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*Edited by*

**A.M. PEARSON**

*Department of Animal Science,  
Oregon State University, Oregon, USA*

and

**T.R. DUTSON**

*Agricultural Experiment Station  
Oregon State University, Oregon, USA*

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# Handling, Grading and Curing of Hides and Skins

DAVID G. BAILEY

*Hides, Leather and Wool Research Unit, USDA, ARS, Eastern Regional  
Research Center, 600 East Mermaid Lane, Philadelphia, PA 19118,  
USA*

## I. INTRODUCTION

Hides are important to everyone involved in meat production, processing and marketing, not just those in the leather business. It is by far the most valuable beef by-product, accounting for 7.5% of the value of a steer (Morgan, 1991). Although beef animals are not produced solely for their hides, the value of the hide has a significant impact on profitability within the beef industry. If it were not for the value of the hide, cow-calf profitability would be lower, resulting in fewer cows, fewer calves, and fewer slaughter animals. Less beef would be produced, and margins would be smaller for most segments of the beef industry. Over the past three decades, hides have increased in value more rapidly than meat because the demand for leather has been stronger worldwide than the demand for beef. In 1990, the US produced about \$1.9 billion worth of hides, equivalent to 1.2 million metric tons. Sixty percent was exported, primarily to Korea, Japan, Taiwan, and Mexico (Morgan, 1991).

Since hides are of such crucial economic importance to the meat industry, it is important to understand how to handle them properly after slaughter to obtain the maximum economic return. This chapter introduces the structure and function of hides and skins, the need for careful handling after slaughter until preservation, modern methods of preservation, and the grading of hides and skins. Although this chapter also mentions some uses for leather, Chapter 3 describes the production of finished leather and its uses while Chapter 14 discusses the production of leather for making sporting goods.

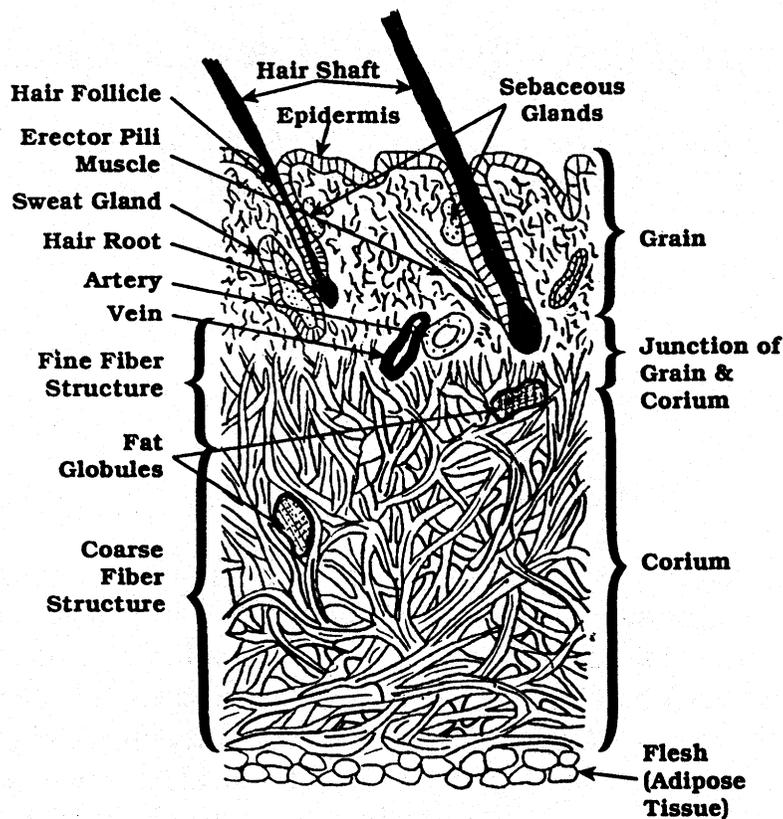


FIG. 2-1. Schematic diagram of the cross-section of a cattlehide.

## II. THE ANIMAL HIDE OR SKIN

### A. Structure and Function

The skin of a living animal protects it from physical and mechanical damage and serves as an active barrier to infection by microorganisms. It may be assisted in these properties by a secondary protective covering of hair, feathers, scales, or a dense network of skin fibers. This secondary covering determines the strength of the underlying skin and thus many of its leather-making properties. The collagen fibers begin near the surface of the skin with a fine structure, becoming coarse full fibers in the center of the skin. In cattle hides, the upper surface contains the fine fiber structure as well as hair follicles, sebaceous glands, erector pili muscles, and the vascular tissue of the skin as illustrated in Fig. 2-1. This is called the grain layer. It usually constitutes less than 10% of the total cross-section of the skin. The grain layer contributes most of the esthetic properties to leather but little of its strength. Under the grain layer are the coarse collagen fiber

structures that make up the corium (Fig. 2-1). The corium provides leather with its inherent strength. While the pattern of hair follicles and scale markings on the grain surface of the hide or skin make it valuable for show and for trade, grain surface damage due to poor treatment after slaughter or cuts and scratches produced during skinning or pre-slaughter can considerably reduce the value of the hide as a leather-making raw material.

The skin of virtually every animal can be tanned to produce leather. The shape, texture, grain surface, and hair-follicle pattern are characteristic for each animal species. Examples of the grain from a variety of different animals can be seen in the book *Hides and Skins* (Tancous, 1986). It is easy to recognize leather made from an alligator, and, with a little practice, one can easily tell the difference between leather made from cattle, deer, and sheep. The designation for referring to the skin of an animal as hide or a skin is loosely based on the size of the animal. Skins from sheep and smaller animals are referred to as sheepskins, calf skins, goat skins, etc. Larger skins from animals such as cattle, horses, elk, and elephants are called hides.

## **B. Raw Material for Leather Manufacture**

By far the most important leather-making raw material in the world in terms of sheer volume and economic value is bovine (cattle) hide. Cattle are raised in almost every country in the world. Bovine leather produced worldwide in 1990 was projected to exceed 10 045 million ft<sup>2</sup> (933 million m<sup>2</sup>) (Byron, 1990). Leather from ovines (goat and sheep) will be 6 218 million ft<sup>2</sup> (578 million m<sup>2</sup>) and porcine leather will be about 3 000 million ft<sup>2</sup> (279 million m<sup>2</sup>) according to Byron (1990). Leather produced from cattlehides is used to manufacture a variety of products, the most important of which are shoes. Thereafter, the order in economic importance is garment leather, upholstery leather, and finally accessory leathers.

In 1989, the USSR had the largest kill of beef animals, more than 41 million head, but had little impact on the international hide market. The US was second with a slaughter of 35.8 million head (Higham, 1990). However, the United States exported more than half of the cattlehides it produced.

Pigskin, the second most common leather-making raw material worldwide, is thinner than cattlehides and is primarily manufactured into garment leather. Light-weight shoes may also be made from pigskin leather. The largest producer of pigskins is the People's Republic of China, which slaughtered 260 million pigs in 1990 (Higham, 1990). The US production

is 88 million head, but the number of skins used to produce leather is very small. In the United States, pork packing practices severely limit the number of skins available to produce top grain leather. Scalding baths, used for unhairing, damage the grain surface of the skin, and the practice of leaving the skin on ham, bellies, and shoulders reduces the usable raw material to only a few percent of the total slaughter. Sheep- and goatskin leathers are produced in many areas of the world primarily for garment leathers, but very little is tanned in the US. Thereafter, in economic importance, are the so-called exotic leathers from deer, elk, alligator, snakes, and other reptiles, ostriches, emus, fish, and frogs.

### **C. Other Uses for Animal Hides and Skins**

Leather is far and away the primary product manufactured from hides and skins. In addition to leather, other uses include food, cosmetic ingredients, and medical prosthetics, such as skin grafts and sutures (Chapter 13). In the case of pigskins, food uses compete strongly with leather. Pigskin is a major source of gelatin (Chapter 10), snack foods, and, in many markets, is left on several pork cuts (hams, picnics, and bacon bellies) all the way to the retail meat counter.

## **III. CURING/PRESERVATION OF RAW HIDES AND SKINS**

While other minor uses may be cited, the economically most important use of animal hides and skins is for leather manufacturing. There are only a few types of commercial tanning processes used currently, and the problems encountered in preserving skins for the manufacture of leather are common to all hides and skins (Bailey, 1989).

### **A. Handling of Raw Skins: Preventing Deterioration**

The skin, like any other part of a living animal, is subject to rapid deterioration once an animal dies. On the living animal, it is an extremely effective barrier to microorganisms and provides effective protection against abrasion. However, once death occurs, the surface of the skin is rapidly invaded by bacteria. The same bacteria that had no effect on the living animal can begin the deterioration of the skin in a matter of hours. If some type of preservation treatment is not applied to the hide within 12 h after slaughter, the quality of the leather made from that hide or skin will begin to deteriorate. The higher the outside temperature during the interim period between flaying and preservation, the more extensive the damage. The grain surface of the hide is particularly sensitive.

If tanning is initiated immediately after the removal of the skin from the animal, the most serious obstacles to producing a high-quality piece of leather are eliminated. However, for most tanneries this is not possible. First, few tanneries are located near the meat packing plants. This means the hides must be transported to a tanner, and during transportation untreated hides will begin to deteriorate. Even when a tannery is located near, or is an integral part of a packing plant, there is a second complication. The manufacture of a uniform leather product requires a uniform starting material. A typical packing plant will slaughter a variety of different size, gender, and age animals in the course of a day. These hides will vary considerably in thickness. If various thickness hides are all tanned in the same processing vessel, the penetration of tanning chemicals with time would be unequal, and manufacture of a uniform high-quality leather would be impossible. To overcome these problems, most hides and skins are preserved in some way at or near the packing plant and then sorted into uniform selections. Individual selections are then purchased by the tanner for manufacture into the appropriate type of leather. This latter obstacle is being overcome in some very large packing plants by sorting the hides off the kill floor by weight and then tanning them immediately. This production of 'wet blue' at the packing plant will be discussed later.

Since deterioration of the hides begins almost immediately after the hide is removed, preservation treatment should begin, particularly in warm weather, almost immediately. The period of time between flaying and preservation can be extended safely in several ways. The most effective way is to remove the body heat from the hide through immersion in a cool water bath or by adding ice as the hides are loaded into the transport container. Another method is to spray a bactericide on the surface of the hide or to alter the surface pH of the hide by treatment with an acidic or caustic solution. These latter two methods, although they do not kill the bacteria, shock them into a temporary lag period of growth for a few hours. However, they are less effective in controlling microorganisms than removing body heat and are generally more expensive.

## **B. Salt Pack**

The most common method of preserving hides and skins today is based on a preservation technique that has been in use since prehistory. The method is salt curing. Originally, hides were simply stacked between layers of rock salt. About one pound of salt was necessary for each pound of hide. Hides built up into piles this way were known as salt packs. The packs had to be allowed to stand for 3 to 4 weeks to allow the salt to extract water from

the hides and fully saturate the remaining moisture within the hide with salt. The pack had to remain standing until it stopped draining. Afterwards, the hides were removed from the pack one at a time, graded, and then repacked for transportation to a tannery. The hides could be fleshed before or after salt packing, although this was generally done afterwards. This was the first method used for preserving cattlehides with salt in the United States. It is still used today for preserving calf skins and other small skins.

The type of salt used for pack curing hides is important. A medium grade of rock salt slowly dissolves as water is drawn from the hide, and the dissolved salt slowly diffuses into the remaining moisture in the hide. A fine salt tends to cake and slow down the exchange of salt and water in the hide. The resulting delay in cure can allow bacteria to damage the hide. It is also important to use clean salt without impurities. Reuse of salt tends to increase bacterial damage during curing, and salt containing various other minerals can stain the hide surface, reducing the quality of leather.

### **C. Frigorificos**

At the turn of the century, when many of the 'Fortune 500' companies were operating tanneries, the best salt-preserved hides were obtained from South America. They were called 'frigorificos', a Spanish term meaning refrigerated, which identified salted hides from large packing plants in certain Latin American countries. These hides were always well preserved and were said to produce the finest quality leather. Frigorificos were salt-packed, as described above, in a pit. After the pack was formed, the pit was filled with a saturated brine. After standing for a few weeks, the pit was drained and the hides were removed, drained, and graded prior to shipping. The combination of salt packing and brine curing prevented deterioration of the hides for several years if they were stored under refrigerated conditions.

### **D. Brine Curing**

In the 1930s, a new salt-curing process was introduced in the United States by Swift and Company in Chicago (O'Flaherty *et al.*, 1965). This process, referred to as brine curing, enabled the packer or the hide dealer to cure a hide in one day instead of thirty. For this type of cure to be most effective, the hide should be fleshed before curing. Fleshing is a mechanical process by which fat and muscle tissue adhering to the hide are removed. The hide is lowered between a series of rollers, one of which has sharp knife edges. As two of the rollers pull the hide out of the machine, the

rapidly revolving roller with sharp edges scrapes off the excess flesh down to the corium.

After fleshing, the hides are placed in a brine raceway saturated with salt. The raceway is usually round or oval in shape and has an island in the middle. The brine in the raceway is kept in constant motion by a revolving paddlewheel. The motion of the brine causes the hides in the raceway to be continually tumbled and rolled during the entire time they are in the raceway. This mechanical flexing action helps speed up the penetration of the salt.

Within 16 h, provided the raceway temperature is higher than 50°F and the salt concentration is maintained at 95% saturation, the hide is properly brine-cured. A properly brine-cured hide is defined (Trade Practices for Proper Packer Cattlehide Delivery, 1990) as a hide containing no less than 40% moisture and salt saturation of at least 85%.

Approximately one gallon of water is removed from a cattle hide during the cure. Salt enters the hide from the flesh side more rapidly than from the grain side. The hides must be fleshed because fat on the surface of the hide could slow down the entry of salt and removal of water.

As water is removed from the hide, the volume of water in the raceway increases. In order to maintain a saturated solution of brine in the raceway, either solid salt must be added directly to the raceway or, alternatively, the brine from the raceway must be continuously pumped out of the raceway, through a bed of solid salt, where it becomes saturated again, before it is returned to the raceway. The density of a salt solution is directly related to the degree of saturation. The density is easily measured by placing a salometer in a sample of brine. The level at which the salometer floats is a direct measure of the density of the solution. Adding solid salt in the raceway does not always ensure that brine saturation will be maintained. If the motion of the raceway is not sufficient, a buildup of undissolved salt, as well as dirt and manure from the hides, can occur on the bottom of the raceway. It is necessary to periodically empty a brine raceway and to remove the debris from the bottom, because it reduces the effective volume of the raceway.

To maintain proper agitation of the hides and sufficient volume of brine to prevent over-dilution by the water drawn out of the hides, a raceway should contain at least a 450% float. Float, a term used in the tanning industry, refers to the weight of a solution in a vessel relative to the weight of the hides. A raceway containing a 450% brine float contains 450 lbs (205 kg) of brine for every 100 lbs (45 kg) of hide.

After curing is completed, the hides are removed from the raceway, run

through a wringer to remove excess brine solution, spread out on a table to be trimmed and graded, treated with additional safety salt, and then are folded and placed on a pallet. They may be folded hair in or hair out. Properly brine cured hides can be kept for a year or more under cool ambient conditions without any adverse effects on their leather-making ability. Storage under hot and humid conditions can result in hide damage in only a few months.

When done properly, brine curing produces well-preserved hides. There are several reasons why brine curing can lead to poorly preserved hides. Hides are added to a raceway during the day as they are received from the packing house. The last hides removed each day at the packing house may not arrive to the curing plant until late in the afternoon. The hides are then pulled from the brine raceway early the next morning to be trimmed, graded, sorted, and palleted for shipment. Sometimes a hide going into the raceway late in the day is the first one pulled in the morning, and the total cure time is less than the 16 h needed for a full cure. If the salt dissolved in the moisture in the hide is not 85% of saturation, then the hide is not properly preserved and over a period of time will begin to deteriorate.

Ideally, brine raceways should be cleaned out periodically to remove the blood components and manure that come into the raceway with the hides. In practice, this is often done only as the raceway begins to fill up with solids. Suspended solids in the raceway provide an excellent nutritive bath for the growth of microorganisms, encouraging the growth of salt-tolerant or halophilic bacteria. Solids in the bottom of the raceway reduce the effective volume and, therefore, the float ratio, making it more difficult to maintain high salt saturation. In a cold raceway, it has been shown that penetration of salt is significantly slowed down and even 16 h might not be enough time for a complete cure (Bailey *et al.*, 1990).

Several things can be done to overcome these problems. First, brine raceways can be treated with a bactericide. This helps to keep down the initial loading of organisms on the cured hide. It also prevents a buildup of microorganisms that adapt to the high-salt environment. Second, after the hide is removed from the raceway, trimmed, and graded, 1 lb of 'safety salt' is spread over the surface of the hide before it is folded. If the hide is not already saturated, this added salt will slowly dissolve and penetrate into the hide, increasing its degree of saturation.

### **E. Non-Salt Preservation**

While the vast majority of hides in the United States are brine-cured, there are other potential methods of preservation. A need has been expressed for

many years for a non-salt hide preservation alternative because of the negative effect of salt curing on the environment. Every brine-cured hide produces a gallon of saturated brine, which must be disposed of by the packer. The first step in tanning a hide is to soak out the salt. This step also adds significantly to the quantity of dissolved solids in the tanner's effluent.

### ***1. Refrigeration/freezing***

The most obvious alternative to salt curing is refrigeration and/or freezing. The disadvantage is that refrigeration is a continuing expense and the longer the period of preservation, the larger the expense incurred. Salt or brine curing has only minimal ongoing costs associated with storage. The major benefit of refrigeration or any other non-salt preservation method is the reduced impact on the environment. The key to this method of preservation is to remove the body heat from the hide as soon after flaying as possible. If the hide temperature can be lowered to 0°C, and maintained there, preservation for at least several months is possible. Freezing hides is not a solution because hides have such good insulation properties. A block of frozen hides thaws from the outside, and long after the outer layer is warmed up and beginning to deteriorate, the interior is still frozen solid.

### ***2. Chemical preservatives***

A number of chemical applications, both organic and inorganic, have been proposed for use as hide preservatives. None of these has resulted in a widely used practical alternative to salt curing, even for short-term preservation.

### ***3. Fresh hide tanning—blue stock***

Another significant alternative to salt preservation, which is in commercial use today, is to process hides into leather immediately after slaughter. As mentioned earlier, large packers have sorted hides off the kill floor by weight, conveyed them into drums or hide processors, and started the tanning process within 6–8 h after slaughter. So far, none of these operations produces finished leather. They stop the process after the addition of chrome to the hide (tanning) to produce 'wet blue' or blue stock, so called because of the blue cast to the hide produced from the chrome tanning materials. Blue stock has a high moisture content and must go through additional processing steps before it can be dried and converted to finished leather. It is necessary to treat blue stock with a fungicide to safely obtain more than a few days' storage. The tanned collagen is quite stable;

however, the grease that is still present in the blue stock from the original hide is subject to fungal attack.

Blue stock has become a significant article of commerce widely traded around the world as an alternative to cured hides. In 1990, 6.2 million hides were exported from the United States as blue stock, representing almost 23% of the total hide export (Byron, 1990). About 89% of these hides were exported to Japan, Taiwan, and Korea.

When transportation of the hides for several hours is necessary to move the raw hides from the packer to the tanning operation, they can safely be temporarily preserved by just removing body heat and, if necessary, transported in refrigerated trucks. They must then be put into process immediately upon arrival at the tannery. Cattle slaughter is not constant on a day-to-day basis; therefore, fresh hide supplies cannot be relied upon. Most tanneries that process fresh hides also process cured hides to maintain constant production.

#### IV. MARKETING OF HIDES AND SKINS

Hides are purchased for their leather-making properties. A tanner purchases hides that will most economically produce the type of leather he wants to manufacture. Hides are purchased by weight, but the leather produced from them is sold by area. If a thin garment is being manufactured, then the best starting material is a thin hide. To make a heavy boot or sole leather, a heavier hide is used. The hide is composed of a surface grain layer and a thicker corium layer underneath. The inherent strength of leather is derived from the corium and its esthetic value from the grain layer. As the proportion of grain to corium increases in a piece of leather, it becomes weaker. Starting with a thin hide to make light leather reduces the proportion of grain layer to corium.

The most prevalent hides on the world market being cattle hides, the following is a discussion of the marketing of cattlehides. Some of the same concepts, however, apply to other hides and skins. The standards to govern the export of North-American cattlehides were developed by the United States Hide, Skin and Leather Association in cooperation with the Leather Industries of America (USHSLA, 1990). They apply to all hides traded within the United States.

##### **A. Standards for Cattlehide Marketing**

Hides are divided first into two groups—mechanically flayed and other than mechanically (hand) flayed. The former are referred to as packer

hides and the latter as small packer or country hides. It is implied that the packer hides have better quality takeoff, although in individual cases, this is certainly not always true.

The first standard for delivery is that all hide weights are determined at time of shipment from point of origin. Salt-cured hides tend to lose moisture during shipping. However, this is due to moisture changes, not to a loss in leather-making material. Unless the hide is overdried, this water can be put back into the hide when it is soaked prior to unhairing.

### ***1. Hide trimming***

The hide must be trimmed to either the standard trim or modern trim. The standard hide trim refers to conventional (unfleshed) hides. To fit this standard, horns, snouts, lips, ears, tail bone, sinews, tendons, and excessive meat and fat should be removed prior to salting. Modern hide trim refers to hides that have been mechanically fleshed to remove all fat and meat. Fleshing should be deep enough to open but not remove the veins. In addition, all ears, ear butts, snouts and lips, fat and muscle tissue should be removed from the pate side of the head by cutting through the eyehole. The narrow side of the head should be trimmed through the eye in a similar manner. All ragged edges should be removed, and cow bags, teats, and cod bags should be removed, preserving a standard pattern. Tails may not be over 6 in long, and Kosher heads should be removed by cutting across the top of the Kosher cut.

### ***2. Hide grading***

Hides are all graded into #1, #2 or #3. A #1 hide is free of holes, cuts, deep scores or gouges more than half way through the hide, visible grain defects and broken grain, and these hides must have a correct pattern. The #2 hide is any hide that is off pattern, contains up to four holes or cuts, a deep score or gouge, a grain break or warts up to one-third of the area of the side. A #3 hide contains hairslip, five or more holes and/or deep scores and gouges, one hole or cut over 6 in or a pepper box (concentrated grub area covering 1 ft<sup>2</sup> or more), warts, or any other defect covering more than one-third of hide. Hairslip refers to the easy removal of hair from the hide just by rubbing the surface. It is generally associated with microbial deterioration. Hides grading as #3s should not be sent without the buyer's consent.

These are the basic rules with some additional minor conditions. Of course, any buyer and seller can mutually agree to any other standards. There are tolerance limits on the number of brands in a native hide

purchase (less than 5%), a weight loss of less than 5%, and a 1% tolerance on the number of hides when sold on a per-piece basis. These standards apply to all hides.

### *3. Cattlehide selections*

Hides are purchased by selection as follows. Cattlehides are classified or selected by gender, weight range, and whether they are branded or native (non-branded). Gender includes bulls, heifers (young bovine, generally female), steers (castrated males), and kips (somewhere in size between steers and calves). Within each classification, hides are graded as # 1, # 2, or # 3. This is a quality assessment based on quality of takeoff pattern, the number of holes due to butcher cuts or grubs, and the overall quality of the hide. Calf skins are traded separate from cattlehides based entirely on weight classifications. Each combination of quality and selection grade has a market, and the price fluctuations depend largely upon the supply of hides and the demand for leather.

Some typical selections of hides would include Heavy Native Steers (steer hides free of brands) weighing 58 lb and more, conventional, and 47 lb and more, trimmed and fleshed. Conventional means that the hides have not been trimmed and fleshed. Light native steerhides would range in weight from 48 to 58 lb. There are different classifications of branded steers. A branded selection may have a brand anywhere on the hide. A selection may be butt-branded, meaning that the brand is located within a line 6 in from the root of the tail toward the rear of the animal. If they are referred to as Colorado, it means they are branded forward of the break. Brands are an important economic consideration for a tanner. Branded areas constitute lost yield in the tanning process. Cows are sold in heavy- and light-weight classifications and can be either native or branded. Bulls are by definition heavy because light bulls are sold as steers. In January of 1991, Light Native Heifers sold for \$1.05/lb (\$2.31/kg), Light Native Steers for \$0.95/lb (\$2.09/kg), and branded and heavy steers for about \$0.78/lb (\$1.72/kg). A list of available selections and their current value can be found monthly in the trade magazine 'American Shoemaker' published by Shoe Trades Publishing, Arlington, MA.

### **B. Pigskins**

Over 90 million pigs are slaughtered in the United States each year. Less than 2% of these skins are pulled, making them potentially available for manufacturing full-grain leather. Currently, all of these pigskins are exported as there are no full-grain pigskin tanneries in the United States.

The only exception is one US tanner who is currently producing suede leather from scalded pigskin. However, their production does not begin to tap this potentially very large resource of leather-making raw material. Most pigskin by-product ends up as gelatin or in renderings.

### **C. Sheepskins and Goatskins**

There is a very small volume of sheepskin leather manufactured in the United States, mostly in the form of shearlings (leather with wool still attached). Raw sheepskins for shearlings are sold by the piece and are priced by the length and quality of the wool. The number of goats produced in the United States is too small to support any tanning operation. At one time, a large number of goat- and sheepskin tanneries were operating in the United States; however, between 10 and 20 years ago the countries that produce goats and sheep restricted the export of these skins to promote their own tanning industry. As a result, there are very few small-skin tanneries remaining in the United States.

## **V. EXPORT OF HIDES AND SKINS**

The largest producer of cattlehides in the world is Soviet Russia, but the largest exporter is by far the United States. More than 60% of the hides produced in this country are sold overseas. In general the other large cattle-producing countries in the world subsidize their tanning industries by not permitting their hides on the world market. As a result, the tanners in these countries, e.g., Argentina and Brazil, are able to purchase raw material at a much reduced cost. This enables them to sell their leather at lower costs than United States tanners. Traditionally, cattle herds in these countries are allowed to range free over large areas of pasture. The herds are culled periodically, producing a mixture of animals in terms of age and size at slaughter. As a result, the quality of the raw material is poor and consequently so is the leather produced from it.

## **VI. FUTURE OF HIDE AND SKIN PRESERVATION AND MARKETING**

The future of hide trading will be shaped by a variety of factors. The largest changes, some of which are already apparent, will be due to the changing nature of the meat industry. As red meat consumption continues

to decline, so will the availability of hides. As a result, their value can only increase. The high cost of raw material has caused the tanning industry to become capital-intensive rather than labor-intensive. This means that low labor costs in other parts of the world have less and less effect on the competitiveness of the American leather industry. American leather exports, while modest, continue to increase (Byron, 1990).

One of the results of deregulation of the meat industry in the United States has been the enormous consolidation of the meat packers (Morgan, 1991). Four packers in the United States now produce 80% of the beef. The number of independent meat packers has been severely reduced over the past decade, and along with that, the number of independent hide processors. In addition, as mentioned earlier, there is a change in the direction of hide processing toward the production of wet blue. Most of the blue stock produced is exported. Rather than sell raw hides to hide dealers, at least one of the very large packers has begun to market its own hides. Moreover, it is processing the raw hides into a tanned blue stock and marketing wet blue both domestically and for export.

The market will be shaped by future regulations dealing with pollution, particularly with respect to dissolved solids. As more and more areas become impacted by the regulation of salt in the effluent, the pressure for a non-salt preservation method will become more intense.

In the future, there is potential for a high-tech preservation procedure using electron-beam irradiation. Investigated by the US Department of Agriculture and Ionizing Energy Company of Canada Ltd, the E-Beam irradiation process has been demonstrated to preserve hides for long periods of time with little impact on the leather produced (Bailey & Wang, 1989). It is superior to salt in terms of pollution abatement, but would require transport in sealed containers.

Another development, still on the drawing boards, is the removal of hair from the carcass on the kill floor before the hide is removed from the animal. If successfully implemented, this will greatly alter the current system of grading hides and will probably require a completely new marketing system for hides.

## VII. SUMMARY

The animal hide or skin is the single most valuable by-product of the meat industry. In the United States alone, the value of raw cattlehides is of the order of 2 000 million dollars. The primary market for hides and skins is

for the manufacture of leather. To obtain the maximum value from this material, it is important to understand the structure and function of the skin and how to preserve it properly until it can be processed into leather.

Preservation of hides and skins is currently done with common salt in one form or another. The most economically important animal hide or skin is the cattlehide and almost all cattlehides in the United States are preserved by brine curing. As a result of ecological considerations, there is strong pressure to develop a non-salt preservation method. Currently, the most successful alternative to salt curing is to process fresh hides directly into blue stock (chrome-tanned hides) without any intermediate preservation.

The marketing of cattlehides is an international business. The major supplier of imported cattlehides for the entire world is the United States. The standards for both domestic and foreign trade have been set down by the United States Hide, Skin and Leather Association and the Leather Industries of America. Although there is strong potential for pigskins to become an important leather-making raw material in this country, so far they have not.

Increasing pressure from the perspective of the environment as well as economics is changing this segment of the meat industry. Meat packers are consolidating, and fewer and fewer packers are controlling more and more of the hides. They are actively involved in investigating value-added processing and marketing of hides such as on-site production of wet blues (chrome-tanned hides). New high-tech methods of preservation, such as electron-beam irradiation, are being investigated as well as depilation of the animals on the slaughter line.

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