

Appendix A—Animal Waste Production Computation Method

A.1 Selected Census of Agriculture Variables

Numerous variables were necessary to evaluate data from the Census of Agriculture Database. Table A-1 summarizes the variables related to characterizing specific animal operations, which are derived from Sections 13 through 17 of the related survey form. These data can be used to estimate the total amount of manure generated in the United States. An existing methodology for beef, dairy, swine, and poultry has already been developed by USDA (Lander et al., 1998). A similar analysis for other animal categories (e.g., sheep, lambs, horses, goats, etc.) was undertaken as part of this study. Table A-2 contains general land classification categories that can be used to determine the amount of available pasture or whether most of an operation's land has been accounted for when evaluating crop nutrient requirements. It also contains variables summarizing the number of irrigated acres and acres fertilized with commercial fertilizer. Table A-3 contains crop-specific variables for estimating crop nutrient requirements. The variables in the third column correspond to the data used by USDA (Lander et al., 1998). The second and fourth columns provide data on acres harvested and irrigated, respectively. These columns would be used if crop yield goals are substituted for actual crops harvested, the latter being more subject to year-to-year weather variations. It is generally not anticipated that detailed analysis of crops will be necessary; rather, operation-by-operation summaries of nutrient requirements will be estimated and carried forward.

Table A-1. Selected Census of Agriculture variables that can be used to describe animal operations.

Questionnaire Brief Description	Census Variable Symbol		
	Inventory (Number on this place 12/31/1997)	Number Sold (in 1997)	Other Characteristic
Section 13-Cattle or Calves			
1 Cattle and calves of all ages	K803		
1.a Beef cows	K804		
1.b Milk cows	K805		
1.c Heifers and heifer calves	K806		
1.d Steers, steer calves, bulls, and bull calves	K807		
2 Calves		K808	
3 Cattle		K810	
3.a Cattle (fattened on grain or concentrates)		K812	
Section 14-Hogs or Pigs			
1 Hogs and pigs	K815		
1.a Hogs and pigs for breeding	K816		
1.b Other hogs and pigs	K817		
2.a Litters farrowed (12/1-5/31)			K818 (# litters)
2.b Litters farrowed (6/1-11/30)			K819 (# litters)
3 Hogs and pigs sold		K820	
3.a Feeder pigs		K822	

Table A-1. Selected Census of Agriculture variables that can be used to describe animal operations.

Questionnaire Brief Description	Census Variable Symbol		
	Inventory (Number on this place 12/31/1997)	Number Sold (in 1997)	Other Characteristic
Section 15-Sheep or Lamb			
1 Sheep and lambs	K824	K825	
1.a Ewes	K826		
2 Sheep and lambs shorn	K827		
Section 16-Poultry			
1 Layers	K892	K893	
2 Pullets		K895	
2.a Pullets (13-19 weeks)	K894		
2.b Pullets (< 13 weeks)	K896		
3 Broilers	K898	K899	
4.a Turkeys for slaughter	K900	K901	
4.b Turkeys hens	K902	K903	
5 Other poultry			
Ducks	K904	K905	
Geese	K906	K907	
Pigeons or squab	K908	K909	
Pheasants	K910	K911	
Quail	K912	K913	
All other poultry	K914	K915	
Section 17-Horses, Bees, Fish, Goats, Other Livestock, or Animal Specialties			
1 Horses and ponies	K830	K831	
3 Milk goats	K843	K844	
4 Angora goats	K847	K848	
5 Other goats	K851	K852	
6 Mules, burros, and donkeys	K833	K834	
7 Mink and their pelts	K836	K837	
8 Rabbits and their pelts	K854	K855	
9 Other	K857	K858	

Table A-2. Selected Census of Agriculture variables that can be used to describe general land classification.

Questionnaire Brief Description	Census Variable Symbol (data reported as acres)
Cropland harvested	K787
Cropland used only pasture or grazing	K788
Cropland used for cover crops	K789
Cropland on which crops failed	K790
Cropland summer fallow	K791
Cropland idle	K793
Woodland pastured	K794
Woodland not pastured	K795
Other pastureland and rangeland	K796
All other land	K797
Total acres	K798
Acres of harvested land irrigated	K680
Acres of pasture, rangeland, and other land irri.	K681
Acres of cropland fertilized	K932
Acres of pastureland and rangeland fertilized.	K933

Table A-3. Selected Census of Agriculture crop-specific variables that can be used to evaluate crop nutrient requirements.

Crop	Census Variable Symbol		
	Acres Harvested	Quantity Harvested	Irrigated Acres Harvested
Field corn, for grain	K67	K68	K69
Field corn for silage	K70	K71	K72
Wheat	K73 (K545)	K74 (K546)	K75 (K547)
Oats	K76	K77	K78
Barley	K79	K80	K81
Sorghums for grain	K82	K83	K84
Sorghums for silage	K85	K86	K87
Soybeans	K88	K89	K90
Cotton (lint + seed)	K91	K92	K93
Tobacco	K94	K95	K96
Irish potatoes	K97	K98	K99
Sweet potatoes harvested	K100	K101	K102
Alfalfa hay	K103	K104	K105
Small grain hay (see variety)	K106	K107	K108
Other tame hay (see variety)	K109	K110	K111

Table A-3. Selected Census of Agriculture crop-specific variables that can be used to evaluate crop nutrient requirements.

Crop	Census Variable Symbol		
	Acres Harvested	Quantity Harvested	Irrigated Acres Harvested
Wild hay (see variety)	K112	K113	K114
Grass silage	K115	K116	K117
Alfalfa seed	K542	K543	K544
Austrian winter peas	K548	K549	K550
Bahia grass seed	K551	K552	K553
Dry beans (seed)	K554	K555	K556
Dry lima beans	K557	K558	K559
Bentgrass seed	K560	K561	K562
Bermuda grass seed	K563	K564	K565
Birdsfoot trefoil seed	K566	K567	K568
Bromegrass seed	K569	K570	K571
Winter wheat harvested	K572	K573	K574
Buckwheat harvested	K575	K576	K577
Durum wheat harvested	K578	K579	K580
Dry fodder corn	K581	K582	K583
Dry southern peas for dry peas	K584	K585	K586
Crimson clover seed	K593	K594	K595
Dill for oil	K596	K597	K598
Emmer and spelt	K599	K600	K601
Fescue seed	K602	K603	K604
Flaxseed	K605	K606	K607
Foxtail millet seed	K608	K609	K610
Canola	K614	K615	K616
Guar	K617	K618	K619
Dry herbs	K620	K621	K622
Hops	K623	K624	K625
Jojoba	K626	K627	K628
Kentucky bluegrass seed	K629	K630	K631
Ladino clover seed	K632	K633	K634
Lentils	K635	K636	K637
Lespedeza seed	K638	K639	K640
Mint for oil	K644	K645	K646
Mungbeans	K647	K648	K649
Mustard seed	K650	K651	K652

Table A-3. Selected Census of Agriculture crop-specific variables that can be used to evaluate crop nutrient requirements.

Crop	Census Variable Symbol		
	Acres Harvested	Quantity Harvested	Irrigated Acres Harvested
Orchardgrass seed	K653	K654	K655
Peanuts for nuts (w/ pods)	K656	K657	K658
Dry field peas	K659	K660	K661
Shelled popcorn	K662	K663	K664
Proso millet	K665	K666	K667
Industrial rapeseed	K668	K669	K670
Red clover seed	K671	K672	K673
Redtop seed	K674	K675	K676
Rice	K677	K678	K679
Rye for grain	K686	K687	K688
Ryegrass seed	K689	K690	K691
Safflower	K692	K693	K694
Salt hay	K695	K696	K697
Sorghum hay	K698	K699	K700
Sorghum hogged	K701	K702	K703
Sorghum syrup	K704	K705	K706
Sudangrass seed	K713	K714	K715
Sugar beets for seed	K716	K717	K718
Sugar beets for sugar (w/o crown)	K719	K720	K721
Sugarcane for sugar	K722	K723	K724
Sugarcane for seed	K725	K726	K727
Other spring wheat	K728	K729	K730
Sunflower seed	K734	K735	K736
Sweetclover seed	K737	K738	K739
Sweet corn for seed	K740	K741	K742
Taro	K743	K744	K745
Timothy seed	K746	K747	K748
Triticale	K749	K750	K751
Other crops	K752	K753	K754
Vetch seed	K755	K756	K757
Wheatgrass seed	K758	K759	K760
White clover seed	K761	K762	K763
Wild rice	K764	K765	K766

A.2 Determining Number of Operations that Might Be CAFOs Based on the Existing Regulations

The methodology described in this section was developed to estimate the number of CAFOs using the Census of Agriculture data based on the criteria from 40 CFR Part 122, Appendix B, and Part 412. The variables used in this description correspond to variables used by the Census of Agriculture and summarized in Section A.1.

A.2.1 Determining the Number of Head

Beef. The current regulation for beef focuses on slaughter and feeder cattle. A strict interpretation of this definition excludes breeding stock and calves. Lander et al. (1998) compute the number of beef cattle on feed from “of the total cattle sold, how many were fattened on this place on grain or concentrates for 30 days or more and sold for slaughter” (K812). They also assume that the cattle are on feed for 140 days, which results in roughly 2.5 cycles per year. Therefore, the number of slaughter and feeder cattle is computed as

$$\text{Slaughter_and_feeder_cattle_CAFO74} = \text{K812}/2.5 \quad [1.1]$$

For those operations with more (less) than 2.5 cycles per year (e.g., operations that are active during only a portion of the year), this algorithm will overestimate (underestimate) the number of CAFOs. It is anticipated that there will be little impact from grazed animals, a desired feature, since the variable K812 specifies fattened on grain or concentrates.

Dairy. The current regulation for dairy focuses on mature dairy cattle. Lander et al. (1998) compute the dairy breeding herd directly from the “milk cows kept for production of milk—include dry milk cows and milk heifers that had calved” (K805). The number of mature dairy cattle is computed as

$$\text{Mature_dairy_cattle_CAFO74} = \text{K805} \quad [1.2]$$

Swine. The current regulation for swine focuses on animals weighing over 25 kg. This would include both breeding stock and hogs grown for slaughter. Lander et al. (1998) compute the number of hogs for breeding from “hogs and pigs used or to be used for breeding” (K816) and the hogs on feed from a combination of “other hogs and pigs” (K817), “hogs and pigs sold from this place in 1997, including feeder pigs” (K820), and “feeder pigs sold from this place for further feeding” (K822). They also assume that the hogs on feed are on feed for 180 days which results in roughly 2 cycles per year. Therefore, the number of swine is computed as

$$\begin{aligned} \text{Swine_CAFO74} = & \text{K816} + \text{K817} && \text{if } \text{K817} > 0 \text{ and } (\text{K820}-\text{K822}) = 0 && [1.3] \\ & \text{K816} + (\text{K820}-\text{K822})/2 && \text{if } \text{K817} = 0 \text{ and } (\text{K820}-\text{K822}) > 0 \\ & \text{K816} + \max[\text{K817}, (\text{K820}-\text{K822})/2] && \text{if } \text{K817} > 0 \text{ and } (\text{K820}-\text{K822}) > 0 \end{aligned}$$

For those operations with more (less) than 2 cycles per year (e.g., operations that are active during only a portion of the year), this algorithm will overestimate (underestimate) the number of CAFOs.

Horses. The current regulation for horses does not specify whether to include ponies. It is speculated that the intention of the regulation was to focus on horses; therefore, this analysis will overestimate the number of CAFOs since the Census of Agriculture does not differentiate between horses and ponies. On the other hand, it is expected that most operations with large numbers of animals (e.g., racetracks) will be predominately horses. Given these limitations, the number of horses is computed as

$$\text{Horses_CAFO74} = \text{K830} \quad [1.4]$$

Sheep or lambs. The current regulation refers to both adult and juvenile animals. The Census of Agriculture has data elements for the “sheep and lambs of all ages” (K824-inventory and K825-number sold) and “ewes one year

old or older” (K826). Therefore, the number of sheep and lambs should include ewes and lambs for slaughter (assuming 1.5 cycles per year) and is computed as

$$\begin{aligned} \text{Sheep_CAFO74} = & \text{K826} + (\text{K824}-\text{K826}) && \text{if } (\text{K824}-\text{K826}) > 0 \text{ and } \text{K825} = 0 && [1.5] \\ & \text{K826} + \text{K825}/1.5 && \text{if } (\text{K824}-\text{K826}) = 0 \text{ and } \text{K825} > 0 \\ & \text{K826} + \max[\text{K824}-\text{K826}, \text{K825}/1.5] && \text{if } (\text{K824}-\text{K826}) > 0 \text{ and } \text{K825} > 0 \end{aligned}$$

The first term on the right side of the equation represents an estimate of breeding stock (without rams) carried over from year to year, while the second term represents an estimate of sheep grown for slaughter. Rams are not directly considered in this analysis although future analyses might need to consider this omission. For those operations with more (less) than 1.5 cycles per year (e.g., operations that are active during only a portion of the year), this algorithm will overestimate (underestimate) the number of CAFOs. This analysis does not distinguish whether the sheep are grown in a concentrated setting or are grazed.

Turkeys. The current regulation does not distinguish among turkeys, whereas the Census of Agriculture does distinguish between breeders and those grown for slaughter. Lander et al. (1998) use “turkeys for slaughter” (K900-inventory and K901-number sold) and “turkey hens kept for breeding” (K902-inventory and K903-number sold) in their calculations using

$$\begin{aligned} \text{Turkeys_for_breeding} = & \text{K902} && \text{if } \text{K902} > 0 \text{ and } \text{K903} = 0 && [1.6] \\ & \text{K903} && \text{if } \text{K902} = 0 \text{ and } \text{K903} > 0 \\ & \max[\text{K902}, \text{K903}] && \text{if } \text{K902} > 0 \text{ and } \text{K903} > 0 \end{aligned}$$

$$\begin{aligned} \text{Turkeys_on_feed} = & \text{K900} && \text{if } \text{K900} > 0 \text{ and } \text{K901} = 0 && [1.7] \\ & \text{K901}/2 && \text{if } \text{K900} = 0 \text{ and } \text{K901} > 0 \\ & \max[\text{K900}, \text{K901}/2] && \text{if } \text{K900} > 0 \text{ and } \text{K901} > 0 \end{aligned}$$

From Equations 1.6 and 1.7, the number of turkeys can be computed as

$$\text{Turkeys_CAFO74} = \text{Turkeys_for_breeding} + \text{Turkeys_on_feed} \quad [1.8]$$

Laying hens or broilers. The current regulation provides different criteria depending on whether the operation uses continuous overflow watering or liquid manure systems. A strict reading of the regulation suggests that the criteria apply separately to laying hens and broilers and do not include pullets. Also as a general rule, continuous overflow watering is not used in the industry and liquid manure systems are used in just a fraction of the laying hen operations. It is therefore likely that there are no broiler CAFOs. Since the number of layers grown using liquid manure systems is a fraction of the overall layer industry, deriving the number of CAFOs from the Census of Agriculture will be substantially overestimated. Lander et al. (1998) compute the number of layer hens and broilers from a combination of “layers 20 weeks old or older” (K892-inventory and K893-number sold) and “broilers, fryers, and other meat-type chickens, including capons and roasters” (K898-inventory and K899-number sold). They also assume six flocks of broilers per year.

$$\begin{aligned} \text{Hens_layers_CAFO74} = & \text{K892} && \text{if } \text{K892} > 0 \text{ and } \text{K893} = 0 && [1.9] \\ & \text{K893} && \text{if } \text{K892} = 0 \text{ and } \text{K893} > 0 \\ & \max[\text{K892}, \text{K893}] && \text{if } \text{K892} > 0 \text{ and } \text{K893} > 0 \end{aligned}$$

$$\begin{aligned} \text{Broiler_chickens_CAFO74} = & \text{K898} && \text{if } \text{K898} > 0 \text{ and } \text{K899} = 0 && [1.10] \\ & \text{K899}/6 && \text{if } \text{K898} = 0 \text{ and } \text{K899} > 0 \\ & \max[\text{K898}, \text{K899}/6] && \text{if } \text{K898} > 0 \text{ and } \text{K899} > 0 \end{aligned}$$

For those operations with more (less) than six flocks of broilers per year, this algorithm will overestimate (underestimate) the number of CAFOs.

Ducks. The Census of Agriculture provides data on duck inventory (K904) and ducks sold (K905). It is assumed that five flocks of ducks can be raised for slaughter in a year.

$$\begin{aligned} \text{Ducks_CAFO74} &= \text{K904} && \text{if K904} > 0 \text{ and K905} = 0 && [1.11] \\ &\text{K905/5} && \text{if K904} = 0 \text{ and K905} > 0 \\ &\text{max[K904 , K905/5]} && \text{if K904} > 0 \text{ and K905} > 0 \end{aligned}$$

Animal units. From Table 1-1, animal units are computed from the number of slaughter and feeder cattle, mature dairy cattle, swine weighing more than 25 kg (~ 55 pounds), horses, and sheep. Combining the multipliers from Table 1-1 with the algorithms described earlier yields

$$\begin{aligned} \text{Animal_units_CAFO74} &= && 1.0 * \text{Slaughter_and_feeder_cattle_CAFO74} + && [1.12] \\ &&& 1.4 * \text{Mature_dairy_cattle_CAFO74} + \\ &&& 0.4 * \text{Swine_CAFO74} + \\ &&& 2.0 * \text{Horses_CAFO74} + \\ &&& 0.1 * \text{K826} \end{aligned}$$

Note that “ewes one year old or older” (K826) is used instead of Sheep_CAFO74 since the animal unit definition does not include lambs.

Total pasture and rangeland. The total pasture and rangeland is computed as

$$\text{Total_pasture_and_rangeland} = \text{K788} + \text{K794} + \text{K796} \quad [1.13]$$

A.2.2 Evaluation Criteria

The next step is to evaluate the criteria summarized in Table 1-1. There are numerous assumptions that will result in underestimating or overestimating the number of CAFOs based on the current regulation. For example, the procedure assumes the number of cycles or flocks per year. This assumption implies an even number of animals during the year, which is unlikely. It is likely that there are cycles in the animal populations during the year that reflect normal animal management practices such as herd build-up/culling, market demand, etc. In these instances, peak animal populations are likely to be higher than those calculated in the previous section. The circumstances associated with sheep (substantial numbers are grazed), broilers (not likely to be any continuous overflow waters or liquid manure systems), and layers (few liquid manure systems) might also result in underestimating or overestimating the number of CAFOs based on the current regulation. Therefore, several alternative criteria are applied.

Criteria (a), Scenario 1—Most Inclusive. Include all operations (regardless of grazing practices) and include all chicken operations over 30,000. If any of the following are true, the operation is a CAFO:

Slaughter_and_feeder_cattle_CAFO74	>	1000	[1.14.1]
Mature_dairy_cattle_CAFO74	>	700	[1.14.2]
Swine_CAFO74	>	2500	[1.14.3]
Horses_CAFO74	>	500	[1.14.4]
Sheep_CAFO74	>	10000	[1.14.5]
Turkeys_CAFO74	>	55000	[1.14.6]
Hens_layers_CAFO74	>	30000	[1.14.7]
Broiler_chickens_CAFO74	>	30000	[1.14.8]
Ducks_CAFO74	>	5000	[1.14.9]
Animal_units_CAFO74	>	1000	[1.14.10]

Equation 1.14.10 is used only if the facility is not classified as a CAFO based on Equations 1.14.1 through 1.14.5. (That is, if a facility is already a CAFO based on Equation 1.14.1, there is no need to reevaluate the number of animal units in Equation 1.14.10.)

Criteria (a), Scenario 2—Fewer Chickens. Include all operations (regardless of grazing practices) and include all chicken operations over 100,000. Apply the same algorithm as *Criteria (a), Scenario 1—Most Inclusive* except replace Equations 1.14.7 and 1.14.8 with

$$\begin{array}{lll} \text{Hens_layers_CAFO74} & > & 100000 & [1.15.7] \\ \text{Broiler_chickens_CAFO74} & > & 100000 & [1.15.8] \end{array}$$

Criteria (a), Scenario 3—Fewer Chickens, Less Grazing. Apply the same algorithm as *Criteria (a), Scenario 2—Fewer Chickens*, except operations are identified as potential CAFOs. To reduce the likelihood of including grazing operations, assessment of the potential that an operation could support their animal levels through existing pastures and rangeland is proposed. Because of the variable used for beef operations (i.e., “of the total cattle sold, how many were fattened on this place on grain or concentrates for 30 days or more and sold for slaughter”), the “grazing screen” will not remove beef operations. It is also unlikely that dairy or swine operations would rely entirely on grazing. Thus, the “grazing screen” would be used for farms that have (a) horses only, (b) sheep only, or (c) a combination of horses and/or sheep together with beef, milk, and/or swine. Sweeten and Reddell (1978) provide space allocation estimates for improved pastures (20-250 ft²/lb) and normal rangeland conditions (greater than 250 ft²/lb). They also state that stocking densities approaching 10 ft²/lb cannot be sustained and that “the vast majority of pasture and rangeland acreage in the nation probably cannot support a stocking density of 20 m²/kg (97.6 ft²/lb) ...” due to dung-fouling. Using a 25 percent safety factor applied to 97.6 ft²/lb, an initial space allocation value of 122 ft²/lb is recommended for the grazing screen. This corresponds to 2.87 acres per animal unit (1 beef cow, 10 sheep, etc.).

Thus, if an operation was identified as a potential CAFO based on horses (Equation 1.14.4) only, compute the grazing animal units as follows

$$\begin{array}{lll} \text{Grazing_animal_units} & = & 1.0 * \text{Slaughter_and_feeder_cattle_CAFO74} + & [1.16] \\ & & 1.4 * \text{Mature_dairy_cattle_CAFO74} + \\ & & 0.4 * \text{Swine_CAFO74} + \\ & & 2.0 * \text{Horses_CAFO74} + \\ & & 0.1 * \text{Sheep_CAFO74} \end{array}$$

If the following is true, “un-mark” the operation as a CAFO for horses:

$$\frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Grazing_animal_units (AU)}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \geq 122 \text{ ft}^2/\text{lb} \quad [1.17]$$

Similarly, if an operation was identified as a potential CAFO based on sheep (Equation 1.14.5) only, evaluate Equations 1.16 and 1.17. If Equation 1.17 is true, “un-mark” the operation as a CAFO for sheep.

Finally, if an operation was identified as a potential CAFO based on animal units (Equation 1.14.10) and the operation included sheep and/or horses, evaluate Equations 1.16 and 1.17. If Equation 1.17 is true, it is assumed that there are sufficient grazing opportunities for the horses and sheep. However, it would still be necessary to consider the remaining animals (i.e., beef, dairy, and swine) to determine if the animal unit criteria (Equation 1.14.10) would still be met. Thus, if Equation 1.17 is true, compute the revised number of animal units excluding sheep and horses using

$$\begin{array}{lll} \text{Re-animal_units_CAFO74} & = & 1.0 * \text{Slaughter_and_feeder_cattle_CAFO74} + & [1.18] \\ & & 1.4 * \text{Mature_dairy_cattle_CAFO74} + \\ & & 0.4 * \text{Swine_CAFO74} \end{array}$$

and reevaluate the criterion in Equation 1.14.10. If the criterion in Equation 1.14.10 is not met, “un-mark” the operation as a CAFO for animal units.

Criteria (a), Scenario 4—No Chickens, Less Grazing. Apply the same algorithm as *Criteria (a), Scenario 3—Fewer Chickens, Less Grazing*, except eliminate Equations 1.15.7 and 1.15.8.

Criteria (b), Scenario 1—Most Inclusive. Apply the same algorithm as *Criteria (a), Scenario 1—Most Inclusive*, except replace Equations 1.14.1 through 1.14.10 with

Slaughter_and_feeder_cattle_CAF074	>	300	[1.20.1]
Mature_dairy_cattle_CAF074	>	200	[1.20.2]
Swine_CAF074	>	750	[1.20.3]
Horses_CAF074	>	150	[1.20.4]
Sheep_CAF074	>	3000	[1.20.5]
Turkeys_CAF074	>	16500	[1.20.6]
Hens_layers_CAF074	>	9000	[1.20.7]
Broiler_chickens_CAF074	>	9000	[1.20.8]
Ducks_CAF074	>	1500	[1.20.9]
Animal_units_CAF074	>	300	[1.20.10]

Criteria (b), Scenario 2—Fewer Chickens. Apply the same algorithm as *Criteria (b), Scenario 1—Most Inclusive* except replace Equations 1.20.7 and 1.20.8 with

Hens_layers_CAF074	>	30000	[1.21.7]
Broiler_chickens_CAF074	>	30000	[1.21.8]

Criteria (b), Scenario 3—Fewer Chickens, Less Grazing. Apply the same algorithm as *Criteria (b), Scenario 2—Fewer Chickens*, except operations are identified as potential CAFOs. Also apply the “grazing screen” from *Criteria (a), Scenario 3—Fewer Chickens, Less Grazing* but update references to Equation 1.14.4, 1.14.5, and 1.14.10 to 1.20.4, 1.20.5, and 1.20.10, respectively.

Criteria (b), Scenario 4—No Chickens, Less Grazing. Apply the same algorithm as *Criteria (b), Scenario 3—Fewer Chickens, Less Grazing*, except eliminate Equations 1.21.7 and 1.21.8.

A.2.3 Determine Baseline Conditions, Part 412

The analysis is the same as that described in Sections A.2.1 and A.2.2 except for the following:

Replace Equation 1.5 with $\text{Sheep_CAF074} = \text{K826}$
 Replace Equation 1.12 with $\text{Animal_units_CAF074} = 1.0 * \text{Slaughter_and_feeder_cattle_CAF074} + 1.4 * \text{Mature_dairy_cattle_CAF074} + 0.4 * \text{Swine_CAF074} + 0.1 * \text{K826}$

A.3 Evaluating the Distribution of Operations From the Census of Agriculture

A.3.1 Estimating Animal Units

This section defines an approach for estimating the number of animal units (AUs) using the Census of Agriculture. The previous work by Lander et al. (1998) was used when possible. This approach is different from the methodology used to compare the Census of Agriculture data to the current regulation. This approach includes juvenile animals, includes more animal species, and focuses on annual average animal populations. This section also summarizes how selected coefficients were developed to address animal groups other than dairy, beef, chickens, and turkeys and provides equations that use a comparable approach for computing animal units.

One of the first steps in this analysis was to compile additional values relating the number of animals per animal unit for different animal groups. Table A-4 provides an extension to the work done by Lander et al. (1988). The procedure developed by Lander et al. (1998) uses an average weight for an animal class; for example, broilers that are raised from hatchlings to market with a final weight of 4 to 4.5 lb. An average weight of 2.2 lb. or 455 animals per animal unit was determined by Landers et al. (1998). If an animal group refers to a single age class, an average weight for that class is used. For example, Lander et al. (1998) used an average weight of 1350 lb. for milk cows.

Table A-4. Summary of animal units for different animal groups. Coefficients for beef, dairy, poultry/chickens, and turkeys adopted from Lander et al. (1998).

Animal Category	Number of Animals per Animal Unit	Reference
Beef cows	1	Lander et al. (1998)
Milk cows	0.74	Lander et al. (1998)
Calves	4	Lander et al. (1998)
Heifers and heifer calves	1.82	Lander et al. (1998)
Steers, steer calves, bulls, and bull calves	1.64	Lander et al. (1998)
Fattened cattle sold	1.14	Lander et al. (1998)
Breeding hogs/pigs	2.67	Lander et al. (1998)
Other hog/pig	9.09	Lander et al. (1998)
Hens/pullets laying age	250	Lander et al. (1998)
Pullets > 3 months, not laying	250	Lander et al. (1998)
Pullets < 3 months	455	Lander et al. (1998)
Broiler	455	Lander et al. (1998)
Turkeys for slaughter	67	Lander et al. (1998)
Turkey hens for breed	50	Lander et al. (1998)
Horses	1	ASAE Standard (1998)
Donkeys/mules/burros	1.7	L. Patton, personal communication 7/13/98
Sheep	16.7	ASAE Standard (1998)
Milk goats	7.6	http://uslink.net/~act/bmf/history.html
Angora goats	10	http://members.aol.com/melodiehl/goats.html
Minks	200	http://agri.gov.ns.ca/rs/greenplan/waste/061.html
Rabbits	154	http://www.rabbit.org/faq/faq.txt
Ducks	244	http://eru.usask.ca/saf_corp/livestock/poultry/ducks_and_geese.html
Geese	101	http://eru.usask.ca/saf_corp/livestock/poultry/ducks_and_geese.html
Pigeons	435	http://www.geocities.com/Athens/Acropolis/6450/BASICPIGEONINFO.html
Pheasants	357	http://ndsuent.nodak.edu/extpubs/alt-ag/pheasan.htm
Quail	4760	http://pages.prodigy.net/nightfalcon/bobwhite.htm

Next, estimates for converting annual animal sales to average inventory values were developed for ducks, geese, pheasants, other poultry, pigeons, quail, goats, mink, and rabbits. Table A-5 provides national inventory and sales data from the 1992 Census of Agriculture for a variety of animal species. For each animal category identified in Table A-5, the ratio of the number of animals sold in 1992 to the animal inventory on December 31, 1992, was computed. For example, ratios of 6.1 and 4.9 were computed for broilers and ducks, respectively. Broilers were

included in this table for comparison to the value used by Lander et al. (1998). Using professional judgment, these ratios were rounded to the nearest 0.5, as shown in the last column of Table A-5. These last values are the number of cycles per year used in the equations presented in Table A-6. It is possible that a more complex algorithm for estimating the number of cycles per year might be necessary in future analyses. It was also necessary to expand the Lander et al. (1998) procedures to accommodate additional animal categories. Table A-6 presents a summary of these equations, including those proposed by Landers et al. (1998).

Table A-5. Summary of calculations used to derive conversion factor for converting annual sales to inventory. Data extracted from 1992 Census of Agriculture.

Animal Category	Number of Farms with Inventory on 12/31/92	Animal Inventory on 12/31/92	Number of Farms with Sales in 1992	Number of Animals Sold in 1992	Animal Sold/Inven. Ratio	Sales to Inventory Conversion Factor^a
Broilers	29,006	888,617,180	23,949	5,428,589,485	6.1	6 ^b
Ducks	16,312	3,339,659	3,038	16,391,031	4.9	5
Geese	12,012	183,217	1,768	324,472	1.8	2
Pheasants	2,383	1,273,383	1,175	4,970,506	3.9	4
Other poultry	5,433	1,241,437	1,397	2,338,877	1.9	2
Pigeons or squab	1,667	315,324	519	960,317	3.0	3
Quail	1,384	3,295,869	887	16,623,548	5.0	5
Mink and their pelts	798	1,767,777	803	3,233,831	1.8	2
Rabbits and their pelts	14,506	789,406	5,184	1,930,921	2.4	2.5

^aThe numbers presented in this column are the number of cycles per year used in Table A-6.

^bValue used by Lander et al. (1998).

Table A-6. Summary of formula used to compute the number of animal units enabling annual manure and nutrient production to be computed. Formula for beef, dairy, poultry/chickens, and turkeys adopted from Lander et al. (1998).

Long Variable Name	Short Variable Name^a	Formula for Computing Number of Animal Units
Beef		
Beef_young_calves_au	calfb_au	$K804 * 0.9 * (5/12) / 4$
Beef_grass_fed_cattle_au	grssb_au	$0.9 * (K804) * (100/365) / 1.82$
Beef_calves_for_breeding_herd_au	heifb_au	$K804 * 0.15 * (5/12) / 1.14$
Beef_cattle_on_feed_au	beef_au	$K812 / (1.14 * 2.5)$
Beef_breeding_herd_au	cow_au	$ \begin{aligned} &K804 && \text{if } K804 > 0 \text{ and } K810 - K812 = 0 \\ &K810 - K812 && \text{if } K804 = 0 \text{ and } K810 - K812 > 0 \\ &(K804 + K810 - K812) / 2 && \text{if } K804 > 0 \text{ and } K810 - K812 > 0 \end{aligned} $
Dairy		
Dairy_young_calves_au	calfd_au	$K805 * 0.45 * (5/12) / 4$
Dairy_grass_fed_cattle_au	grssd_au	$0.45 * (K805) * (100/365) / 1.82$
Dairy_calves_for_breeding_herd_au	heifd_au	$K805 * 0.2 * (5/12) / 0.94$
Dairy_breeding_herd_au	dair_au	$K805 / 0.74$

Table A-6. Summary of formula used to compute the number of animal units enabling annual manure and nutrient production to be computed. Formula for beef, dairy, poultry/chickens, and turkeys adopted from Lander et al. (1998).

Long Variable Name	Short Variable Name ^a	Formula for Computing Number of Animal Units	
Swine			
Hogs_for_breeding_au	sow_au	K816/2.67	
Hogs_on_feed_au	fhog_au	K817/9.09 (K820-K822)/(2*9.09) (K817+ (K820-K822)/2)/(2*9.09)	if K817> 0 and (K820-K822)= 0 if K817= 0 and (K820-K822)> 0 if K817> 0 and (K820-K822)> 0
Poultry/Chickens			
Hens_layers_au	layer_au	K892/250 K893/250 (K892+ K893)/(2*250)	if K892> 0 and K893= 0 if K892= 0 and K893> 0 if K892> 0 and K893> 0
Pullets_au (5 th option added to method developed by Lander et al. (1998))	pull_au	K894/250 + K896/455 (K896/455 + K895/(2*404))/2 (K894/250 + K895/(2*404))/2 (K894/250+ K896/455 + K895/(2*404))/2 K895/(2*404)	if (K894> 0 or K896> 0) and K895= 0 if K894= 0 and K896> 0 and K895> 0 if K894> 0 and K896= 0 and K895> 0 if K894> 0 and K896> 0 and K895> 0 if K894= 0 and K896= 0 and K895> 0
Broiler_chickens_au	broil_au	K898/455 K899/(6*455) (K898+ K899/6)/(2*455)	if K898> 0 and K899= 0 if K898= 0 and K899> 0 if K898> 0 and K899> 0
Turkeys			
Turkeys_for_breeding_au	hen_au	K902/50 K903/50 (K902+ K903)/(2*50)	if K902> 0 and K903= 0 if K902= 0 and K903> 0 if K902> 0 and K903> 0
Turkeys_on_feed_au	turk_au	K900/67 K901/(2*67) (K900+ K901/2)/(2*67)	if K900> 0 and K901= 0 if K900= 0 and K901> 0 if K900> 0 and K901> 0
Ducks_au	duck_au	K904/244 K905/(5*244) (K904+ K905/5)/(2*244)	if K904> 0 and K905= 0 if K904= 0 and K905> 0 if K904> 0 and K905> 0
Geese_au	gees_au	K906/101 K907/(2*101) (K906+ K907/2)/(2*101)	if K906> 0 and K907= 0 if K906= 0 and K907> 0 if K906> 0 and K907> 0
Pigeons_or_squab_au	pigen_au	K908/435 K909/(3*435) (K908+ K909/3)/(2*435)	if K908> 0 and K909= 0 if K908= 0 and K909> 0 if K908> 0 and K909> 0
Pheasants_au	pheas_au	K910/357 K911/(4*357) (K910+ K911/4)/(2*357)	if K910> 0 and K911= 0 if K910= 0 and K911> 0 if K910> 0 and K911> 0
Quail_au	quail_au	K912/4760 K913/(5*4760) (K912+ K913/5)/(2*4760)	if K912> 0 and K913= 0 if K912= 0 and K913> 0 if K912> 0 and K913> 0
Other_poultry_au	othpl_au	K914/250 K915/(2*250) (K914+ K915/2)/(2*250)	if K914> 0 and K915= 0 if K914= 0 and K915> 0 if K914> 0 and K915> 0

Table A-6. Summary of formula used to compute the number of animal units enabling annual manure and nutrient production to be computed. Formula for beef, dairy, poultry/chickens, and turkeys adopted from Lander et al. (1998).

Long Variable Name	Short Variable Name ^a	Formula for Computing Number of Animal Units
Sheep		
Lambs_for_feed_au	lamb_au	$(K824-K826)/16.7$ if $(K824-K826) > 0$ and $K825 = 0$ $(K825/1.5)/16.7$ if $(K824-K826) = 0$ and $K825 > 0$ $(K824-K826 + K825/1.5)/(2*16.7)$ if $(K824-K826) > 0$ and $K825 > 0$
Ewes_for_breeding_au	ewes_au	$K826/16.7$
Goats		
Milk_goats_au	mgoat_au	$K843/7.6$ if $K843 > 0$ and $K844 = 0$ $K844/7.6$ if $K843 = 0$ and $K844 > 0$ $(K843 + K844)/(2*7.6)$ if $K843 > 0$ and $K844 > 0$
Angora_goats_au	agoat_au	$K847/10$ if $K847 > 0$ and $K848 = 0$ $K848/10$ if $K847 = 0$ and $K848 > 0$ $(K847 + K848)/(2*10)$ if $K847 > 0$ and $K848 > 0$
Other_goats_au	ogoaat_au	$K851/8$ if $K851 > 0$ and $K852 = 0$ $K852/8$ if $K851 = 0$ and $K852 > 0$ $(K851 + K852)/(2*8)$ if $K851 > 0$ and $K852 > 0$
Horses_au	Hors_au	$K830/1$ if $K830 > 0$ and $K831 = 0$ $K831/1$ if $K830 = 0$ and $K831 > 0$ $(K830 + K831)/(2*1)$ if $K830 > 0$ and $K831 > 0$
Mules_burros_donkeys_au	mule_au	$K833/1.7$ if $K833 > 0$ and $K834 = 0$ $K834/1.7$ if $K833 = 0$ and $K834 > 0$ $(K833 + K834)/(2*1.7)$ if $K833 > 0$ and $K834 > 0$
Mink_au	mink_au	$K836/200$ if $K836 > 0$ and $K837 = 0$ $K837/(2*200)$ if $K836 = 0$ and $K837 > 0$ $(K836 + K837/2)/(2*200)$ if $K836 > 0$ and $K837 > 0$
Rabbits_au	rabb_au	$K854/154$ if $K854 > 0$ and $K855 = 0$ $K855/(2.5*154)$ if $K854 = 0$ and $K855 > 0$ $(K854 + K855/2.5)/(2*154)$ if $K854 > 0$ and $K855 > 0$

^aVariable name presented has been adjusted from that used by Lander et al. (1998). In general the suffix "inv" was replaced by "_au".

A.3.2 Beef Operations.

a. Using the definitions provided in Table A-6, the number of beef animal units for each operation can be computed as

$$\text{Beef_au} = \text{Beef_young_calves_au} + \text{Beef_grass_fed_cattle_au} + \text{Beef_calves_for_breeding_herd_au} + \text{Beef_cattle_on_feed_au} + \text{Beef_breeding_herd_au} \quad [2.1]$$

b. An analysis of Beef_cattle_on_feed_au would provide a distribution of beef operations that grow out cattle for slaughter.

c. An analysis of Beef_cattle_on_feed_au when $\text{Beef_cattle_on_feed_au} > 0.95 * \text{Beef_au}$ and $(\text{Beef_au} - \text{Beef_cattle_on_feed_au}) < 25$ would provide a distribution of beef operations that grow out cattle for slaughter when this is their primary beef activity. The selection of 95 percent and 25 animal units is heuristic.

A.3.3 Dairy Operations

Using the definitions provided in Table A-6, the number of dairy animal units for each operation can be computed as

$$\text{Dairy_au} = \text{Dairy_young_calves_au} + \text{Dairy_grass_fed_cattle_au} + \text{Dairy_calves_for_breeding_herd_au} + \text{Dairy_breeding_herd_au} \quad [3.1]$$

A.3.4 Swine Operations

a. Using the definitions provided in Table A-6, the number of swine animal units for each operation can be computed as

$$\text{Swine_au} = \text{Hogs_for_breeding_au} + \text{Hogs_on_feed_au} \quad [4.1]$$

b. An analysis of Hogs_on_feed_au would provide a distribution of swine operations that grow out swine for slaughter.

c. An analysis of Hogs_on_feed_au when $\text{Hogs_for_breeding_au} < 0.05 * \text{Swine_au}$ and $\text{Hogs_for_breeding_au} < 25$ would provide a distribution of swine operations that grow out pigs for slaughter when this is their primary swine activity. The selection of 5 percent and 25 animal units is heuristic.

d. An analysis of Hogs_for_breeding_au when $\text{Hogs_on_feed_au} < 0.05 * \text{Swine_au}$ and $\text{Hogs_on_feed_au} < 25$ would provide a distribution of swine operations that primarily do farrowing when this is their primary swine activity. The selection of 5 percent and 25 animal units is heuristic.

e. An analysis of Swine_au when an operation was not included in either c or d would provide a distribution of integrated operations (e.g., those that have both farrowing and grow-out activities).

A.3.5 Sheep and Lamb Operations

a. Using the definitions provided in Table A-6, the number of sheep animal units for each operation can be computed as

$$\text{Sheep_au} = \text{Lambs_for_feed_au} + \text{Ewes_for_breeding_au} \quad [5.1]$$

b. An analysis Lambs_for_feed_au would provide a distribution of operations that grow out sheep for slaughter.

A.3.6 Poultry Operations

a. Using the definitions provided in Table A-6, the number of chicken animal units for each operation can be computed as

$$\text{Chicken_au} = \text{Hens_layers_au} + \text{Pullets_au} + \text{Broiler_chickens_au} \quad [6.1]$$

- b. An analysis of (Hens_layers_au + Pullets_au) would provide a distribution of layer operations.
- c. An analysis of Broiler_chickens_au would provide a distribution of broiler operations.

A.3.7 Turkey Operations

- a. Using the definitions provided in Table A-6, the number of turkey animal units for each operation can be computed as

$$\text{Turkey_au} = \text{Turkeys_for_breeding_au} + \text{Turkeys_on_feed_au} \quad [7.1]$$

- b. An analysis of Turkeys_for_breeding_au would provide a distribution of operation breeding stock.
- c. An analysis of Turkeys_on_feed would provide a distribution of turkeys being grown for slaughter.

A.3.8 Goat Operations

- a. Using the definitions provided in Table A-6, the number of goat animal units for each operation can be computed as

$$\text{Goat_au} = \text{Milk_goats_au} + \text{Angora_goats_au} + \text{Other_goats_au} \quad [8.1]$$

- b. An analysis of Milk_goats_au would provide a distribution of milk goats.
- c. An analysis of Angora_goats_au would provide a distribution of Angora goats.
- d. An analysis of Other_goats_au would provide a distribution of other goats

A.3.9 Other Animal Operations

Using the definitions provided in Table A-6, the number of animal units for different operations could be estimated using the following variables:

- | | | | |
|-----------------------------|----------------------|-------------------------|------------------|
| (a) Ducks_au | (b) Geese_au | (c) Pigeons_or_squab_au | (d) Pheasants_au |
| (e) Quail_au | (f) Other_poultry_au | (g) Horses_au | |
| (h) Mules_burros_donkeys_au | (i) Mink_au | (j) Rabbits_au | |

A.3.10 All Operations

Using the definitions provided in Table A-6, the total number of animal units could be estimated using the following formula:

$$\text{Total_au} = \text{Beef_au} + \text{Dairy_au} + \text{Swine_au} + \text{Sheep_au} + \text{Chicken_au} + \text{Turkey_au} + \text{Goat_au} + \text{Ducks_au} + \text{Geese_au} + \text{Pigeons_or_squab_au} + \text{Pheasants_au} + \text{Quail_au} + \text{Other_poultry_au} + \text{Horses_au} + \text{Mules_burros_donkeys_au} + \text{Mink_au} + \text{Rabbits_au} \quad [10.1]$$

A.3.11 Space Allocation

For beef cattle; dairy cattle; swine; sheep and lambs; horses and ponies; goats; and mules, burros, and donkeys, some proportion of farms might substantially use open pastureland for their operations. These types of operations would generally not fall under the traditional definition of an animal feedlot operation. For each animal type, the space allocation can be computed to determine areas of the country where animals might be largely grazed.

a. For those operations where $\text{Beef_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Beef_au} < 25$, space allocation can be computed as

$$\text{Beef_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Beef_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.1]$$

b. For those operations where $\text{Dairy_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Dairy_au} < 25$, space allocation can be computed as

$$\text{Dairy_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Dairy_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.2]$$

c. For those operations where $\text{Swine_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Swine_au} < 25$, space allocation can be computed as

$$\text{Swine_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Swine_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.3]$$

d. For those operations where $\text{Sheep_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Sheep_au} < 25$, space allocation can be computed as

$$\text{Sheep_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Sheep_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.4]$$

e. For those operations where $\text{Horses_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Horses_au} < 25$, space allocation can be computed as

$$\text{Horses_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Horses_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.5]$$

f. For those operations where $\text{Goat_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Goat_au} < 25$, space allocation can be computed as

$$\text{Goat_density} = \frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Goat_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.6]$$

g. For those operations where $\text{Mules_burros_donkeys_au} > 0.95 * \text{Total_au}$ and $\text{Total_au} - \text{Mules_burros_donkeys_au} < 25$, space allocation can be computed as

Mules_burros_donkeys_density =

$$\frac{\text{Total_pasture_and_rangeland (acres)}}{\text{Mules_burros_donkeys_au}} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} \times \frac{1 \text{ AU}}{1000 \text{ lb}} \quad [11.7]$$

The screening algorithm of 95 percent and 25 animal units is used to consider only those operations that are primarily single-animal operations, but is heuristically chosen.

A.4 Procedure for Estimating Manure and Nutrient Production Using the Census of Agriculture Summary Data

The general approach for estimating animal units from the raw Census of Agriculture data is described in Section A.3. Manure and nutrient production can also be estimated from the Census of Agriculture summary data. The calculations for beef, dairy, swine, broilers, layers, and turkeys were provided by Lander et al. (1998) and were extended to accommodate additional animal sectors. Figure A-1 provides a selected section of code that was used to estimate the manure and nutrient production as excreted. Figure A-2 provides a selected section of code that was used to estimate recoverable manure and nutrient production after losses using the assumptions documented by Lander et al. (1998). Note that for horses, sheep, goats, and ducks all manure is assumed to be recoverable. Section 2.2 describes the approach and documents the source of coefficients. Table A-7 presents state-level results of manure and nutrient production as excreted. Table A-8 presents state-level results of recoverable manure and nutrient production after losses (values for horses, sheep, goats, and ducks assume 100 percent recoverable).

Exhibit A-1. Selected SAS code used to estimate manure and nutrient production as excreted.

```
/*----< DO MANURE CALCULATIONS USING LANDER ET AL., 1998 >----*/
/*----< Accounts for manure as excreted >----*/

DATA MANURE ; SET FILE1;
  *** MANURE CALCULATIONS FOR BEEF ;
  * A1. Young calves ;
  calfb_au=(d_140020*0.9*5)/(12*4) ;
  calfb_n = calfb_au*10.59*10.98 ;
  calfb_p = calfb_au*10.59*3.37 ;
  calfb_k = calfb_au*10.59*7.87 ;

  * A2. Grass-Fed Cattle ;
  grssb_au= 0.9*(d_140020)*(100/365)/1.82 ;
  grssb_n = grssb_au*12.05*6.06 ;
  grssb_p = grssb_au*12.05*1.30 ;
  grssb_k = grssb_au*12.05*5.03 ;

  * A3. Calves Raised for Breeding Herd ;
  heifb_au=(d_140020*0.15*5)/(12*1.14) ;
  heifb_n = heifb_au*12.05*6.06 ;
  heifb_p = heifb_au*12.05*1.30 ;
  heifb_k = heifb_au*12.05*5.03 ;

  * A4. Cattle on Feed ;
  beef_au=(d_140137)/(2.5*1.14) ;
  beef_n = beef_au*10.59*10.98 ;
  beef_p = beef_au*10.59*3.37 ;
  beef_k = beef_au*10.59*7.87 ;

  * A5. Breeding herd ;
  cow_au= d_140020 ;
  cow_n = cow_au*11.5*10.95 ;
  cow_p = cow_au*11.5*3.79 ;
  cow_k = cow_au*11.5*8.25 ;

  *** MANURE CALCULATIONS FOR DAIRY ;
  * A1. Young calves ;
  calfd_au=(d_140036*0.45*5)/(12*4) ;
  calfd_n = calfd_au*10.59*10.98 ;
  calfd_p = calfd_au*10.59*3.37 ;
  calfd_k = calfd_au*10.59*7.87 ;
```

Exhibit A-1. Continued

* A2. Grass-Fed Cattle	;
grssd_au= $0.45*(d_140036)*(100/365)/1.82$;
grssd_n = grssd_au*12.05*6.06	;
grssd_p = grssd_au*12.05*1.30	;
grssd_k = grssd_au*12.05*5.03	;
* A3. Calves Raised for Breeding Herd	;
heifd_au= $(d_140036*0.2*5)/(12*0.94)$;
heifd_n = heifd_au*12.05*6.06	;
heifd_p = heifd_au*12.05*1.30	;
heifd_k = heifd_au*12.05*5.03	;
* A5. Breeding herd	;
dair_au= $d_140036/0.74$;
dair_n = dair_au*15.24*10.69	;
dair_p = dair_au*15.24*1.92	;
dair_k = dair_au*15.24*6.7	;
*** MANURE CALCULATIONS FOR SWINE	;
* B1. Hogs for breeding	;
sow_au= $d_150018/2.67$;
sow_n = sow_au*6.11*13.26	;
sow_p = sow_au*6.11*4.28	;
sow_k = sow_au*6.11*7.85	;
* B2. Hogs on Feed	;
fhog_au= $(d_150024+(d_150032-d_150049)/2)/(2*9.09)$;
fhog_n = fhog_au*14.69*11.30	;
fhog_p = fhog_au*14.69*3.29	;
fhog_k = fhog_au*14.69*7.95	;
*** MANURE CALCULATIONS FOR LAYERS	;
* C1. Hens - layers	;
layer_au= $(d_160005+d_160031)/(2*250)$;
layer_n = layer_au*11.45*26.93	;
layer_p = layer_au*11.45*9.98	;
layer_k = layer_au*11.45*10.44	;
* C2. Pullets	;
pull_au= $(d_160016/250+d_160018/455+d_160033/(2*404))/2$;
pull_n = pull_au*8.32*27.2	;
pull_p = pull_au*8.32*10.53	;
pull_k = pull_au*8.32*11.41	;

Exhibit A-1. Continued

```

*** MANURE CALCULATIONS FOR BROILERS ;
* D. Broiler Chickens ;
  broil_au=(d_160020+d_160035/6)/(2*455) ;
  broil_n = broil_au*14.97*26.83 ;
  broil_p = broil_au*14.97*7.8 ;
  broil_k = broil_au*14.97*10.49 ;

*** MANURE CALCULATIONS FOR TURKEYS ;
* E1. Turkeys for Breeding ;
  hen_au=(d_160024+d_160043-d_160045)/(2*50) ;
  hen_n = hen_au*9.12*22.41 ;
  hen_p = hen_au*9.12*13.21 ;
  hen_k = hen_au*9.12*7.60 ;

* E2. Turkeys on Feed ;
  turk_au=(d_160022-d_160024+d_160045/2)/(2*67) ;
  turk_n = turk_au*8.18*30.36 ;
  turk_p = turk_au*8.18*11.83 ;
  turk_k = turk_au*8.18*11.61 ;

/*---< DO MANURE CALCULATIONS USING TETRA TECH DEVELOPMENT >---*/
/*---< formulas for est. AU are of the general type below >---*/
/*---< ???_au= (inventory+sold/prod_cyc)/(2*animal_au) >---*/

*** MANURE CALCULATIONS FOR HORSES ;
* F. Horses: 180002 Horses and ponies-inventory (number) ;
*          180004 Horses and ponies-sales (number) ;
  hors_au= max( (d_180002+d_180004/1)/(2*1) ,
                (d_180002)/(1) ,
                (d_180004/1)/(1) ) ;
  hors_n = hors_au*9.31*11.76 ;
  hors_p = hors_au*9.31*2.78 ;
  hors_k = hors_au*9.31*9.8 ;

*** MANURE CALCULATIONS FOR SHEEP ;
* G. Sheep: 170002 Sheep and lambs inventory (number) ;
*          170019 Sheep and lambs sold, (number) ;
  sheep_au= max( (d_170002+d_170019/1.5)/(2*16.7) ,
                 (d_170002)/(16.7) ,
                 (d_170019/1.5)/(16.7) ) ;
  sheep_n = sheep_au*7.30*21.0 ;
  sheep_p = sheep_au*7.30*4.35 ;
  sheep_k = sheep_au*7.30*16.00 ;

```

Exhibit A-1. Continued

```

*** MANURE CALCULATIONS FOR GOATS ;
* H1. Milk Goats: 190002 Milk goats-inventory (number) ;
* 190004 Milk goats-sales (number) ;
mgoat_au= max( (d_190002+d_190004/1)/(2*7.6) ,
              (d_190002)/( 7.6) ,
              ( d_190004/1)/( 7.6) ) ;
mgoat_n = mgoat_au*7.48*21.95 ;
mgoat_p = mgoat_au*7.48*5.37 ;
mgoat_k = mgoat_au*7.48*15.12 ;

* H2. Angora Goats: 200002 Angora goats-inventory(number);
* 200004 Angora goats-sales (number) ;
agoat_au= max( (d_200002+d_200004/1)/(2*10) ,
              (d_200002)/( 10) ,
              ( d_200004/1)/( 10) ) ;
agoat_n = agoat_au*7.48*21.95 ;
agoat_p = agoat_au*7.48*5.37 ;
agoat_k = agoat_au*7.48*15.12 ;

*** MANURE CALCULATIONS FOR DUCKS ;
* I. Ducks: 240002 Ducks, Inventory (number) ;
* 240004 Ducks, Sales (number) ;
ducks_au= max( (d_240002+d_240004/5)/(2*244) ,
              (d_240002)/( 244) ,
              ( d_240004/5)/( 244) ) ;
ducks_n = ducks_au*20.08*27.27 ;
ducks_p = ducks_au*20.08*9.82 ;
ducks_k = ducks_au*20.08*12.91 ;

```

Exhibit A-2. Selected SAS code used to estimate recoverable manure and nutrient production after losses.

```

/*----< DO MANURE CALCULATIONS USING LANDER ET AL., 1998 >----*/
/*----< Accounts for manure losses and recoverable >----*/

DATA MANURE ; SET FILE1;
  *** MANURE CALCULATIONS FOR BEEF ;
  * A1. Young calves ;
  calfb_au=(d_140020*0.9*5)/(12*4) ;
  calfb_n = calfb_au*10.59*3.3 *R804 ;
  calfb_p = calfb_au*10.59*2.86 *R804 ;
  calfb_k = calfb_au*10.59*7.08 *R804 ;

  * A2. Grass-Fed Cattle ;
  grssb_au= 0.9*(d_140020)*(100/365)/1.82 ;
  grssb_n = grssb_au*12.05*1.82 *R804 ;
  grssb_p = grssb_au*12.05*1.1 *R804 ;
  grssb_k = grssb_au*12.05*4.53 *R804 ;

  * A3. Calves Raised for Breeding Herd ;
  heifb_au=(d_140020*0.15*5)/(12*1.14) ;
  heifb_n = heifb_au*12.05*1.82 *R804 ;
  heifb_p = heifb_au*12.05*1.1 *R804 ;
  heifb_k = heifb_au*12.05*4.53 *R804 ;

  * A4. Cattle on Feed ;
  beef_au=(d_140137)/(2.5*1.14) ;
  beef_n = beef_au*10.59*4.39 *R812 ;
  beef_p = beef_au*10.59*2.86 *R812 ;
  beef_k = beef_au*10.59*7.08 *R812 ;

  * A5. Breeding herd ;
  cow_au= d_140020 ;
  cow_n = cow_au*11.5*3.3 *R804 ;
  cow_p = cow_au*11.5*3.23 *R804 ;
  cow_k = cow_au*11.5*7.44 *R804 ;

  *** MANURE CALCULATIONS FOR DAIRY ;
  * A1. Young calves ;
  calfd_au=(d_140036*0.45*5)/(12*4) ;
  calfd_n = calfd_au*10.59*3.3 *R805 ;
  calfd_p = calfd_au*10.59*2.86 *R805 ;
  calfd_k = calfd_au*10.59*7.08 *R805 ;

```


Exhibit A-2. Continued

```

*** MANURE CALCULATIONS FOR BROILERS ;
* D. Broiler Chickens ;
  broil_au=(d_160020+d_160035/6)/(2*455) ;
  broil_n = broil_au*14.97*16.1 *R898 ;
  broil_p = broil_au*14.97*6.61 *R898 ;
  broil_k = broil_au*14.97*9.48 *R898 ;

*** MANURE CALCULATIONS FOR TURKEYS ;
* E1. Turkeys for Breeding ;
  hen_au=(d_160024+d_160043-d_160045)/(2*50) ;
  hen_n = hen_au*9.12*11.2 *R902 ;
  hen_p = hen_au*9.12*11.23 *R902 ;
  hen_k = hen_au*9.12*6.84 *R902 ;

* E2. Turkeys on Feed ;
  turk_au=(d_160022-d_160024+d_160045/2)/(2*67) ;
  turk_n = turk_au*8.18*16.18 *R900 ;
  turk_p = turk_au*8.18*10.06 *R900 ;
  turk_k = turk_au*8.18*10.44 *R900 ;

/*----< DO MANURE CALCULATIONS USING TETRA TECH DEVELOPMENT >----*/
/*----< formulas for est. AU are of the general type below >----*/
/*----< ????_au= (inventory+sold/prod_cyc)/(2*animal_au) >----*/

*** MANURE CALCULATIONS FOR HORSES ;
* F. Horses: 180002 Horses and ponies-inventory (number) ;
* 180004 Horses and ponies-sales (number) ;
  hors_au= max( (d_180002+d_180004/1)/(2*1) ,
               (d_180002 )/( 1) ,
               ( d_180004/1)/( 1) ) ;
  hors_n = hors_au*9.31*3.53 ;
  hors_p = hors_au*9.31*2.37 ;
  hors_k = hors_au*9.31*8.82 ;

*** MANURE CALCULATIONS FOR SHEEP ;
* G. Sheep: 170002 Sheep and lambs inventory (number) ;
* 170019 Sheep and lambs sold, (number) ;
  sheep_au= max( (d_170002+d_170019/1.5)/(2*16.7) ,
                (d_170002 )/( 16.7) ,
                ( d_170019/1.5)/( 16.7) ) ;
  sheep_n = sheep_au*7.30*6.30 ;
  sheep_p = sheep_au*7.30*3.70 ;
  sheep_k = sheep_au*7.30*14.40 ;

```

Exhibit A-2. Continued

```

*** MANURE CALCULATIONS FOR GOATS ;
* H1. Milk Goats: 190002 Milk goats-inventory (number) ;
* 190004 Milk goats-sales (number) ;
mgoat_au= max( (d_190002+d_190004/1)/(2*7.6) ,
              (d_190002 )/( 7.6) ,
              ( d_190004/1)/( 7.6) ) ;
mgoat_n = mgoat_au*7.48*6.59 ;
mgoat_p = mgoat_au*7.48*4.56 ;
mgoat_k = mgoat_au*7.48*13.61 ;

* H2. Angora Goats: 200002 Angora goats-inventory(number);
* 200004 Angora goats-sales (number) ;
agoat_au= max( (d_200002+d_200004/1)/(2*10) ,
              (d_200002 )/( 10) ,
              ( d_200004/1)/( 10) ) ;
agoat_n = agoat_au*7.48*6.59 ;
agoat_p = agoat_au*7.48*4.56 ;
agoat_k = agoat_au*7.48*13.61 ;

*** MANURE CALCULATIONS FOR DUCKS ;
* I. Ducks: 240002 Ducks, Inventory (number) ;
* 240004 Ducks, Sales (number) ;
ducks_au= max( (d_240002+d_240004/5)/(2*244) ,
              (d_240002 )/( 244) ,
              ( d_240004/5)/( 244) ) ;
ducks_n = ducks_au*20.08*16.36 ;
ducks_p = ducks_au*20.08*8.35 ;
ducks_k = ducks_au*20.08*11.62 ;

```

Table A-7. Estimate of manure and nutrient production as excreted.

Location	Beef			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	51,051,678	5,982,252,928	1,954,935,519	4,489,332,277
Northeast	793,453	93,022,044	30,513,652	70,002,691
Connecticut	9,461	1,109,824	365,746	838,060
Delaware	3,667	430,464	142,548	326,221
Maine	15,787	1,851,789	610,029	1,397,941
Maryland	73,590	8,630,073	2,837,469	6,505,620
Massachusetts	10,101	1,184,920	390,508	894,789
New Hampshire	5,032	590,426	194,825	446,268
New Jersey	17,288	2,027,618	667,165	1,529,342
New York	107,208	12,569,207	4,124,240	9,460,871
Pennsylvania	274,932	32,191,874	10,456,544	24,050,615
Rhode Island	1,242	145,749	48,265	110,454
Vermont	16,670	1,955,040	643,180	1,474,423
West Virginia	258,475	30,335,060	10,033,134	22,968,086
Southeast	8,182,932	960,385,726	317,702,692	727,256,253
Alabama	1,001,054	117,492,014	38,876,959	88,987,839
Florida	1,244,283	146,045,099	48,339,393	110,638,375
Georgia	779,344	91,469,629	30,264,742	69,275,799
Kentucky	1,425,287	167,270,156	55,313,972	126,631,750
Mississippi	762,957	89,548,669	29,635,064	67,830,960
North Carolina	504,021	59,152,046	19,562,563	44,784,038
South Carolina	289,747	34,006,224	11,250,021	25,752,226
Tennessee	1,287,382	151,093,379	49,983,851	114,417,889
Virginia	888,857	104,308,508	34,476,125	78,937,377
North-Central	18,423,410	2,156,935,644	699,931,832	1,610,293,686
Illinois	801,990	93,886,811	30,449,000	70,062,913
Indiana	467,619	54,789,735	17,889,197	41,090,232
Iowa	2,054,241	240,371,633	77,667,182	178,886,710
Kansas	3,567,666	416,871,078	133,183,559	307,674,191
Michigan	237,373	27,765,550	8,945,849	20,620,035
Minnesota	686,421	80,356,180	26,057,575	59,960,229
Missouri	2,505,362	293,974,936	97,081,202	222,329,168
Nebraska	3,839,324	449,057,973	144,608,344	333,365,415
North Dakota	1,115,172	130,855,653	43,221,634	98,978,464
Ohio	447,856	52,462,140	17,098,426	39,292,410
South Dakota	2,331,852	273,414,550	89,777,450	205,908,240
Wisconsin	368,533	43,129,405	13,952,414	32,125,679
South-Central	12,572,182	1,473,449,953	482,115,437	1,106,769,058
Arkansas	1,071,292	125,737,156	41,608,989	95,239,097
Louisiana	570,748	66,990,616	22,173,977	50,750,952
Oklahoma	2,568,209	301,072,435	98,717,018	226,496,482
Texas	8,361,933	979,649,746	319,615,452	734,282,526
Mountain	8,145,163	954,556,620	312,204,093	716,788,959
Arizona	474,816	55,625,187	18,142,007	41,682,932
Colorado	1,958,177	228,967,327	73,562,951	169,688,541
Idaho	980,934	114,860,753	37,316,598	85,825,592
Montana	1,986,796	233,152,812	77,060,935	176,441,134
Nevada	360,403	42,282,968	13,947,814	31,951,646
New Mexico	881,249	103,364,073	34,031,675	77,998,362
Utah	491,506	57,656,543	18,999,641	43,535,935
Wyoming	1,011,283	118,646,957	39,142,471	89,664,818
West	2,814,767	329,847,691	107,822,206	247,584,966
California	1,395,789	163,520,978	53,339,557	122,547,953
Oregon	854,746	100,279,276	33,077,168	75,774,227
Washington	564,233	66,047,437	21,405,481	49,262,786
Other	119,770	14,055,251	4,645,608	10,636,664
Alaska	4,236	497,150	164,360	376,297
Hawaii	115,534	13,558,100	4,481,248	10,260,367

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Dairy			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	14,756,164	2,249,817,525	414,454,599	1,436,773,766
Northeast	2,795,275	426,185,284	78,510,568	272,169,555
Connecticut	53,715	8,189,758	1,508,693	5,230,126
Delaware	13,461	2,052,417	378,090	1,310,710
Maine	66,440	10,129,825	1,866,086	6,469,087
Maryland	147,302	22,458,549	4,137,246	14,342,432
Massachusetts	48,047	7,325,558	1,349,492	4,678,232
New Hampshire	33,672	5,133,769	945,727	3,278,517
New Jersey	37,196	5,671,109	1,044,715	3,621,672
New York	1,121,325	170,964,286	31,494,525	109,180,855
Pennsylvania	971,894	148,181,009	27,297,459	94,631,047
Rhode Island	3,988	607,974	111,999	388,263
Vermont	261,911	39,932,657	7,356,274	25,501,710
West Virginia	36,325	5,538,374	1,020,263	3,536,905
Southeast	1,543,804	235,378,043	43,360,633	150,316,634
Alabama	70,664	10,773,827	1,984,722	6,880,359
Florida	266,889	40,691,617	7,496,087	25,986,395
Georgia	158,573	24,176,995	4,453,813	15,439,862
Kentucky	289,298	44,108,125	8,125,466	28,168,239
Mississippi	100,289	15,290,614	2,816,791	9,764,860
North Carolina	154,360	23,534,652	4,335,483	15,029,650
South Carolina	49,628	7,566,614	1,393,899	4,832,175
Tennessee	236,406	36,043,991	6,639,915	23,018,338
Virginia	217,698	33,191,607	6,114,458	21,196,755
North-Central	6,024,585	918,546,148	169,211,801	586,600,021
Illinois	235,529	35,910,308	6,615,289	22,932,966
Indiana	224,692	34,257,992	6,310,904	21,877,767
Iowa	402,530	61,372,226	11,305,806	39,193,403
Kansas	132,348	20,178,586	3,717,238	12,886,406
Michigan	492,743	75,126,668	13,839,608	47,977,236
Minnesota	946,816	144,357,526	26,593,108	92,189,302
Missouri	335,673	51,178,878	9,428,019	32,683,748
Nebraska	129,492	19,743,167	3,637,027	12,608,340
North Dakota	116,418	17,749,770	3,269,809	11,335,321
Ohio	459,665	70,083,444	12,910,561	44,756,543
South Dakota	182,596	27,839,774	5,128,559	17,778,978
Wisconsin	2,366,082	360,747,807	66,455,873	230,380,011
South-Central	976,770	148,924,563	27,434,434	95,105,893
Arkansas	100,159	15,270,941	2,813,167	9,752,296
Louisiana	122,778	18,719,448	3,448,440	11,954,574
Oklahoma	140,401	21,406,386	3,943,420	13,670,502
Texas	613,433	93,527,789	17,229,407	59,728,521
Mountain	924,621	140,973,491	25,969,711	90,028,196
Arizona	137,711	20,996,329	3,867,880	13,408,632
Colorado	127,207	19,394,738	3,572,840	12,385,827
Idaho	282,606	43,087,960	7,937,534	27,516,743
Montana	34,837	5,311,539	978,476	3,392,044
Nevada	33,843	5,159,842	950,530	3,295,167
New Mexico	171,664	26,173,000	4,821,511	16,714,546
Utah	124,943	19,049,626	3,509,265	12,165,432
Wyoming	11,809	1,800,457	331,675	1,149,804
West	2,473,182	377,076,837	69,463,958	240,808,022
California	1,941,779	296,055,780	54,538,503	189,066,523
Oregon	153,962	23,473,973	4,324,304	14,990,900
Washington	377,441	57,547,084	10,601,150	36,750,599
Other	17,926	2,733,159	503,494	1,745,444
Alaska	1,112	169,474	31,220	108,229
Hawaii	16,815	2,563,684	472,274	1,637,215

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Swine			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	7,814,778	1,076,934,658	320,192,156	734,241,003
Northeast	196,158	26,990,491	8,026,270	18,396,469
Connecticut	745	91,313	27,560	60,807
Delaware	8,884	1,162,213	347,800	784,439
Maine	686	80,905	24,551	53,410
Maryland	20,636	2,717,302	812,495	1,836,427
Massachusetts	2,237	292,387	87,508	197,313
New Hampshire	710	84,602	25,636	55,981
New Jersey	3,248	469,581	138,815	322,978
New York	11,953	1,583,558	473,131	1,071,500
Pennsylvania	142,193	19,873,950	5,898,761	13,585,523
Rhode Island	721	93,684	28,059	63,149
Vermont	606	69,787	21,249	45,815
West Virginia	3,540	471,208	140,705	319,127
Southeast	1,178,963	163,651,531	48,613,643	111,726,991
Alabama	40,099	5,565,109	1,653,183	3,799,249
Florida	16,110	2,120,898	634,185	1,433,292
Georgia	140,879	19,200,790	5,716,493	13,063,531
Kentucky	108,301	14,576,381	4,346,470	9,893,392
Mississippi	22,565	3,043,666	907,332	2,066,687
North Carolina	662,761	93,497,936	27,720,015	64,023,012
South Carolina	46,838	6,364,634	1,895,587	4,327,812
Tennessee	86,547	11,687,032	3,483,476	7,937,358
Virginia	54,863	7,595,084	2,256,902	5,182,658
North-Central	6,050,406	833,166,731	247,738,216	567,963,016
Illinois	777,882	106,936,359	31,803,612	72,874,416
Indiana	638,782	88,212,046	26,220,386	60,165,360
Iowa	1,897,841	263,407,989	78,247,994	179,828,078
Kansas	215,508	29,661,073	8,820,138	20,217,748
Michigan	178,032	23,913,993	7,132,586	16,224,835
Minnesota	632,371	87,293,690	25,948,611	59,534,763
Missouri	405,170	54,660,711	16,294,282	37,116,545
Nebraska	566,299	78,050,541	23,205,462	53,215,240
North Dakota	45,333	6,171,020	1,837,525	4,197,560
Ohio	268,080	36,906,723	10,974,368	25,157,858
South Dakota	266,353	36,479,858	10,854,313	24,842,637
Wisconsin	158,756	21,472,729	6,398,939	14,587,975
South-Central	202,028	27,553,449	8,202,582	18,748,775
Arkansas	96,832	13,356,470	3,970,675	9,107,850
Louisiana	5,422	700,967	210,090	471,986
Oklahoma	35,160	4,877,694	1,449,052	3,329,698
Texas	64,614	8,618,318	2,572,766	5,839,243
Mountain	130,311	17,857,332	5,312,959	12,162,037
Arizona	12,404	1,645,643	491,592	1,113,823
Colorado	65,037	8,944,999	2,660,148	6,096,341
Idaho	8,835	1,199,004	357,160	815,088
Montana	28,829	4,012,536	1,191,560	2,740,776
Nevada	1,549	206,535	61,658	139,928
New Mexico	3,274	440,387	131,329	298,861
Utah	5,516	747,605	222,731	508,107
Wyoming	4,867	660,622	196,780	449,114
West	52,329	7,118,173	2,119,745	4,841,153
California	36,953	5,066,732	1,507,365	3,451,142
Oregon	7,820	1,043,948	311,609	707,431
Washington	7,555	1,007,494	300,770	682,580
Other	4,583	596,951	178,741	402,563
Alaska	300	37,487	11,286	25,064
Hawaii	4,283	559,464	167,455	377,499

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Layers			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,246,034	365,941,500	136,448,094	143,468,518
Northeast	188,708	55,426,169	20,666,412	21,729,493
Connecticut	14,355	4,205,073	1,568,455	1,649,602
Delaware	2,269	662,187	247,111	260,002
Maine	20,246	5,935,091	2,213,524	2,327,862
Maryland	15,878	4,665,383	1,739,461	1,828,860
Massachusetts	1,949	588,582	218,688	229,264
New Hampshire	872	257,445	95,931	100,813
New Jersey	5,621	1,703,542	632,664	663,008
New York	15,775	4,628,599	1,726,063	1,815,049
Pennsylvania	104,472	30,682,142	11,440,387	12,028,991
Rhode Island	713	219,784	81,451	85,207
Vermont	596	181,149	67,249	70,451
West Virginia	5,964	1,697,195	635,427	670,384
Southeast	341,458	99,623,050	37,177,828	39,118,153
Alabama	56,171	16,402,673	6,120,537	6,439,366
Florida	36,030	10,612,486	3,955,584	4,157,814
Georgia	90,946	26,612,253	9,927,536	10,442,385
Kentucky	8,652	2,564,888	955,216	1,003,360
Mississippi	26,548	7,652,362	2,860,244	3,013,439
North Carolina	70,429	20,422,295	7,627,368	8,030,734
South Carolina	20,588	6,114,818	2,276,745	2,391,029
Tennessee	7,588	2,141,012	802,506	847,449
Virginia	24,505	7,100,263	2,652,091	2,792,577
North-Central	371,666	109,238,660	40,727,554	42,819,452
Illinois	14,092	4,236,157	1,574,860	1,651,818
Indiana	85,577	25,053,495	9,345,449	9,829,585
Iowa	43,406	12,793,211	4,768,009	5,011,431
Kansas	6,048	1,800,380	670,148	703,619
Michigan	18,141	5,288,654	1,973,842	2,077,028
Minnesota	48,127	14,115,456	5,264,104	5,535,727
Missouri	30,587	8,851,293	3,306,675	3,482,305
Nebraska	20,902	6,445,251	2,388,548	2,498,642
North Dakota	945	286,156	106,285	111,392
Ohio	84,523	24,616,205	9,188,520	9,669,921
South Dakota	6,316	1,925,190	714,470	748,291
Wisconsin	13,003	3,827,213	1,426,642	1,499,692
South-Central	182,946	53,402,670	19,927,787	20,966,703
Arkansas	88,827	25,725,295	9,609,484	10,119,011
Louisiana	7,299	2,103,591	786,277	828,400
Oklahoma	19,829	5,914,303	2,200,910	2,310,359
Texas	66,991	19,659,480	7,331,116	7,708,933
Mountain	30,321	9,042,922	3,365,207	3,532,584
Arizona	1,049	322,323	119,498	125,049
Colorado	13,107	3,901,735	1,452,318	1,524,849
Idaho	4,432	1,318,110	490,692	515,250
Montana	2,249	676,839	251,591	263,855
Nevada	30	9,093	3,374	3,534
New Mexico	4,238	1,263,867	470,338	493,736
Utah	5,164	1,534,865	571,421	600,053
Wyoming	53	16,089	5,974	6,259
West	128,050	38,333,359	14,258,481	14,961,738
California	104,157	31,202,909	11,605,188	12,176,662
Oregon	8,482	2,546,168	946,744	993,152
Washington	15,411	4,584,283	1,706,549	1,791,924
Other	2,885	874,669	324,826	340,396
Alaska	5	1,455	541	568
Hawaii	2,880	873,214	324,284	339,828

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Broilers			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,970,429	791,413,049	230,079,082	309,426,868
Northeast	239,198	96,072,761	27,930,210	37,562,552
Connecticut	305	122,404	35,585	47,857
Delaware	83,030	33,348,586	9,695,079	13,038,638
Maine	175	70,150	20,394	27,427
Maryland	97,477	39,151,150	11,381,997	15,307,326
Massachusetts	50	19,909	5,788	7,784
New Hampshire	20	7,931	2,306	3,101
New Jersey	45	18,021	5,239	7,046
New York	471	189,079	54,969	73,926
Pennsylvania	39,549	15,884,657	4,617,977	6,210,587
Rhode Island	0	0	0	0
Vermont	8	3,178	924	1,243
West Virginia	18,070	7,257,696	2,109,953	2,837,616
Southeast	1,057,628	424,791,181	123,495,014	166,084,961
Alabama	260,512	104,633,530	30,418,991	40,909,643
Florida	34,937	14,032,226	4,079,440	5,486,323
Georgia	276,199	110,933,901	32,250,631	43,372,964
Kentucky	10,043	4,033,836	1,172,714	1,577,150
Mississippi	139,315	55,955,356	16,267,304	21,877,439
North Carolina	188,946	75,889,083	22,062,424	29,671,132
South Carolina	37,527	15,072,558	4,381,884	5,893,072
Tennessee	36,164	14,525,207	4,222,759	5,679,069
Virginia	73,984	29,715,483	8,638,866	11,618,167
North-Central	69,076	27,744,186	8,065,772	10,847,429
Illinois	46	18,429	5,358	7,205
Indiana	7,062	2,836,444	824,609	1,108,993
Iowa	3,607	1,448,804	421,195	566,454
Kansas	37	14,933	4,341	5,838
Michigan	121	48,732	14,167	19,053
Minnesota	13,029	5,233,126	1,521,371	2,046,049
Missouri	30,020	12,057,377	3,505,313	4,714,196
Nebraska	701	281,455	81,824	110,043
North Dakota	39	15,531	4,515	6,072
Ohio	9,053	3,636,212	1,057,117	1,421,687
South Dakota	83	33,395	9,709	13,057
Wisconsin	5,278	2,119,747	616,251	828,779
South-Central	507,569	203,862,469	59,266,763	79,706,198
Arkansas	310,710	124,795,343	36,280,420	48,792,514
Louisiana	41,971	16,857,609	4,900,833	6,590,992
Oklahoma	49,436	19,855,799	5,772,465	7,763,225
Texas	105,451	42,353,717	12,313,045	16,559,467
Mountain	129	51,686	15,026	20,208
Arizona	10	3,999	1,163	1,564
Colorado	14	5,666	1,647	2,215
Idaho	18	7,179	2,087	2,807
Montana	74	29,642	8,617	11,589
Nevada	0	15	4	6
New Mexico	3	1,211	352	473
Utah	7	2,862	832	1,119
Wyoming	3	1,113	324	435
West	96,608	38,802,310	11,280,582	15,170,937
California	78,566	31,555,604	9,173,824	12,337,618
Oregon	6,062	2,434,876	707,866	951,988
Washington	11,980	4,811,830	1,398,892	1,881,330
Other	220	88,455	25,716	34,584
Alaska	0	83	24	33
Hawaii	220	88,372	25,691	34,552

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Turkeys			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,836,468	443,821,162	184,322,262	167,256,479
Northeast	108,078	24,887,416	11,511,697	9,124,305
Connecticut	138	34,232	13,374	13,083
Delaware	14	3,389	1,331	1,294
Maine	91	19,459	10,568	6,795
Maryland	624	154,969	60,477	59,242
Massachusetts	1,123	237,311	131,059	82,393
New Hampshire	142	29,897	16,726	10,333
New Jersey	580	143,925	56,219	55,008
New York	1	98	248	-8
Pennsylvania	49,302	12,207,590	4,790,561	4,661,000
Rhode Island	8	1,868	751	709
Vermont	76	18,904	7,383	7,226
West Virginia	55,977	12,035,776	6,422,999	4,227,230
Southeast	525,201	128,806,235	51,699,503	48,930,056
Alabama	2	159	404	-13
Florida	20	4,516	2,115	1,650
Georgia	15,600	3,856,648	1,519,098	1,471,289
Kentucky	16	3,495	1,710	1,261
Mississippi	9	2,009	1,096	700
North Carolina	357,607	87,636,762	35,237,940	33,277,268
South Carolina	31,829	7,698,592	3,191,162	2,902,583
Tennessee	27	5,894	3,005	2,101
Virginia	120,091	29,598,160	11,742,973	11,273,217
North-Central	762,162	182,224,020	77,558,021	68,265,165
Illinois	35,918	7,663,664	4,153,132	2,677,927
Indiana	80,492	19,808,227	7,887,026	7,538,368
Iowa	58,831	14,563,386	5,718,470	5,559,727
Kansas	8,440	1,810,945	970,553	635,150
Michigan	42,125	10,421,662	4,097,889	3,977,343
Minnesota	254,943	62,458,282	25,132,058	23,712,611
Missouri	113,517	27,600,940	11,303,429	10,436,103
Nebraska	25,737	5,427,573	3,010,258	1,881,639
North Dakota	8,939	2,219,860	865,165	848,860
Ohio	40,678	9,805,546	4,096,315	3,690,077
South Dakota	18,601	4,618,776	1,800,438	1,766,120
Wisconsin	73,940	15,825,160	8,523,286	5,541,242
South-Central	224,411	54,767,619	22,235,811	20,749,854
Arkansas	135,992	33,627,101	13,238,370	12,830,067
Louisiana	7	1,566	806	557
Oklahoma	18,906	4,024,023	2,191,469	1,403,793
Texas	69,506	17,114,930	6,805,166	6,515,438
Mountain	38,580	9,559,522	3,745,050	3,651,311
Arizona	5	1,102	510	404
Colorado	17,123	4,252,149	1,657,167	1,626,007
Idaho	50	10,877	5,662	3,851
Montana	152	33,127	17,174	11,744
Nevada	5	1,238	573	454
New Mexico	23	5,001	2,574	1,777
Utah	21,215	5,254,520	2,060,634	2,006,534
Wyoming	7	1,508	757	540
West	178,033	43,575,900	17,571,977	16,535,621
California	171,190	41,899,650	16,897,392	15,899,244
Oregon	6,484	1,600,323	632,756	609,994
Washington	359	75,927	41,830	26,384
Other	2	450	202	166
Alaska	1	343	141	129
Hawaii	1	107	61	37

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Horses			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	2,049,522	224,393,146	53,045,319	186,994,288
Northeast	198,415	21,723,585	5,135,337	18,102,988
Connecticut	5,794	634,360	149,959	528,633
Delaware	2,672	292,546	69,156	243,788
Maine	5,745	628,995	148,691	524,162
Maryland	24,326	2,663,347	629,601	2,219,456
Massachusetts	9,017	987,232	233,376	822,693
New Hampshire	4,243	464,547	109,816	387,123
New Jersey	23,867	2,613,093	617,721	2,177,577
New York	43,278	4,738,318	1,120,113	3,948,598
Pennsylvania	58,024	6,352,792	1,501,766	5,293,994
Rhode Island	1,015	111,128	26,270	92,607
Vermont	7,827	856,944	202,577	714,120
West Virginia	12,607	1,380,285	326,292	1,150,237
Southeast	370,878	40,605,800	9,598,990	33,838,167
Alabama	29,741	3,256,211	769,751	2,713,509
Florida	52,001	5,693,361	1,345,879	4,744,467
Georgia	31,087	3,403,579	804,588	2,836,316
Kentucky	78,083	8,548,964	2,020,929	7,124,137
Mississippi	25,015	2,738,782	647,433	2,282,319
North Carolina	30,492	3,338,435	789,188	2,782,029
South Carolina	19,402	2,124,240	502,159	1,770,200
Tennessee	61,080	6,687,380	1,580,860	5,572,817
Virginia	43,977	4,814,848	1,138,204	4,012,374
North-Central	560,233	61,337,446	14,499,838	51,114,538
Illinois	46,088	5,045,972	1,192,840	4,204,977
Indiana	48,112	5,267,571	1,245,225	4,389,643
Iowa	47,681	5,220,383	1,234,070	4,350,319
Kansas	42,878	4,694,524	1,109,760	3,912,103
Michigan	53,991	5,911,237	1,397,384	4,926,031
Minnesota	43,155	4,724,851	1,116,929	3,937,376
Missouri	64,628	7,075,835	1,672,689	5,896,529
Nebraska	35,757	3,914,877	925,456	3,262,397
North Dakota	24,914	2,727,724	644,819	2,273,104
Ohio	71,989	7,881,759	1,863,205	6,568,132
South Dakota	37,475	4,102,973	969,920	3,419,144
Wisconsin	43,565	4,769,740	1,127,541	3,974,783
South-Central	336,607	36,853,619	8,711,995	30,711,349
Arkansas	29,563	3,236,723	765,144	2,697,269
Louisiana	27,978	3,063,188	724,121	2,552,657
Oklahoma	70,006	7,664,649	1,811,881	6,387,207
Texas	209,060	22,889,060	5,410,849	19,074,216
Mountain	349,963	38,315,909	9,057,672	31,929,924
Arizona	48,371	5,295,928	1,251,929	4,413,273
Colorado	69,381	7,596,220	1,795,705	6,330,184
Idaho	45,621	4,994,843	1,180,754	4,162,369
Montana	56,364	6,171,046	1,458,802	5,142,539
Nevada	13,347	1,461,304	345,444	1,217,754
New Mexico	41,430	4,535,988	1,072,283	3,779,990
Utah	34,778	3,807,690	900,117	3,173,075
Wyoming	40,671	4,452,889	1,052,639	3,710,741
West	227,906	24,952,425	5,898,618	20,793,688
California	124,919	13,676,832	3,233,129	11,397,360
Oregon	51,891	5,681,317	1,343,032	4,734,431
Washington	51,096	5,594,276	1,322,456	4,661,897
Other	5,520	604,361	142,868	503,634
Alaska	1,604	175,615	41,514	146,346
Hawaii	3,916	428,746	101,353	357,288

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Sheep			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	673,154	103,194,531	21,376,010	78,624,405
Northeast	20,347	3,119,214	646,123	2,376,544
Connecticut	449	68,856	14,263	52,462
Delaware	111	17,037	3,529	12,981
Maine	751	115,122	23,847	87,712
Maryland	1,514	232,162	48,091	176,886
Massachusetts	679	104,106	21,565	79,319
New Hampshire	482	73,914	15,311	56,316
New Jersey	773	118,436	24,533	90,237
New York	4,592	703,913	145,811	536,315
Pennsylvania	6,469	991,768	205,438	755,633
Rhode Island	81	12,438	2,577	9,477
Vermont	1,027	157,385	32,601	119,912
West Virginia	3,419	524,075	108,558	399,295
Southeast	13,753	2,108,352	436,730	1,606,364
Alabama	660	101,123	20,947	77,046
Florida	447	68,526	14,195	52,210
Georgia	493	75,613	15,663	57,610
Kentucky	2,259	346,339	71,742	263,877
Mississippi	386	59,181	12,259	45,090
North Carolina	1,170	179,425	37,167	136,705
South Carolina	188	28,861	5,978	21,989
Tennessee	1,101	168,713	34,948	128,543
Virginia	7,049	1,080,572	223,833	823,293
North-Central	151,345	23,201,257	4,805,975	17,677,148
Illinois	6,605	1,012,533	209,739	771,454
Indiana	4,334	664,477	137,642	506,269
Iowa	24,273	3,721,004	770,779	2,835,051
Kansas	12,369	1,896,202	392,785	1,444,725
Michigan	5,834	894,400	185,269	681,448
Minnesota	13,280	2,035,833	421,708	1,551,111
Missouri	6,668	1,022,263	211,755	778,867
Nebraska	9,088	1,393,258	288,604	1,061,530
North Dakota	13,008	1,994,185	413,081	1,519,379
Ohio	11,164	1,711,489	354,523	1,303,992
South Dakota	39,633	6,075,747	1,258,548	4,629,141
Wisconsin	5,087	779,866	161,544	594,183
South-Central	140,644	21,560,736	4,466,153	16,427,228
Arkansas	719	110,211	22,829	83,970
Louisiana	554	84,857	17,577	64,653
Oklahoma	6,212	952,222	197,246	725,503
Texas	133,160	20,413,446	4,228,500	15,553,102
Mountain	266,732	40,890,052	8,470,082	31,154,325
Arizona	14,794	2,267,995	469,799	1,727,997
Colorado	71,949	11,029,846	2,284,754	8,403,692
Idaho	20,819	3,191,559	661,109	2,431,664
Montana	37,986	5,823,206	1,206,236	4,436,728
Nevada	7,317	1,121,642	232,340	854,584
New Mexico	27,587	4,229,060	876,020	3,222,141
Utah	31,122	4,771,072	988,294	3,635,103
Wyoming	55,158	8,455,670	1,751,532	6,442,415
West	78,825	12,083,859	2,503,085	9,206,750
California	51,487	7,892,976	1,634,974	6,013,696
Oregon	23,530	3,607,204	747,207	2,748,346
Washington	3,807	583,678	120,905	444,707
Other	1,507	231,061	47,863	176,046
Alaska	134	20,498	4,246	15,618
Hawaii	1,374	210,563	43,617	160,429

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Goats			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	194,064	31,862,542	7,795,073	21,948,138
Northeast	2,271	372,945	91,240	256,899
Connecticut	71	11,731	2,870	8,081
Delaware	31	5,012	1,226	3,452
Maine	73	11,968	2,928	8,244
Maryland	340	55,814	13,655	38,447
Massachusetts	184	30,245	7,399	20,834
New Hampshire	105	17,304	4,233	11,920
New Jersey	86	14,046	3,436	9,675
New York	756	124,133	30,369	85,508
Pennsylvania	389	63,860	15,623	43,989
Rhode Island	0	0	0	0
Vermont	57	9,326	2,282	6,424
West Virginia	180	29,507	7,219	20,325
Southeast	1,969	323,296	79,093	222,699
Alabama	183	30,094	7,362	20,730
Florida	0	0	0	0
Georgia	226	37,045	9,063	25,518
Kentucky	277	45,410	11,110	31,280
Mississippi	0	0	0	0
North Carolina	273	44,814	10,964	30,870
South Carolina	150	24,650	6,030	16,980
Tennessee	415	68,137	16,670	46,936
Virginia	446	73,147	17,895	50,386
North-Central	12,118	1,989,595	486,748	1,370,509
Illinois	537	88,207	21,580	60,760
Indiana	427	70,146	17,161	48,319
Iowa	389	63,838	15,618	43,974
Kansas	1,237	203,123	49,693	139,919
Michigan	1,252	205,614	50,303	141,635
Minnesota	901	147,855	36,172	101,848
Missouri	2,396	393,363	96,235	270,963
Nebraska	618	101,541	24,842	69,946
North Dakota	1,248	204,888	50,125	141,135
Ohio	1,365	224,148	54,837	154,402
South Dakota	630	103,486	25,318	71,285
Wisconsin	1,117	183,385	44,864	126,322
South-Central	157,526	25,863,594	6,327,449	17,815,833
Arkansas	1,033	169,650	41,504	116,861
Louisiana	20	3,305	809	2,277
Oklahoma	5,126	841,625	205,901	579,744
Texas	151,347	24,849,014	6,079,235	17,116,952
Mountain	16,340	2,682,852	656,352	1,848,051
Arizona	7,507	1,232,619	301,556	849,075
Colorado	793	130,228	31,860	89,706
Idaho	334	54,825	13,413	37,766
Montana	1,040	170,724	41,767	117,601
Nevada	41	6,713	1,642	4,625
New Mexico	6,431	1,055,942	258,333	727,374
Utah	111	18,233	4,461	12,560
Wyoming	83	13,567	3,319	9,345
West	3,836	629,871	154,096	433,879
California	2,499	410,348	100,390	282,664
Oregon	746	122,436	29,954	84,339
Washington	591	97,087	23,752	66,877
Other	2	389	95	268
Alaska	0	0	0	0
Hawaii	2	389	95	268

Table A-7. Estimate of manure and nutrient production as excreted (continued).

Location	Ducks			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	15,059	8,245,887	2,969,366	3,903,719
Northeast	2,965	1,623,764	584,722	768,713
Connecticut	77	42,431	15,279	20,087
Delaware	13	6,941	2,500	3,286
Maine	16	8,674	3,124	4,107
Maryland	134	73,223	26,368	34,665
Massachusetts	26	14,403	5,187	6,819
New Hampshire	5	2,776	1,000	1,314
New Jersey	43	23,467	8,451	11,110
New York	2,014	1,102,924	397,166	522,139
Pennsylvania	626	343,035	123,528	162,398
Rhode Island	0	224	81	106
Vermont	4	2,112	760	1,000
West Virginia	6	3,553	1,279	1,682
Southeast	199	109,011	39,255	51,608
Alabama	0	0	0	0
Florida	50	27,491	9,900	13,015
Georgia	11	5,992	2,158	2,837
Kentucky	25	13,694	4,931	6,483
Mississippi	12	6,647	2,394	3,147
North Carolina	28	15,285	5,504	7,236
South Carolina	10	5,543	1,996	2,624
Tennessee	33	17,949	6,463	8,497
Virginia	30	16,409	5,909	7,768
North-Central	8,498	4,653,351	1,675,684	2,202,962
Illinois	84	45,793	16,490	21,679
Indiana	4,796	2,626,044	945,646	1,243,206
Iowa	37	20,471	7,372	9,691
Kansas	26	13,977	5,033	6,617
Michigan	303	165,989	59,773	78,582
Minnesota	98	53,436	19,243	25,298
Missouri	43	23,483	8,456	11,117
Nebraska	18	9,771	3,519	4,626
North Dakota	7	3,723	1,341	1,763
Ohio	184	100,854	36,318	47,746
South Dakota	55	29,854	10,751	14,134
Wisconsin	2,849	1,559,955	561,744	738,504
South-Central	185	101,197	36,441	47,908
Arkansas	30	16,169	5,823	7,655
Louisiana	20	10,725	3,862	5,077
Oklahoma	26	14,381	5,179	6,808
Texas	109	59,922	21,578	28,368
Mountain	102	55,916	20,136	26,471
Arizona	4	2,202	793	1,042
Colorado	23	12,848	4,627	6,082
Idaho	14	7,561	2,723	3,579
Montana	31	17,018	6,128	8,056
Nevada	2	1,225	441	580
New Mexico	16	8,757	3,153	4,146
Utah	8	4,484	1,615	2,123
Wyoming	3	1,822	656	863
West	3,105	1,700,432	612,330	805,008
California	3,039	1,664,325	599,328	787,915
Oregon	35	18,927	6,816	8,961
Washington	31	17,179	6,186	8,133
Other	4	2,216	798	1,049
Alaska	1	297	107	141
Hawaii	4	1,919	691	908

Table A-8. Estimate of recoverable manure and nutrient production after losses.

Location	Beef			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	51,051,678	426,668,482	301,120,636	741,402,701
Northeast	793,453	5,348,436	3,836,900	9,437,007
Connecticut	9,461	56,087	45,433	110,922
Delaware	3,667	12,966	12,140	29,410
Maine	15,787	96,582	77,677	189,723
Maryland	73,590	520,528	405,930	993,264
Massachusetts	10,101	59,714	48,402	118,167
New Hampshire	5,032	26,668	22,193	54,100
New Jersey	17,288	115,816	91,330	223,327
New York	107,208	865,122	657,960	1,612,380
Pennsylvania	274,932	3,216,884	2,197,737	5,422,803
Rhode Island	1,242	4,390	4,110	9,958
Vermont	16,670	170,117	141,373	344,658
West Virginia	258,475	203,561	132,616	328,295
Southeast	8,182,932	18,139,075	15,896,635	38,642,708
Alabama	1,001,054	353,201	230,103	569,627
Florida	1,244,283	0	0	0
Georgia	779,344	315,215	205,357	508,365
Kentucky	1,425,287	4,998,396	4,424,543	10,749,802
Mississippi	762,957	2,909,088	2,656,677	6,444,176
North Carolina	504,021	317,637	206,935	512,272
South Carolina	289,747	147,281	95,950	237,528
Tennessee	1,287,382	5,116,636	4,611,565	11,193,643
Virginia	888,857	3,981,620	3,465,505	8,427,295
North-Central	18,423,410	221,850,879	155,718,012	383,537,334
Illinois	801,990	8,383,418	6,039,857	14,851,204
Indiana	467,619	4,483,165	3,300,620	8,104,659
Iowa	2,054,241	24,923,732	17,615,315	43,367,377
Kansas	3,567,666	63,447,410	42,261,837	104,458,903
Michigan	237,373	3,515,827	2,415,095	5,956,947
Minnesota	686,421	10,804,721	7,779,691	19,129,948
Missouri	2,505,362	11,181,642	9,711,348	23,618,435
Nebraska	3,839,324	67,851,973	46,197,503	114,016,228
North Dakota	1,115,172	1,560,836	1,016,854	2,517,248
Ohio	447,856	4,409,137	3,225,347	7,923,026
South Dakota	2,331,852	16,740,317	12,981,017	31,773,776
Wisconsin	368,533	4,548,700	3,173,528	7,819,583
South-Central	12,572,182	96,147,000	67,059,237	165,237,482
Arkansas	1,071,292	3,990,117	3,667,881	8,894,032
Louisiana	570,748	131,973	85,978	212,841
Oklahoma	2,568,209	12,980,440	8,456,506	20,934,287
Texas	8,361,933	79,044,469	54,848,872	135,196,323
Mountain	8,145,163	60,888,806	41,519,383	102,460,093
Arizona	474,816	4,568,336	3,165,506	7,803,346
Colorado	1,958,177	33,739,286	22,562,557	55,752,885
Idaho	980,934	10,093,395	6,575,652	16,278,187
Montana	1,986,796	2,756,049	1,990,293	4,893,128
Nevada	360,403	1,363,497	1,060,058	2,594,312
New Mexico	881,249	2,605,782	1,697,616	4,202,490
Utah	491,506	2,119,707	1,611,727	3,949,714
Wyoming	1,011,283	3,642,753	2,855,975	6,986,031
West	2,814,767	23,828,609	16,689,596	41,112,672
California	1,395,789	13,327,306	9,240,384	22,777,723
Oregon	854,746	3,257,767	2,529,419	6,190,813
Washington	564,233	7,243,536	4,919,794	12,144,136
Other	119,770	465,678	400,872	975,405
Alaska	4,236	15,962	13,859	33,705
Hawaii	115,534	449,717	387,013	941,700

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Dairy			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	14,756,164	700,185,629	278,166,648	1,009,863,197
Northeast	2,795,275	134,649,144	53,501,070	194,243,379
Connecticut	53,715	2,870,365	1,140,496	4,140,725
Delaware	13,461	639,553	254,146	922,754
Maine	66,440	3,156,549	1,254,352	4,554,306
Maryland	147,302	6,998,296	2,780,990	10,097,224
Massachusetts	48,047	2,282,713	907,107	3,293,525
New Hampshire	33,672	1,599,731	635,703	2,308,110
New Jersey	37,196	1,767,171	702,240	2,549,695
New York	1,121,325	53,274,090	21,170,107	76,864,478
Pennsylvania	971,894	46,128,168	18,320,841	66,505,675
Rhode Island	3,988	189,451	75,284	273,341
Vermont	261,911	14,020,718	5,576,100	20,252,167
West Virginia	36,325	1,722,338	683,706	2,481,378
Southeast	1,543,804	55,125,188	21,898,448	79,498,621
Alabama	70,664	1,675,237	665,008	2,413,519
Florida	266,889	7,908,993	3,139,583	11,394,511
Georgia	158,573	6,578,799	2,611,544	9,478,096
Kentucky	289,298	12,025,202	4,778,328	17,348,799
Mississippi	100,289	3,575,921	1,421,499	5,161,887
North Carolina	154,360	5,425,112	2,153,573	7,815,976
South Carolina	49,628	1,744,225	692,394	2,512,910
Tennessee	236,406	8,429,384	3,350,846	12,167,923
Virginia	217,698	7,762,315	3,085,673	11,205,000
North-Central	6,024,585	307,901,111	122,340,680	444,175,854
Illinois	235,529	11,189,992	4,446,689	16,145,051
Indiana	224,692	8,011,704	3,184,810	11,564,996
Iowa	402,530	20,794,166	8,262,508	29,998,543
Kansas	132,348	6,673,714	2,650,534	9,621,470
Michigan	492,743	26,322,563	10,457,209	37,963,968
Minnesota	946,816	50,639,998	20,130,393	73,099,476
Missouri	335,673	12,963,621	5,152,741	18,710,355
Nebraska	129,492	6,150,054	2,443,479	8,871,169
North Dakota	116,418	5,519,871	2,191,189	7,952,496
Ohio	459,665	24,563,007	9,759,734	35,434,048
South Dakota	182,596	8,675,137	3,447,334	12,516,589
Wisconsin	2,366,082	126,397,285	50,214,062	182,297,692
South-Central	976,770	39,321,900	15,617,432	56,691,941
Arkansas	100,159	2,977,695	1,184,022	4,300,009
Louisiana	122,778	3,638,390	1,444,309	5,241,840
Oklahoma	140,401	5,408,825	2,147,107	7,792,511
Texas	613,433	27,296,989	10,841,993	39,357,582
Mountain	924,621	46,779,357	18,574,092	67,417,328
Arizona	137,711	6,536,075	2,595,949	9,423,441
Colorado	127,207	6,037,506	2,397,931	8,704,625
Idaho	282,606	15,912,037	6,316,501	22,924,521
Montana	34,837	1,548,892	614,923	2,231,843
Nevada	33,843	1,606,238	637,954	2,315,808
New Mexico	171,664	8,648,059	3,432,966	12,459,286
Utah	124,943	5,930,074	2,355,262	8,549,734
Wyoming	11,809	560,475	222,605	808,070
West	2,473,182	115,557,542	45,896,661	166,607,987
California	1,941,779	92,161,004	36,603,818	132,873,905
Oregon	153,962	5,482,356	2,177,822	7,906,159
Washington	377,441	17,914,182	7,115,021	25,827,923
Other	17,926	851,387	338,265	1,228,086
Alaska	1,112	52,792	20,975	76,150
Hawaii	16,815	798,595	317,290	1,151,937

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Swine			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	7,814,778	203,903,543	206,320,921	501,120,315
Northeast	196,158	5,386,142	5,451,489	13,230,762
Connecticut	745	18,251	18,722	43,756
Delaware	8,884	232,227	236,394	564,653
Maine	686	16,173	16,673	38,426
Maryland	20,636	542,941	552,270	1,321,932
Massachusetts	2,237	58,423	59,478	142,028
New Hampshire	710	16,911	17,411	40,277
New Jersey	3,248	93,793	94,422	232,587
New York	11,953	316,401	321,612	771,329
Pennsylvania	142,193	3,970,086	4,011,340	9,781,990
Rhode Island	721	18,720	19,070	45,454
Vermont	606	13,952	14,428	32,957
West Virginia	3,540	88,263	89,670	215,373
Southeast	1,178,963	31,539,312	31,877,255	77,666,575
Alabama	40,099	1,042,251	1,053,896	2,564,524
Florida	16,110	211,887	215,534	515,869
Georgia	140,879	2,397,486	2,429,157	5,878,193
Kentucky	108,301	2,184,182	2,216,165	5,341,772
Mississippi	22,565	494,077	501,188	1,208,875
North Carolina	662,761	21,011,418	21,208,244	51,862,879
South Carolina	46,838	783,596	794,213	1,920,095
Tennessee	86,547	1,897,142	1,924,205	4,642,850
Virginia	54,863	1,517,273	1,534,652	3,731,518
North-Central	6,050,406	156,790,941	158,669,706	385,249,182
Illinois	777,882	18,692,878	18,921,645	45,909,531
Indiana	638,782	17,622,325	17,829,056	43,318,638
Iowa	1,897,841	52,620,628	53,208,254	129,477,793
Kansas	215,508	5,925,536	5,997,271	14,556,425
Michigan	178,032	3,965,622	4,024,599	9,694,678
Minnesota	632,371	18,528,818	18,746,969	45,543,577
Missouri	405,170	8,873,042	9,000,581	21,710,729
Nebraska	566,299	12,941,735	13,096,377	31,800,849
North Dakota	45,333	770,541	780,828	1,888,764
Ohio	268,080	6,912,213	6,995,681	16,981,162
South Dakota	266,353	6,376,906	6,457,620	15,650,145
Wisconsin	158,756	3,560,696	3,610,826	8,716,891
South-Central	202,028	4,873,659	4,940,159	11,940,220
Arkansas	96,832	1,667,665	1,687,446	4,098,472
Louisiana	5,422	140,070	142,782	339,724
Oklahoma	35,160	913,511	923,760	2,247,569
Texas	64,614	2,152,413	2,186,171	5,254,455
Mountain	130,311	3,683,231	3,729,558	9,040,610
Arizona	12,404	349,355	355,050	851,914
Colorado	65,037	1,898,677	1,921,811	4,663,573
Idaho	8,835	209,601	212,472	513,461
Montana	28,829	801,570	810,272	1,973,406
Nevada	1,549	43,845	44,534	107,027
New Mexico	3,274	97,753	99,100	239,436
Utah	5,516	158,697	160,893	388,666
Wyoming	4,867	123,734	125,425	303,126
West	52,329	1,510,976	1,531,271	3,703,200
California	36,953	1,075,484	1,088,963	2,640,016
Oregon	7,820	221,615	225,069	541,098
Washington	7,555	213,877	217,238	522,087
Other	4,583	119,281	121,483	289,766
Alaska	300	7,492	7,668	18,038
Hawaii	4,283	111,789	113,815	271,728

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Layers			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,246,034	229,114,062	110,195,969	122,514,783
Northeast	188,708	34,338,151	16,519,695	18,366,993
Connecticut	14,355	2,769,305	1,335,444	1,485,199
Delaware	2,269	391,258	189,356	210,679
Maine	20,246	3,519,904	1,696,222	1,886,276
Maryland	15,878	2,772,115	1,332,967	1,481,936
Massachusetts	1,949	357,407	167,611	185,779
New Hampshire	872	170,595	81,683	90,766
New Jersey	5,621	1,037,366	484,908	537,256
New York	15,775	2,747,062	1,322,688	1,470,743
Pennsylvania	104,472	19,236,062	9,253,905	10,288,668
Rhode Island	713	135,575	62,435	69,047
Vermont	596	110,578	51,544	57,089
West Virginia	5,964	1,090,925	540,931	603,554
Southeast	341,458	61,775,725	29,905,172	33,273,893
Alabama	56,171	10,235,593	4,950,609	5,507,703
Florida	36,030	6,669,142	3,199,651	3,556,283
Georgia	90,946	15,759,093	7,607,377	8,461,493
Kentucky	8,652	1,364,450	650,695	722,698
Mississippi	26,548	4,475,243	2,191,574	2,441,760
North Carolina	70,429	13,336,851	6,493,835	7,230,295
South Carolina	20,588	4,072,148	1,938,675	2,152,762
Tennessee	7,588	1,229,352	614,813	686,665
Virginia	24,505	4,633,852	2,257,942	2,514,233
North-Central	371,666	70,207,342	33,744,500	37,513,773
Illinois	14,092	2,847,950	1,341,110	1,487,232
Indiana	85,577	15,666,680	7,559,204	8,407,440
Iowa	43,406	8,382,443	4,019,227	4,466,886
Kansas	6,048	1,141,054	542,114	601,830
Michigan	18,141	3,469,217	1,680,558	1,870,017
Minnesota	48,127	9,305,284	4,482,101	4,984,028
Missouri	30,587	4,904,993	2,392,939	2,664,929
Nebraska	20,902	4,418,096	2,034,335	2,249,735
North Dakota	945	164,464	76,936	85,250
Ohio	84,523	16,134,000	7,823,190	8,706,139
South Dakota	6,316	1,242,903	578,052	640,054
Wisconsin	13,003	2,530,256	1,214,736	1,350,235
South-Central	182,946	31,710,793	15,330,675	17,054,954
Arkansas	88,827	13,426,196	6,545,055	7,288,334
Louisiana	7,299	1,366,776	669,400	745,827
Oklahoma	19,829	3,951,814	1,874,149	2,080,140
Texas	66,991	12,966,006	6,242,072	6,940,652
Mountain	30,321	5,613,973	2,662,540	2,955,201
Arizona	1,049	198,363	91,598	101,332
Colorado	13,107	2,472,953	1,174,849	1,304,255
Idaho	4,432	790,853	376,050	417,515
Montana	2,249	455,427	214,250	237,565
Nevada	30	5,563	2,586	2,864
New Mexico	4,238	759,935	360,457	400,083
Utah	5,164	920,522	437,917	486,232
Wyoming	53	10,357	4,833	5,354
West	128,050	24,905,751	11,770,592	13,058,812
California	104,157	20,921,552	9,882,470	10,963,349
Oregon	8,482	1,538,940	725,594	804,774
Washington	15,411	2,445,259	1,162,528	1,290,689
Other	2,885	562,327	262,796	291,157
Alaska	5	926	438	486
Hawaii	2,880	561,401	262,358	290,672

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Broilers			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,970,429	459,346,392	188,588,798	270,472,285
Northeast	239,198	54,986,273	22,575,110	32,377,011
Connecticut	305	69,779	28,648	41,087
Delaware	83,030	19,011,056	7,805,160	11,194,087
Maine	175	39,990	16,418	23,547
Maryland	97,477	22,318,928	9,163,237	13,141,829
Massachusetts	50	11,350	4,660	6,683
New Hampshire	20	4,759	1,954	2,802
New Jersey	45	10,273	4,218	6,049
New York	471	107,788	44,253	63,468
Pennsylvania	39,549	9,055,379	3,717,768	5,331,987
Rhode Island	0	0	0	0
Vermont	8	1,812	744	1,067
West Virginia	18,070	4,355,159	1,788,050	2,564,404
Southeast	1,057,628	247,302,366	101,532,214	145,616,549
Alabama	260,512	61,532,160	25,262,582	36,231,359
Florida	34,937	7,999,363	3,284,210	4,710,184
Georgia	276,199	63,240,180	25,963,825	37,237,075
Kentucky	10,043	1,936,482	795,040	1,140,239
Mississippi	139,315	31,898,515	13,096,223	18,782,480
North Carolina	188,946	45,539,107	18,696,490	26,814,331
South Carolina	37,527	9,044,658	3,713,366	5,325,675
Tennessee	36,164	8,280,397	3,399,591	4,875,662
Virginia	73,984	17,831,505	7,320,885	10,499,545
North-Central	69,076	15,828,401	6,498,493	9,320,077
Illinois	46	11,059	4,540	6,512
Indiana	7,062	1,616,974	663,863	952,106
Iowa	3,607	860,696	353,367	506,795
Kansas	37	8,513	3,495	5,013
Michigan	121	29,243	12,006	17,219
Minnesota	13,029	3,140,266	1,289,264	1,849,051
Missouri	30,020	6,511,793	2,673,475	3,834,273
Nebraska	701	168,894	69,341	99,448
North Dakota	39	7,922	3,252	4,665
Ohio	9,053	2,181,998	895,839	1,284,804
South Dakota	83	19,038	7,816	11,210
Wisconsin	5,278	1,272,006	522,234	748,982
South-Central	507,569	118,588,353	48,687,516	69,827,179
Arkansas	310,710	71,142,183	29,208,064	41,889,931
Louisiana	41,971	10,115,822	4,153,142	5,956,397
Oklahoma	49,436	11,914,960	4,891,794	7,015,765
Texas	105,451	25,415,387	10,434,516	14,965,085
Mountain	129	29,896	12,274	17,604
Arizona	10	2,160	887	1,272
Colorado	14	3,230	1,326	1,902
Idaho	18	3,877	1,592	2,283
Montana	74	17,787	7,303	10,473
Nevada	0	8	3	5
New Mexico	3	654	269	385
Utah	7	1,545	635	910
Wyoming	3	635	261	374
West	96,608	22,560,676	9,262,489	13,284,175
California	78,566	18,935,715	7,774,228	11,149,725
Oregon	6,062	1,314,996	539,884	774,296
Washington	11,980	2,309,965	948,377	1,360,153
Other	220	50,426	20,703	29,692
Alaska	0	48	20	28
Hawaii	220	50,378	20,683	29,664

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Turkeys			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	1,836,468	171,300,747	114,874,416	109,771,865
Northeast	108,078	12,620,590	9,571,530	7,987,004
Connecticut	138	17,326	10,804	11,176
Delaware	14	1,714	1,075	1,105
Maine	91	9,381	8,535	5,808
Maryland	624	78,445	48,857	50,608
Massachusetts	1,123	114,064	105,849	70,433
New Hampshire	142	14,336	13,509	8,834
New Jersey	580	72,846	45,417	46,992
New York	1	16	200	-7
Pennsylvania	49,302	6,175,269	3,870,084	3,981,765
Rhode Island	8	942	607	606
Vermont	76	9,568	5,965	6,173
West Virginia	55,977	6,126,682	5,460,628	3,803,511
Southeast	525,201	66,702,252	42,867,701	42,912,567
Alabama	2	24	292	-10
Florida	20	1,996	1,528	1,262
Georgia	15,600	1,436,852	904,259	926,129
Kentucky	16	1,444	1,163	907
Mississippi	9	866	792	536
North Carolina	357,607	46,058,889	29,665,147	29,625,927
South Carolina	31,829	3,460,449	2,306,519	2,218,778
Tennessee	27	2,570	2,171	1,606
Virginia	120,091	15,739,162	9,985,829	10,137,433
North-Central	762,162	60,445,576	42,024,779	38,599,307
Illinois	35,918	3,696,062	3,354,282	2,289,114
Indiana	80,492	10,002,148	6,371,497	6,439,964
Iowa	58,831	5,350,345	3,355,360	3,449,656
Kansas	8,440	690,868	618,848	428,618
Michigan	42,125	2,485,485	1,561,162	1,602,305
Minnesota	254,943	13,261,801	8,548,473	8,529,605
Missouri	113,517	10,963,919	7,208,837	7,038,843
Nebraska	25,737	1,764,369	1,645,540	1,088,724
North Dakota	8,939	1,005,565	625,362	648,819
Ohio	40,678	3,626,017	2,438,247	2,323,000
South Dakota	18,601	1,969,125	1,224,846	1,270,512
Wisconsin	73,940	5,629,872	5,072,326	3,490,146
South-Central	224,411	23,193,055	15,089,855	14,904,432
Arkansas	135,992	12,529,093	7,880,281	8,076,105
Louisiana	7	642	548	401
Oklahoma	18,906	1,632,865	1,490,473	1,010,517
Texas	69,506	9,030,455	5,718,553	5,817,410
Mountain	38,580	3,313,689	2,073,794	2,136,905
Arizona	5	373	282	236
Colorado	17,123	1,472,955	915,994	950,395
Idaho	50	3,615	3,129	2,252
Montana	152	15,252	13,141	9,510
Nevada	5	452	341	286
New Mexico	23	1,665	1,422	1,039
Utah	21,215	1,818,796	1,139,003	1,172,822
Wyoming	7	582	482	364
West	178,033	5,025,393	3,246,616	3,231,527
California	171,190	4,447,035	2,873,752	2,859,549
Oregon	6,484	553,378	349,749	356,547
Washington	359	24,981	23,115	15,432
Other	2	192	140	122
Alaska	1	149	99	96
Hawaii	1	43	42	27

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Horses			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	2,049,522	67,356,106	45,222,088	168,294,859
Northeast	198,415	6,520,770	4,377,967	16,292,689
Connecticut	5,794	190,416	127,843	475,770
Delaware	2,672	87,813	58,957	219,409
Maine	5,745	188,805	126,762	471,746
Maryland	24,326	799,457	536,746	1,997,510
Massachusetts	9,017	296,337	198,957	740,424
New Hampshire	4,243	139,443	93,621	348,411
New Jersey	23,867	784,372	526,618	1,959,820
New York	43,278	1,422,301	954,916	3,553,738
Pennsylvania	58,024	1,906,918	1,280,282	4,764,594
Rhode Island	1,015	33,357	22,396	83,346
Vermont	7,827	257,229	172,700	642,708
West Virginia	12,607	414,320	278,170	1,035,214
Southeast	370,878	12,188,646	8,183,312	30,454,350
Alabama	29,741	977,417	656,226	2,442,158
Florida	52,001	1,708,976	1,147,386	4,270,021
Georgia	31,087	1,021,652	685,925	2,552,684
Kentucky	78,083	2,566,143	1,722,878	6,411,723
Mississippi	25,015	822,100	551,948	2,054,087
North Carolina	30,492	1,002,098	672,797	2,503,826
South Carolina	19,402	637,633	428,099	1,593,180
Tennessee	61,080	2,007,351	1,347,712	5,015,535
Virginia	43,977	1,445,273	970,339	3,611,136
North-Central	560,233	18,411,665	12,361,373	46,003,085
Illinois	46,088	1,514,650	1,016,918	3,784,479
Indiana	48,112	1,581,167	1,061,577	3,950,678
Iowa	47,681	1,567,003	1,052,067	3,915,287
Kansas	42,878	1,409,155	946,090	3,520,893
Michigan	53,991	1,774,376	1,191,295	4,433,428
Minnesota	43,155	1,418,259	952,202	3,543,638
Missouri	64,628	2,123,954	1,425,997	5,306,877
Nebraska	35,757	1,175,129	788,967	2,936,157
North Dakota	24,914	818,781	549,720	2,045,793
Ohio	71,989	2,365,868	1,588,416	5,911,319
South Dakota	37,475	1,231,590	826,875	3,077,230
Wisconsin	43,565	1,431,733	961,249	3,577,305
South-Central	336,607	11,062,353	7,427,132	27,640,215
Arkansas	29,563	971,567	652,299	2,427,542
Louisiana	27,978	919,477	617,326	2,297,391
Oklahoma	70,006	2,300,698	1,544,661	5,748,487
Texas	209,060	6,870,611	4,612,846	17,166,795
Mountain	349,963	11,501,289	7,721,829	28,736,932
Arizona	48,371	1,589,679	1,067,292	3,971,946
Colorado	69,381	2,280,158	1,530,871	5,697,165
Idaho	45,621	1,499,302	1,006,614	3,746,132
Montana	56,364	1,852,363	1,243,655	4,628,285
Nevada	13,347	438,640	294,498	1,095,978
New Mexico	41,430	1,361,568	914,141	3,401,991
Utah	34,778	1,142,955	767,366	2,855,768
Wyoming	40,671	1,336,624	897,393	3,339,667
West	227,906	7,489,971	5,028,678	18,714,319
California	124,919	4,105,375	2,756,300	10,257,624
Oregon	51,891	1,705,361	1,144,959	4,260,988
Washington	51,096	1,679,234	1,127,418	4,195,707
Other	5,520	181,411	121,797	453,270
Alaska	1,604	52,714	35,392	131,711
Hawaii	3,916	128,697	86,405	321,559

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Sheep			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	673,154	30,958,359	18,181,894	70,761,964
Northeast	20,347	935,764	549,576	2,138,890
Connecticut	449	20,657	12,132	47,216
Delaware	111	5,111	3,002	11,683
Maine	751	34,537	20,283	78,941
Maryland	1,514	69,649	40,905	159,197
Massachusetts	679	31,232	18,343	71,387
New Hampshire	482	22,174	13,023	50,684
New Jersey	773	35,531	20,867	81,213
New York	4,592	211,174	124,023	482,683
Pennsylvania	6,469	297,531	174,740	680,070
Rhode Island	81	3,732	2,192	8,529
Vermont	1,027	47,215	27,730	107,921
West Virginia	3,419	157,222	92,337	359,366
Southeast	13,753	632,506	371,472	1,445,727
Alabama	660	30,337	17,817	69,341
Florida	447	20,558	12,074	46,989
Georgia	493	22,684	13,322	51,849
Kentucky	2,259	103,902	61,022	237,489
Mississippi	386	17,754	10,427	40,581
North Carolina	1,170	53,828	31,613	123,034
South Carolina	188	8,658	5,085	19,790
Tennessee	1,101	50,614	29,726	115,689
Virginia	7,049	324,172	190,387	740,964
North-Central	151,345	6,960,377	4,087,841	15,909,434
Illinois	6,605	303,760	178,399	694,308
Indiana	4,334	199,343	117,075	455,642
Iowa	24,273	1,116,301	655,605	2,551,546
Kansas	12,369	568,861	334,093	1,300,253
Michigan	5,834	268,320	157,585	613,303
Minnesota	13,280	610,750	358,694	1,396,000
Missouri	6,668	306,679	180,113	700,980
Nebraska	9,088	417,978	245,479	955,377
North Dakota	13,008	598,256	351,356	1,367,441
Ohio	11,164	513,447	301,548	1,173,592
South Dakota	39,633	1,822,724	1,070,489	4,166,227
Wisconsin	5,087	233,960	137,405	534,765
South-Central	140,644	6,468,221	3,798,796	14,784,505
Arkansas	719	33,063	19,418	75,573
Louisiana	554	25,457	14,951	58,187
Oklahoma	6,212	285,667	167,773	652,953
Texas	133,160	6,124,034	3,596,655	13,997,792
Mountain	266,732	12,267,016	7,204,438	28,038,893
Arizona	14,794	680,399	399,599	1,555,197
Colorado	71,949	3,308,954	1,943,354	7,563,323
Idaho	20,819	957,468	562,322	2,188,498
Montana	37,986	1,746,962	1,025,993	3,993,056
Nevada	7,317	336,493	197,623	769,126
New Mexico	27,587	1,268,718	745,120	2,899,927
Utah	31,122	1,431,322	840,618	3,271,592
Wyoming	55,158	2,536,701	1,489,809	5,798,174
West	78,825	3,625,158	2,129,061	8,286,075
California	51,487	2,367,893	1,390,667	5,412,327
Oregon	23,530	1,082,161	635,555	2,473,511
Washington	3,807	175,103	102,839	400,237
Other	1,507	69,318	40,711	158,442
Alaska	134	6,149	3,612	14,056
Hawaii	1,374	63,169	37,099	144,386

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Goats			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	194,064	9,566,021	6,619,280	19,756,228
Northeast	2,271	111,968	77,477	231,243
Connecticut	71	3,522	2,437	7,274
Delaware	31	1,505	1,041	3,108
Maine	73	3,593	2,486	7,421
Maryland	340	16,757	11,595	34,607
Massachusetts	184	9,080	6,283	18,753
New Hampshire	105	5,195	3,595	10,729
New Jersey	86	4,217	2,918	8,709
New York	756	37,268	25,788	76,968
Pennsylvania	389	19,172	13,267	39,596
Rhode Island	0	0	0	0
Vermont	57	2,800	1,937	5,782
West Virginia	180	8,859	6,130	18,296
Southeast	1,969	97,062	67,163	200,458
Alabama	183	9,035	6,252	18,659
Florida	0	0	0	0
Georgia	226	11,122	7,696	22,969
Kentucky	277	13,633	9,434	28,157
Mississippi	0	0	0	0
North Carolina	273	13,454	9,310	27,787
South Carolina	150	7,400	5,121	15,284
Tennessee	415	20,457	14,155	42,248
Virginia	446	21,961	15,196	45,354
North-Central	12,118	597,332	413,328	1,233,639
Illinois	537	26,482	18,325	54,692
Indiana	427	21,060	14,573	43,494
Iowa	389	19,166	13,262	39,583
Kansas	1,237	60,983	42,198	125,946
Michigan	1,252	61,731	42,715	127,490
Minnesota	901	44,390	30,716	91,677
Missouri	2,396	118,098	81,719	243,903
Nebraska	618	30,486	21,095	62,960
North Dakota	1,248	61,513	42,564	127,040
Ohio	1,365	67,296	46,566	138,982
South Dakota	630	31,070	21,499	64,166
Wisconsin	1,117	55,057	38,097	113,707
South-Central	157,526	7,764,970	5,373,029	16,036,607
Arkansas	1,033	50,934	35,244	105,191
Louisiana	20	992	687	2,049
Oklahoma	5,126	252,679	174,843	521,846
Texas	151,347	7,460,364	5,162,255	15,407,521
Mountain	16,340	805,467	557,349	1,663,490
Arizona	7,507	370,066	256,070	764,280
Colorado	793	39,098	27,054	80,747
Idaho	334	16,460	11,390	33,994
Montana	1,040	51,256	35,467	105,857
Nevada	41	2,016	1,395	4,163
New Mexico	6,431	317,023	219,367	654,732
Utah	111	5,474	3,788	11,305
Wyoming	83	4,073	2,818	8,412
West	3,836	189,105	130,852	390,549
California	2,499	123,198	85,248	254,435
Oregon	746	36,759	25,435	75,916
Washington	591	29,148	20,169	60,198
Other	2	117	81	241
Alaska	0	0	0	0
Hawaii	2	117	81	241

Table A-8. Estimate of recoverable manure and nutrient production after losses (continued).

Location	Ducks			
	Animal Units	N (lb)	P (lb)	K (lb)
United States	15,059	4,946,928	2,524,868	3,513,649
Northeast	2,965	974,139	497,192	691,901
Connecticut	77	25,455	12,992	18,080
Delaware	13	4,164	2,125	2,958
Maine	16	5,204	2,656	3,696
Maryland	134	43,929	22,421	31,201
Massachusetts	26	8,641	4,410	6,137
New Hampshire	5	1,665	850	1,183
New Jersey	43	14,079	7,186	10,000
New York	2,014	661,673	337,712	469,966
Pennsylvania	626	205,796	105,036	146,170
Rhode Island	0	135	69	96
Vermont	4	1,267	647	900
West Virginia	6	2,131	1,088	1,514
Southeast	199	65,399	33,379	46,451
Alabama	0	0	0	0
Florida	50	16,493	8,418	11,714
Georgia	11	3,595	1,835	2,553
Kentucky	25	8,215	4,193	5,835
Mississippi	12	3,988	2,035	2,832
North Carolina	28	9,170	4,680	6,513
South Carolina	10	3,325	1,697	2,362
Tennessee	33	10,768	5,496	7,648
Virginia	30	9,844	5,025	6,992
North-Central	8,498	2,791,669	1,424,843	1,982,836
Illinois	84	27,472	14,022	19,513
Indiana	4,796	1,575,434	804,088	1,118,982
Iowa	37	12,281	6,268	8,723
Kansas	26	8,385	4,280	5,956
Michigan	303	99,581	50,825	70,729
Minnesota	98	32,058	16,362	22,770
Missouri	43	14,088	7,190	10,006
Nebraska	18	5,862	2,992	4,164
North Dakota	7	2,234	1,140	1,586
Ohio	184	60,505	30,881	42,975
South Dakota	55	17,910	9,141	12,721
Wisconsin	2,849	935,858	477,654	664,711
South-Central	185	60,711	30,986	43,121
Arkansas	30	9,700	4,951	6,890
Louisiana	20	6,434	3,284	4,570
Oklahoma	26	8,627	4,403	6,128
Texas	109	35,949	18,348	25,533
Mountain	102	33,546	17,121	23,826
Arizona	4	1,321	674	938
Colorado	23	7,708	3,934	5,475
Idaho	14	4,536	2,315	3,222
Montana	31	10,209	5,211	7,251
Nevada	2	735	375	522
New Mexico	16	5,253	2,681	3,731
Utah	8	2,690	1,373	1,911
Wyoming	3	1,093	558	776
West	3,105	1,020,134	520,668	724,570
California	3,039	998,473	509,612	709,184
Oregon	35	11,355	5,796	8,065
Washington	31	10,306	5,260	7,320
Other	4	1,329	679	944
Alaska	1	178	91	127
Hawaii	4	1,151	588	818