

# Animal Disease Spread Model

## Population and Production Types



# Table of Contents

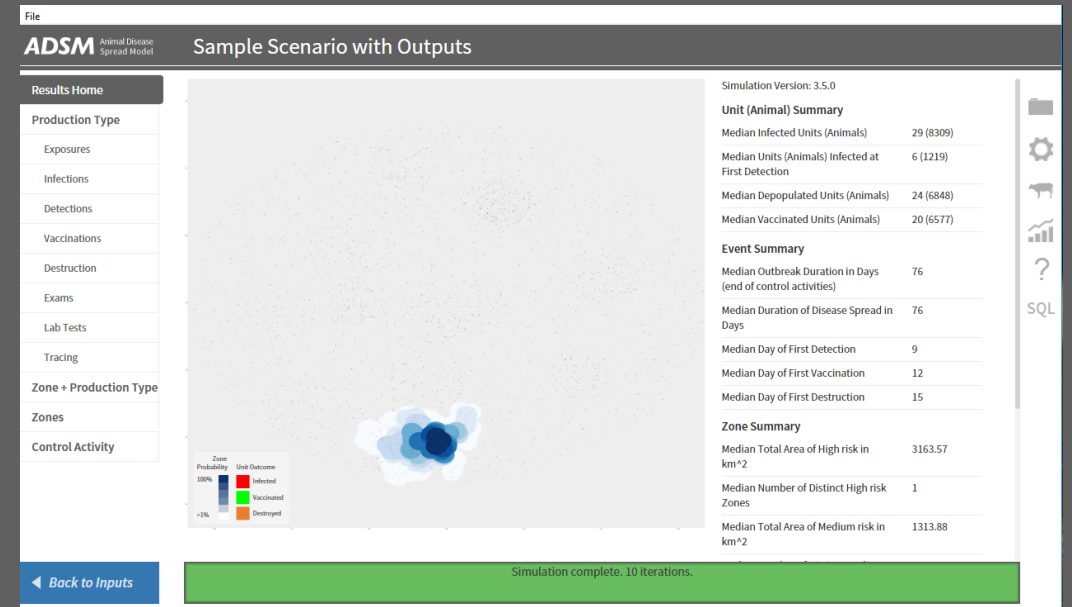
What is a Population?

What is a Production Type?

Assembling a Population

Sample Scenario

What's Next



# What is a Population?

---





A photograph of a rural landscape. In the foreground, a herd of longhorn cattle with various brown and white patterns are grazing in a lush green field. Some are standing, while others are partially obscured by the grass. In the middle ground, a line of tall, leafy green trees stretches across the frame. Behind the trees, a tall, dark metal windmill stands prominently against a clear sky. The overall scene is peaceful and pastoral.

The **population** is the collection of farm units that will be used in the model. A little later we will cover the details needed to make a complete population.



# What is a Production Type?

---





A key concept in the population is the use of

# Production Types

A production type describes both the species and the management practice of the farms to be included in the simulation

The Sample Scenario includes very simple production types

| Population Production Types  |              | ➡ | 🔗 | ✎ | 🔗 |
|------------------------------|--------------|---|---|---|---|
| Swine                        | (460 units)  | ● | ● | ○ | ● |
| Cattle                       | (3497 units) | ● | ● | ● | ● |
| + define new production type |              |   |   |   |   |



The production types that go into the population depend on a number of factors, such as the disease that is being simulated.





The production types will also depend on the area (location) that you want to represent and the animal management practices that are commonly used in that area.





A limitation in building a population may be the information you are able to find about the real farms in the area you want to represent.

In the United States, the National Agricultural Statistics Service, Census of Agriculture provides an estimate of farm populations and farm types.

[www.nass.usda.gov/AgCensus/](http://www.nass.usda.gov/AgCensus/)



Many of the parameters in the model are assigned by production type.

For example, disease spread parameters for swine production types might be different for cattle production types, even though you are modeling the same disease.

Similarly, direct and indirect movements might be very different between production types for the same species (e.g. swine move from a nursery to a feeder operation, but not from a feeder operation to a nursery).

The disease control parameters are also assigned by production type, giving the user flexibility in how control strategies are modeled (e.g. vaccinate large dairy and large and small swine nursery operations only).



# Assembling a Population

---



# Assembling the Population

Depending on the source of your units, assembling the population file may be a quick process or a long complicated process. The final file is expected to follow some rules for ADSM to recognize the parts of the file that are necessary for the simulation to complete.





# File Type

ADSM expects the file type to be a comma-separated value, or .csv file. It is possible to make a .csv file with Excel and other programs. The examples that are pictured will be in Excel as it is familiar to most users.

|   | A      | B              | C        | D        | E         | F      |
|---|--------|----------------|----------|----------|-----------|--------|
| 1 | UnitID | ProductionType | UnitSize | Lat      | Lon       | Status |
| 2 | 2      | Swine          | 89       | 33.41808 | -35.2526  | S      |
| 3 | 3      | Dairy Cattle   | 141      | 36.78172 | -36.36554 | S      |
| 4 | 4      | Dairy Cattle   | 341      | 32.93898 | -35.34563 | L      |
| 5 | 5      | Feedlot        | 114      | 36.31128 | -35.21025 | S      |
| 6 | 6      | Feedlot        | 155      | 33.27371 | -35.20067 | S      |
| 7 | 7      | Feedlot        | 161      | 36.58602 | -36.28207 | S      |

# Required and Optional fields in the Population File

| Field Name   | Data Type                    | Description  |
|--|------------------------------|--|
| The following fields are required:                                       |                              |  |
| UnitID   | Text                         | User-defined Identifier of a unit. It is suggested that this identifier be unique.       |
| ProductionType   | Text                         | User-defined name of Production Type   |
| UnitSize   | Integer                      | Number of animals in the unit, noted in application as Initial Size.                     |
| Lat  | Real (floating point) number | Latitude of the unit, between -90 and 90 inclusive                                       |
| Lon  | Real (floating point) number | Longitude of the unit, between -180 and 180 inclusive                                    |
| Initial_State  | Text                         | Disease state at the beginning of the simulation, see valid list on the following slide. |
| The following fields are optional if needed to adjust the disease state: |                              |  |
| Daysinstate  | Integer                      | Number of days the unit has been in the disease state, null or -1 indicate no days       |
| Daysleftinstate  | Integer                      | Number of days the unit has left in the disease state, null or -1 indicate no days       |



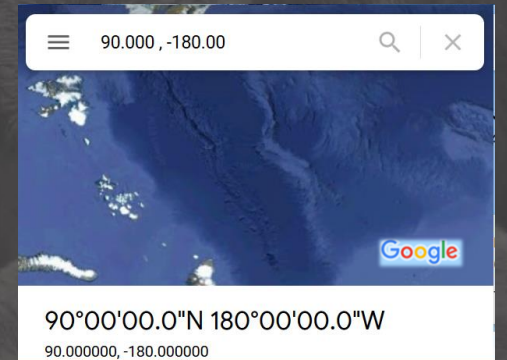
# Disease State Options for the Required Population File

## Field: Initial\_State

| Disease State    | Single Character Code |
|------------------|-----------------------|
| Susceptible      | S                     |
| Latent           | L                     |
| Subclinical      | B                     |
| Clinical         | C                     |
| Naturally Immune | N                     |
| Vaccine Immune   | V                     |
| Destroyed        | D                     |

# Some critical notes about the population file...

- ⚙ Field Names must match exactly as shown, with no spaces
- ⚙ Latitude and Longitude (Lat and Lon) must be valid within the accepted world boundaries
- ⚙ An error message will appear if the population file import fails to meet the expected guidelines



The online version of population requirements has a slightly more flexibility interpretation. A single version is presented here to simplify the process.



Unit ID is reflected in the Supplemental File outputs. It is not necessary to be unique for the application. Therefore, the application is not performing a verification of uniqueness.

However, if you wish to perform herd-level follow-up analysis, a unique identifier could be helpful.

The thought behind the text identifier is that you may acquire your population from a source that uses a herd-level identifier that has a meaning and needs to be conserved and used for analysis (e.g. CH\_120.0760).

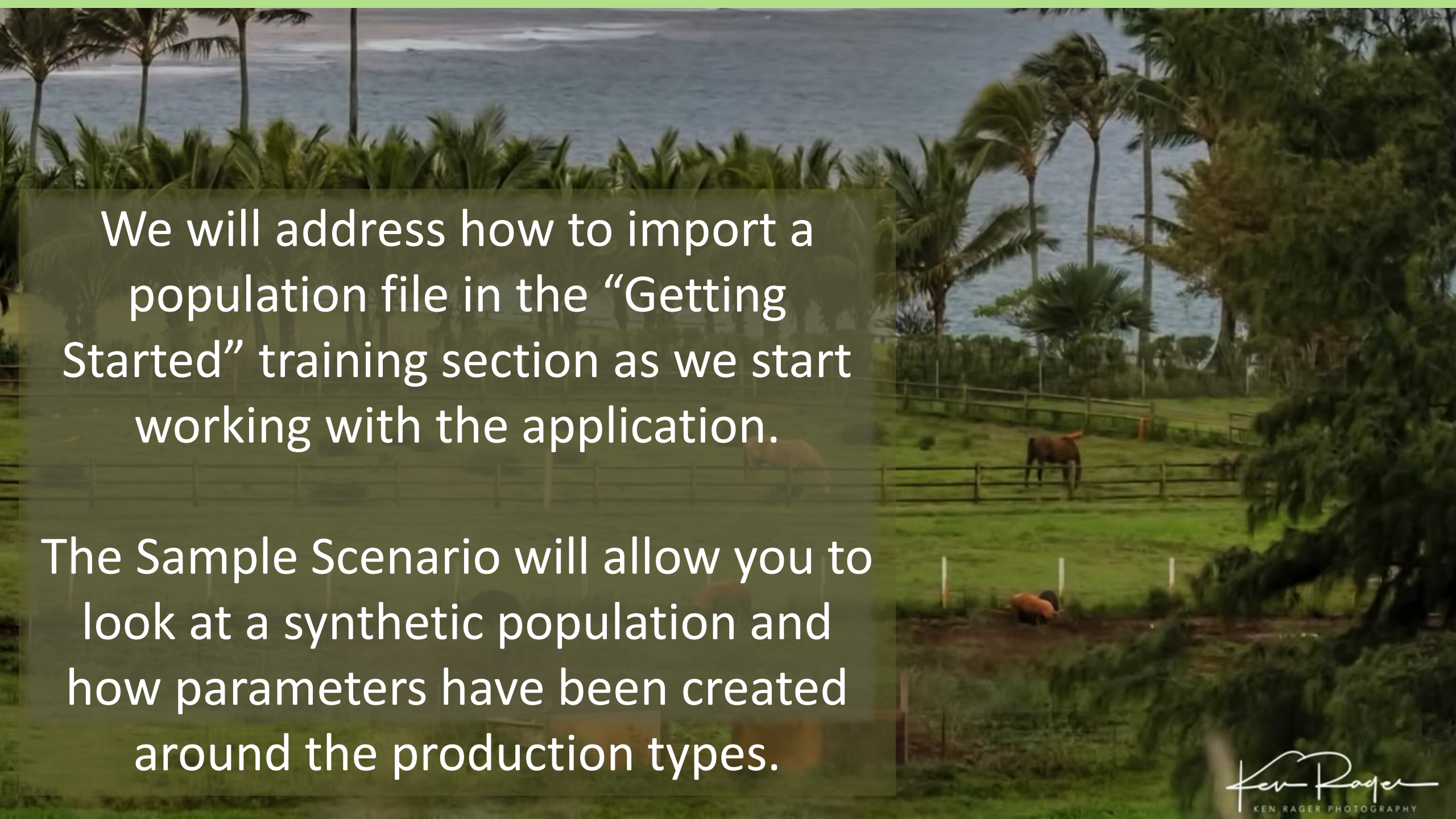


# Sample Scenario

---





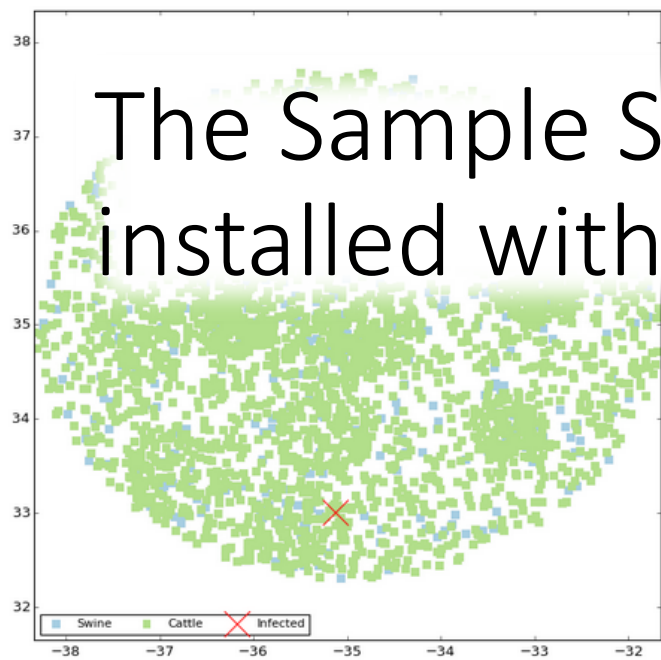


We will address how to import a population file in the “Getting Started” training section as we start working with the application.

The Sample Scenario will allow you to look at a synthetic population and how parameters have been created around the production types.

- Scenario Description
- Population
- Disease
  - Disease Progression
  - Assign Progression
  - Disease Spread
  - Review Disease Spread
- Controls on
  - Control Protocol
  - Vaccination Triggers
  - Vaccination Rings
  - Vaccination Global
  - Destruction Global
- Assign Protocols
- Zones
  - Zone Effects
  - Assign Effects
- Output Settings

Population File: Sample\_Pop\_Big.xml (3,957 units) [Replace Population](#)



The map displays a representative sampling of population data

[Refresh Map](#)

FILTERS

Production Type

Initial State

Initial Size Min:  Max:

Longitude Min:  Max:

Latitude Min:  Max:

[Clear Filters](#)

| Production type | Latitude | Longitude | Initial state | Initial size | Unit id |
|-----------------|----------|-----------|---------------|--------------|---------|
| Cattle          | 32.99984 | -35.12144 | Latent        | 107          | 19      |
|                 | 33.41808 | -35.2526  | Susceptible   | 89           | 2       |
|                 | 36.78172 | -36.36554 | Susceptible   | 141          | 3       |
|                 | 32.93898 | -35.34563 | Susceptible   | 341          | 4       |
|                 | 36.31128 | -35.21025 | Susceptible   | 114          | 5       |
|                 | 33.27371 | -35.20067 | Susceptible   | 155          | 6       |
| Cattle          | 36.59603 | -36.28207 | Susceptible   | 161          | 7       |
| Cattle          | 34.54935 | -32.81917 | Susceptible   | 827          | 8       |
| Cattle          | 35.55098 | -31.74311 | Susceptible   | 355          | 9       |
| Cattle          | 32.79245 | -34.2104  | Susceptible   | 46           | 10      |
| Cattle          | 35.76083 | -37.81564 | Susceptible   | 518          | 11      |
| Cattle          | 34.47019 | -36.0473  | Susceptible   | 356          | 12      |
| Cattle          | 36.11096 | -35.13854 | Susceptible   | 100          | 13      |
| Cattle          | 34.92398 | -33.8703  | Susceptible   | 904          | 14      |
| Swine           | 36.0872  | -34.33728 | Susceptible   | 142          | 15      |
| Cattle          | 34.83321 | -32.90607 | Susceptible   | 191          | 16      |
| Cattle          | 37.38944 | -35.13237 | Susceptible   | 156          | 17      |
| Cattle          | 36.50795 | -36.37611 | Susceptible   | 228          | 18      |
| Cattle          | 33.89553 | -34.55941 | Susceptible   | 327          | 20      |
| Cattle          | 33.95002 | -35.69487 | Susceptible   | 55           | 21      |
| Cattle          | 34.00686 | -35.59949 | Susceptible   | 169          | 22      |
| Swine           | 34.5475  | -35.05291 | Susceptible   | 841          | 23      |
| Cattle          | 36.01563 | -34.36979 | Susceptible   | 31           | 24      |
| Cattle          | 37.40086 | -35.21244 | Susceptible   | 115          | 25      |
| Cattle          | 35.26371 | -36.31808 | Susceptible   | 56           | 26      |
| Cattle          | 33.10394 | -32.70794 | Susceptible   | 55           | 27      |
| Cattle          | 36.89481 | -34.46319 | Susceptible   | 81           | 28      |
| Cattle          | 33.92407 | -33.14195 | Susceptible   | 20           | 29      |

Showing the first 100 Units. Use sort and filters to find specific Units.

[Edit Population](#)

- 
- 
- 
- 
- 
- SQL



# What's Next

---





**Join the flock!**  
**Learn more about ADSM or try an example**

ADSM is currently available at <https://github.com/NAVADMC/ADSM/releases/latest>

Try the sample scenario

<https://github.com/NAVADMC/ADSM/wiki/A-Quick-Start-Guide:-Running-the-sample-scenario>

Read the wiki pages link

<https://github.com/NAVADMC/ADSM/wiki>



**Addition training materials will be posted at**  
**<http://navadmc.github.io/ADSM/>**





This work was funded in whole through Cooperative Agreement AP18VSCEAH00C005 with the University of Tennessee Department of Animal Science by the Animal and Plant Health Inspection Service, an agency of the United States Department of Agriculture.

### Photo credits

Canva.com

Mariposa Ranch Watusi

Ken Rager Photography

Ali Seamans, Dubois Holler Farms

Barton Farm

Roksolana Zasiadko unsplash

Pinecroft Farms, Woodstock CT, Mariah Chapman



**Animal Science**