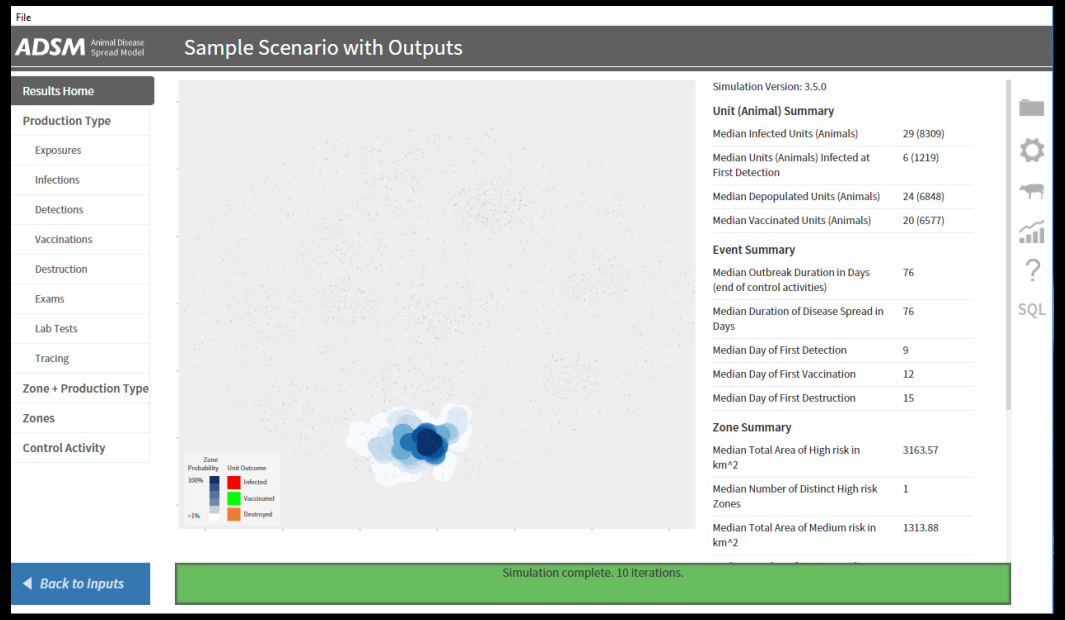
Animal Disease Spread Model

Population and Production Types

Table of Contents



Document Conventions

The following conventions are used throughout the training modules:

TRAINING MODULES other than the one you are currently in will use all capital letters, bold face, italics and underline.

Rhetorical questions and *extra notes* will be in orange italics.

Conventions applying to the ADSM application are:

Navigation tabs on right and Admin panels on left are designated with an underline. Examples are Project Panel or Population tab.

Items with an action on click, such as [Apply] Button or [Save As] icon are enclosed in square brackets.

Parameter fields (inputs) are in blue italics and *Variables* (outputs) are in green italics.

Navigation Tabs > *Parameter field* indicates to go to the given navigation tab to find the given field.

Hyperlinks appear in bright green type with underline http://navadmc.github.io/ADSM/

What is a Population?


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.
Mariposa Ranch Watusi

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 many factors, such as the disease that is being simulated.

The production types will also depend on the selected area (location) 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's Census of Agriculture provides an estimate of farm populations and farm types.

USDA - National Agricultural Statistics Service - Census of Agriculture

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).

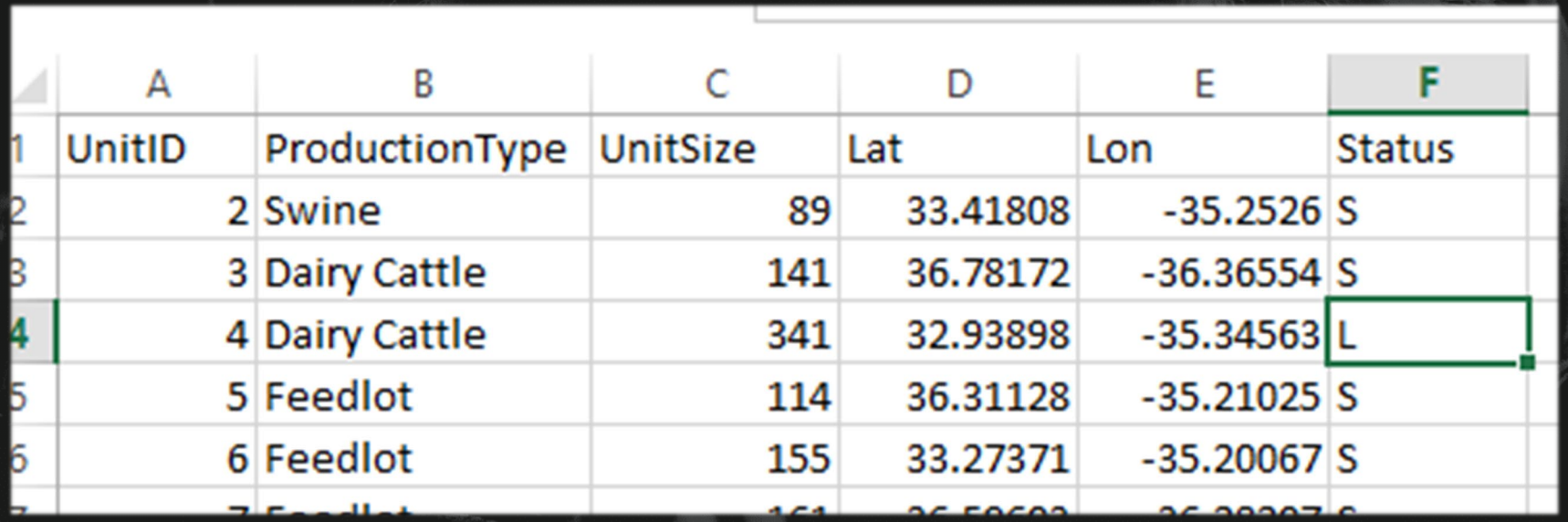
The disease control parameters are also assigned by production type, giving the user flexibility in how control strategies are modeled (e.g., vaccinate large dairy and large and small swine nursery operations only).

Assembling a Population

Depending on the source of your units, assembling the population file may be a quick process or a long and complicated one. 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-separate 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

Required and optional fields in the population file

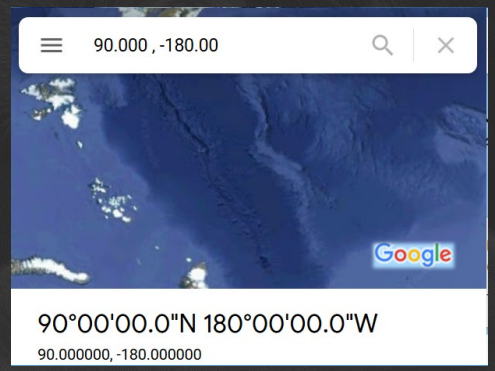
Field Name	Data Type	Description
The following fields are required:		
UnitID	Text	User-defined Identifier of a unit. It is suggested that this identifier be unique.
ProductionType	Text	User-defined name of Production Type
UnitSize	Integer	Number of animals in the unit, noted in application as Initial 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
Status	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: Status

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
- Unit size should be entered as a whole number
- An error message will appear if the population file import fails to meet the expected guidelines



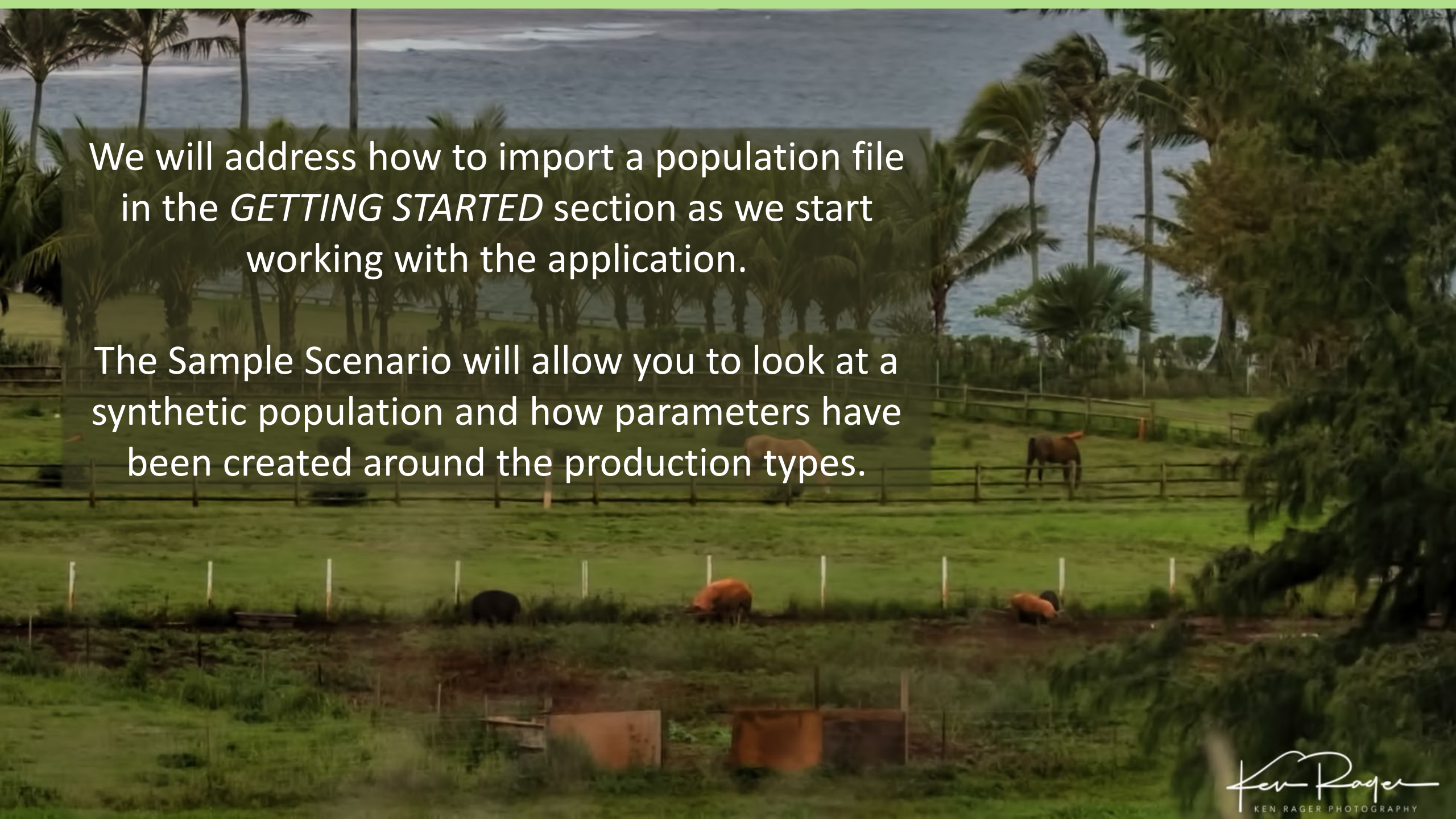
The online version of population requirements has a slightly more flexible interpretation. A single version is presented here to simplify the process.

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* 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.
KEN RAGER PHOTOGRAPHY

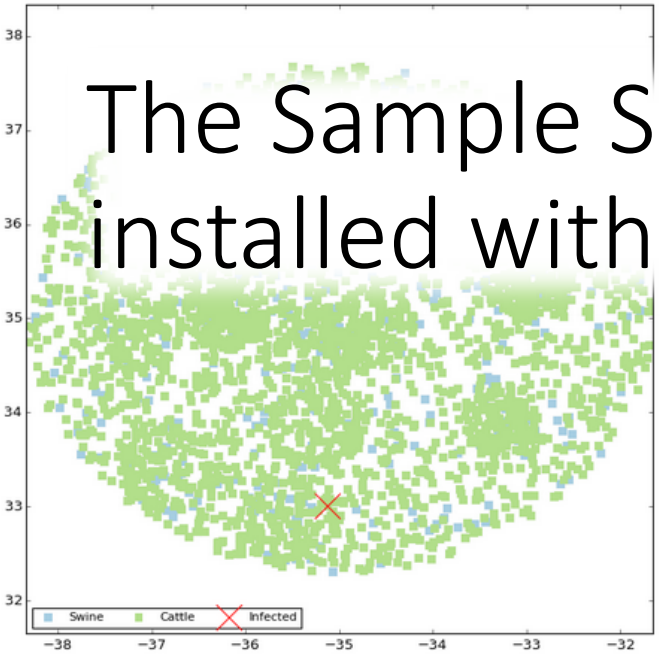
ADSM Animal Disease Spread Model

Sample Scenario

- 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

Validate Scenario

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

The Sample Scenario installed with ADSM

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

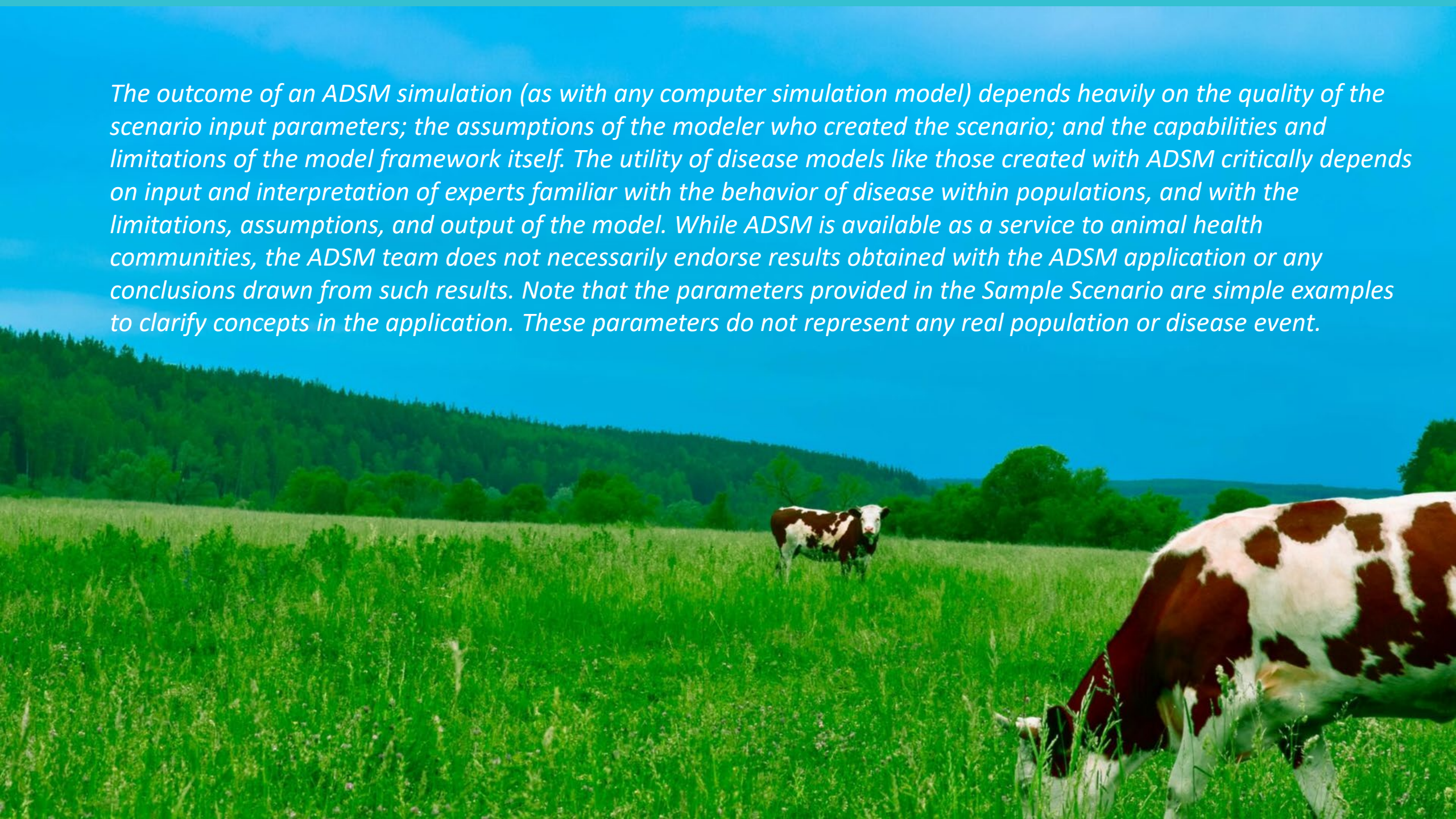
Read the wiki pages link
https://github.com/NAVADMC/ADSM/wiki

Additional training materials will be posted at
http://navadmc.github.io/ADSM/

Training includes:

- **Overview**
- **Populations and Production Types**
- **Getting Started**
- **Defining Disease**
- **Control Parameters**
- **Output Settings and Run**
- **Results**
- **Detailed Evaluation of Results - Verification and Validation**
- **Vaccination Strategy**
- **Administration**

The outcome of an ADSM simulation (as with any computer simulation model) depends heavily on the quality of the scenario input parameters; the assumptions of the modeler who created the scenario; and the capabilities and limitations of the model framework itself. The utility of disease models like those created with ADSM critically depends on input and interpretation of experts familiar with the behavior of disease within populations, and with the limitations, assumptions, and output of the model. While ADSM is available as a service to animal health communities, the ADSM team does not necessarily endorse results obtained with the ADSM application or any conclusions drawn from such results. Note that the parameters provided in the Sample Scenario are simple examples to clarify concepts in the application. These parameters do not represent any real population or disease event.



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