



United States
Department
of Agriculture

LDP-M-108-01
June 2003



Electronic Outlook Report from the Economic Research Service

www.ers.usda.gov

Interstate Livestock Movements

Dennis A. Shields and Kenneth H. Mathews, Jr.¹

Abstract

This article provides a current national picture of interstate movements of livestock. A better understanding of livestock shipping patterns helps in characterizing the livestock sectors, estimating the economic effects of potential disease outbreak, and assessing marketing issues. For cattle, large movements occur in most regions of the country, with greatest volume into (and within) the Northern and Southern Plains. For hogs, the dominant flow is into (and within) the Corn Belt. Sheep shipments are most numerous in the western two-thirds of the United States. Several factors shape these patterns, including relative costs of transporting animals versus feed/forage, geographic differences in feed/forage availability and prices, and the development of concentrated livestock feeding areas.

Keywords: Livestock, cattle, sheep, hogs, movements, shipments, inshipments, outshipments

Note: A web data product, including several hundred maps, accompanies this article and is available at: www.ers.usda.gov/Data/InterstateLivestockMovements

Acknowledgments

The authors gratefully acknowledge the reviews of Don Blayney, Ron Gustafson, Joy Harwood, Ken Nelson, and Janet Perry of ERS; Steve Anderson of the National Agricultural Statistics Service; John Green and Jennifer Grannis of the Animal and Plant Health Inspection Service; Warren Preston of the Agricultural Marketing Service; Shayle Shagam of the World Agricultural Outlook Board; and Rhonda Skaggs of New Mexico State University. Excellent support was provided by the editor, Dale Simms, and by the designer, Wynnice Pointer-Napper.

¹ Agricultural economists with the Market and Trade Economics Division in USDA's Economic Research Service.

Introduction

An economic reality in the livestock industry is the geographic separation between livestock in one stage of production and the feed/forage resources or facilities needed for successive stages of production. This is most apparent when animals are moved from growing areas (e.g., prior to weaning) to finishing areas (where livestock are fed to slaughter weight) and then to slaughter plants. Differences in costs for shipping live animals versus animal feed and forage, as well as regional differences in livestock productivity, largely determine what will be shipped. Because shipping animals is often cheaper than shipping the feed needed to reach slaughter weight, moving livestock enables the efficient use of feed and forage (grass or hay) supplies that vary by region and season.

Livestock movements across the U.S. have a long history. In the 1800s, cattle drives brought animals from grazing areas in the Great Plains to the Midwest and slaughter plants farther east. Today, livestock travel coast to coast. Pigs, for example, are frequently shipped from farrowing operations in North Carolina to nursery facilities or grower/finisher facilities in Iowa where they are fed to market weights, then moved again to California for slaughter (Zering, 2001). Cattle and hogs are also shipped from Canada to the United States for feeding or slaughter.²

In recent decades, increased movement of hogs (including imports) has elevated the number of livestock crossing State lines—from 30 million head in 1970 to 50 million in 2001. Today, interstate livestock movements, as a share of the annual number of animals born, are about 27 percent for hogs, 34 percent for sheep, and 57 percent for cattle. (Including

intrastate movements, which are not covered in this study, would result in even greater shares.)

Livestock movements affect profits for livestock owners and jobs in the transportation sector, as well as what consumers pay at supermarkets and restaurants. Livestock marketing patterns also have implications for how buyers and sellers arrive at prices, along with how those prices are reported. In addition, industry and policymakers are combating an increased public perception of risk from animal disease and grappling with how best to mitigate the effect of a disease outbreak within this transportation framework. The highly contagious nature of some diseases (e.g., foot and mouth disease—FMD), the potential for bioterrorism, and the economic implications of both make livestock movements that much more consequential.

A recent, well-documented, and thorough picture of interstate trade in cattle, hogs, and sheep has been unavailable. Previous writings described general patterns of livestock movements (e.g., Lesser) or patterns for selected species, periods, or markets (e.g., Abbott and Smith, Hoffman et al., Judge et al., McCauley et al.). This article describes U.S. livestock movements by assessing patterns in State-to-State shipments of major species, and discusses the economic factors shaping these patterns. A map of each State's shipments by species is available online at www.ers.usda.gov/Data/InterstateLivestockMovements.

Information on the volume and direction of livestock movements has many uses. The economic effects of a potential disease outbreak, for example, are highly dependent on livestock movements. By tracking livestock movements, the disease can be contained regionally, perhaps minimizing the effects of a major outbreak. Also, information on livestock movements is crucial in analyzing price differentials for various classes of livestock, especially when considering market and financial prospects for the industry.

² As of May 20, 2003, imports of Canadian cattle and cattle products were temporarily suspended following the discovery of a cow in Canada infected with bovine spongiform encephalopathy (BSE, also known as mad cow disease).

Livestock Movements and Costs of Disease Spread

Movements of livestock and other animals have historically affected the spread of disease. For example, more than 30 foot-and-mouth disease (FMD) outbreaks around the world since the 1800s (out of more than 800) have been due to livestock importations or other livestock movements (USDA, 1994). Texas cattle fever, a tickborne disease, spread north in the late 1800s as cattle drives crossed Texas, Oklahoma, and Kansas (McCoy and Bieber). Today, interstate commerce in livestock continues, and knowledge of animal movements could facilitate disease control efforts by alerting epidemiologists and veterinarians to potential areas of spread and by providing information necessary to develop response plans that would minimize costs of control and eradication.

The potential for wider spread of diseases is affected by modern livestock production systems. Livestock are often moved between facilities to reduce costs and improve productivity by linking production and marketing stages. Most movement for these opera-

tions is local, but animals are also moved across State and international boundaries. The prevalence of inter-auction movements and intra-auction mixing and dispersion, particularly for cattle, also increases the potential for disease spread.

If a serious disease outbreak were to occur, livestock movement could be curtailed temporarily to help contain the outbreak. Halting all livestock transport could result in higher costs for producers unable to move livestock to market or to another facility as scheduled. These costs include production losses due to over-crowding, extra feed, increased management, and perhaps increased health care as stressed animals become more easily infected. In addition, indemnities paid by the government for condemned livestock may not cover these costs, except for livestock in quarantine areas. Knowledge of livestock movement patterns might allow authorities to selectively manipulate or stop transportation, thus mitigating the costs of a total transportation shutdown.

Locations of Production

The U.S. inventory of major livestock species on January 1, 2002, was 164 million head, including 97 million cattle, 60 million hogs, and 7 million sheep. The geographic concentration of animals varies by species, contingent on resource bases and other factors that contribute to industry productivity (fig. 1).

The U.S. **cattle** herd is dispersed throughout the U.S., reflecting the distribution of forage, the most important production input. In many areas, cattle are considered the “residual claimant” of land because the land has few or perhaps no other uses that offer comparable returns.

About half the U.S. *beef* cow inventory is on rangeland and pastures between the Mississippi River and the Rocky Mountains. Most feeder cattle, though, are concentrated in the Southern Plains and southern portion of the Northern Plains where weather is generally most conducive to weight gain (fig. 2).³ Also, feed grains (e.g., sorghum or corn) are relatively plentiful there. Calves move frequently prior to slaughter because of geographic differences in where calves are born, raised (e.g., placed on wheat pasture), fed (placed in feedlots), and slaughtered. A study that identified feeder cattle markets for two feeding areas in Texas and Kansas found that 80 percent of feeder cattle are shipped more than 200 miles (Bailey et al., 1995).⁴

Much of the U.S. *dairy* herd is in the Lake States, Northeast, and West (Pacific and Mountain regions). In the West, a warm, dry climate and large, dependable supplies of high-quality forage provide a cost advantage in milk production. Due to industry expansion in the West and particular production practices (e.g., maintaining high turnover rates in cow herds), demand for dairy heifers in that region is greater than its supply (Miller, 2001). California, for example, imports dairy cattle from the Lake States and other areas.

³ Before entering feedlots, weaned calves for beef production are generally sent to an intermediate stage called backgrounding for several months, which encourages structural growth. During the backgrounding period—when animals eat roughage and/or light energy rations or graze pasture (native grass or winter wheat)—producers decide when to place them in feedlots to fatten for slaughter, based on market conditions and forage availability. Once in the feedlot, these feeder steers or heifers are fed a high-energy ration of grain, silage, hay, and/or protein supplement for approximately 4 months. In some cases, weaned calves are sent directly to the feedlot (bypassing the backgrounding phase) where they are fed for a longer period of time.

⁴ Several other studies have also investigated spatial characteristics and price differentials for cattle (Walburger and Foster; Schroeder and Goodwin; Goodwin and Schroeder, 1990 and 1991) and hogs (Roe et al.).

The bulk of U.S. **hog** production is located in the Corn Belt, near abundant feed supplies. With substantial corn output in Iowa, Illinois, Indiana, and other Corn Belt States, feed and transportation costs are relatively low. Despite a feed cost disadvantage, hog production has expanded since the 1970s into less traditional areas like North Carolina, where production expanded almost exclusively from the use of contracting by a few large integrators who developed close links among producers, packers, and consumers (McBride and Key, 2003). Also, the new facilities allowed for more environmentally controlled production, which improves animal performance and spreads overhead costs over more units of production (McBride, 1995). Expansion has occurred more recently in Oklahoma, where open space and low population density enable flexibility in managing animal waste (McBride and Key, 2003).

Some larger farrow-to-finish operations ship weaned pigs to faraway facilities for growing-finishing.⁵ For example, farrowing operations in North Carolina ship 3 to 4 million head to the Corn Belt annually for growing-finishing, and not all of these pigs change legal ownership (Zering, 2001). Nationally, only 29 percent of pigs enter the grower/finisher phase at the same site on which they were farrowed (USDA, 2001).

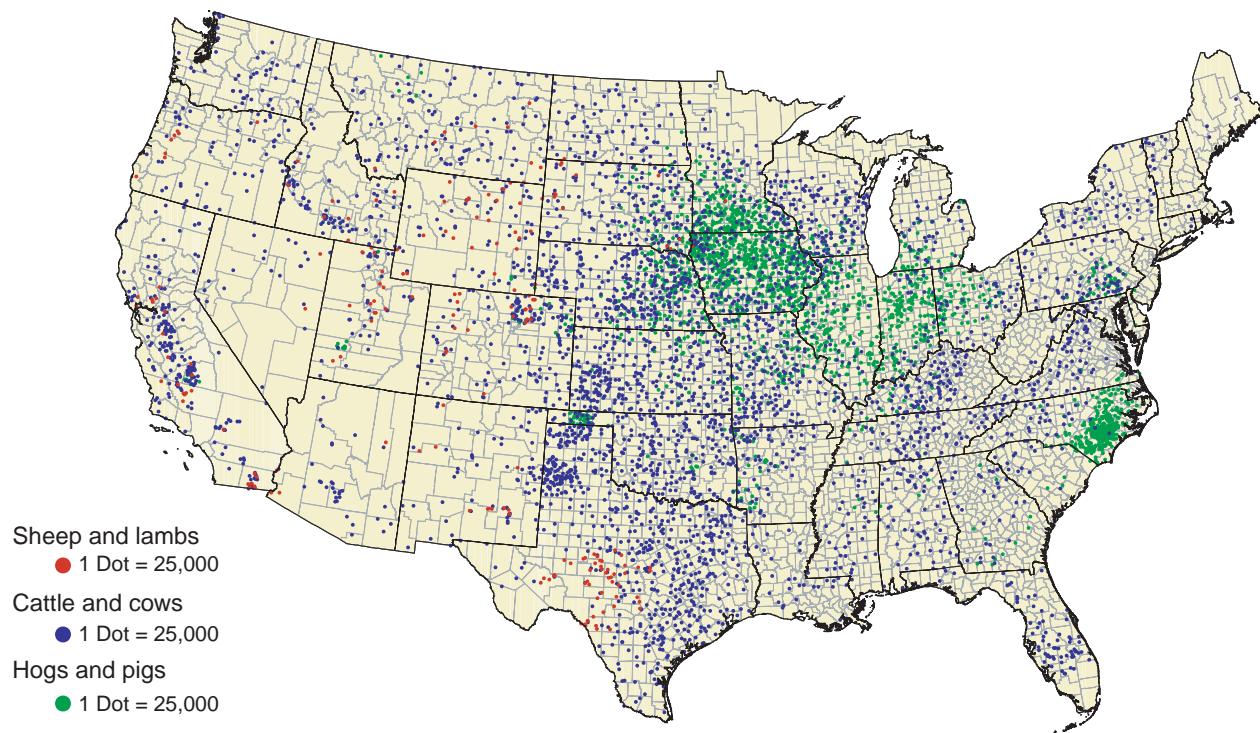
Sheep are raised all around the country, but mostly in arid regions of Western States (Mountain and Pacific regions) and in areas of the Northern and Southern Plains with few or no agricultural alternatives. Compared with cattle, sheep can graze on terrain that is more rugged or hardscrabble, typical conditions in the western half of the United States.⁶ Small flocks of sheep are also kept to utilize marginal forages and pastures on many farms (Shapouri, 1991). Texas has the largest sheep inventory, while Colorado has major feeding and slaughter industries and receives animals from many sheep-producing States. Nationally, only 24 percent of lambs are fed (for slaughter) on the same operation where they originated (USDA, 2002a).

⁵ Three types of specialized enterprises account for most hog farms. *Farrow-to-finish operations* raise hogs from birth to slaughter weight, about 250 to 270 pounds. *Feeder pig producers* raise pigs from birth to about 20 to 60 pounds, then generally sell them to *feeder pig finishers* who grow them to slaughter weight.

⁶ Sheep farms include lambing production systems, growing, and/or finishing operations. Lamb feeding programs may include a combination of grain and grass, or lambs may be placed in a feedlot for high-concentrate (energy) feeding.

Figure 1

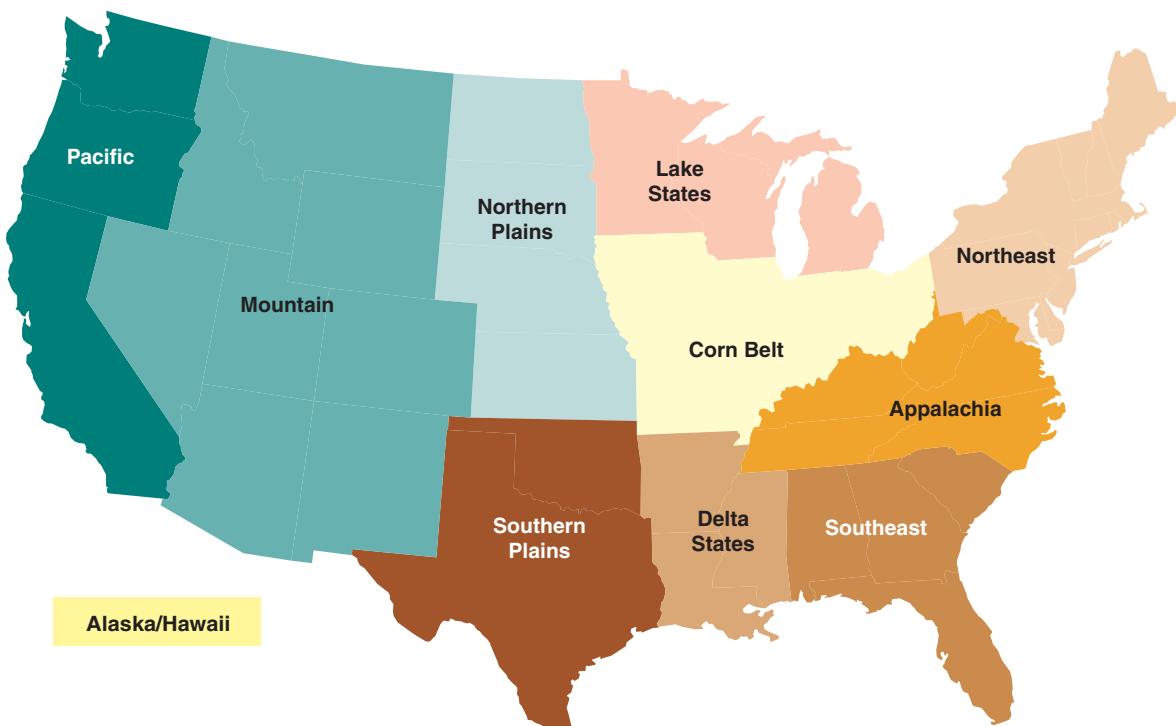
Distribution of selected livestock



Source: 1997 Census of Agriculture.

Figure 2

USDA farm production regions



Economics of Livestock Movements

Patterns in livestock movements are a function of at least three economic features of the livestock and feed/forage industries. The **first** is the relative costs of transporting animals versus feed/forage. Generally, transporting an animal is less costly than transporting the feed required for it to reach slaughter weight because the weight of the animal is less than the total feed it will consume.⁷ This situation arises because many cattle and sheep are reared in low-cost areas where land may have little or no other agricultural uses, and where growing feed for raising the animals to slaughter weights is not feasible. The same transportation principle generally applies in the hog industry. North Carolina, for example, ships hogs to the Corn Belt for feeding, although the State also imports feed for a large number of hogs fed instate.

The **second** economic feature affecting movements is industry structure, particularly for the hog and cattle industries. In reducing costs in recent decades, farms, feeding operations, and processors have specialized in certain aspects of the livestock production system and grown larger. With specialization, firms take advantage of regional cost advantages related to climate, proximity to feed sources, regulatory differences, or proximity to processing facilities.⁸ Large, high-density feeding operations tend to have lower capital and labor costs per unit because animals kept closer together require less labor and facilities per animal. This specialization, along with the development of irrigated feedgrain acreage, has resulted in areas of concentrated beef cattle production in the Great Plains. Similarly, production has expanded in the West for dairy cattle and in the Midwest and Southeast for hogs. When production activities are geo-

graphically distinct, animals must be shipped between production stages.

The **third** economic feature affecting livestock movement is geographic differences in forage availability and prices, which depend in part on climate, time of year, species of livestock, and production technology. In the West, from California to Colorado, producers move sheep and cattle between rangelands and pastures at various elevations as forage availability changes with the season. Beef calves, shortly after weaning in the fall, move from widely dispersed cow/calf areas in the northern Rocky Mountains, the Southeast, and other areas into the Plains States where wheat or other cool-season pastures are located. These calves subsequently move to summer pastures or feedlots. Many of these cattle (about 85 percent) move through local auctions, often several (USDA, 1998), where they are sorted and mixed with calves from other areas before ultimately arriving at pastures or feedlots.

Together, these characteristics create economic incentives to ship live animals from where they are born across the country to low-cost feeding or grazing regions.⁹ Demand for lighter weight cattle, for example, elevates feeder cattle prices in major feeding areas such as the central and southern Plains, resulting in an inflow of cattle from other regions of the country (fig. 3). Other factors such as livestock quality may also help explain price differences and consequent movement of animals.

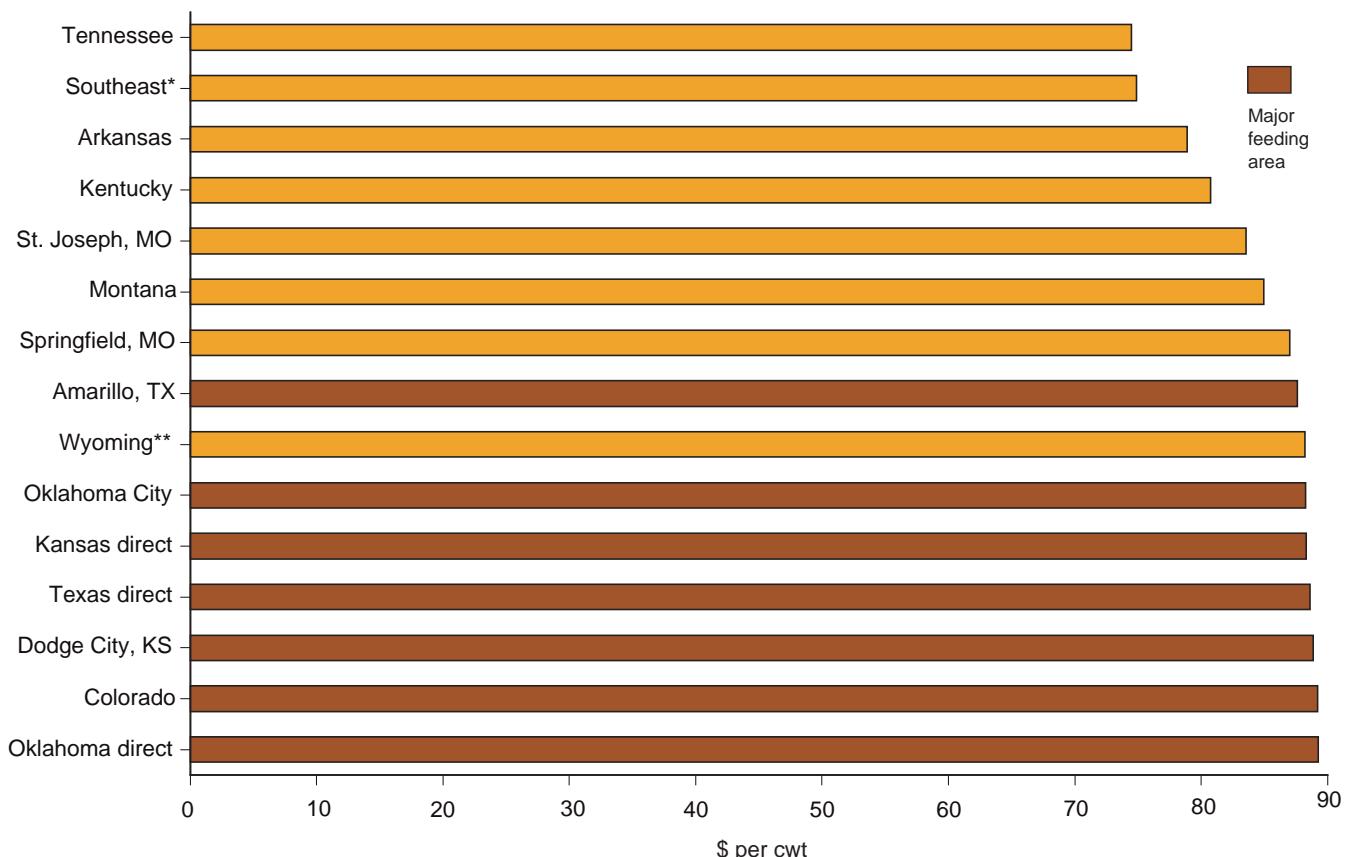
⁷ For example, it costs less to ship a 500-pound steer from cow-calf producing areas (e.g., southeastern U.S.) to the Great Plains (where there is forage for growth and grain for finishing) than shipping 2 tons of grain and several tons of forage needed to grow it to slaughter weight and produce a carcass that will grade USDA Select or better (Schmidt).

⁸ To the extent that environmental concerns, including waste disposal, limit livestock production (e.g., hog production in North Carolina), animal movement can also be affected.

⁹ For the same reasons, the U.S. imports cattle from Mexico (mostly feeder cattle) and hogs from Canada (increasingly more feeder pigs than slaughter hogs). Historically, cattle have been both imported and exported, with some moving back and forth across the U.S.-Canadian border (e.g., U.S. feeder cattle shipped to Canada and returned to the United States for slaughter). As of May 20, 2003, imports of Canadian cattle and cattle products were suspended following the discovery of a cow in Canada infected with bovine spongiform encephalopathy (BSE, also known as mad cow disease).

Figure 3

Feeder cattle prices are highest in major feeding areas



700-800 pound steers (medium and large No. 1). Weekly data averaged for month of October 2001. Almost 80 percent of cattle on feed are located in Texas, Oklahoma, Kansas, Colorado, and Nebraska.

*Alabama, Florida, Georgia, Mississippi, Louisiana, South Carolina.

**Includes western Nebraska, western North and South Dakota.

Source: *National Feeder Cattle Summary* (report no. SJ_LS850), USDA-Agricultural Marketing Service.

Geographic Distribution by Production Stage

The patterns of livestock movement follow from the geographic distribution of livestock at various stages of production. Understanding movement patterns can be heightened by comparing a State's share of U.S. livestock births with its share of market inventories and livestock slaughter.¹⁰ Identical shares across all three would imply minimal interstate livestock movements. However, share data for cattle, hogs, and sheep show the opposite.

The U.S. calf crop is widely dispersed, reflecting a widely dispersed cow herd (fig. 4). The top four States (Texas, Missouri, California, and Oklahoma) account for about one-fourth of the U.S. calf crop. In contrast, the top four cattle feeding States (Texas, Kansas, Nebraska, and Colorado) account for 65 percent of U.S. feeder cattle supply. Cattle slaughter is even more concentrated, with more than two-thirds of U.S. cattle slaughter occurring in these same major feeding States. For all species, the slaughter process is more specialized than feeding, and increasing returns to larger operations, combined with refrigerated shipping technology, has resulted in the location of large packing plants near major feeding areas, which lowers the costs of transporting livestock to slaughter plants. Even so, fed cattle are shipped an average of 100 miles to slaughter (USDA, 2000).

The hog industry is more concentrated in grain-producing areas than are the cow-calf and backgrounding components of the cattle industry. Swine production is much less dependent on forages, with grain a major feed component for pigs throughout their life cycle. Consequently, State shares across stages of production are more even (fig. 5). In fact, the top four States are the same for the pig crop, market hog inventory, and slaughter. Half of the pig crop is located in four States (North Carolina, Iowa, Minnesota, and Illinois), compared with about 60 percent of the Nation's market hog inventory and about 56 percent of U.S. hog slaughter.¹¹

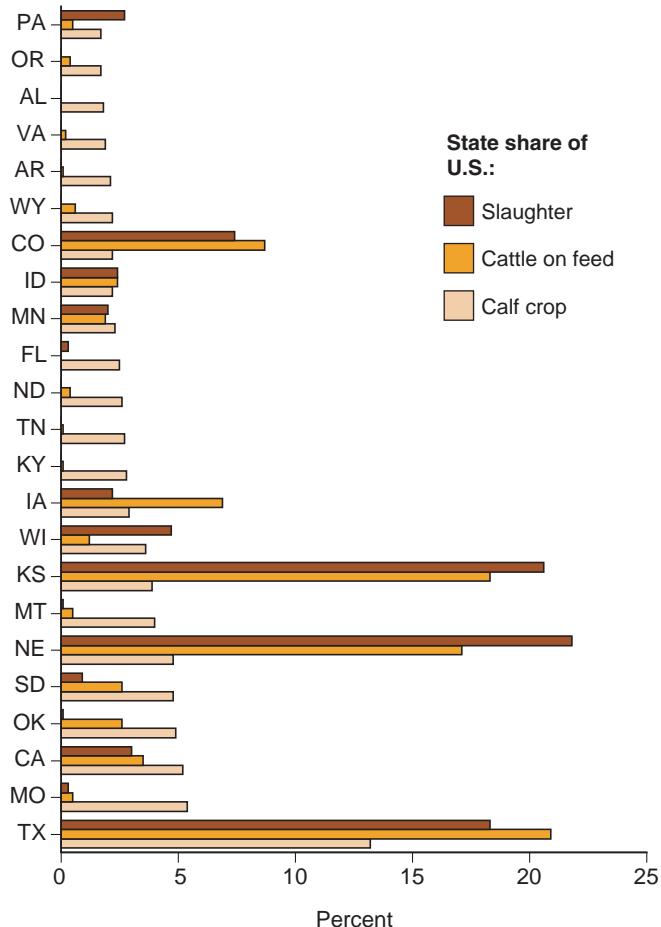
The ability of sheep to forage in arid climates with sparse vegetation determines the industry's regional

¹⁰ Data from this section, as reported by USDA's National Agricultural Statistics Service, include calf, pig, and lamb crops (births); cattle on feed, market hog, and sheep inventories; and livestock slaughter.

¹¹ Iowa is the leading State for both market hog inventory and slaughter (North Carolina is second).

Figure 4

Most States produce more calves than they feed or slaughter



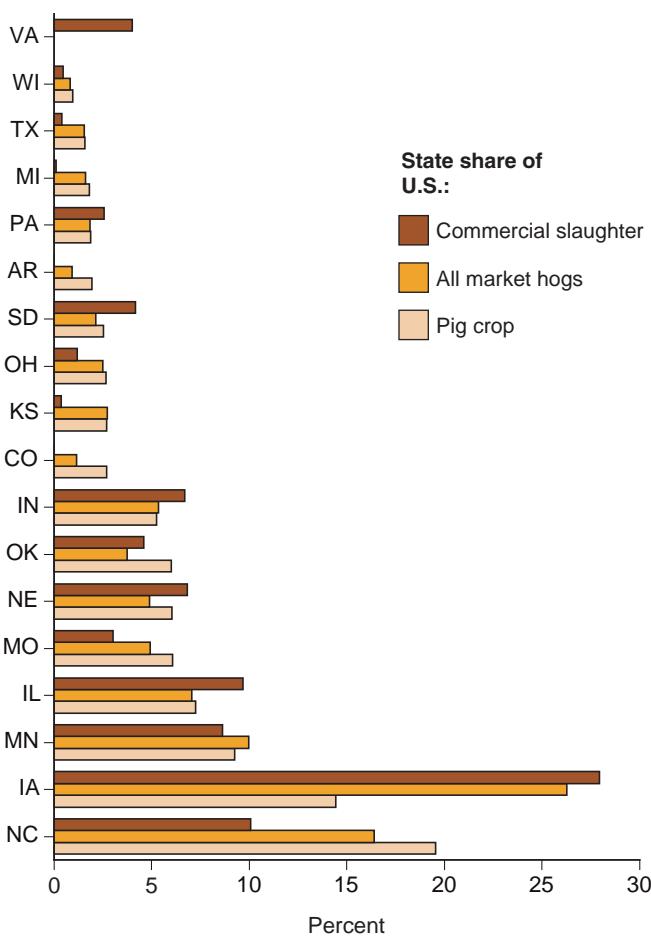
Shares based on 2001 calf crop, January 1, 2002 cattle on feed, and 2001 commercial slaughter.

Source: National Agricultural Statistics Service, USDA.

distribution (Stillman et al., 1990). Consequently, the lamb crop is widely dispersed, mostly in the arid, western half of the United States where the top four States (Texas, Wyoming, Montana, and South Dakota) account for a third of the total (fig. 6). Similarly, lamb feeding is concentrated in the Great Plains and West, with about 54 percent of the market lamb and sheep inventory located in California, Texas, Colorado, and Oregon. As with cattle, sheep slaughter is the most concentrated stage of the production process, mostly in States with major feeding industries and/or a long history of cattle/sheep slaughter. More than 80 percent of U.S. sheep slaughter is in Colorado, California, Iowa, and Texas.

Figure 5

**State shares across stages of hog production
are more even than for cattle or sheep**

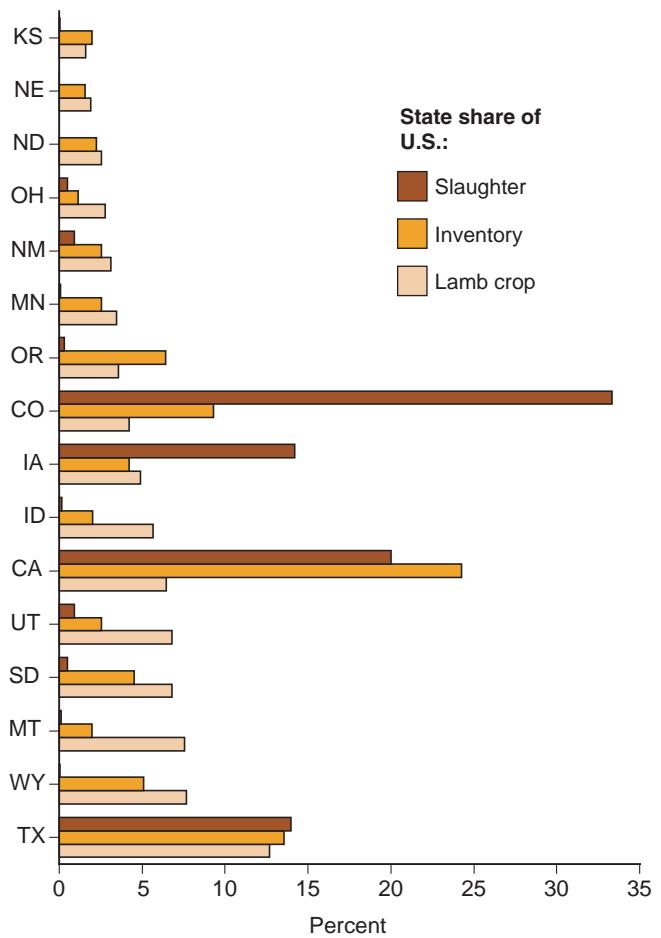


Shares based on December 2001–February 2002 pig crop, March 1, 2002 market hog inventory, and 2001 commercial slaughter.

Source: National Agricultural Statistics Service, USDA.

Figure 6

Most States produce more lambs than they feed or slaughter



Shares based on 2001 lamb crop, January 1, 2002 market sheep inventory, and 2001 commercial slaughter.

Source: National Agricultural Statistics Service, USDA.

Trends in Interstate Livestock Shipments

Total inshipments of livestock by State are reported in “Meat Animals Production, Disposition, and Income—2001 Summary” by USDA’s National Agricultural Statistics Service. Inshipments are livestock shipped into States for feeding or breeding and exclude animals brought in for immediate slaughter.¹² These data describe trends in the total number of animals shipped into a State (without reference to State of origin) (table 1 and fig. 7).

In 2001, U.S. cattle inshipments (beef and dairy) totaled nearly 22 million head, with the top four States (Kansas, Nebraska, Texas, and Colorado) receiving 63 percent of the total. Oklahoma and Iowa each received more than 1 million head as well. In the last three decades, the U.S. total has been relatively unchanged, but shipments still represent more than half the number of calves born each year. Moreover, with the total cattle inventory declining, the number of animals

¹² To estimate inshipments, NASS uses inventory levels, marketings, and information provided by each State Department of Agriculture, including data from certificates of veterinary inspection and branding programs (cattle).

shipped as a share of the national herd has increased since the 1970s. Shipments increased significantly in the 1950s and 1960s when the large-scale cattle feeding industry developed in the High Plains.

U.S. hog inshipments in 2001 totaled 26.9 million head (about 27 percent of the national pig crop), compared with 3-5 million head from the 1970s to the early 1990s. The dramatic increase in the last 10 years reflects significant feeder pig imports from Canada and development of the hog industry in North Carolina and other States. Many of these hogs are shipped to Iowa and other Midwest States for feeding. Iowa received nearly half of U.S. inshipments in 2001, while Minnesota, Missouri, Illinois, and Indiana each imported more than 1 million head.

U.S. sheep inshipments in 2001 totaled 1.5 million head or about one-third of the U.S. lamb crop. Colorado and California—two major feeding and slaughter States—accounted for almost two-thirds of the total. All other States imported 81,000 head or less. In contrast to cattle and hogs, sheep inshipments have been declining markedly during the last several decades as the total inventory continues a long-term decline.

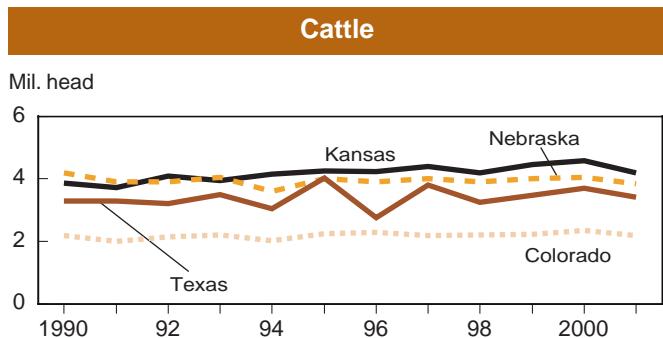
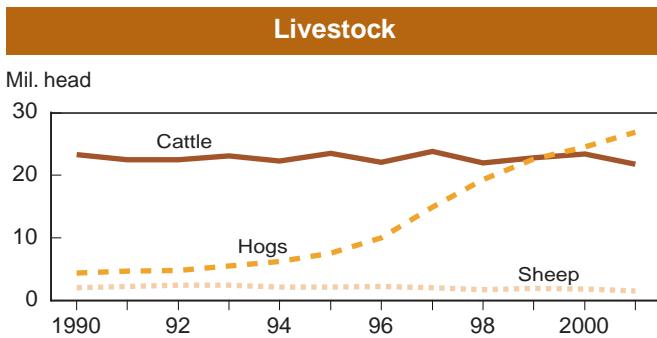
Table 1—Livestock shipments, 1960-2001

	1960	1970	1980	1990	2000	2001
<i>1,000 head</i>						
Inshipments:						
Cattle	13,477	22,884	20,034	22,533	23,512	21,813
Hogs	2,500	3,214	4,598	3,643	22,636	26,889
Sheep	6,099	4,036	2,216	2,186	1,891	1,543
Total	22,076	30,134	26,848	28,362	48,039	50,245
<i>Percent</i>						
Inshipments as a share of births:						
Cattle	34	50	45	58	61	57
Hogs	3	3	5	4	22	27
Sheep	29	30	27	28	41	34
Inshipments as a share of national inventory:						
Cattle	14	20	18	24	24	22
Hogs	4	5	7	7	38	45
Sheep	18	20	17	19	27	22

Inshipments are livestock shipped into states for feeding and breeding. Excludes animals brought in for immediate slaughter.

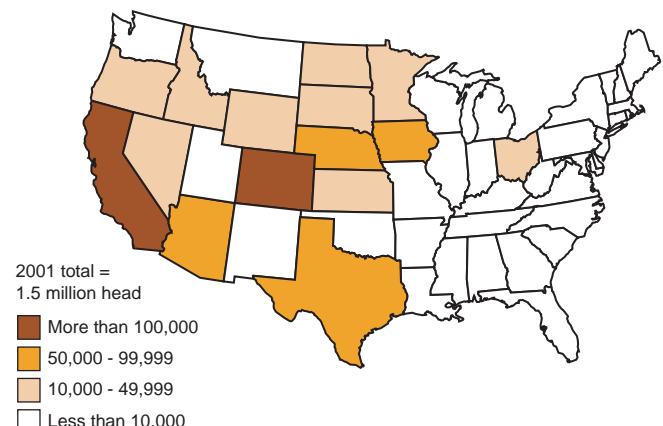
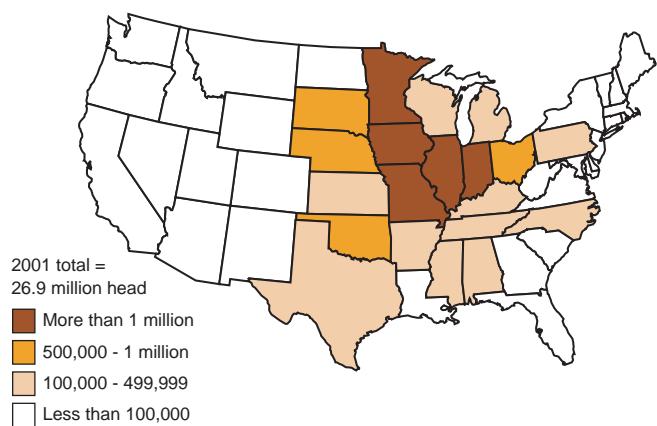
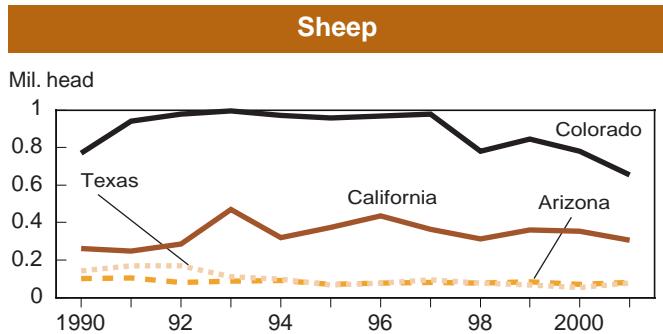
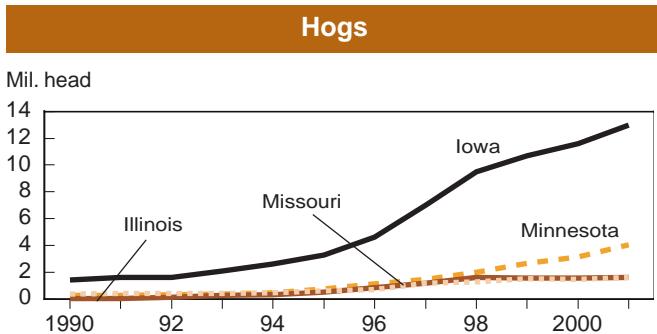
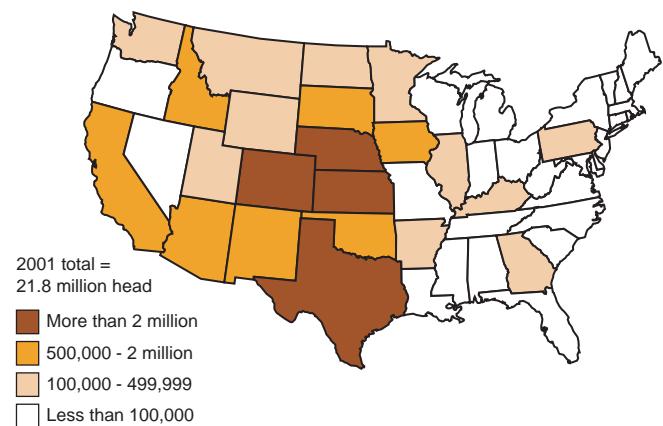
Source: National Agricultural Statistics Service, USDA.

Figure 7
U.S. inshipments for livestock (cattle, hogs, sheep)



Livestock inshipments in 2001

Rank	Cattle		Hogs		Sheep	
			1,000 head			
1	KS	4,195	IA	13,000	CO	654
2	NE	3,850	MN	4,050	CA	305
3	TX	3,420	IL	1,600	AZ	81
4	CO	2,180	MO	1,590	TX	77
5	OK	1,100	IN	1,290	IA	74
6	IA	1,080	SD	910	NE	57
7	NM	864	OK	890	OR	40
8	CA	750	NE	750	SD	39
9	AZ	625	OH	600	WY	32
10	ID	555	KS	480	MN	28



Source: National Agricultural Statistics Service, USDA.

Livestock Movements—Estimates by Origin and Destination

To protect animal health, States regulate interstate movement of livestock, often through their departments of agriculture. State-certified veterinarians verify that animals are free of disease and meet State-specific requirements. In general, States require certificates of veterinary inspection and import permits for animals destined for feeding or breeding purposes.¹³

Data from these certificates are used in this section to approximate State-to-State flows that are not provided in the data used in previous sections. Shipments have been grouped into 11 U.S. regions. A complete set of maps for each State's inshipments/outshipments by species is available at www.ers.usda.gov/Data/InterstateLivestockMovements.

Tabulation and summarization of certificates varies widely by State. Some State animal health departments maintain databases that indicate State of origin/destination by species and by month. A few tabulate by shipments, by purpose (e.g., feeding or breeding), or by cattle type (e.g., beef or dairy). Other States only store printed certificates and do not tabulate data by State of origin/destination, in some cases due to declining resources.

State certificate data from 2000 and 2001 were collected in spring 2002. Data (tabulated by origin/destination) were available for 29 States representing all regions of the country. Animals in these States represent about two-thirds of the U.S. cattle inventory, 80 percent of the hog inventory, and half of the sheep inventory. See the

appendix table for a description of the data by species (States and year of data).

In order to compile these data into State and regional flows, inshipments (if available) are used first to identify livestock movements (i.e., by origin and destination) since States may keep better track of animals coming into the State than outgoing animals. If inshipments are not available for a particular State, outshipment data (animals moving out of State) from other States to that State are used as a proxy. Together, these data still provide incomplete coverage of all U.S. shipments. For example, cattle shipments compiled from the 29 State sources totaled about 17.7 million head, compared with a U.S. total of 21.8 million reported by NASS.¹⁴ For hogs, shipments compiled from State sources were 24.7 million head, compared with a U.S. total of 26.9 million reported by NASS. For sheep, State sources tallied 860,000 head, compared with 1.5 million reported by NASS. Certificate data provide an estimate of the minimal level of interstate livestock movement because undocumented shipments likely occur, particularly where local production regions straddle State borders.

In the following sections, regional livestock flows are graphically depicted using the procedures described above (tables 2, 4, and 5). On each summary map, calculated shipments from a region are compared with livestock births in that region to illustrate the extent of livestock movements for each of the three species. Table 3 summarizes these numbers for all three species.

¹³ Many States do not require certificates for animals shipped to slaughter plants, the terminal destination for these animals and from where the risk of spreading animal diseases is minimal.

¹⁴ Both data sources (i.e., State and NASS) exclude animals for slaughter.

Livestock Shipments—Example of North Carolina

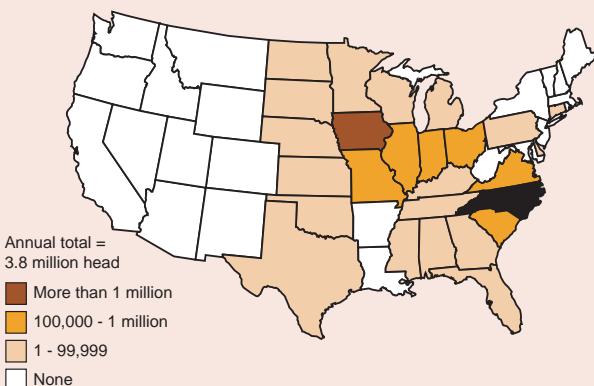
Examining shipments for particular States helps illustrate the geographic range and variety of origins/destinations for livestock. Livestock are shipped from North Carolina to almost every other State. Cattle have the widest geographic distribution, with most of the cattle sent to pastures and feedlots in the Northern and Southern Plains, as well as to operations in the Corn Belt. Hog shipments out of North Carolina are much greater (3.8 million head versus 45,000 head for cattle), with shipments not extending into or beyond the Rocky Mountains, mostly to Iowa, Illinois, Indiana, and

Missouri. A small sheep industry results in few shipments (less than 400), with a geographic range covering most of the eastern third of the United States.

All areas of the country are affected in some way by livestock shipments, although certain livestock flows tend to dominate, especially for the hog industry and for some beef and dairy cattle movements. The breadth of livestock marketing increases the potential for a single disease outbreak to affect many regions of the country.

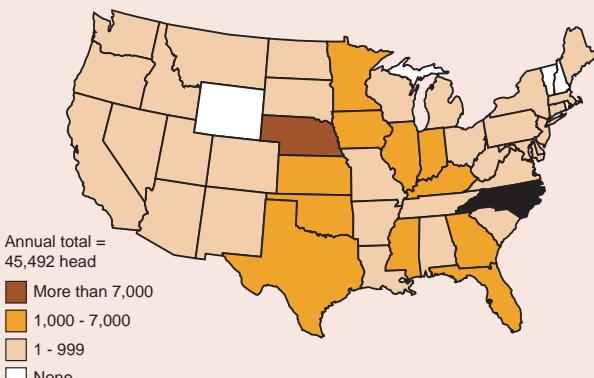
North Carolina hog shipments to other States

Rank	State	No. head
1	Iowa	1,232,108
2	Illinois	803,272
3	Indiana	652,213
4	Missouri	231,883
5	S. Carolina	176,474
6	Virginia	136,736
7	Ohio	130,164
8	Alabama	98,366
9	Minnesota	96,254
10	Mississippi	78,863



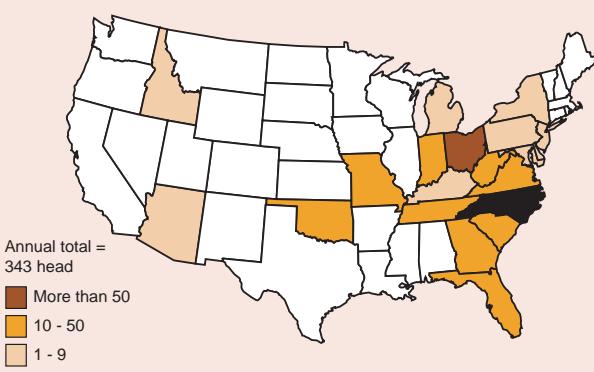
North Carolina cattle shipments to other States

Rank	State	No. head
1	Nebraska	8,717
2	Kansas	6,879
3	Texas	5,000
4	Kentucky	4,140
5	Georgia	3,049
6	Mississippi	3,029
7	Florida	2,088
8	Iowa	2,072
9	Oklahoma	2,013
10	Illinois	1,715



North Carolina sheep shipments to other States

Rank	State	No. head
1	Ohio	90
2	Georgia	50
3	S. Carolina	48
4	Oklahoma	28
5	Florida	22
6	Virginia	19
7	Missouri	16
8	Tennessee	15
9	Indiana	12
10	W. Virginia	12



Data source: Animal health certificates as reported by North Carolina Department of Agriculture and Consumer Services and other States (2001).

Regional Cattle Flows

Cattle are moved regularly in most regions of the country, with greatest movement into (and within) the Northern Plains. Many feeder cattle cross from the eastern U.S. into the Northern and Southern Plains to be fed or grazed (prior to entering feedlots). The Mountain region sees significant grazing as well. In

the Corn Belt, feeding operations bring in cattle from the Delta, Northern Plains, and other States.¹⁵

¹⁵ Shipments from the Appalachian region are underestimated because data were not available from Tennessee, a State with a large beef cow herd.

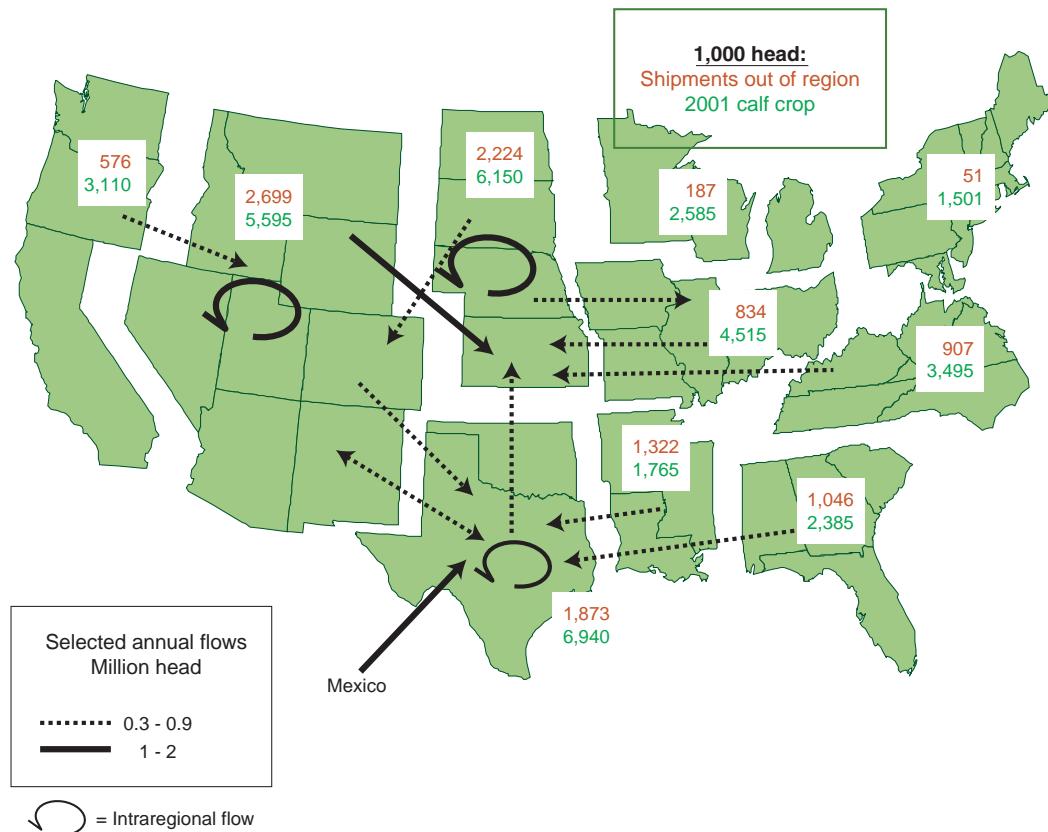
Table 2—Regional cattle flow

Destination	Destination											
	Pacific	Mountain	Northern Plains	Southern Plains	Lake States	Corn Belt	Delta States	South-east	Appalachian	Northeast	Other*	Total
1,000 head												
Pacific	133	447	78	23	21	3	**	**	4	**	**	708
Mountain	209	1,245	1,160	971	103	218	2	2	14	**	20	3,944
Northern Plains	12	597	1,596	167	211	555	1	2	8	1	670	3,820
Southern Plains	11	806	945	561	7	27	16	14	3	**	44	2,435
Lake States	18	36	57	3	13	64	1	2	5	1	**	200
Corn Belt	22	48	600	88	37	244	3	6	10	1	19	1,079
Delta States	1	89	292	800	10	34	65	11	81	**	12	1,395
Southeast	**	29	245	557	3	31	91	148	84	6	**	1,194
Appalachian	7	64	382	183	11	212	28	18	73	2	**	979
Northeast	4	2	8	**	**	2	**	15	20	10	**	61
Other*	18	110	32	1,725	4	14	8	**	1	1	0	1,913
Total	435	3,473	5,395	5,078	420	1,404	215	218	303	22	765	17,728

*Mostly Mexico and Canada, but also includes U.S. States not specifically identified as a source/destination in the original data.

** = flows from 1 to 499 head.

Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.



Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.

Many feeder cattle enter Texas from the rest of the southern U.S. and Mexico. Zebu (Brahman) is a popular breed raised in the U.S. Southwest and these cattle perform better in the warmer feedlots of south Texas, southern New Mexico, and Arizona. Cattle from the Southeast and other areas are also shipped to feedlots in the Texas and Oklahoma Panhandles. Feeder cattle from Mexico are shipped across the U.S. border for feeding in neighboring States and as far north as the Northern Plains (Skaggs et al., 2001). Breeding cattle are also shipped to Mexico from Texas, New Mexico, and Arizona. Spent dairy cows are shipped to Mexico for slaughter.

Cattle shipments from the Northeast and Lake States are often dairy breeds (Miller, 2001). In New York, for example, dairy producers ship heifer calves to the Midwest for feeding before they mature and return to enter the milking herd (Huse, 2002). Many operations ship their dairy steer and bull calves to other locations, often through auction markets.

Movement of dairy cattle into the West is also quite extensive. In 2001, California brought in dairy cattle from 44 States, with more than 5,000 head each arriving from Arizona, Colorado, Idaho, Indiana, Iowa, Kentucky, Minnesota, Nevada, Oregon, Utah, Washington, and Wisconsin.

Table 3—Livestock shipments vary by region

	Cattle		Hogs		Sheep	
	Annual shipments from region	Calf crop*	Shipments/ calf crop	Annual shipments from region	Pig crop**	Shipments/ pig crop
	1,000 head	Percent	1,000 head	Percent	1,000 head	Percent
Pacific	576	3,110	18	16	342	5
Mountain	2,699	5,595	48	1,359	4,684	29
Northern Plains	2,224	6,150	36	3,233	10,915	30
Southern Plains	1,873	6,940	27	2,562	7,690	33
Lake States	187	2,585	7	2,177	12,395	18
Corn Belt	834	4,515	18	1,554	36,886	4
Delta States	1,322	1,765	75	912	2,580	35
Southeast	1,046	2,385	44	576	1,691	34
Appalachian	907	3,495	26	3,427	21,071	16
Northeast	51	1,501	3	19	2,210	1
Weighted average			31			16

*2001. **December 2000 to November 2001. ***Not available.

Sources: Shipments from region compiled from State certificate data (using both inshipment and outshipment data). Calf, pig, and lamb crops from National Agricultural Statistics Service, USDA.

Regional Hog Flows

The Corn Belt accounts for more than 70 percent of total hog movements. Along with intraregional movements, the Corn Belt is the major destination for hogs shipped from all other regions, particularly Appalachia, Southern Plains (e.g., Oklahoma), Northern Plains (e.g., Nebraska), and Canada.

There are also substantial flows of feeder pigs from the Northern Plains and Canada into the Lake States (mostly Minnesota) as well as from the Southern Plains into the Northern Plains. Small numbers of breeding animals are shipped around the country as well.

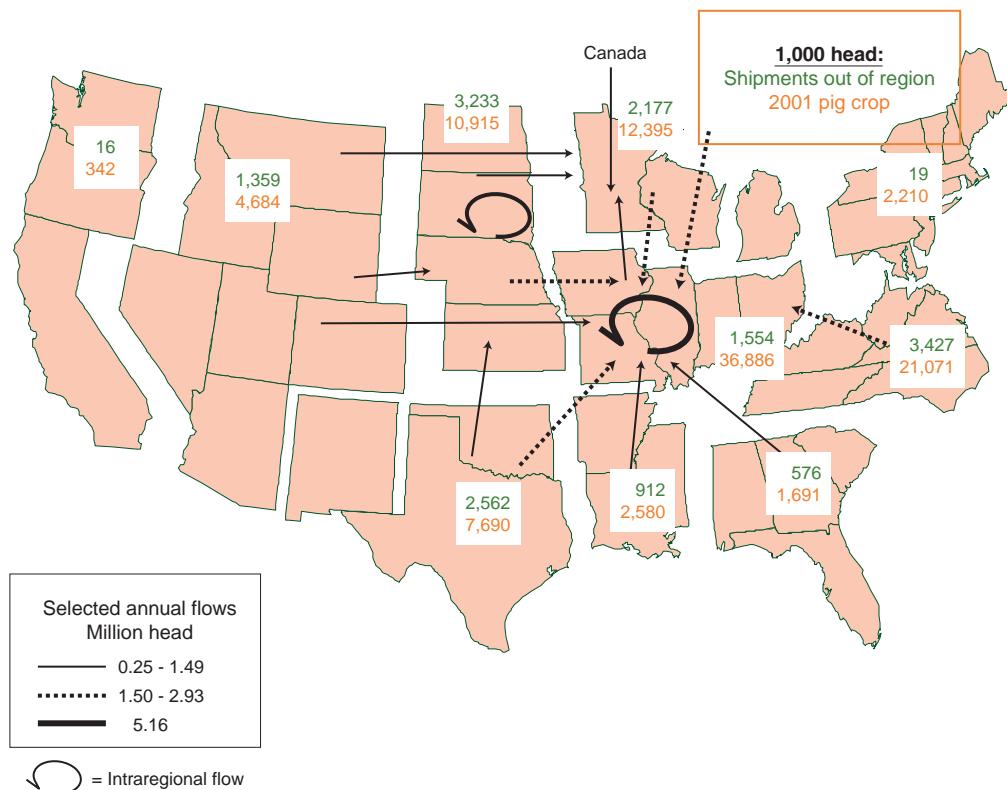
Table 4—Regional hog flows

Destination	Destination											
	Pacific	Mountain	Northern Plains	Southern Plains	Lake States	Corn Belt	Delta States	South-east	Appalachian	Northeast	Other*	Total
<i>1,000 head</i>												
Pacific	**	**	na	na	1	14	na	na	**	**	**	16
Mountain	17	1	478	**	283	571	**	na	1	8	**	1,360
Northern Plains	9	21	393	10	1,181	1,947	1	2	19	4	36	3,626
Southern Plains	17	**	282	na	135	2,071	53	4	**	**	na	2,562
Lake States	**	18	191	1	74	1,899	**	1	65	3	**	2,252
Corn Belt	16	5	147	20	1,163	5,159	50	2	128	1	22	6,713
Delta States	**	**	3	6	37	847	**	**	17	**	**	910
Southeast	**	**	3	5	6	362	17	178	177	7	na	754
Appalachian	1	**	44	2	74	2,934	92	220	210	61	na	3,637
Northeast	**	**	na	na	**	18	na	**	**	9	na	27
Other*	7	na	167	na	912	1,711	na	1	12	4	na	2,814
Total	66	46	1,709	43	3,868	17,532	213	408	629	96	58	24,670

*Mexico, Canada, and U.S. States not specifically identified as source/destination in original data. ** = flows from 1 to 499 head.

Totals may not add due to rounding. na = Not available.

Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.



Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.

Regional Sheep Flows

Sheep shipments are much smaller than cattle or hogs, and some regions, particularly in the eastern U.S., are nearly devoid of interstate shipments. Out-of-state shipments are most numerous in the western two-thirds of the United States, although the Southeast has a sizeable intraregional flow. The bulk of movement is within the Mountain region and between that region and the Corn Belt and Northern Plains. Within the

Mountain region, breeding stock move between summer and winter grazing programs.

Shipments of sheep to Mexico from Texas include old breeding stock that may be kept for a few more breeding cycles before being slaughtered for mutton, or wool-type sheep (Ramboulet) that will be shorn and then slaughtered.

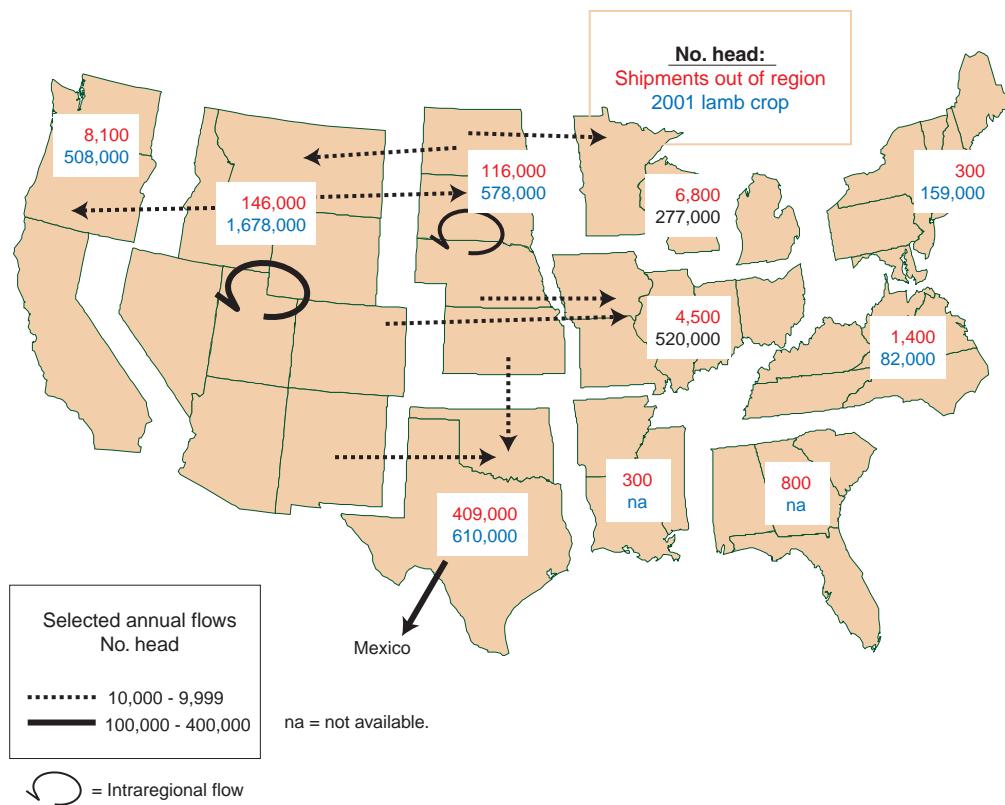
Table 5—Regional sheep flows

Destination	Destination											
	Pacific	Mountain	Northern Plains	Southern Plains	Lake States	Corn Belt	Delta States	South-east	Appalachian	Northeast	Other*	Total
<i>No. head</i>												
Pacific	708	3,900	159	4,000	3	na	na	10	6	na	na	8,786
Mountain	18,571	122,046	47,764	23,050	4,925	50,868	278	15	301	16	na	267,834
Northern Plains	5,808	15,241	30,235	19,158	22,703	51,754	17	28	15	3	1,122	146,084
Southern Plains	8,178	9,002	2,400	1,000	6	2,056	na	1,328	38	82	386,000	410,090
Lake States	1	35	1,246	2,009	342	3,401	3	142	5	5	2	7,191
Corn Belt	40	743	1,712	197	1,182	775	na	260	323	76	na	5,309
Delta States	na	na	na	na	na	na	na	258	na	na	na	258
Southeast	3	5	na	39	22	165	132	9,882	413	59	na	10,720
Appalachian	11	24	39	34	4	115	na	1,018	1,691	170	na	3,106
Northeast	42	5	7	na	na	23	na	56	212	1,125	na	1,470
Other*	11	na	964	1,000	14	na	na	34	na	618	na	2,641
Total	33,373	151,001	84,526	50,487	29,201	109,157	430	13,031	3,004	2,154	387,124	863,489

*Mexico, Canada, and U.S. States not specifically identified as source/destination in original data.

Totals may not add due to rounding. na = Not available.

Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.



Source: State certificate data (generally 2001) compiled by Economic Research Service, USDA.

Conclusions and Further Research Needs

Hog inshipments have increased dramatically since the early 1990s and now surpass cattle inshipments. The dominant flow in hog shipments is into (and within) the Corn Belt. Cattle inshipments have declined slightly since the early 1990s. Movements of cattle occur throughout the country, but especially into (and within) the Northern and Southern Plains. Sheep inshipments have declined sharply since the early 1990s as the U.S. herd continues its long-term decline. Shipments are most numerous in the western two-thirds of the United States.

Regional shipping patterns described here are based on data from certificates of veterinary inspection required for interstate commerce by many, but not all, States. A tabulation of source/destination shipments for all States would take this analysis a step further. A current project by USDA's Animal and Plant Health Inspection Service may accomplish this in the coming years. APHIS is developing a web-based system for State certificates that, once implemented, would provide veterinarians with an electronic means of issuing certificates. Summary reports on shipments could be tabulated from the database, but all States must participate if livestock tracking is to be thorough.

Another potential source of data is the recordkeeping systems needed to verify country-of-origin labels. The Farm Security and Rural Investment Act of 2002 amended the Agricultural Marketing Act of 1946 to require retailers to inform consumers of the country of origin for muscle cuts of beef, lamb, and pork; ground beef, ground lamb, and ground pork. Mandatory regulations are to be promulgated by September 30, 2004. In order to implement the requirements mandated in this legislation, some cow-calf producers are considering upgraded animal identification and/or tracking programs.

Using more complete data, disaggregation of shipments by month and animal type (e.g., beef/dairy, feeding/breeding, weight, and value) could be used to better identify patterns and isolate specific flows for further analysis. For example, health experts and livestock analysts could more easily track a disease affecting only certain animals (e.g., young or one species of livestock) or more easily identify its potential for spread given seasonal shipping patterns. Also, price differentials between various classes of livestock and locations, which motivate shipments of livestock, could be more transparent with increasingly disaggregated data.

Glossary

Crop (cattle, pig, lamb)—number of animals born.

Growing area—a region where livestock are born and weaned or raised until they are ready for finishing.

Feedlots—farm or commercial operations that maintain 600- to 800-pound cattle or 50- to 80-pound lambs in pens and feed them grain and other feedstuffs to grade “Select” or better.

Finishing area—a region where livestock are fed grain and other feedstuffs to reach slaughter weight.

Inshipments—livestock shipped into States for feeding or breeding (excludes animals brought in for immediate slaughter).

Operation—farm, ranch, feedlot, or other organized unit of production.

Cattle

Beef cow-calf production—an operation that breeds and maintains cows for the primary purpose of producing calves for beef production.

Backgrounding—a stage of cattle production when calves eat roughage and/or light energy rations or graze pasture (native grass or winter wheat), which encourages structural growth. During the backgrounding period, producers decide when to place them in feedlots to fatten for slaughter.

Hogs

Farrow-to-finish—an operation that raises hogs from birth to slaughter weight, about 250-270 pounds.

Feeder pig production—an operation that raises pigs from birth to about 20-60 pounds, then generally sells them to feeder pig finishers.

Feeder pig finishers—an operation that buys pigs from feeder pig producers and grows them to slaughter weight.

Sheep

Sheep production—an operation where lambs are born, raised, and/or fed to slaughter weight. Lamb feeding programs may include a combination of grain and grass, or lambs may be placed in a feedlot for high-concentrate (energy) feeding.

References

- Abbott, E.C., and H.H. Smith. *We Pointed Them North*, University of Oklahoma Press, Norman, OK. 1955.
- Bailey, D., B.W. Brorsen, and M.R. Thomsen. "Identifying Buyer Market Areas and the Impact of Buyer Concentration in Feeder Cattle Markets Using Mapping and Spatial Statistics," *American Journal of Agricultural Economics* 77: 309-18. 1995.
- Goodwin, B.K., and T.C. Schroeder. "Testing Perfect Spatial Market Integration: An Application to Regional United States Cattle Markets," *North Central Journal of Agricultural Economics* 12: 173-85. 1990.
- Goodwin, B.K., and T.C. Schroeder. "Cointegration Tests and Spatial Price Linkages in Regional Cattle Markets," *American Journal of Agricultural Economics* 73: 452-64. 1991.
- Hoffman, L.A., P. Boles, and T.Q. Hutchinson. *Livestock Trucking Services: Quality, Adequacy, and Shipment Patterns*, Economic Research Service, USDA. Agricultural Economic Report No. 312, October 1975.
- Huse, Jeff. New York State Department of Agriculture and Markets. Personal communication, April 12, 2002.
- Judge, G.G., J. Havlicek, and R. L. Rizek. "An Interregional Model: Its Formulation and Application to the Livestock Industry," *Agricultural Economics Research*. Vol. XVII, No. 1, January 1965.
- Lesser, W. *Marketing Livestock and Meat*. Food Products Press. 1993.
- McBride, William. *U.S. Hog Production Costs and Returns, 1992: An Economic Basebook*, Economic Research Service, USDA. Agricultural Economic Report No. 724. November 1995.
- McBride, William and Nigel Key. *Economic and Structural Relationships in U.S. Hog Production*, Economic Research Service, USDA. Agricultural Economic Report No. 818, February 2003.
- McCauley, E., N. Aulaqi, J. New, Jr., and W. B. Sundquist, *A Study of the Potential Economic Impact of Foot-and-Mouth Disease in the United States*. U.S. Department of Agriculture and University of Minnesota, TB-1597, May 1979.
- McCoy, J.G., and R.P. Bieber (editors). *Historic Sketches of the Cattle Trade of the West and Southwest*, University of Nebraska Press, 1986.
- Miller, Jim. "Heifer Math & the Western Dairy Industry," *Agricultural Outlook*. Economic Research Service, USDA. December 2001.
- Roe, B., E. Irwin, and J. Sharp. "Pigs in Space: Modeling the Spatial Structure of Hog Production in Traditional and Nontraditional Production Regions," *American Journal of Agricultural Economics* 94(2) (May 2002):259-278.
- Schmidt, Steve. Department of Animal & Dairy Sciences, Auburn University, <http://www.ag.auburn.edu/~sschmidt/>
- Schroeder, T.C., and B.K. Goodwin. "Regional Fed Cattle Price Dynamics," *Western Journal of Agricultural Economics* 15:111-22. 1990.
- Shapouri, Hosein. "Sheep Production in 11 Western States." Economic Research Service, USDA. Staff Report No. AGES 9150. September 1991.
- Skaggs, R., D. Mitchell, W. Gorman, T. Crawford, and L. Southard. "Forecasting Mexican Live Cattle Exports to the United States." Paper presented to the Western Agricultural Economics Association, July 10, 2001.
- Stillman, R., T. Crawford, and L. Aldrich. "The U.S. Sheep Industry." Economic Research Service, USDA. Staff Report No., AGES 9048. July 1990.
- USDA. "Foot and Mouth Disease: Sources of Outbreaks and Hazard Categorization of Modes of Virus Transmission." Animal and Plant Health Inspection Service, Centers for Epidemiology and Animal Health, Ft. Collins, CO, December 1994.
- USDA, Animal and Plant Health Inspection Service. "Changes in the U.S. Beef Cow-Calf Industry, 1993-1997." National Animal Health Monitoring System. May 1998.

USDA, APHIS. *Part I: Reference of Swine Health and Management in the United States, 2000.* August 2001.

USDA, APHIS. *Part I: Reference of Sheep Management in the United States, 2001.* July 2002a.

USDA, APHIS. *Part II: Baseline Reference of Feedlot Health and Health Management in the United States, 1999.* November 2002.

USDA, National Agricultural Statistics Service, "Meat Animals Production, Disposition, and Income—2001 Summary," April 2002; "Livestock

Slaughter—2001 Summary," March 2002; livestock inventory appears in Agricultural Statistics Database at www.nass.usda.gov:81/ipedb/.

Walburger, A.M., and K.A. Foster. "Assessing the Relationship between Market Factors and Regional Price Dynamics in U.S. Cattle Markets," *Journal of Agricultural and Resource Economics* 22: 133-44. 1997.

Zering, K.D. North Carolina State University, Raleigh, NC. Personal communication, August 29, 2001.

Appendix table—Compiled shipment data

State	Inshipments	Outshipments	Year	Source
Alabama	Cattle, hogs, sheep	Cattle, hogs, sheep	2001*	Alabama Dept. of Agriculture and Industries, Animal Industry Division
Alaska	Cattle, sheep		2001	Alaska Agricultural Statistics Service
Arizona				
Arkansas	Cattle, hogs	Cattle, hogs	2001	Arkansas Livestock and Poultry Commission
California	Cattle, hogs		2001	California Dept. of Food and Agriculture, Animal Health Branch
Colorado	Cattle		1994	Colorado Agricultural Statistics Service
Connecticut				
Delaware				
Florida	Cattle, hogs	Cattle, hogs	2001	Florida Agricultural Statistics Service
Georgia	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	Georgia Dept. of Agriculture
Hawaii				
Idaho	Cattle	Cattle	2001	Idaho Department of Agriculture
Illinois	Cattle, hogs	Cattle, hogs	2001	Illinois Department of Agriculture
Indiana	Cattle, hogs		2000	Indiana Agricultural Statistics Service
Iowa	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	Iowa Department of Agriculture and Land Stewardship
Kansas	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	Kansas Agricultural Statistics Service
Kentucky	Cattle, hogs	Cattle, hogs	2000	Kentucky Department of Agriculture
Louisiana				
Maine				
Maryland	Cattle, hogs	Cattle, hogs	2001	Maryland Department of Agriculture, Animal Health Section
Massachusetts	Cattle, hogs, sheep	Cattle, hogs, sheep	2001*	Massachusetts Dept. of Food and Agriculture
Michigan				
Minnesota	Cattle, hogs, sheep	Cattle, hogs, sheep	2001**	Minnesota Board of Animal Health
Mississippi	Cattle, hogs	Cattle, hogs	2000***	Mississippi Agricultural Statistics Service
Missouri	Hogs	Hogs	2001	Missouri Dept. of Agriculture, Division of Animal Health
Montana				
Nebraska				
Nevada	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	Nevada Dept. of Agriculture, Bureau of Animal Industry
New Hampshire	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	New Hampshire Dept. of Agriculture Markets & Food
New Jersey	Cattle, hogs, sheep		2001	New Jersey Department of Agriculture
New Mexico				
New York				
North Carolina	Cattle, hogs, sheep	Cattle, hogs, sheep	2001	North Carolina Dept. of Agriculture and Consumer Services
North Dakota	Cattle, hogs, sheep		2001	North Dakota Department of Agriculture
Ohio				
Oklahoma				
Oregon	Cattle, hogs, sheep		2001	Oregon Dept. of Agriculture, Animal Health & Identification Div.
Pennsylvania				
Rhode Island				
South Carolina				
South Dakota	Cattle, hogs, sheep	Cattle, hogs, sheep	2001****	South Dakota Animal Industry Board
Tennessee				
Texas	Cattle, sheep	Cattle, sheep	2000	Texas Agricultural Statistics Service
Utah				
Vermont				
Virginia				
Washington				
West Virginia	Cattle, hogs, sheep	Cattle, hogs, sheep	2001****	West Virginia Dept. of Agriculture
Wisconsin		Cattle, hogs	2000	Wisconsin Agricultural Statistics Service
Wyoming	Cattle, hogs, sheep	Cattle, hogs, sheep	1999	Wyoming Agricultural Statistics Service

Blank indicates no available tabulations of shipment data by State of origin/destination.

*Fiscal year beginning October 2000.

**September 1, 2000, to September 30, 2001.

***2001 for hogs.

****July 1, 2000, to June 30, 2001.