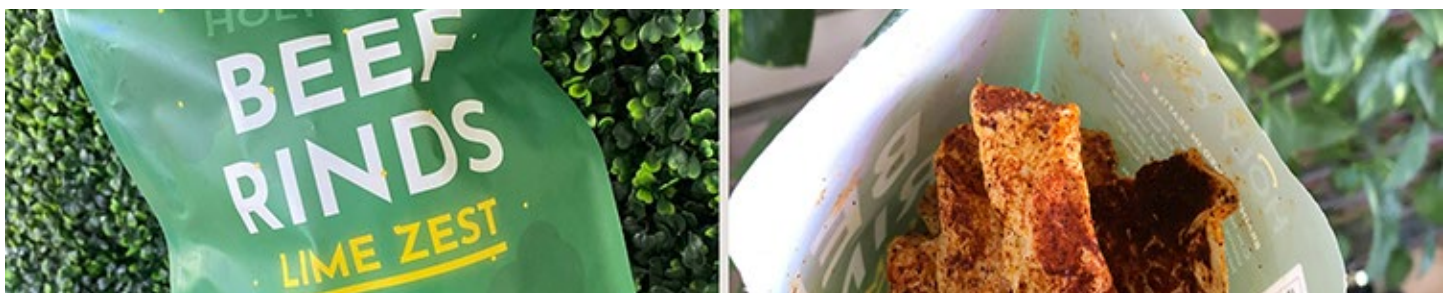
Figure 3. Rawhide product examples



Beef skin, or beef rinds, are processed from cattle’s rawhide that is cleaned, trimmed and prepared for processing. After further processing, the rawhide is boiled to render any fat under the skin, cooled, and then excess fat scraped away, resulting in just the outer layer of the skin. Finally, the skin is cut into strips or smaller pieces for consumption.

Beef Rinds	
Raw Material	Hide
Product	Nutrient-dense snack as an alternative to pork rinds
Description	The meat snack category has continued to expand, not only with new flavors but with new formats. One of the latest evolutions introduced a new competitor to the traditional pork rind.
Estimated Technology Readiness Level	Development Phase 6-7 product trial stage
Data Sources	News, company website

Figure 4. Beef rind product examples



Parchment membrane is a leather-like material that can be used to produce lampshades, chandeliers, wall hangings, tabletops, footwear, handbags, purses, wallets, etc. Its advantages include reduced environmental impact and value-added products (Sastry et al., 2005).

Parchment	
Raw Material	Hide
Product	Parchment made from dry rawhide that is untanned product
Description	Parchment can be made from the hides and skin of sheep, goats, cattle, pigs, and buffalo. The skin is dried without tanning. The material is dried, greased, and smoothed during the production process. After drying in a drying frame, it is sanded with pumice stone. While the parchment is still wet, the product can be formed more easily and has more tension. After drying, the hide is rigid and no longer malleable.
Estimated Technology Readiness Level (TRL)	Fully commercialized TRL 9
Data Sources	Company websites and articles

Figure 5. Examples of animal hide parchment products



Another Tier I application is producing collagen-rich bone broth. The process is fairly simple and cost-effective. It involves steeping animal bones containing the nutrient-rich marrow from the hollow central core of bone, along with remains of meat and cartilage still attached.

Bone Broth	
Raw Material	Animal marrow bones (femur, shank, tibia)
Product	Bone broth
Description	Bone broth can be made from the bones of chickens/poultry, sheep, goats, cattle, pigs, and buffalo.
Estimated Technology Readiness Level	Fully commercialized
Data Sources	Company websites, articles

Figure 6. Bone broth product example. Credit: <https://www.takingstockfoods.com>



Small processors that already process meat into value-added products, like sausage, can easily incorporate the byproduct of pig intestines for casings. This application produces a natural casing and may be of particular interest to processors developing clean-label products.

Sausage Casings	
Raw Material	Pig intestines
Product	Sausage casings for smoked meat products
Description	For several hours, casings are soaked in heavily salted water to make them more pliable and remove any impurities. The small intestine is then detached and unraveled. Afterwards it is cut into smaller sections and rinsed thoroughly with a hose.
Estimated Technology Readiness Level	Fully commercialized
Data Sources	Articles

Figure 7. Examples of pig intestine casings. Credits: <https://www.tompress.co.uk/A-10002777-how-to-prepare-intestines-for-sausages.aspx> and <https://premiumpackind.md/en/kishka.html>



A final Tier I application is composting. Composting is an efficient method for managing animal waste, especially animal hide waste. This procedure entails the breakdown of organic resources to provide a nutrient-rich soil amendment that can be used in agriculture and gardening. It is crucial to combine hide waste with other organic materials in a temperate and moist environment.

Composting	
Raw Material	Animal waste
Product	Soil amendment
Description	<p>There are various types of composting, four of which are described below. Composting can be utilized in small—to large-scale meat processing establishments.</p> <ul style="list-style-type: none"> • Aerated Static Pile Composting: This technique uses a sizable pile of organic materials, such as hides and other materials, and aerates the pile by employing a system of pipes or hoses to blow air through the material. The procedure expedites the breakdown of the hides and creates an excellent-grade compost. • Vermicomposting: Worms are used in the vermicomposting process to break down organic materials like hides. The worms consume the organic material and create a superior compost. • In-Vessel Composting: Composting in a closed container to break down animal skins and other organic materials, is known as “in-vessel composting.” The procedure takes less time and generates compost of higher quality due to strict monitoring. • Open Windrow Composting: This technique entails building extensive piles of organic materials like animal hides and rotating the piles frequently to allow air to enter. Although it takes longer than other procedures, it yields a high-quality compost.
Estimated TRL	Fully commercialized
Data Sources	Articles

Figure 8. Examples of compost



Acknowledgments

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