June, 2018

Veterinarian Needs Assessment for Arizona Study Area of Arizona

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CENTER FOR ANIMAL HEALTH IN APPALACHIA

NATIONAL CENTER FOR RURAL HEALTH WORKS

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Veterinarian Needs Assessment for the Arizona Study Area (ASA)
Prepared by
Center for Animal Health in Appalachia (CAHA)
And the
National Center for Rural Health Works (NCRHW)
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Introduction

Around the world, access to veterinary care is crucial for both animal and human health; veterinarians are instrumental in public health, food safety, food security, stem cell research, gene therapy, vaccinology, zoonotic disease prevention and research, bioterrorism protection, and general animal practice, just to mention a few. In rural settings in the USA, veterinarians are oftentimes the most highly trained and revered in-residence professionals. However, there are areas of the country that lack access to qualified veterinarians. Access to veterinary care, as with human medical care, is a complex concept with many contributing factors, one of which is geography.

With the growing concern about food safety, the role of the veterinarian has become increasing evident, as seen in the recent funding of Department of Agriculture grants to support rural veterinary practices and help them recruit more large animal veterinarians[1]. A recent report the USDA indicated that more than 80% of the states had a shortage of veterinarians. As with the medical profession, the issue is less about shortages and more about distribution of existing and future workforce.

Purpose of Study

We sought to determine through our established methodologies, the veterinarian needs and the economic impact of Veterinarians/Veterinarian clinics for the study area of the following eleven counties and two Indian nations: Apache, Cochise, Coconino, Gila, Graham, Greenlee, La Paza, Navajo, Navajo Nation, Santa Cruz, South Apache, Yavapai and Yuma. The research results would be utilized in assessing the need for additional veterinary medical education programs.

Methodology

For our research, we initially reviewed the literature and realized the lack of methodologies specific to the wide variation of skill and effort veterinarians must provide in treating small and large animals. And although there are several publications describing the economic impact of veterinarians at a state level, they lacked the specificity to determine the impact in rural areas which is typically where a majority of need resides and workforce shortages occur. To be able to effectively target workforce, education and other resource planning in an effort to meet the growing veterinarian needs in rural, methodologies were needed that enable users to measure animal specific needs relative to current workforce supply. In applying these tools, we are then able to apply the economic impact model specifically created for veterinarians to the results. Therefore, we started our research by identifying

[1] Olson, N.C., 6/2018. "American's Veterinarian Shortage is bad for Animals and Humans Alike." Retrieved 6/11/2018 from: http://fortune.com/2018/06/05/veterinarians-public-health-food-safety/

three components of information that were required: 1) Total animal needs for veterinarians, 2) Veterinarian workforce and the 3) Economic impact of veterinarian.

Animal Needs Model

As previously mentioned, the lack of specific information within existing data and publications, caused us to make our initial assumption regarding veterinarians practices patterns: All licensed veterinarians practice in one location on small and large animal in a full time capacity. (Note: The AVMA has practice patterns for some of their membership, it does not contain complete information for all licensed veterinarians which was required for our analysis.) Because of this assumption, we realized that the need for creating separate small and large animal needs methodologies that would then be applied to existing veterinarian workforce. We chose the following animals to research because they collectively represent the higher percentage veterinarian patients (See **Table 1** below for entire results):

- Small Animals: Feline, Canine and Birds
- Large Animals: Bovine, Porcine, Ovine, Caprine and Equine

(**Note:** The complete set of Arizona animal densities maps and analysis are found in **Appendix A.**)

We determined the most complete and reliable data sources for determining small animal need was by applying our methodology to data from the U.S. Pet Ownership Demographics Sourcebook. We combine statistics specific to the state from this report with household estimate counts from the 2017 U.S. Census to ascertain small animal estimates. For large animals, we applied our methodology to data from the most current U.S. Ag Census (2012). For veterinarians, we acquired the licensure data from the Arizona Veterinary Medical Examiners Board (4/2018) and only considered those licensees that were actively practicing in state.

Because Arizona has multiple areas with Indian Reservation area within counties, we were diligent in our data analysis to ensure that our analysis accurately reflected Veterinary needs. Therefore, because the 2012 Ag Census data includes the Indian reservation areas in its county herd estimate but the household count from the U.S. Census breaks out this population, we utilized a mixed methodology for determine Veterinary need.

Based upon our methodology, the state total Veterinarian needs is 1,761.7 FTE, with 22% of this need in the ASA. (Note: This is primarily because our small animal methodology is based upon the number of reported households and the study areas has less than 15% of the total small animal need.) As for large animal veterinarian need, the state total of 300.2 FTE veterinarians are needed with 47% of this need coming from the study area.

County (study area counties in green)	Total Small Animal Need	Total Large Animal Need	Total Veterinarian Need	Total Actively Licensed Veterinarians	Veterinarian Shortage/ Surplus
Apache	15.7	37.7	53.4	5	-48.4
Chocise	29.2	17.9	47.0	42	-5.0
Coconino	31.6	28.3	59.9	47	-12.9
Gila	16.0	3.5	19.6	14	-5.6
Graham	6.4	3.9	10.3	4	-6.3
Greenlee	2.1	2.8	5.0	1	-4.0
La Paz	7.8	3.3	11.1	1	-10.1
Maricopa	830.4	56.8	887.2	1,204	316.8
Mohave	54.7	7.2	61.9	42	-19.9
Navajo	27.6	23.5	51.2	22	-29.2
Navajo Nation	23.9	0.0	23.9	0	-23.9
Pima	219.7	7.5	227.3	343	115.7
Pinal	83.0	85.7	168.7	40	-128.7
Santa Cruz	8.7	6.2	14.9	7	-7.9
South Apache	4.8	0.0	4.8	0	-4.8
Yavapai	55.7	13.7	69.4	98	28.6
Yuma	44.2	2.1	46.3	21	-25.3
State Totals	**1,461.5**	**300.2**	**1,761.7**	**1,891**	**129.3**

Table 1-Statewide Veterinarian Needs Analysis

Veterinarian Clinic Economic Impact Model

The most important outcome from a veterinarian establishing a practice in a rural area is the care given to large and small animals. But it is also important to fully understand that in establishing a clinic, a veterinarian causes a significant positive impact upon the economy of the community (s) they serve. Therefore in February of 2013, the National Center for Rural Health Works was contracted to create a rural Veterinary practice economic impact model similar to what they had been creating over the last 25 years for measuring healthcare economic impact. To create the methodology for determining the economic impact, a research team of veterinary medicine, statistics and agriculture-economic experts was enlisted during all stages of the research. The methodology described below is one of the results of the research team.

Even though there isn't a "typical practice" defined for veterinary clinics, for the purposes of measuring the economic impact, we are assumed that a typical established veterinary clinic practice has one veterinarian and five employees, (**Table 2**).

Table 2
Employment and Income for Typical Established Veterinary Clinic

Employee	Full- time equivalent Employees	Estimated Income
Veterinarian	1	$124,051
Credentialed Technician	1	$31,129
Non-credentialed Technician	1	$31,116
Veterinary assistant	1	$22,464
Other Staff	2	$49,504
Total	**6**	**$258,264**

SOURCES: American Veterinary Medical Association. (2013). Report *on Veterinary practice business measures* (2013 ed.). Schaumburg, IL: n.a.

This employment configuration was derived through research and expert advice from the veterinary professionals affiliated with Lincoln Memorial University College of Veterinary Medicine and data from the recent AVMA business practice report. In this report, a mixed animal veterinary clinic had an average of 5.8 full-time equivalents. Wage data were also taken from that report. A typical veterinary clinic would generate annual wages of $258,264.

As the veterinary clinics and employees spend money locally, they create secondary economic impact in other businesses in the county. The secondary benefits are estimated from economic multipliers derived using an input-output model and IMPLAN data. (See **Appendix B** for more information on the input-output model.)

Consider, for instance, the opening of a veterinary clinic. The dollars going to households will increase as employees receive wages. Likewise, the veterinary clinic will purchase goods from other businesses and dollar flow to other businesses will increase. This, in turn, increases these businesses' purchases of labor and inputs. Thus, the changes in the economic impacts affect the entire local economy.

A measure that yields the effects created by an increase or decrease in economic activity is called the *multiplier effect*. Multipliers are used to indicate the ratio between direct impacts and the total impact. An employment multiplier of 2.0 indicates that if one job is created by a new industry, such as a veterinary clinic, 1.0 job is created in other sectors due to business and household spending.

The data in **Table 3** illustrates the secondary and total impacts from a veterinary clinic. Employment and wage multipliers were derived by running the model on 37 Kentucky counties, 42 Tennessee counties and 22 Virginia counties. All counties were in the Appalachian Region. The average of these multipliers was used to estimate secondary impacts. (Note: This large of a sample size of counties legitimately represents all counties in the nation.)

Table 3
Total Economic Impact of a Typical Veterinary Clinic Practice on an Rural County

Employment Impact	
Jobs from Veterinary Practice	6
Veterinary Sector Employment Multiplier	1.32
Secondary Employment Impact	2
Total Employment Impact	8
Wage Impact	
Wages from Veterinary Practice	258,264
Veterinary Sector Wage Multiplier	1.26
Secondary Wage Impact	67,149
Total Wage Impact	$325,413

The average employment multiplier for a rural veterinarian is 1.32 (**Table 2**). This indicates that for each job created by the veterinarian, .32 jobs are created throughout the county due to business and employee spending. Applying the average multiplier to the average veterinary clinic of six employees yields a secondary impact of two employees. The total estimated average employment of a veterinarian is six, the secondary average employment income estimate is two jobs, and the total average employment impact is estimated to be eight.

The average wage income multiplier for a rural veterinary practice is 1.26 (**Table 3**). This indicates that for each dollar created in that sector, an additional $.26 is created throughout the county due to business and employee spending. The veterinary clinic generates an average wage of $258,264. Applying the average wage multiplier of 1.26 to the average direct impact results in an estimated average secondary wage impact from the clinic of $67,149. The total average direct wages of the veterinary clinic is estimated to be $258,264 and the average total wage impact is estimated to be $325,413.

Arizona's Economic Impact Analysis

These methodologies were applied in Arizona using IMPLAN and licensed Veterinarian data at both the county level and the state level.

Currently, there are 1,891 actively licensed veterinarians with 14% of these practicing in the study area. The current state total Veterinarian needs is 1,761.7 FTE, with 22% of this need in the ASA. (Note: This is primarily because our small animal methodology is based upon the number of reported households and the study areas has less than 15% of the total small animal need.) As for large animal veterinarian need, the state total of 300.2 FTE LMAP veterinarians are needed with 47% of this need coming from the study area.

In applying the economic impact methodology described above to determine both the state and study area employment and financial impacts, we first looked at the impact of the **just** veterinarians. With 1,891 actively practicing veterinarians, a state multiplier of 1.695 was applied to add an additional 1,314 jobs for a total of 3,015 total state jobs attributed to just the veterinarians.

	Employment Impact of Just Veterinarians			
	Current Veterinarians	State Veterinary Sector Employment Multiplier	Secondary Employment Impact	Total Employment Impact
State	1,891	1.695	1,314	3,205
Study Area	262	1.266	70	332
Data sources: 2018 Veterinarian Medical Examiners Board; IMPLAN				

Table 4 - Just Veterinarians Economic Impact

When factoring in the entire veterinarian clinic within the economic model, we generated county level multipliers for the study area and state level multipliers to determine the impact of veterinarian clinics. For the study area, we used an average of all county multipliers of 1.26. Within the study area, the direct impact of the veterinarians clinics is 1,310 (262 Veterinarians X 5 employees/clinic) and the combined total employment impact is 1,777 jobs (See **Table 5** below).

Employment Impact of Veterinarian Clinics				
	Veterinarian Clinic Employment	State Veterinarian Services Sector	Secondary Employment Impact	Total Employment Impact
State	11,346	1.695	7,885	19,231
Study Are	1,572	1.266	561	2,133

Table 5- Employment Impact of Veterinarian Clinics

In factoring the financial impact the current veterinarians and current veterinarian clinics have upon Arizona, we utilized the salary figures from **Table 2**. The direct and secondary impact of the current Veterinarian workforce is just over $400 million, with 10% of this coming from the thirteen county study area. (See **Table 6** below for details)

	Payroll Impact of Just Veterinarians			
	Current Veterinarians Payrol'	State Veterinary Payroll Multiplier	Secondary Employment Impact	Total Employment Impact
State	$234,580,441	1.715	$167,725,015	$402,305,456
Study Area	$32,501,362	1.288	$9,362,347	$41,863,709
Data sources: 2018 Veterinarian Medical Examiners Board; IMPLAN				

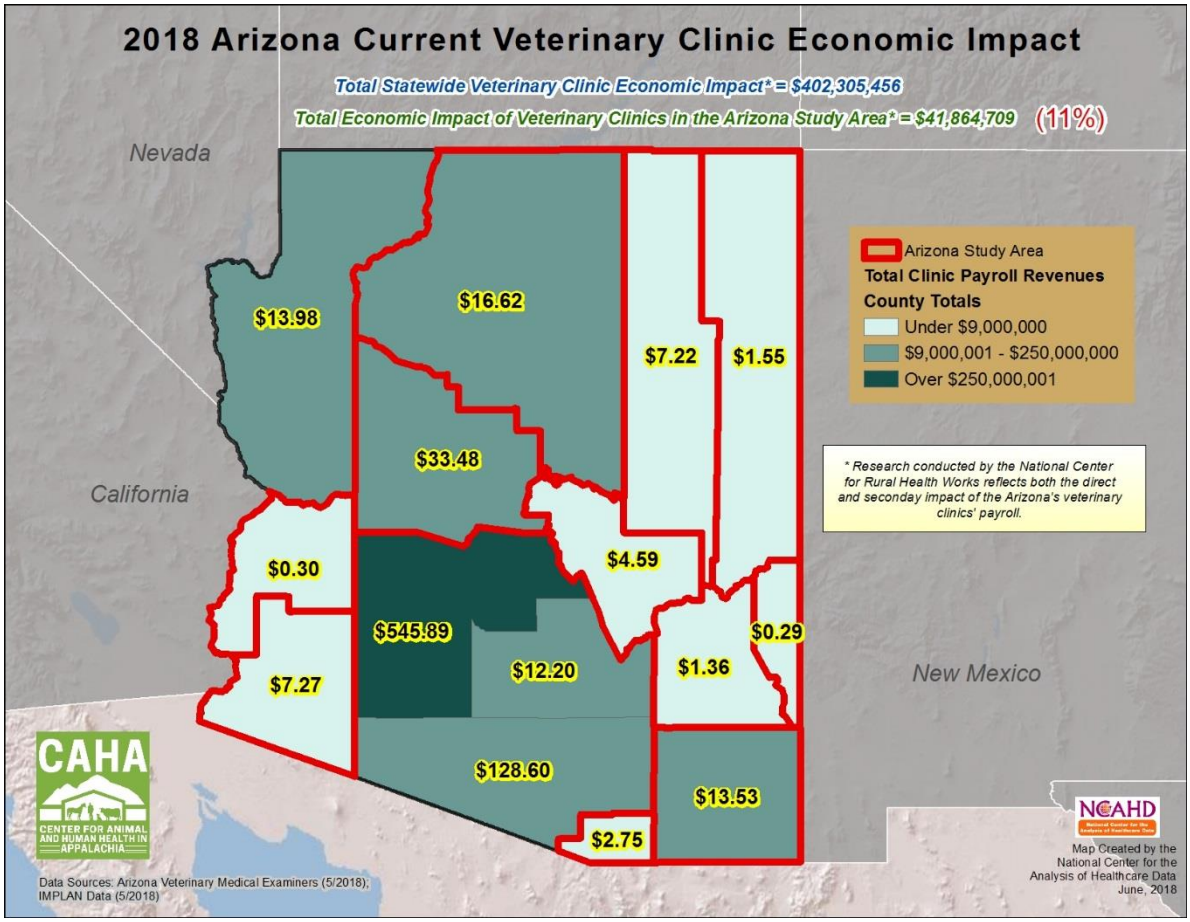
Table 6 - Payroll Impact of Just Veterinarians

When factoring in the financial impact an entire veterinarian clinic for each veterinarian, we generated county and state level multipliers of the veterinary services sector. For the state impact of veterinarian clinics from the study area, we used an average of all county multipliers of 1.288.

	Payroll Impact of Veterinarian Clinics			
	Veterinarian Clinic Employment	State Verterinarian Services sector multiplier	Secondary Employment Impact	Total Employment Impact
State	$488,377,224	1.695	$339,422,170	$827,799,394
Study Area	$67,655,168	1.288	$21,294,383	$88,959,551
Data sources: 2018 Veterinarian Medical Examiners Board; IMPLAN				

Table 7- Payroll Impact of Arizona Veterinarian Clinics

Within the study area, the direct impact of the veterinarians' clinics was just over $67 Million annually with an additional estimated $21 Million from payroll to total nearly $89 Million being generated in the community within each county. In **Map 1** below, the aggregated payroll figures are visualized. (See **Table 7** above for details)



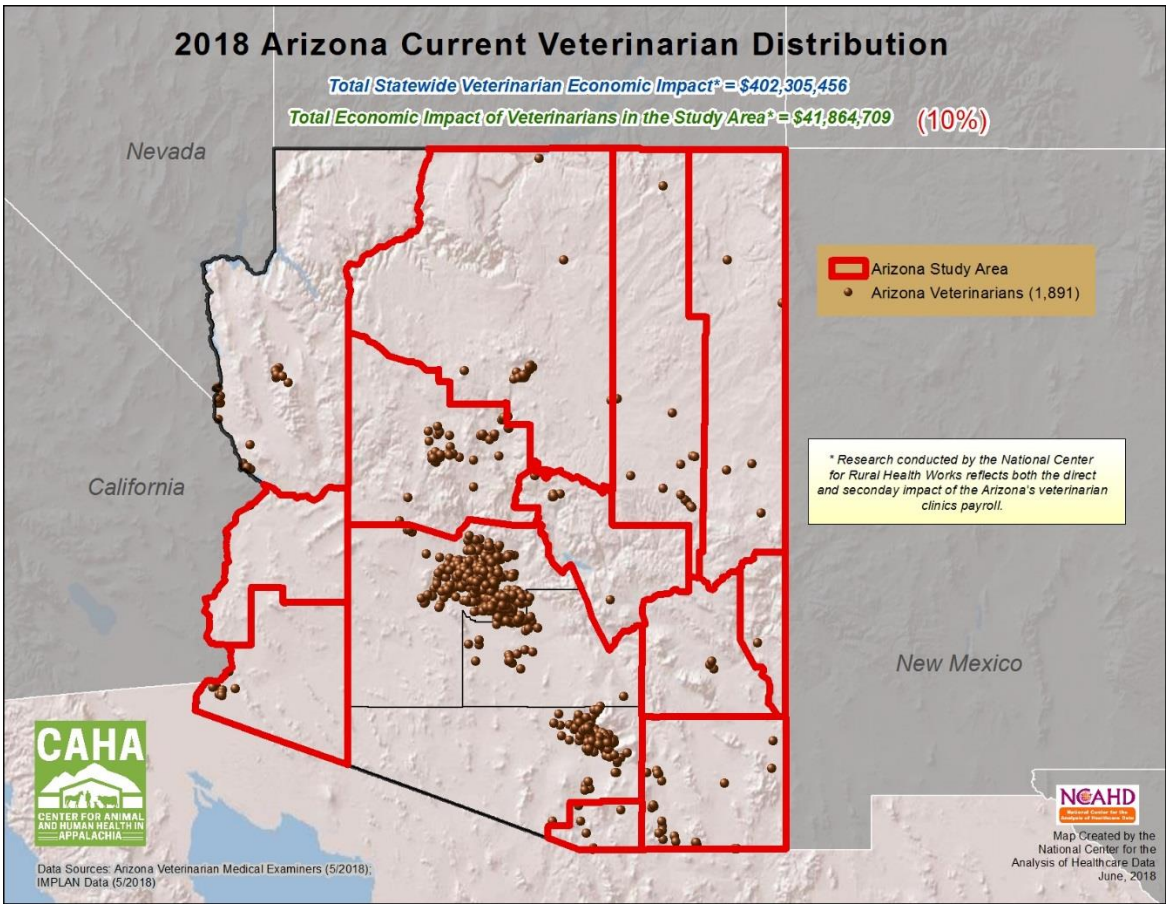
Map 1- Arizona County Veterinarian Clinic Economic Impact

Impact of Taxable Retail Sales Attributed to Existing Veterinarian Clinics

As a part of our research, we were able to estimate the amount of revenue being generated statewide by the veterinarian clinics. We determined the average sale capture tax ratio to be 34.7% which we applied to the total economic impact of all Veterinarian clinics ($837,566,939) which is $290,635,728. To this value, we applied the current state sales tax of 5.6% to determine the additional potential financial impact that can be attributed to the state's Veterinarian clinics which is $16,275,601.

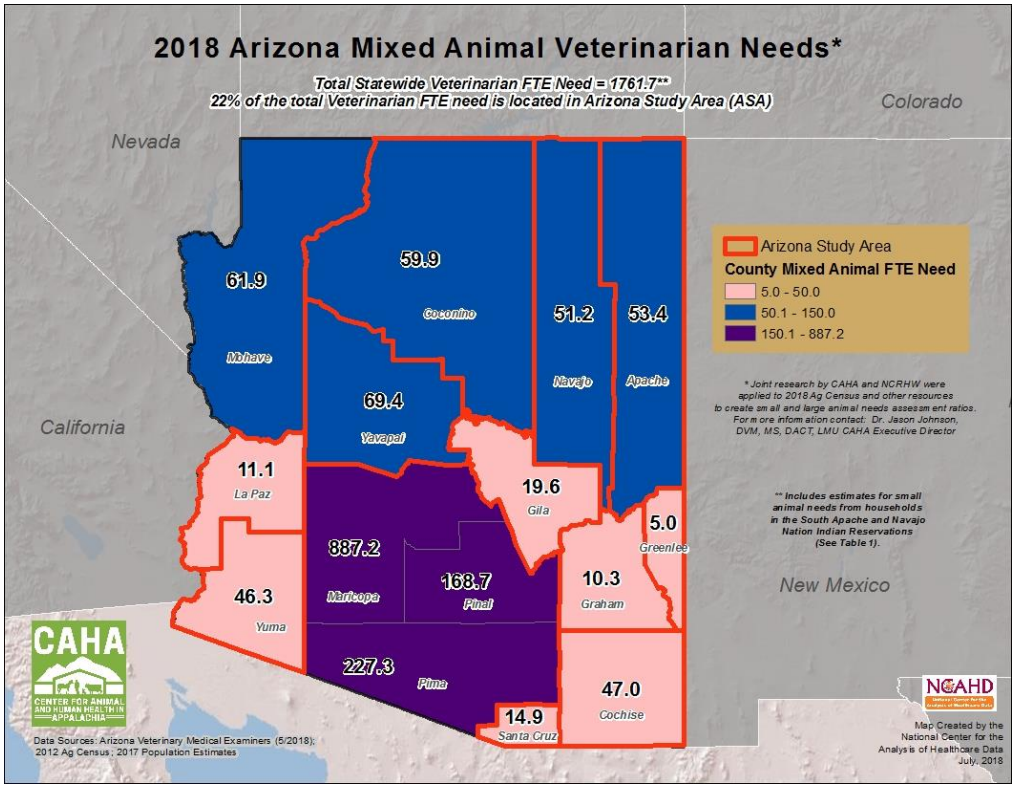
Economic Impact on Arizona's Veterinarian Shortages and Aging Workforce

As a part of our research, we apply both the results of the animal needs analysis in combination with the current veterinarian workforce to determine shortages and surplus at the county level. Similar to medical workforce, veterinarian workforce predominantly practices in urban areas (see **Map 2 – Arizona Veterinarian Distribution)**.

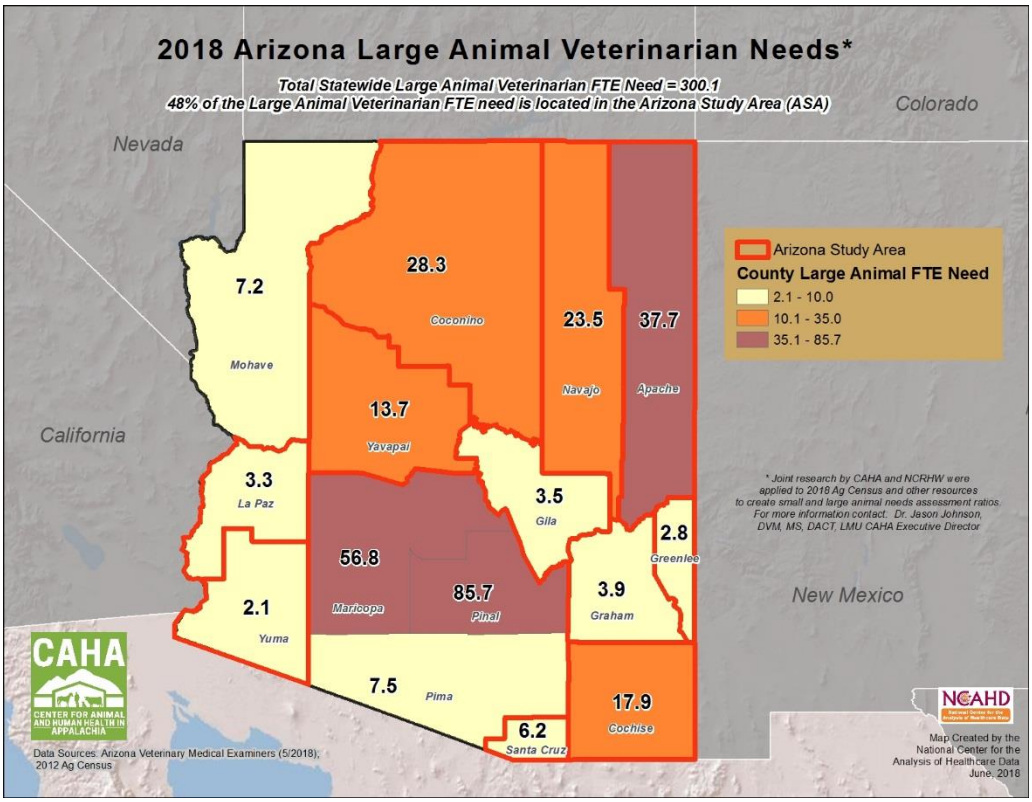


Map 2 - Arizona Veterinarian Distribution

As indicated in the animal densities maps (see **Appendix A**), the veterinarian practice site densities do not correlate with veterinarian need (see **Map 3 – Arizona Mixed Animal Veterinarian Need)**, especially as it pertains to large animal veterinarians (see **Map 4 – Arizona Large Animal Veterinarian Need**).



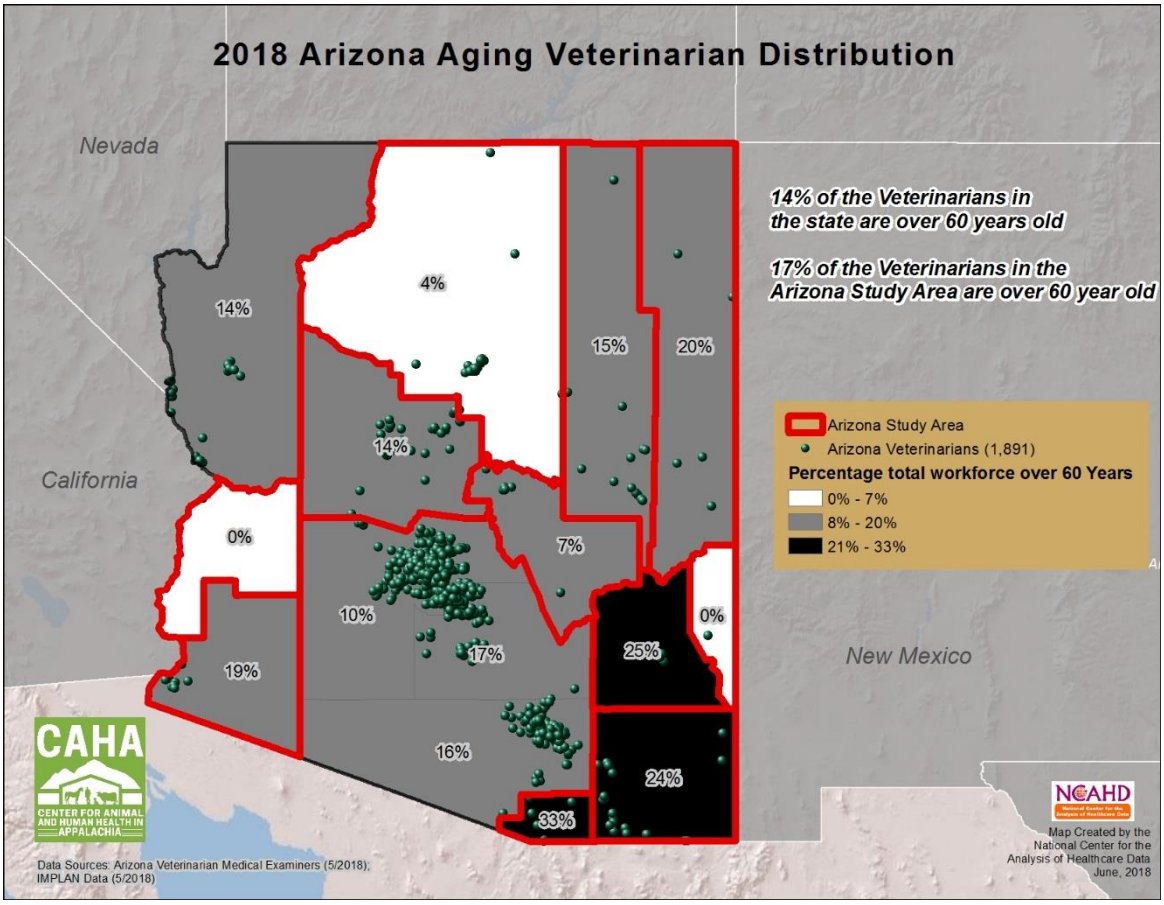
Map 3 - Arizona Mixed Animal Veterinarian Needs



Map 4 - Arizona Large Animal Veterinarian Needs

The growing concern as to the potential impact to human health caused by the large animal veterinarian shortages has been recently reported by several state agencies. This reality is further exacerbated by the correlation of higher veterinarian need areas to densities of aging veterinarian workforce. (See **Map 5 – Arizona Aging Veterinarians Distribution**).

As indicated in **Table 1,** our research indicated that statewide veterinarian supply be greater than veterinarian need. But in the thirteen county study area, the opposite is true with only 14% of the total veterinarian supply handling 48% of the large animal needs. This maldistribution of workforce causes not only an animal population risk but also a loss of economic revenue and jobs in areas desperately needing both.



Map 5 - Arizona Aging Veterinarian Distribution

The growing concern as to the potential impact to human health caused by the large animal veterinarian shortages has been recently reported by several state agencies. This reality is further exacerbated by the correlation of higher veterinarian need areas to densities of aging veterinarian workforce. (See **Map 5 – Arizona Aging Veterinarians Distribution**).

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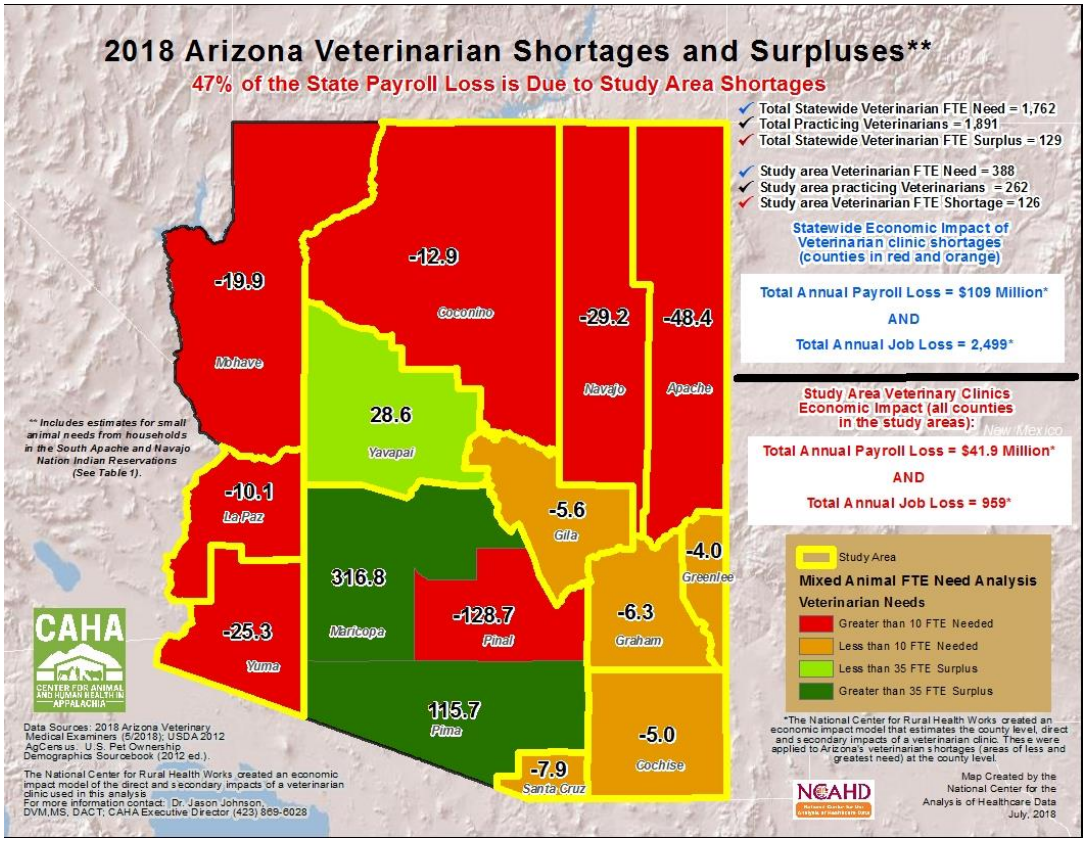
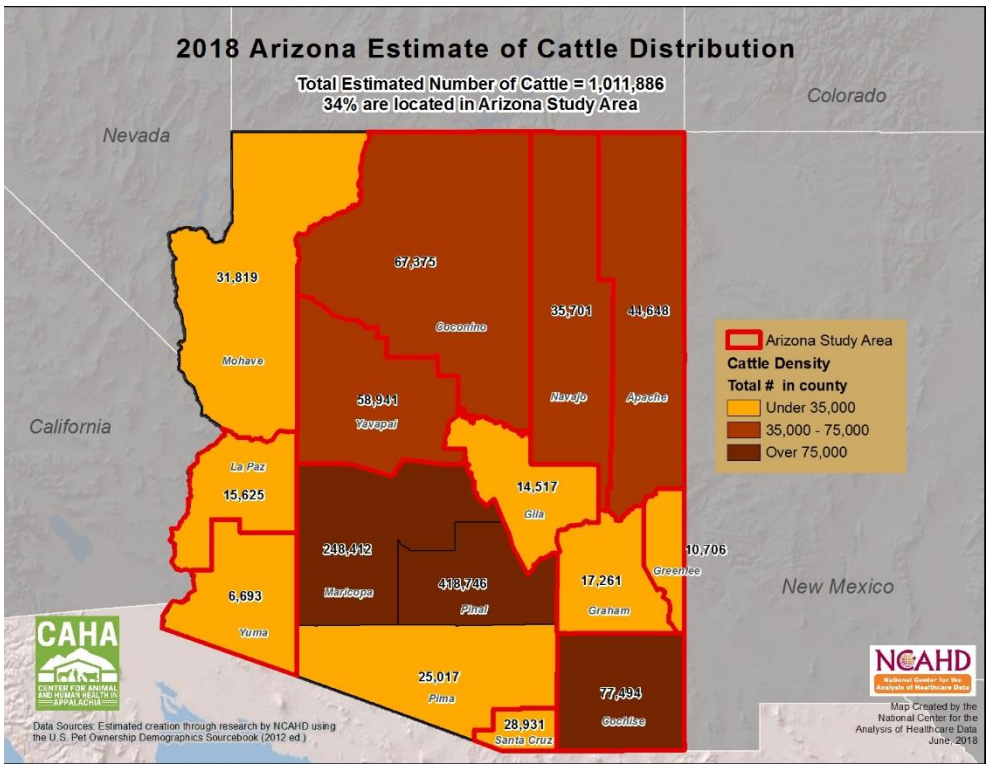
desperately needing both. As seen in **Map 6** below, twelve of Arizona's counties are currently experiencing veterinarian shortages (red and orange counties) with an annual payroll loss of $**109** Million dollars annually and a job loss of nearly 1,500 in the communities.

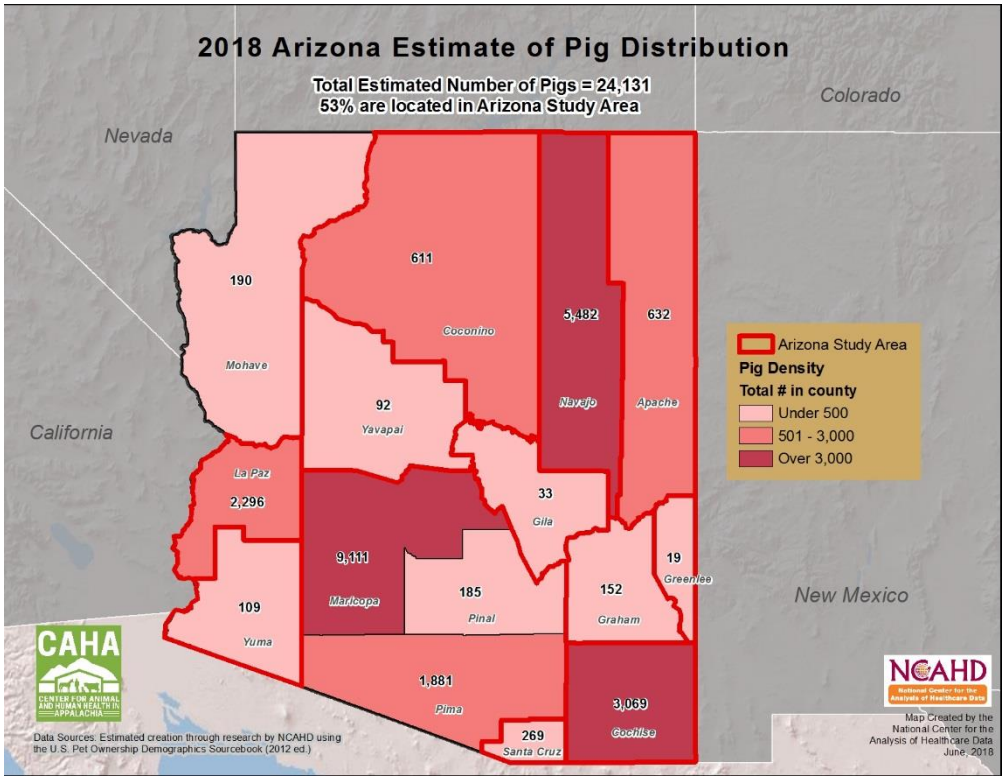


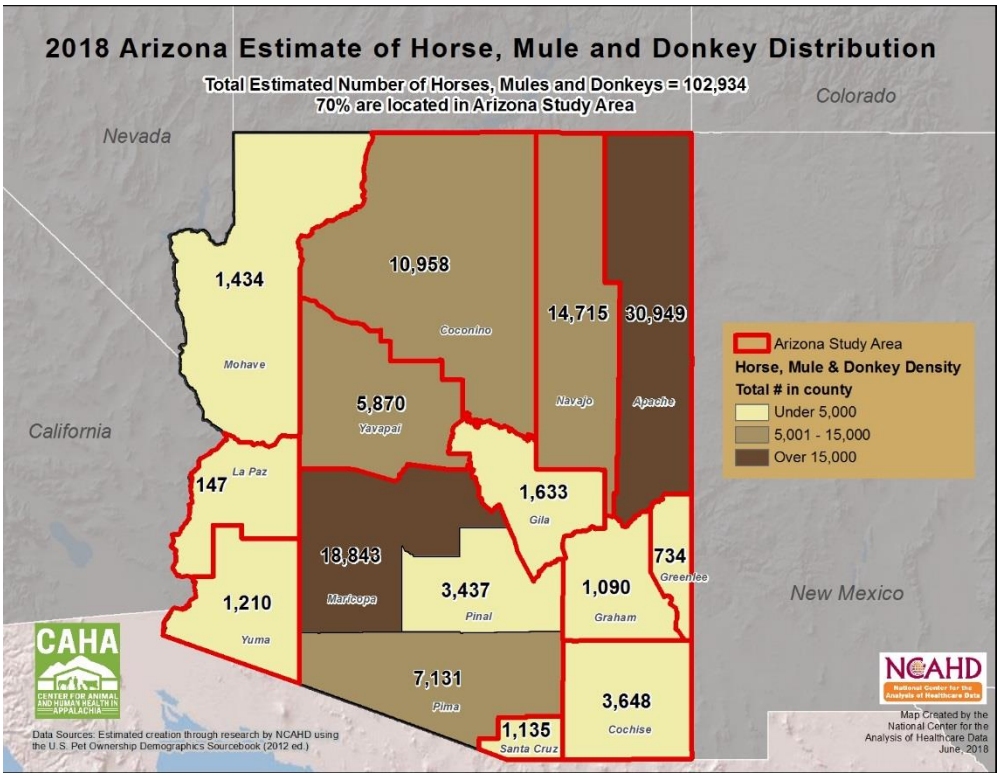
Map 6 - Arizona Veterinarian Shortages and Surpluses

With 48% of these losses occurring in the study area, it further defines the need for an additional veterinary medical school.

Appendix A – Animal Densities Maps/Analysis






2018 Arizona Estimate of Horse, Mule and Donkey Distribution
Total Estimated Number of Horses, Mules and Donkeys = 102,934
70% are located in Arizona Study Area
Nevada
Colorado
California
New Mexico
1,434
Mohave
10,958
Coconino
14,715
Navajo
30,949
Apache
5,870
Yavapai
147
La Paz
1,633
Gila
18,843
Maricopa
3,437
Pinal
734
Greenlee
1,090
Graham
1,210
Yuma
7,131
Pima
3,648
Cochise
1,135
Santa Cruz
Arizona Study Area
Horse, Mule & Donkey Density
Total # in county
Under 5,000
5,001 - 15,000
Over 15,000
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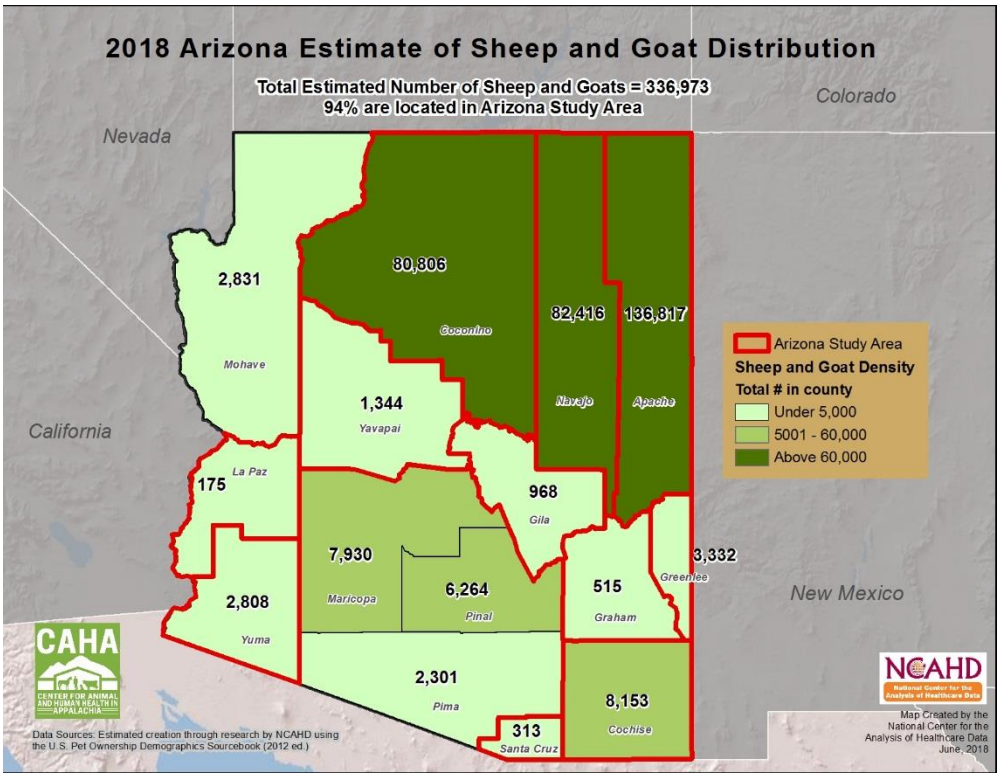
Data Sources: Estimated creation through research by NCAHD using the U.S. Pet Ownership Demographics Sourcebook (2012 ed.)
Map Created by the National Center for the Analysis of Healthcare Data June, 2018


2018 Arizona Estimate of Sheep and Goat Distribution
Total Estimated Number of Sheep and Goats = 336,973
94% are located in Arizona Study Area
Nevada
Colorado
California
New Mexico
2,831
Mohave
80,806
Coconino
82,416
Navajo
136,817
Apache
1,344
Yavapai
175
La Paz
968
Gila
7,930
Maricopa
6,264
Pinal
3,332
Greenlee
515
Graham
2,808
Yuma
2,301
Pima
8,153
Cochise
313
Santa Cruz
Arizona Study Area
Sheep and Goat Density
Total # in county
Under 5,000
5001 - 60,000
Above 60,000
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Data Sources: Estimated creation through research by NCAHD using the U.S. Pet Ownership Demographics Sourcebook (2012 ed.)
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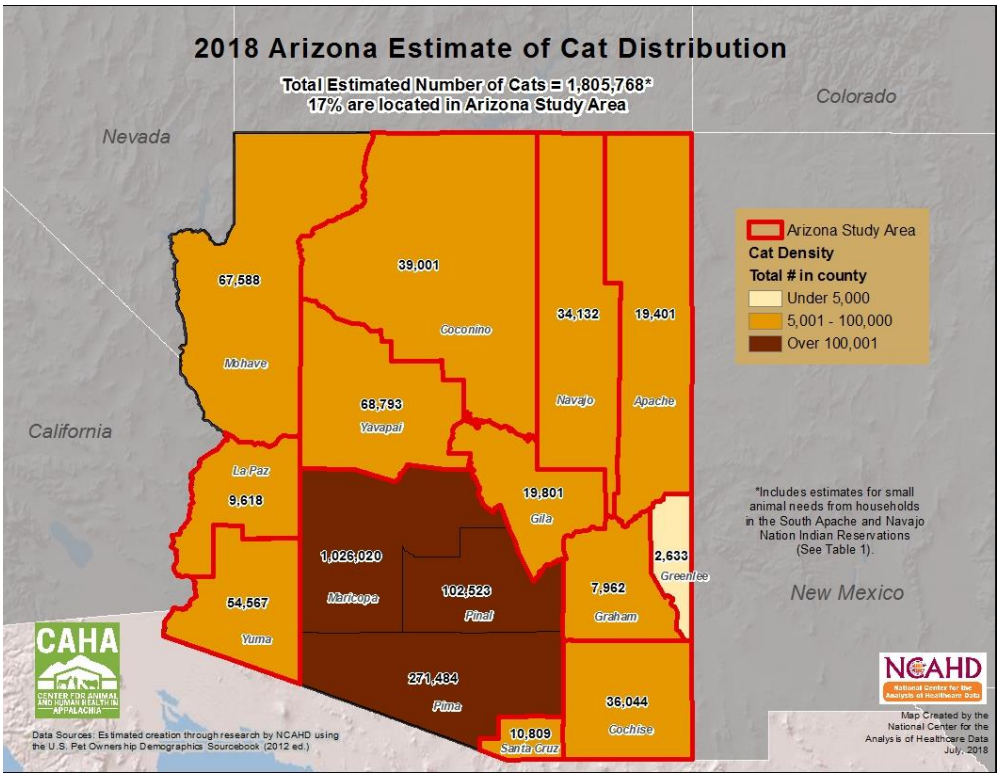
2018 Arizona Estimate of Cat Distribution
Total Estimated Number of Cats = 1,805,768*
17% are located in Arizona Study Area
Colorado
Nevada
California
New Mexico
Arizona Study Area
Cat Density
Total # in county
Under 5,000
5,001 - 100,000
Over 100,001
67,588
Mohave
39,001
Coconino
34,132
Navajo
19,401
Apache
68,793
Yavapai
La Paz
9,618
19,801
Gila
1,026,020
Maricopa
102,523
Pinal
2,633
Greenlee
7,962
Graham
54,567
Yuma
271,484
Pima
36,044
Cochise
10,809
Santa Cruz
*Includes estimates for small animal needs from households in the South Apache and Navajo Nation Indian Reservations (See Table 1).
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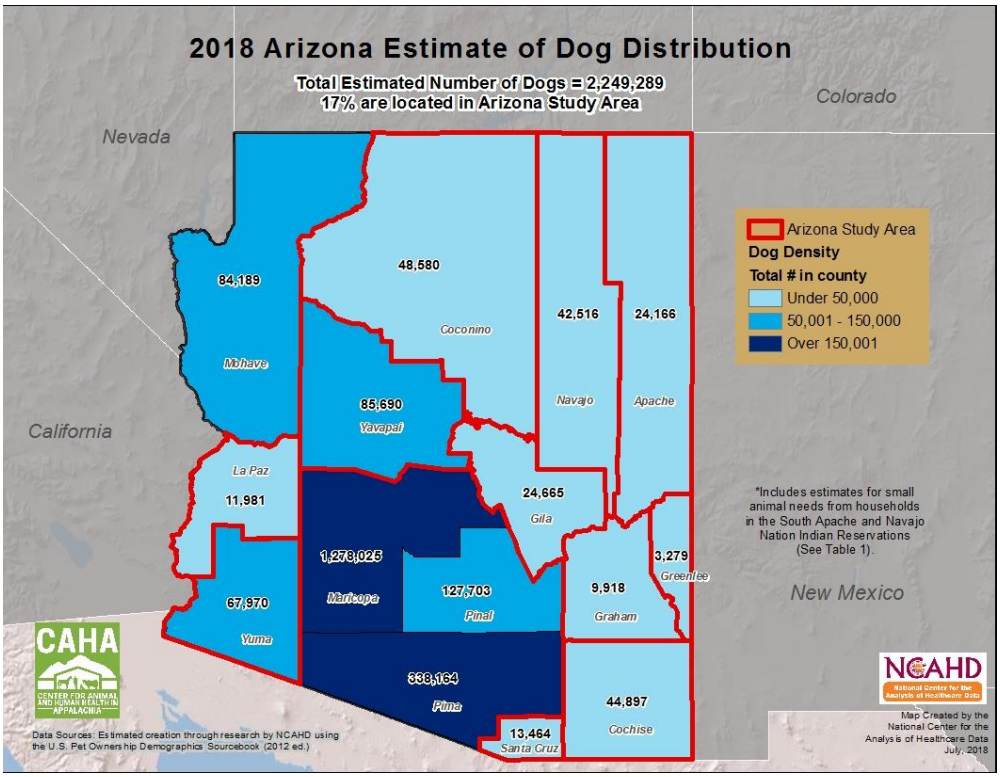
Data Sources: Estimated creation through research by NCAHD using the U.S. Pet Ownership Demographics Sourcebook (2012 ed.)
Map Created by the National Center for the Analysis of Healthcare Data July, 2018


2018 Arizona Estimate of Dog Distribution
Total Estimated Number of Dogs = 2,249,289
17% are located in Arizona Study Area
Colorado
Nevada
California
New Mexico
Arizona Study Area
Dog Density
Total # in county
Under 50,000
50,001 - 150,000
Over 150,001
84,189
Mohave
48,580
Coconino
42,516
Navajo
24,166
Apache
85,690
Yavapai
La Paz
11,981
24,665
Gila
1,278,025
Maricopa
127,703
Pinal
3,279
Greenlee
9,918
Graham
67,970
Yuma
338,164
Pima
44,897
Cochise
13,464
Santa Cruz
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Data Sources: Estimated creation through research by NCAHD using the U.S. Pet Ownership Demographics Sourcebook (2012 ed.)
Map Created by the National Center for the Analysis of Healthcare Data July, 2018

Appendix B – Economic Impact Input-Output Modeling

The multipliers are estimated using an input-output model and IMPLAN data. This report focuses on the impact in terms of employment and wages. Before presenting these impacts, the base concepts of employment and wage multipliers will be discussed. **Figure 1** illustrates the major flow of goods, services, and dollars of any economy.

The foundation of a county's economy includes those businesses which sell some or all of their goods and services to buyers outside of the county. Such a business is considered to be a "basic" industry. The flow of products out of, and dollars into, a county are represented by the two arrows in the upper right portion of **Figure 1**. To produce these goods and services for "export" outside the county, the basic industry purchases inputs from outside of the county (upper left portion of **Figure 1**), labor from the residents or "households" of the county (left side of **Figure 1**), and inputs from service industries located within the county (right side of **Figure 1**). The flow of labor, goods, and services in the county is completed by households using their earnings to purchase goods and services from the county's service industries (bottom of **Figure 1**). The interrelationships in **Figure 1** illustrate that a change in any one segment of a county's economy will have reverberations throughout the entire economic system of the county.

Consider, for instance, the opening of a veterinary clinic. The dollars going to households will increase as employees receive wages. Likewise, the veterinary clinic will purchase goods from other businesses and dollar flow to other businesses will increase. This, in turn, increases these businesses' purchases of labor and inputs. Thus, the changes in the economic impacts affect the entire local economy.

Community Economic System

A measure is needed that yields the effects created by an increase or decrease in economic activity. In economics, this measure is called the *multiplier effect*. Multipliers are used to indicate the ratio between direct impacts and the total impact. An employment multiplier of 2.0 indicates that if one job is created by a new industry, such as a veterinary clinic, 1.0 job is created in other sectors due to business and household spending.

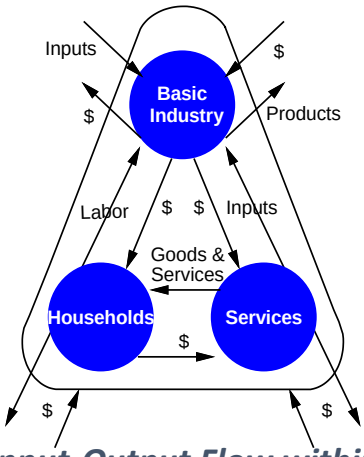

Figure 1 - Input-Output Flow within a Community

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Ms. Kimberly Kertis, Research Specialist, Lincoln Memorial University

Ryan Hutchinson, M.S. Econ, Assistant Director, National Center for Rural Health Works

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