COMET-Farm™ Manual

Overview

COMET-Farm™ is a web-based greenhouse gas (GHG) accounting decision-support tool that can be used by farmers, ranchers, conservation planners, and more to run a full greenhouse gas assessment for carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) from major on-farm emission sources, in addition to CO_2 removal into biomass and carbon sinks within the farm-gate. Implementing the methods outlined in the U.S. Department of Agriculture’s (USDA) Methods for Entity-Scale Inventory (henceforth referred to as the “USDA methods document” or the “Blue Book”), the tool allows users to input land management-related activity

data to annual/perennial cropping, grazing, agroforestry, and forestry systems to compare business as usual, baseline management to one or more conservation scenarios.

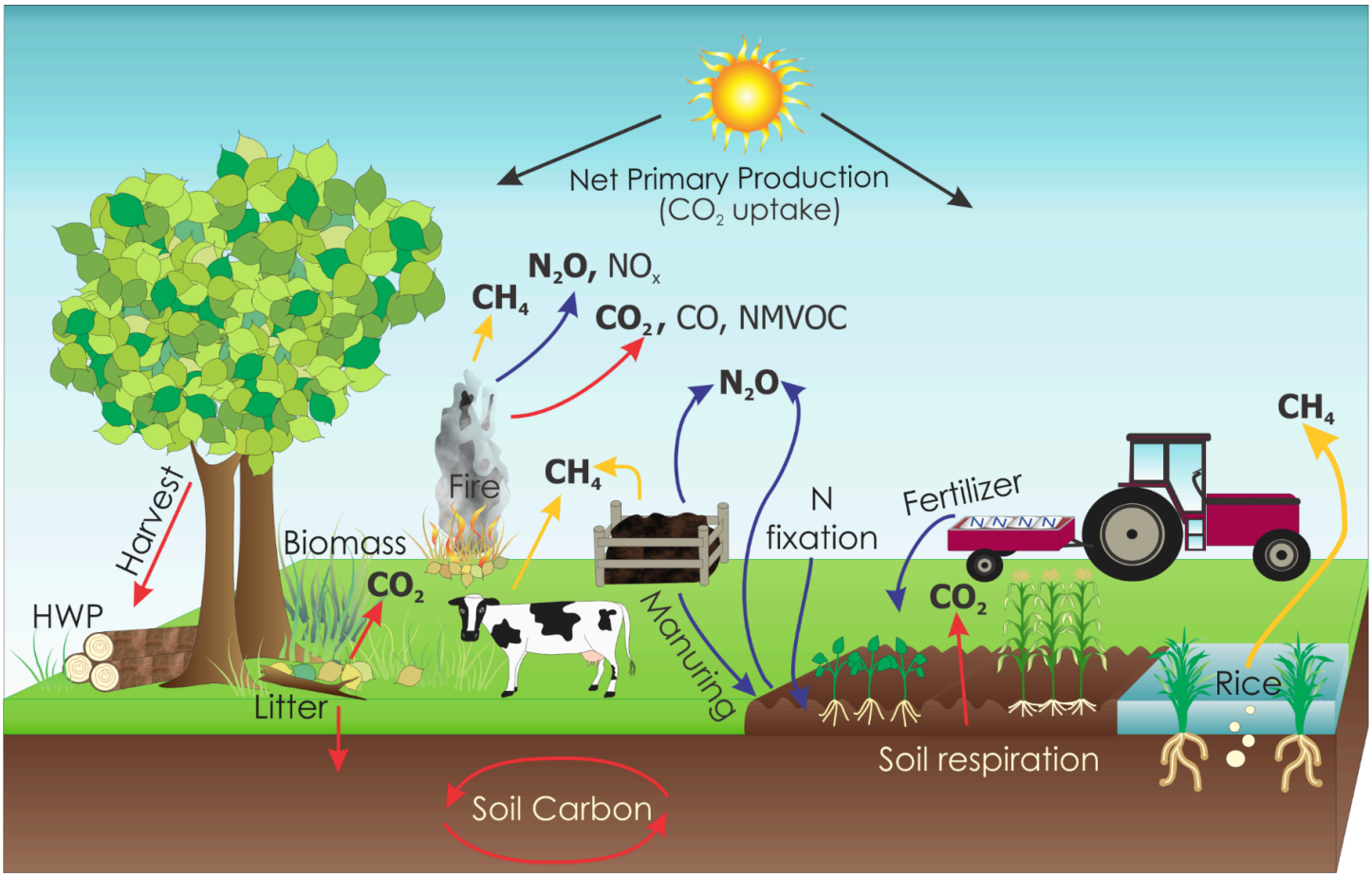


Image courtesy of IPCC 2006 and Amy Swan of the NREL at Colorado State University

COMET-Farm was created in parallel with and as a function of the peer-reviewed USDA Methods for Entity-Scale Inventory document. For estimations of soil carbon and GHG impacts for a management activity or conservation practice to be included in the COMET-Tools, clearly defined methods for GHG accounting need to be included in the methods document.

Users can access COMET-Farm via the graphical user interface (GUI) for all accounting activities and/or an application programming interface (API) for only cropland, pasture, range, orchard/vineyard accounting activity. Due to soil and weather data limitations, COMET-Farm can only be used within most regions of the contiguous United States. Regions with too rocky or cobbly soil types are unavailable for accounting in COMET. COMET-Farm is not designed to run analysis on urban agricultural systems.

COMET-Farm itself is entirely independent of the carbon markets and does not advise on credits nor answer questions in regards to carbon credits - COMET-Farm is solely an estimation tool. The methods defined in the USDA methods document, and therefore in COMET-Farm, are not intended as an accounting framework for emission reduction crediting or trading.

Information Safety

COMET-Farm abides by the USDA privacy policy; therefore, user data, including project-specific management, demographic, and contact information, will not be viewed, used, or shared.

Methods

As previously mentioned, COMET-Farm was developed in parallel with and as a function of the USDA methods document (aka the “Blue Book”). Each accounting activity in the tool can be associated with a chapter in this document. For estimations of soil carbon and GHG impacts for a management activity or conservation practice to be included in the COMET-Tools, clearly defined methods for GHG accounting need to be included in the methods document.

Accounting Activity	Description	Blue Book Chapter
Cropland, Pasture, Range, Orchards/Vineyards	This accounting activity uses DayCent to estimate changes in soil-related emissions and direct nitrous oxide emissions resulting from management practices such as planting dates, tillage, and fertilizer application. Emission estimates will only relate to soil-related emissions and direct nitrous oxide emissions within the defined entity or entities (i.e. fields, pastures, vineyards, etc.).	Chapter 3: Quantifying Greenhouse Gas Sources and Sinks in Cropland and Grazing Land Systems
Animal Agriculture	This accounting activity uses empirical calculations to estimate emissions resulting from livestock management practices, such as how the animals are housed or how manure is handled. Emission estimates will only relate to emissions related to livestock within the defined entity (i.e., heads of cattle, poultry, swine, etc.).	Chapter 4: Quantifying Greenhouse Gas Sources and Sinks for Animal Production Systems
Agroforestry	This accounting activity uses empirical calculations to estimate emissions resulting from agroforestry practices such as silvopasture systems, riparian buffers, or windbreaks.	Chapter 5: Quantifying Greenhouse Gas Sources and Sinks for Managed Forest Systems
Forestry	This accounting activity uses empirical calculations to estimate emissions resulting from forestry management practices such as clear-cut harvesting.	Chapter 5: Quantifying Greenhouse Gas Sources and Sinks for Managed Forest Systems

DayCent in COMET-Farm

Soil-related emissions, or those captured in the cropland/pasture/rangeland/orchard/vineyard accounting activity are calculated through the DayCent model, a daily time-step version of the CENTURY biogeochecmial model. COMET-Farm switched from the 20cm to 30cm DayCent model in 2022 to align with the national inventory. As the principle soil carbon and direct nitrous oxide estimation model in the tool, DayCent runs simulations about how crops are grown and about how nitrogen and carbon cycle through the soil and the ecosystem. The model also simulates data like how specific crops are harvested, how crop residue decomposes, and how carbon fluctuates between sources and sinks as a result of physical properties of the soil (such as temperature and moisture). COMET-Farm and DayCent pull from the SSURGO soil database and the PRISM weather dataset to drive the model. All the information driving the model comes from a dataset developed from peer-reviewed studies from over 200 sites, going back 170 years, and is maintained by universities and private corporations.

In the cropland accounting activity, the DayCent and COMET-Farm models are going to run on every soil map unit included in a project to provide a weighted average in the report. The more map units included in a project (greater number of fields or greater acreage), the longer it will take for a report to be generated. Because DayCent is only run in the cropland module, all the other reports (animal agriculture, agroforestry, and forestry) should be generated within no more than 30 seconds.

System Boundaries

COMET-Farm is designed to do an entire greenhouse gas inventory within an *entity* as defined by the user. The boundaries of these entities are important to the interpretation of results because they will include the GHG emissions and carbon sequestration occurring onsite for the management practice of interest. These entities should fall into one of COMET-Farm's four accounting modules: cropland/pasture/rangeland/orchard/vineyard, animal agriculture, agroforestry, and forestry. Entity boundaries include physical boundaries (e.g., actual field boundaries), temporal boundaries (e.g., one year of management for an animal production system), activities boundaries (e.g., land-based activities such as tillage and harvest), and material boundaries (e.g., the assessment of the three main GHG associated with agriculture). The COMET-Farm report will not address any upstream, downstream, or indirect offsite emissions such as from manufacturing or transportation. These emissions can instead be accounted for in COMET-Energy.

The accounting activities in COMET-Farm are entirely separate from one another and do not "talk to" or interact with each other. This means, for example, that even if a grazing event is included in the cropland section of the tool, any enteric emissions from the grazing livestock must be accounted for separately in the animal agriculture module. Greenhouse gas emissions and reductions from each of these accounting activities are also presented as separate reports, even if they are included in the same project.

Geographic Limitations

Due to soil and weather data limitations, COMET-Farm can only be used within most regions of the contiguous United States (lower 48). Regions with too rocky or cobbly soil types are unavailable for accounting in COMET-Farm due to the lack of soil data. The tool is not designed to run analysis on urban agricultural systems and will throw an error if non-agricultural lands (housing or water) are included in defined fields or stands.

Assessments of conservation practices in Alaska and Hawaii have limited availability in COMET-Planner. Regions outside of the United States can be assessed using COMET-Planner Global. See the Other COMET-Tools section for more information.

Version Log

In September 2022, COMET-Farm updated from the 20cm DayCent Model to the 30cm DayCent Model (version comparison).

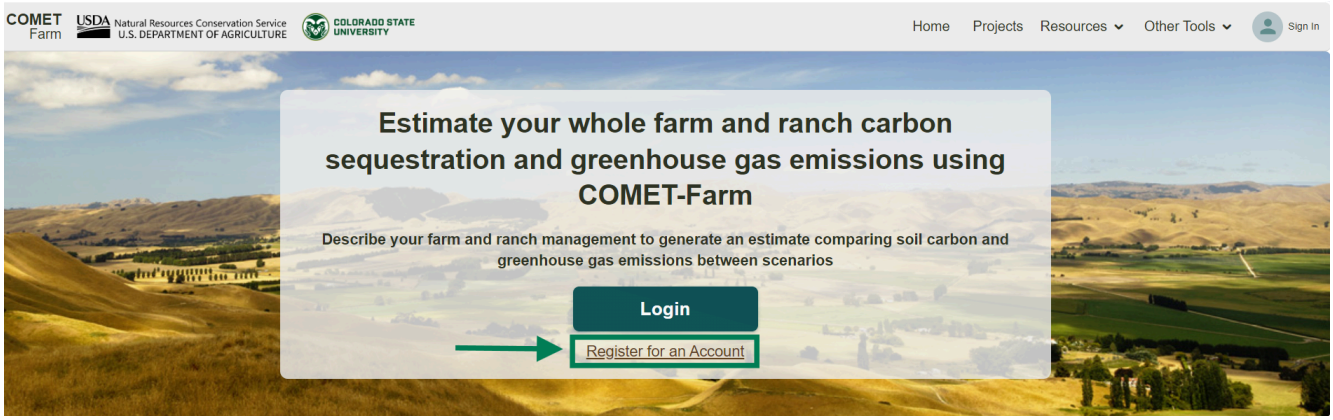
User Accounts

To create a COMET-Farm project on either interface, users must create an account.

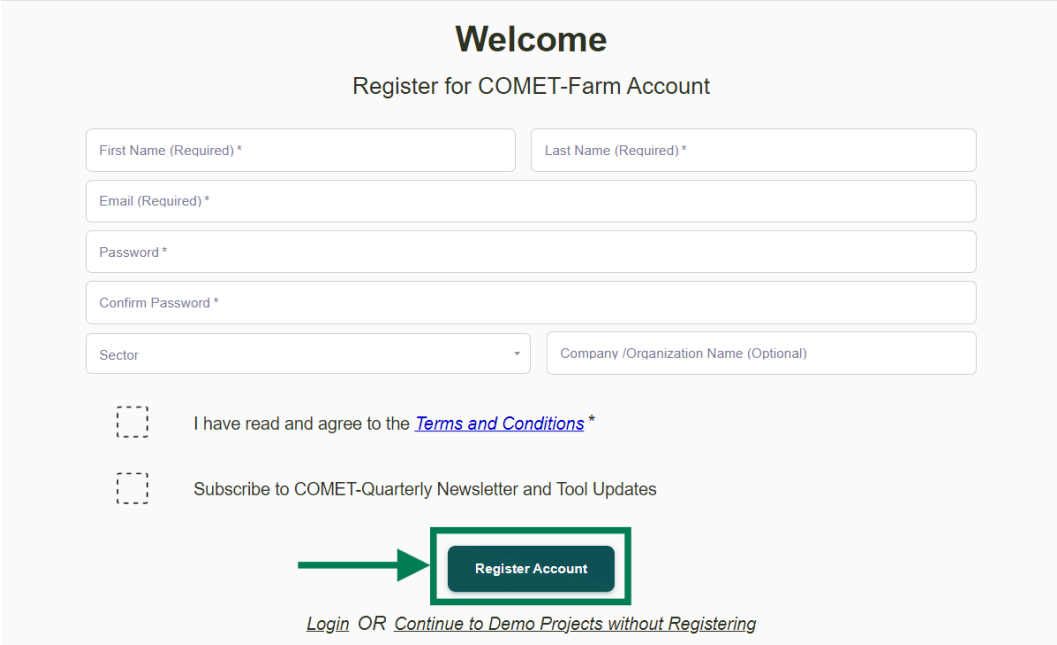
Account holders are the only individuals with access to their account and any data included in their projects. Please review the Information Safety section of this manual for more details on the COMET-Farm and the USDA Privacy Policy. Account holders may share their login credentials at their discretion.

Creating a COMET-Farm Account

1. Navigate to www.comet-farm.com
2. Select “Register for an Account”



3. Complete the *required* registration details and select “Register Account”:



   a. Users may subscribe to the COMET-Quarterly Newsletter and tool updates. The team releases four newsletters and two to three tool updates annually.

4. Upon registration, users will receive a confirmation email from info@comet-farm.com to confirm registration.
   a. If you have not received a confirmation email within five minutes of registering, please check your spam/junk email folder. If you still have not received a confirmation email within any folder, please contact the COMET-Support Team via the “Need Help?” Widget or email at appnrel@colostate.edu.

GUI and API

Graphical User Interface (GUI)

The COMET-Farm GUI is the digital interface where users interact with graphical components (buttons, icons, maps, etc.) at www.comet-farm.com. The COMET-Farm GUI is free for all users. Users can register for an account to store and access projects they have created or imported. COMET-Farm abides by the USDA privacy policy; therefore, user data, including project-specific management, demographic, and contact information, will not be viewed, used, or shared.

The COMET-Farm GUI allows for full GHG accounting of all accounting activities available in the tool: cropland, pasture, range, orchard/vineyard; animal agriculture; agroforestry; and forestry.

Application Programming Interface (API)

The COMET-Farm API is the application programming interface where users can programmatically access the methods/models implemented in the tool, bypassing the GUI. The API is really intended for rapid, bulk processing such as a user attempting to assess thousands of acres of land, which would be tedious on the

GUI. COMET-Farm API users *must* create an account and can access the tool for free for up to 50 model runs per day (what is a model run?). The API runs in the Google Cloud; therefore, to access additional model runs, users should contact appnrel@colostate.edu to set up a service agreement. The API utilizes XML input and output files through POST connections and Webhooks responses. **The COMET-Farm API is only available for the cropland/pasture/rangeland/orchard/vineyard accounting activity**.

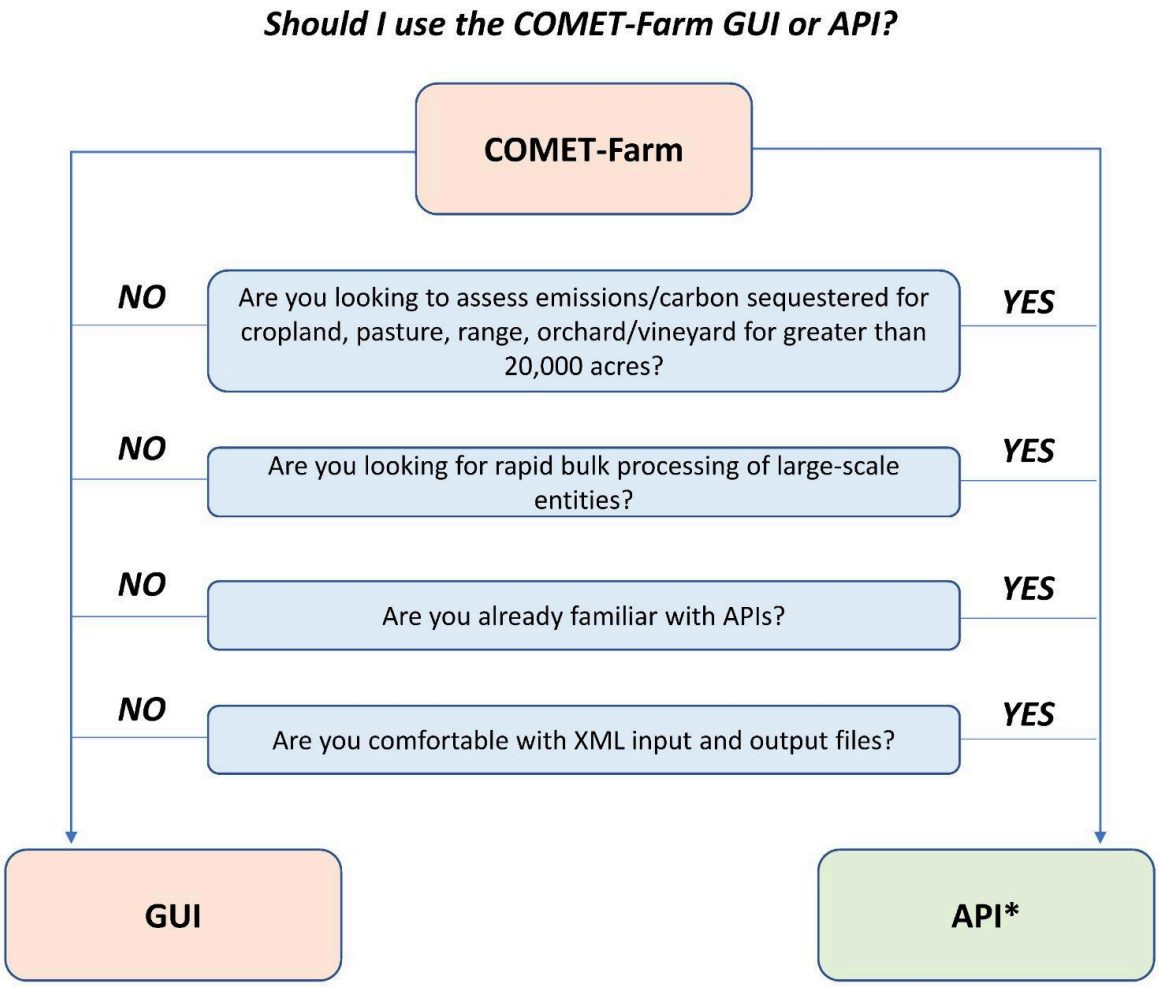
While the new API (updated to reflect the 2024 version of COMET-Farm) will be available for use concurrent with the launch of the new GUI, resources and documentation to assist users engaging with the API will not be available until shortly after the release. In the meantime, users can try exporting a project from the GUI, opening it in an XML reader, and updating their API input files accordingly.

The API pricing model, shown below, is calibrated on an annual basis to ensure that costs associated with API processing, administrative overhead, and technical support are accounted for.

API Tier	Number of API Runs	Total Price (USD)	Price (USD) / Run
T1	1,000	$ 207.13	$ 0.21
T2	5,000	$ 746.47	$ 0.15
T3	10,000	$ 1,268.01	$ 0.13
T4	25,000	$ 2,929.02	$ 0.12
T5	50,000	$ 5,054.73	$ 0.10
T6	100,000	$ 9,145.49	$ 0.09

Unsure of whether to use the GUI or the API? Check out the decision tree below.

Should I use the COMET-Farm GUI or API?



*For help getting started with the API, visit the Accessing API article in the Need Help? widget

Terms of Use

The methodologies supporting COMET-Farm are not intended as an accounting framework for emission reduction crediting or trading. Neither COMET-Farm nor the provided results constitute an offset protocol or a full lifecycle GHG analysis.

Users agree not to use the software or tools provided on this website for the purpose of engaging in an offset protocol or full lifecycle GHG analysis. Any user found in violation of this policy, including but not limited to using the software tool for purposes related to an offset protocol, may receive a warning. Continued violation of the policy may result in further action, including the suspension or termination of the user's access to the software tool.

COMET-Farm and related software is provided "as is" without any warranties, express or implied, including but not limited to the implied warranties of merchantability, fitness for a particular purpose, and non-infringement.

CSU or USDA makes no representations or warranties regarding the performance or results that may be obtained from the use of the COMET API and related Software.

In no event shall CSU or USDA be liable for any direct, indirect, incidental, special, or consequential damages arising out of or in any way connected with the use of the COMET API and related Software, even if CSU has been advised of the possibility of such damages.

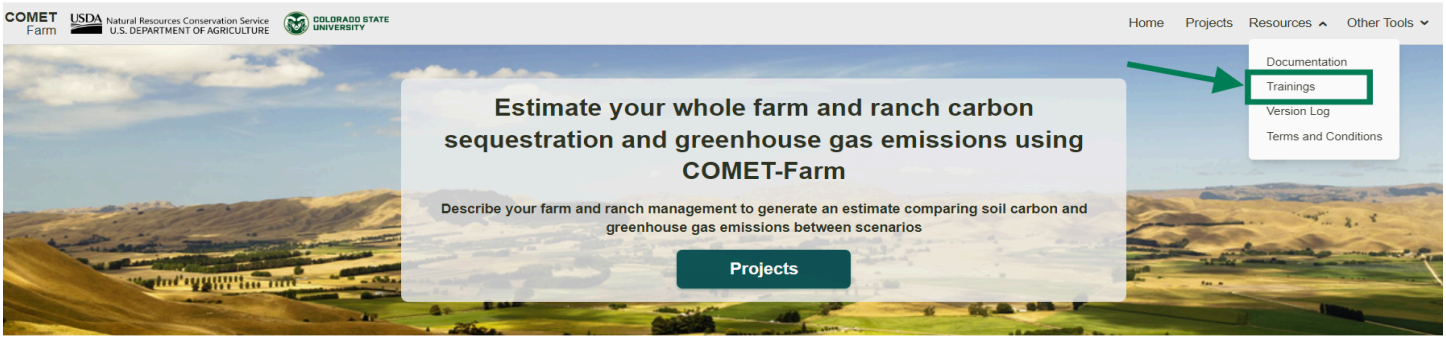
Troubleshooting and Tool Support

Recommended Browser and Settings

Google Chrome, Firefox, and Microsoft Edge browsing windows set to 100% are the recommended web browsers for best tool performance. The COMET-Tools are *not* tested on Safari.

Trainings

The COMET-Farm Outreach team offers free, weekly trainings for anyone to attend. Trainings occur in a sequence of 3: an introduction and demo of the cropland/rangeland/pasture/orchard/vineyard accounting activity, an introduction and demo of the animal agriculture accounting activity, and a demo of a multi-accounting project (cropland, animal agriculture, and agroforestry). Individuals interested in attending a training must register ahead of time on the Resources → Training tab to attend and receive a recording of the training. Because topics vary in each week's training, be sure to review the details in the calendar event. The COMET-Team does *not* offer individual trainings. A repository of previous trainings are available on the COMET-Tools YouTube channel.



Office Hours

The COMET-Farm Outreach team offers weekly Office Hours where COMET-Users can engage with the Outreach Specialist(s) with questions about their specific projects, troubleshooting, or general questions not otherwise covered in a training. It is highly recommended to attend a training before attending an office hours session, and participants must register in advance one time and then use the same link each week. Office hours are not recorded. Registrants will be notified via the email they provided if scheduled office hours are canceled.

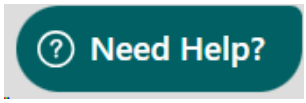
Contact

Users may contact the team with COMET-related questions at the email: appnrel@colostate.edu or through the “Need Help?” Widget that follows users on every page of the COMET-Tools. If users experience an issue with the tool or have a question about activity data entry, please be sure to include a detailed explanation of the issue complete with screenshots, if necessary.

Support Materials

The COMET-Team has developed a suite of resources to support users. We recommend all users begin by registering and attending free, open training. Support materials include:

- The COMET-Farm Manual
- The Need Help? Widget populated with tool FAQs

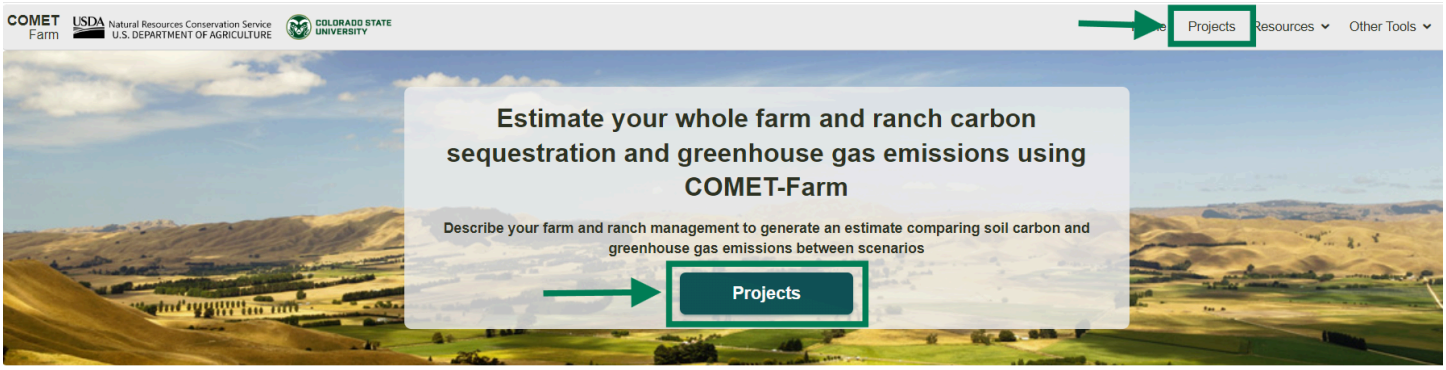


    - Full repository of FAQs
- COMET-YouTube training and tutorial video repository
- Data entry spreadsheets available for cropland, animal ag (dairy), animal ag (beef), and animal ag (swine) projects. These spreadsheets are simply for organizational purposes and ***cannot*** be imported into COMET-Farm.
- Step-by-step guidance documents are also available for cropland and animal ag (dairy).

Projects

Creating a New Project

Once users have logged into their COMET-Farm account, they will be brought to the COMET-Farm Home Page. From there, users can click either the *Projects* button in the center of the page or click the *Projects* tab in the upper-right-hand corner.



This will bring users to their **Project Repository**, which lists all of the projects they have created since registering a COMET-Farm account. By default, projects will be organized by Date Accessed, but users can also opt to have their projects organized by Name. To create a new project, click “New Project” at the bottom of your project repository.

Project Name

Users will first be prompted to name their project and, if they want, provide project notes. Because users can have unlimited projects linked to their account, it is recommended to include some reference to the location, management, or other details in the Project Name (e.g., “Corn-Soy Alameda CA,” rather than “Project 1”). Project titles are limited to 25 characters, but users can provide more details in the Project Notes.

Accounting Activities

COMET-Farm consists of four accounting activities or modules: Cropland/Pasture/Range/Orchards/Vineyards, Animal Agriculture, Agroforestry, and Forestry. These modules are independent of each other, performing a greenhouse gas inventory only within your defined entity (see System Boundaries). Users can select multiple accounting activities within one project (i.e., a multi-accounting project); however, each activity’s reported emission estimates will be generated in their own report. Users must select at least one activity.

Accounting Activity	Description
Cropland, Pasture, Range, Orchards/Vineyards	This accounting activity uses DayCent to estimate changes in soil-related emissions and direct nitrous oxide emissions resulting from management practices such as planting dates, tillage, and fertilizer application. Emission estimates will only relate to soil-related emissions and direct nitrous oxide emissions within the defined entity or entities (i.e. fields, pastures, vineyards, etc.).
Animal Agriculture	This accounting activity uses empirical calculations to estimate emissions resulting from livestock management practices, such as how the animals are housed or how manure is handled. Emission estimates will only relate to emissions related to livestock within the defined entity (i.e., heads of cattle, poultry, swine, etc.).
Agroforestry	This accounting activity uses empirical calculations to estimate emissions resulting from agroforestry practices such as silvopasture systems, riparian buffers, or windbreaks
Forestry	This accounting activity uses empirical calculations to estimate emissions resulting from forestry management practices such as clear-cut harvesting.

Baseline Years- *Cropland, Pasture, Range, Orchards/Vineyards Accounting*

Baseline years are only applicable in the *Cropland, Pasture, Rangeland, Orchard/Vineyard* accounting activity. “Baseline” refers to current management, or “business as usual” management before a change in management occurs in the scenario period. COMET-Farm requires *at least* a 5-year baseline for any *cropland, pasture, rangeland, orchard/vineyard* accounting activities. For projects that include *Cropland, Pasture, Rangeland, Orchard/Vineyard,* and other accounting activities, the selected baseline period will *only* be applicable to the *Cropland, Pasture, Rangeland, Orchard/Vineyard* activity.

Project Options

Once a project has been created, there are several options for how users can engage with that project. Clicking on a project will expand that panel to reveal the following options:

Edit

Editing a project includes the option to rename the project, add project notes, adjust the accounting activities to include in the project, and, for a cropland project, adjust the baseline years.

Delete

Deleting a project will permanently remove it from the project repository. In order to confirm that a user wants to delete their project, they will be asked to type the project name to enable the delete function.

Duplicate

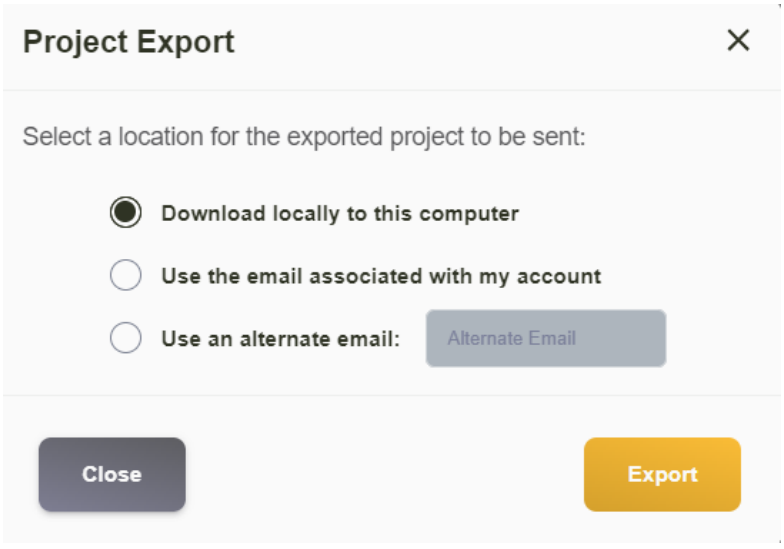
Duplicating a project will create a copy of that project under the same name plus “copy.” All of the project’s information, including accounting activities, management inputs, and scenarios will be copied over to the duplicated project.

Go to Report

The “Go to Report” button allows users who have already generated a report for their project to jump straight to the report rather than click through their whole project. This option will be grayed out on projects that have not already generated a report.

Export Project

Exporting a project allows users to either download their project (as a .cmt file) locally to their device or email the file to themselves or another user. The .cmt file extension functions the same as an xml file. Users can only export a project from the Projects page if a report has already been generated; otherwise, the button will be grayed out. This option will also be available on the Report page.

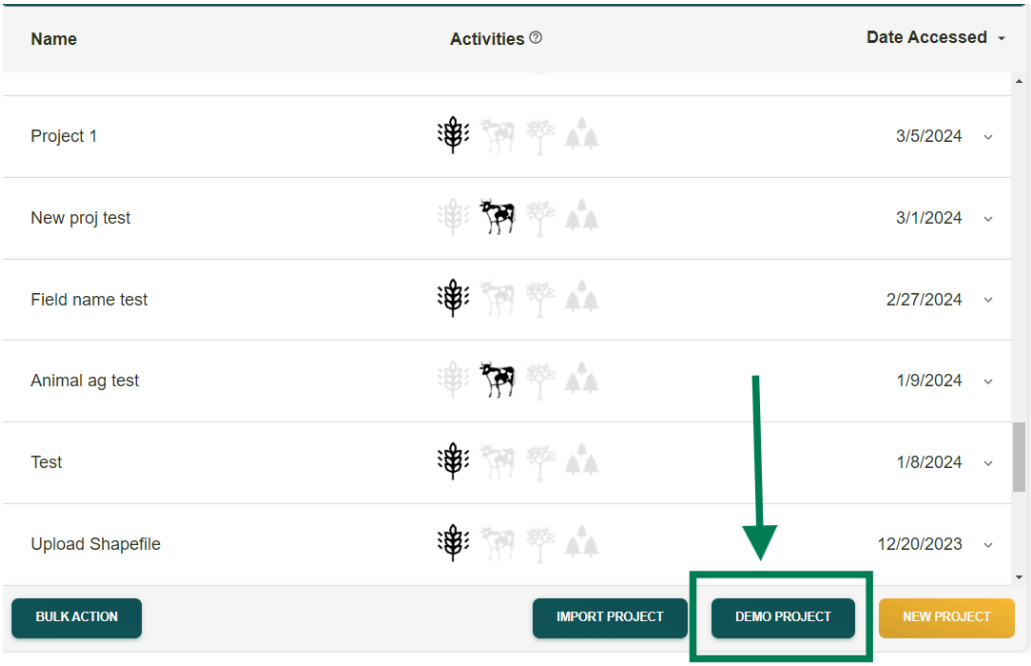


Enter Management

Use the Enter Management button to input specific management details. Users will always be brought to the first page of management entry (e.g., field location for a cropland project), but they can use the Project Roadmap to jump to the right page.

Creating a Demo Project

Demo projects allow users to run a sample COMET-Farm project and generate a report for each activity, using pre-populated data to help users navigate the COMET-Farm application. The land at each demo site is owned and operated by a public university or government organization. Actual regional crop, tree, and livestock management practices were used to develop the management practices for each demonstration project site. While all of the management required to run a report will be pre-populated, demo projects can be edited by users. However, at this time, only one demo project for each accounting activity can exist in the project repository at a time. To get started, click the Demo Project button at the bottom of the page and select which accounting activities to include.

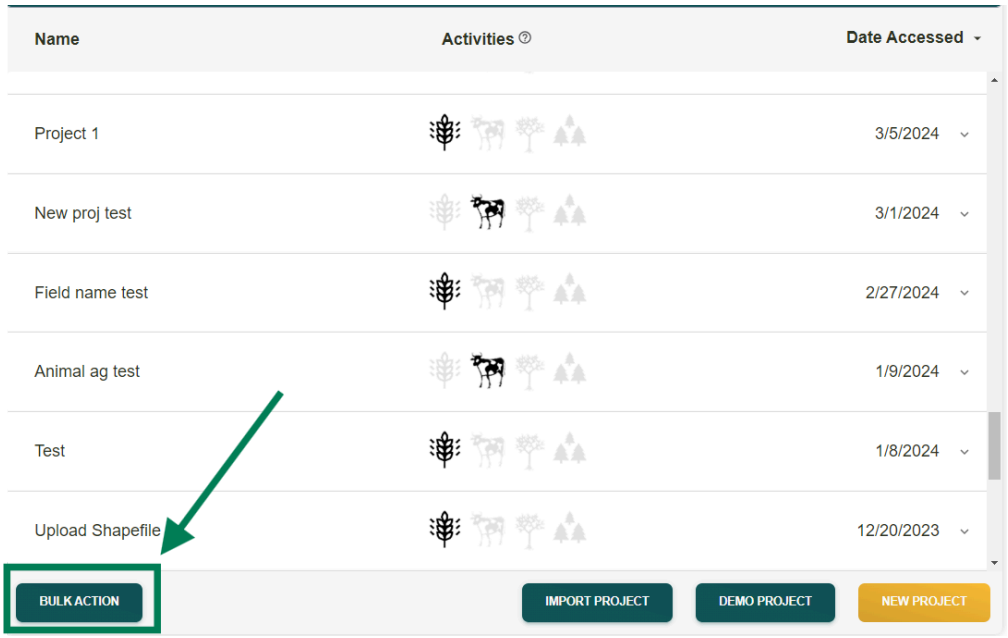


Import Project

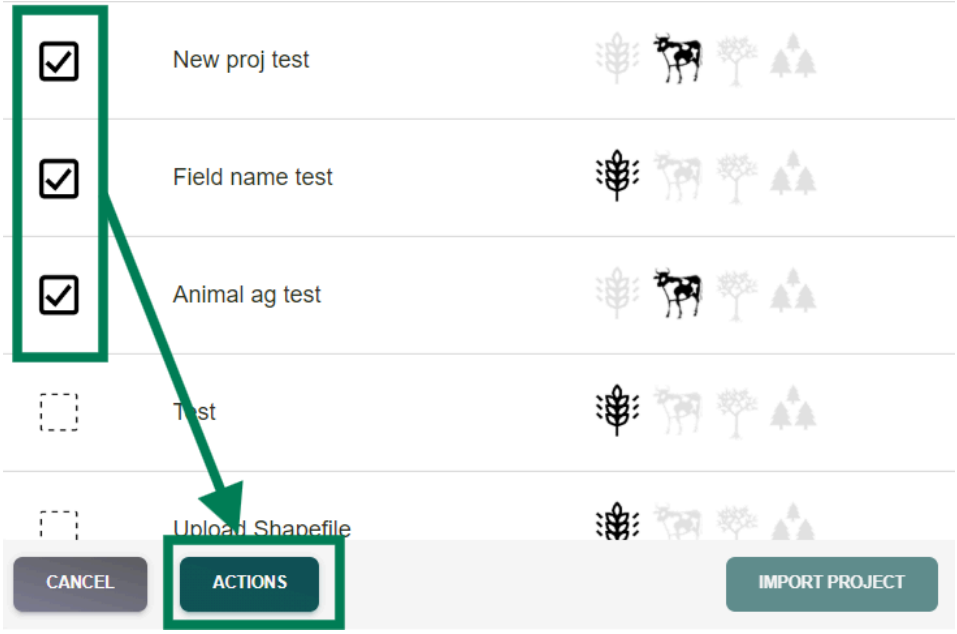
COMET-Farm allows users to import other projects into their account using .cmt (or xml) files. To import a project into an account, click the *Import Project* button at the bottom of the page and select the file to import. Errors with importing are likely due to a mismatched file type. COMET-Farm will only accept .cmt or xml files. **Excel spreadsheets or .csv files cannot be imported into the tool.** As of December 2024, renaming imported cropland projects will force users to manually re-define their baseline years.

Bulk Actions

The Bulk Actions button on the Projects page allows users to perform an action to more than one project at a time. **At this time, the only Bulk Actions available are exporting and deleting projects**. To do this, click the *Bulk Actions* button at the bottom-left of the project repository.



Checkboxes will then appear next to each project, allowing users to select however many projects they'd like to perform an action to. Once those projects have been selected, click the Actions button at the bottom of the page. This will prompt users to select whether they would like to Export or Delete their selected projects. To ensure that users want to follow through with bulk-deleting projects, they will be asked to type the word "DELETE" in order for the action to be completed. ***Deleted projects cannot be recovered!***

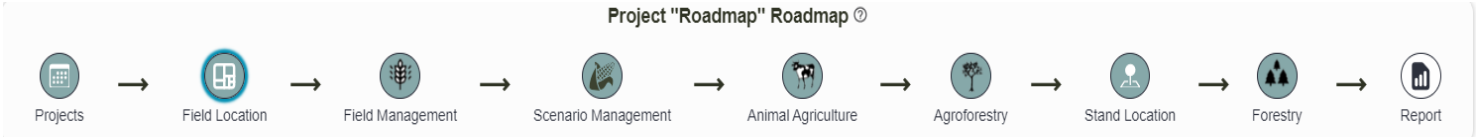


Project Roadmap

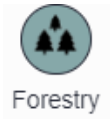
Once a user creates and begins entering management for a project, a Project Roadmap will appear at the top of the browser window to follow users on every page of their project, tracking their progress. The project roadmap will include all accounting activities a user selects for each project and a report icon. The roadmap is interactive, so if all necessary management data has been entered, users can click on a section of the roadmap to jump to that page.

Example Project Roadmap for a project including only *Cropland, pasture, range, orchard/vineyard accounting:*

Example Project Roadmap for a project including all accounting activities*:*



Icon	Icon Description
	Unavailable section: The icon and name are greyed out. This section requires action in a previous section. Hover over the icon to see which previous section.
	Incomplete Section: The icon has a white background and is not filled in with blue. The icon and name are *not* greyed out. One or more steps in this section are incomplete. You can access this section at any time.
	Selected Section: Light blue shadowing appears around the icon. This section is currently selected. Click on any available icon to access the corresponding section.
	Complete Section: Blue filling indicates that this section includes all the necessary information to run a report. You can return to completed sections at any time to add, remove, or change management.
	Project Repository. Selecting this icon at any time in a project will return the user to their project repository or “Projects” page.
	Field Location. *Cropland, pasture, range, orchard/vineyard accounting* requires users to spatially define fields before adding management. Selecting this icon will bring users directly to the *Cropland, pasture, range, orchard/vineyard* map page.
	Field Management. *Cropland, pasture, range, orchard/vineyard accounting* requires users to add management activity data to specific field locations. Selecting this icon will bring users to the historic, baseline, and scenario (optional) management pages.
	Animal Agriculture. Selecting this icon will bring users to the baseline and scenario (optional) pages to enter animal agriculture activity data.
	Agroforestry. Selecting this icon will bring users to the page to enter agroforestry activity data.

	Stand Location. *Forestry accounting* requires users to spatially define stands before adding management. Selecting this icon will bring users directly to the *Forestry* map page.
	Stand Management. *Forestry accounting* requires users to add management activity data to specific stand locations. Selecting this icon will bring users to the forestry management activity data entry page.
	Report(s). COMET-Farm will generate a separate report for each accounting activity in the project. Selecting this icon will bring users to the report page. COMET will only generate a report if all required activity data is entered for that accounting activity.

Creating a Cropland, Pasture, Rangeland, Orchard/Vineyard Projects

Overview

Before creating any COMET-Farm projects, users must first create a COMET-Farm Account. Please review the Creating a New Project before proceeding.

Soil Data

Users can view and download the SSURGO soil map units via the Web Soil Survey (WSS) overlayer on the mapping page of cropland, pasture, rangeland, orchard/vineyard projects on the GUI. Downloading soil data via the API is currently unavailable. For consistency in input data, users cannot upload their own soil data at this time. Due to soil and weather data limitations, COMET-Farm can only be used within most regions of the contiguous United States.

> COMET-Farm relies on the SSURGO database of soil information compiled by the National Cooperative Soil Survey (3). SSURGO provides nearly complete coverage of soil data for the conterminous United States at approximately 1:15,000 to 1:20,000 scale. SSURGO data for soil texture, pH, percent rock fragments, and rooting depth are preprocessed for all map units in the WSS. During preprocessing, the soil profile is reconfigured into prescribed layers for DayCent input. Pedotransfer functions (4) are used to estimate bulk density, field capacity, wilting point, and saturated hydraulic conductivity for each soil layer. The resulting soil data are archived and accessed during the COMET-Farm session. (Paustian et al., 2017)

Soil data is *only* used in *Cropland, Pasture, Rangeland, and Orchard/Vineyard* accounting projects.

Climate Data

COMET-Farm uses observed historical PRISM weather data (PRISM Climate Group 2019). *Cropland, Pasture, Rangeland, and Orchard/Vineyard* accounting activity executes the DayCent model to estimate soil carbon changes and direct nitrous oxide emissions/reductions as a result of management activity included. The DayCent model uses daily, observed historical precipitation and temperature data at a county scale for baseline scenarios. COMET-Farm does *not* predict any future climate patterns; therefore, any scenarios that include a future year will use recycled historical weather data. Where historical weather data is available, it is used; however, data for future years will recycle weather data from the previous 10 years (e.g., the year 2028

will use weather data from 2018, etc).

Baseline Year	Baseline Weather Year	Scenario Year	Scenario Weather Year
2019	2019	2024	Partial 2024, 2014
2020	2020	2025	2015
2021	2021	2026	2016
2022	2022	2027	2017
2023	2023	2028	2018

This manual was written in Spring 2024.

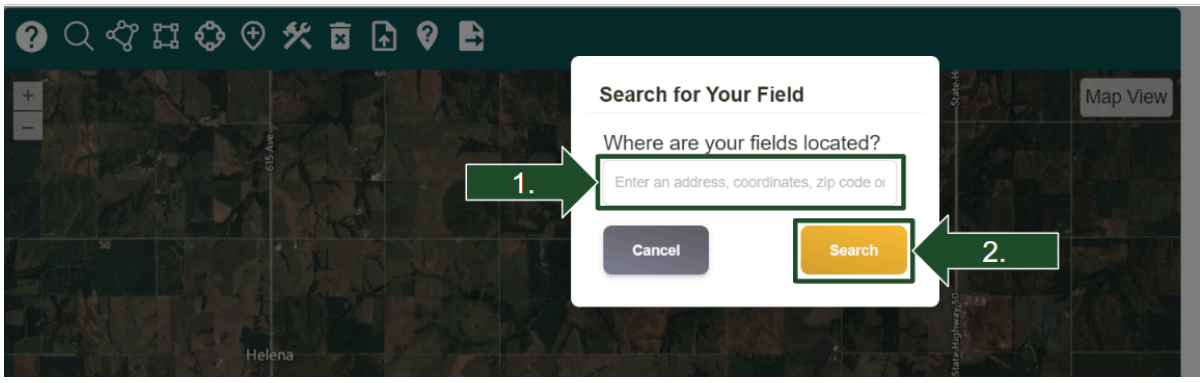
Activity Data

COMET-Farm was created in parallel with and as a function of the USDA Methods for Entity-Scale Inventory document, and therefore, will only ask for activity data necessary to execute the DayCent model and empirical models outlined in the document. For a detailed list of required and suggested activity data for each accounting activity, we recommend users create a free COMET account to create sample projects or review the activity data entry spreadsheets. Required activity data will be noted for each accounting activity. These are intended as information guidelines and for organizational purposes. COMET-Farm does *not* support the upload of activity data via spreadsheets.

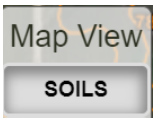
Spatially Defining Fields

COMET-Farm requires users to define field boundaries to link management activity data to a specific area for *cropland, pasture, range, orchard/vineyard* accounting. A "field" boundary includes the boundary of a crop field, pasture, rangeland, or orchard/vineyard. Users may include any combination of *cropland, pasture, range, orchard/vineyard* within a single project.

From the Projects page, select "**Enter/Edit Management".** When users first enter the field definition page, they may either enter an address, coordinates, zip code, or landmark in the search field and select "Search" to go directly to the location. They may also select "Cancel" and manually zoom to a desired location.



Review mapping tools functionalities:

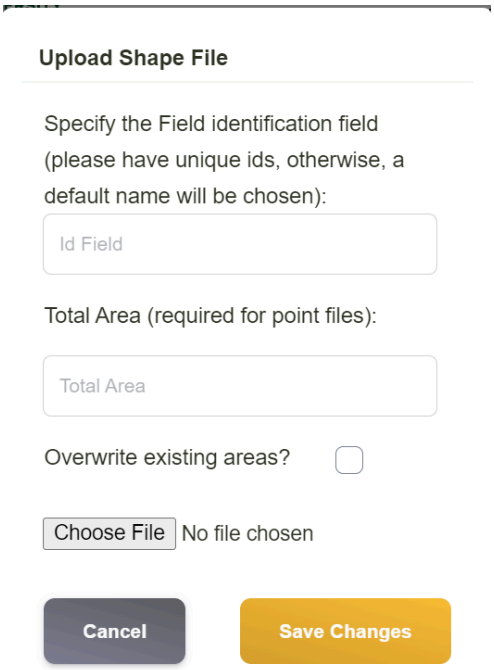
Symbol	Function
	Find location. Users may create projects with far-apart fields. Use the search function to enter an address, zip code, or landmark to jump to that location. If using coordinates, make sure to format in decimal degrees with parentheses around them. For example: (40.583210,-105.081520)
	Defining a field by a polygon. Use this tool to define the field boundary of an irregular field shape. Left-click to drop a vertice. Connect the polygon to complete the shape. Double left-click at any time to “snap” the polygon closed.
	Defining a field by a rectangular polygon. Left-click to begin the rectangular field definition. Move the cursor to the edge of the field boundary. Left-click again to close the rectangle.
	Defining a field by circle. Left-click in the center of the field. Move the cursor to the edge of the field boundary. Left-click again to close the circle.
	Defining a field by point. Left-click in the center of the field. Enter the field acreage when prompted. Using field definition by point creates a circular field boundary in the database.
	Delete a single field. Select the field to be deleted. Deleting a field will erase the field boundary and respective management. Users *cannot* undo a field deletion.
	Shapefile upload. Users may upload a shapefile (.shp) with a maximum of 50 field definitions. For upload instructions and file specifications, please review the shapefile upload section below or view the solution article.
	View soil by click. Select anywhere on the map within the contiguous United States to view soil information: map unit, texture, sand/silt/clay fractions, bulk density, and if the soil is hydric. COMET uses SSURGO soil data.
	Export soil data per field. A .csv file will download automatically and will include the “*view soil by click”* data by the defined field.
	Modify field. Select a previously defined field to modify the boundary by adjusting the vertices and/or modifying the field name.
	View SSURGO soil map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. This soil map data is viewable via the Web Soil Survey.

Define fields

a. Users may include up to 50 fields per project. An individual field may be up to 1200 acres.
    i. COMET will run all models on every map unit within a defined field boundary for all scenarios and provide a weighted average of the estimates across the field. *Cropland, pasture, range, orchard/vineyard* accounting reports may take 2-20 minutes to generate depending on the number/size of the fields and the number of scenarios

b. Users may define fields by irregular polygon, rectangle, circle, point, or by uploading a shapefile.

i. Uploading a shapefile  :

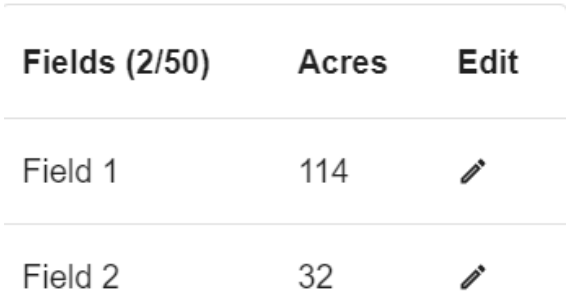


1. Select “Choose File” to browse and locate the *zipped* shapefile. Users may need to select *all file types* on their file explorer window to find a .zip file.
2. Specify the parcel identification field. This needs to be a field (column in the attribute table) that is unique for each parcel. The image below is the .dbf file opened and viewed in Excel. The parcel identification field should be different for each parcel (when you have more than one). For this example, I used FieldName as the unique parcel ID.

FieldName	Acres	Shape_Le_1	Shape_Le_2	Shape_Area
Allee Demo Farm	##############	2256.78211889000	2210.46846778000	249572.18492700000

3. Select “Save Changes”.

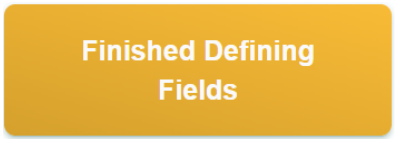
c. When a field is defined, the name and respective acres will appear in the field table to the right of the map.



d. Fields should be defined where the management is uniform within the boundary. Uniform management means that the management applied later, either in the baseline or scenario(s), in

the project will be applied to the entirety of the field boundary. If a user is interested in estimating the soil carbon and GHG impacts of converting a *portion* of the field to different management in a scenario, they should define the single field as two separate fields. For example, if the field below on the left is a corn-soy rotation historically; however, this user would like to compare a scenario where a portion of the field is removed from production and converted to an alfalfa field, the field should be defined as two separate field boundaries as shown below on the right.

When finished defining all field boundaries, select “Finished Defining Fields”



Selecting Fields for Management Entry

Using the dropdown menu or directly selecting a field location on the small map, select a field to add historic, baseline, and optional scenario management activity data.

Icon	Icon Details
Selected	Field is selected for adding management. Proceed to the Historic Management section
Data Complete	Baseline management is complete for this field. Proceed to the next field, scenario management (optional), or run a report.
Data Incomplete	Baseline management is incomplete for this field. Data must be complete in order to proceed.

Historic Management

Overview

> Information on historic land use, predating the start of the baseline period, is requested from the user to represent the longer-term trajectory of soil organic carbon (SOC) stocks. This is mainly to capture major changes in land use that have taken place in the last few decades, such as plowout of pasture to annual cropping or converting annual cropland to permanent grassland or woody vegetation. Major shifts in vegetation and land use typically result in large changes in SOC stocks which attenuate over several decades. Users need only enter a very limited amount of information for past management history before the year 2000, using drop-down menus, from which they select the most representative choice for a given field.
>
> A database of crop and pasture rotations and management practices before 2000 was built for each Major Land Resource Area (MLRA) and are stored in the PostgreSQL database. These representative sets of the most common management practices in each MLRA were developed to allow users to easily choose representative historical management conditions on their field, to capture major changes in past management (e.g., conversion of pasture or rangeland to annual crops or from annual crops to pasture or rangeland, change from dryland to irrigated crops, etc.) that can have longer-term impacts on soil C trajectories. This information is used in the 'spinup' (i.e., initialization) of the DayCent ecosystem model, prior to the current [baseline] period, and thus the exact details of historical management practices are not necessary.

(Paustian et al., 2017)

Historic management options for a defined field are dependent on the county-rectified MLRA in which the field is located. Users are not able to copy historic management from one county to another, but may copy historic management to other fields located within the same county-rectified MLRA.

Once a field is selected, users will be able to enter historic management activity data. Using the dropdown menus, select the historic management that best corresponds to the management of this field before the baseline period.

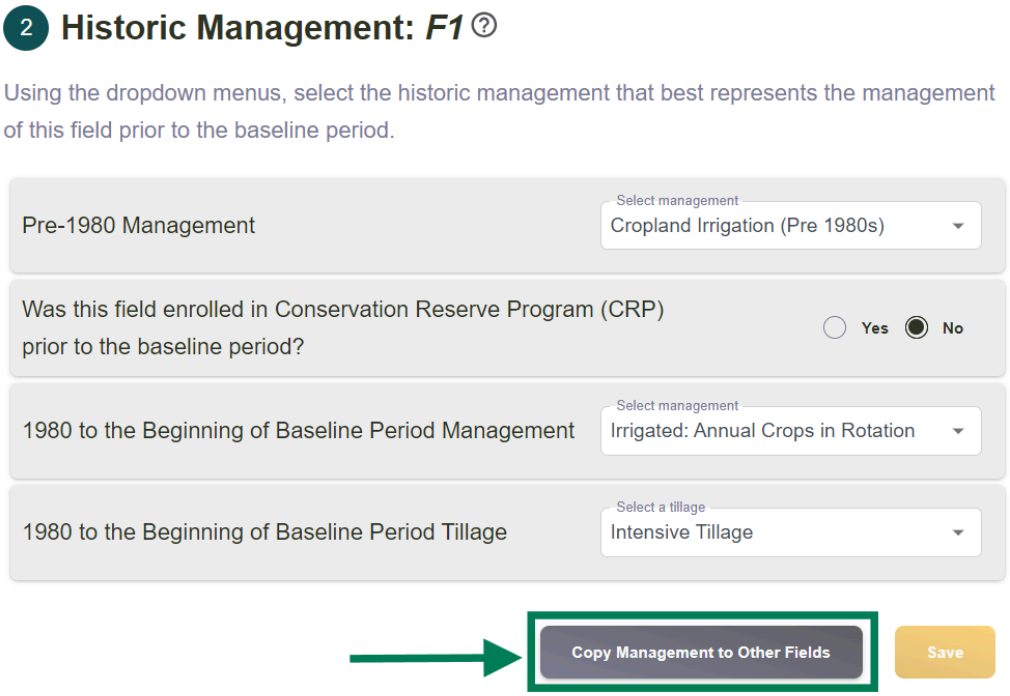
- If users select "yes" to if a field was enrolled in the Conservation Reserve Program (CRP) prior to the baseline period, more CRP program details will be required.

"What if I don't know my historic management?"

Gaps in historical management records are expected; however, users should select the option that is *most representative* of their field. Extension offices and resource conservation districts may be able to provide insight into management typical of the area and time.

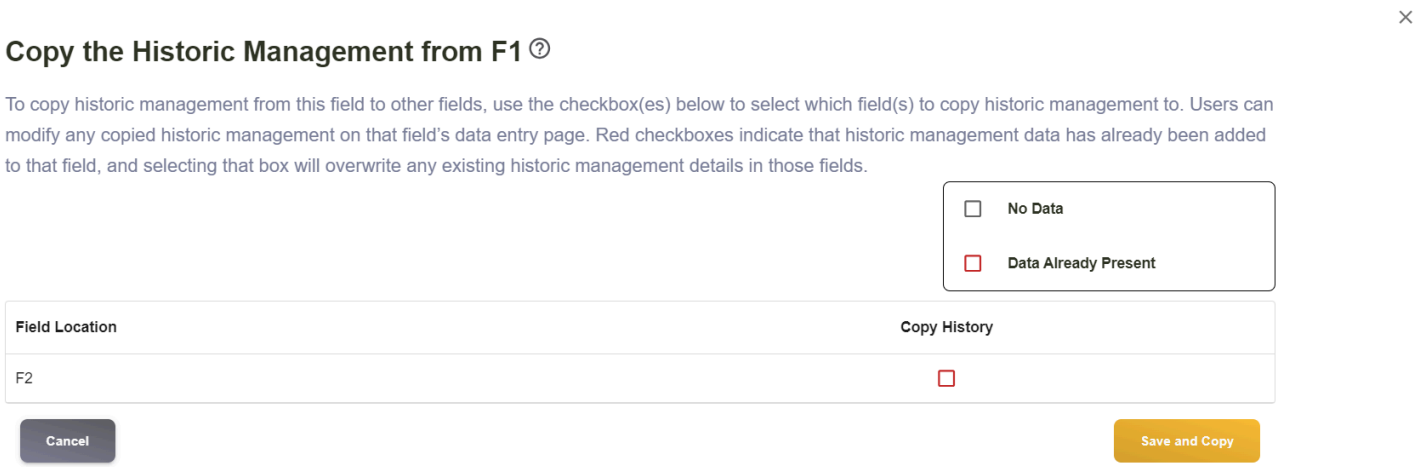
Copying Historic Management

If historic management between fields located in the *same* county is identical, select the *Copy Management to Other Fields* button to copy historic management from this field to other fields. This action will overwrite any existing historic management details in those fields. Users can modify any copied historic management on that field's data entry page.



A popup window will appear prompting a user to select which field(s) they would like to copy the historic management to. Please review the copy window symbol descriptions below. Copying management to a field with existing historic management will overwrite the original management, and while copied management can be edited, *it cannot be undone.*

Copy Window Symbol	Description
☑	No existing management data in this year/field. Management data will be copied to this field/year.
☑	This year/field has management data. Management data will be copied to this field/year, overwriting the existing data. Users cannot undo this action once *Save and Copy* is selected.
☐	This year/field has management data. If it remains unselected, management data will not be copied to this year.
☐	This year/field has no management data. If it remains unselected, management data will not be copied to this year.



Select *Save and Copy* to complete the copy function.

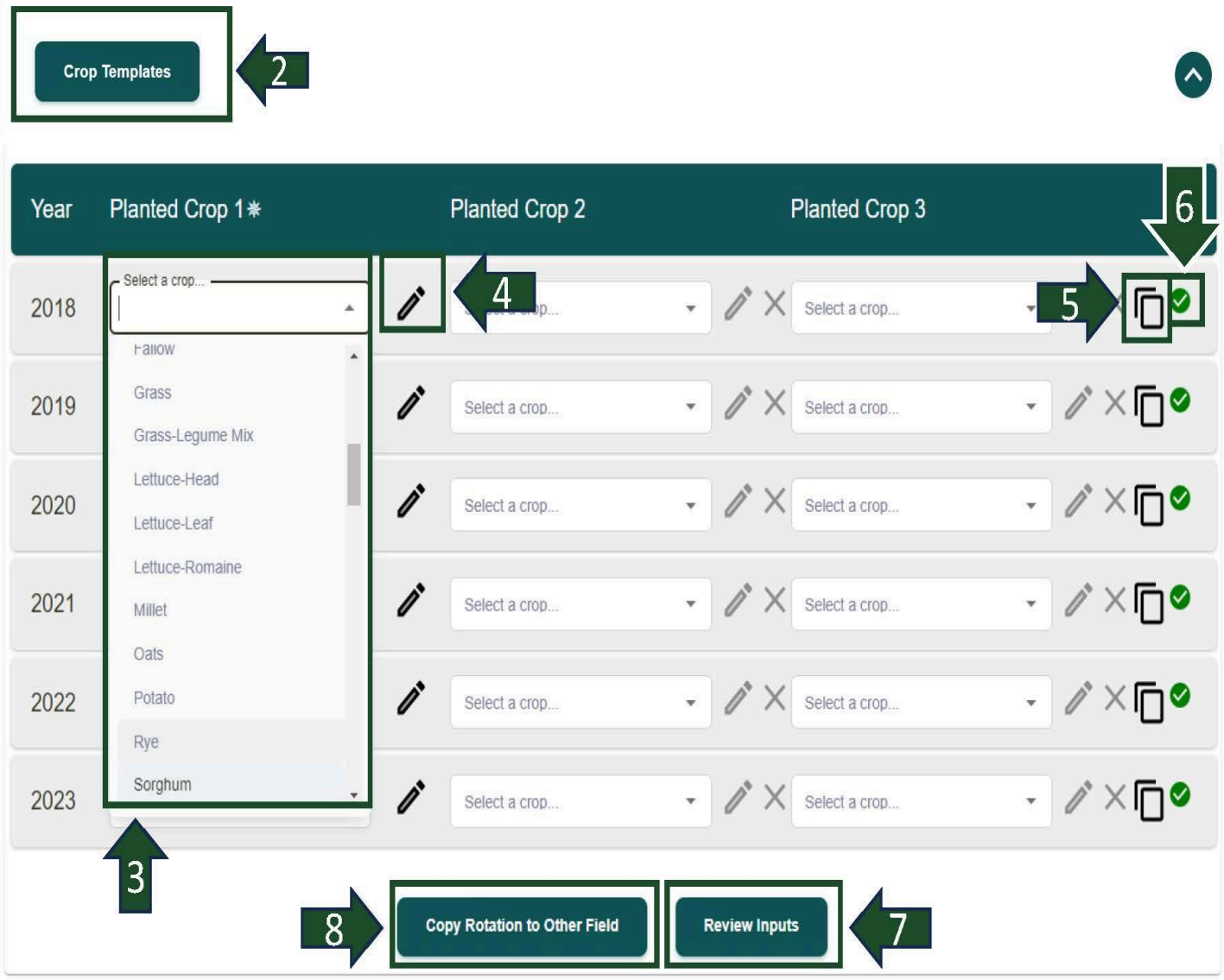
Click *Save* to complete Historic Management and move on to Baseline management data entry.

Baseline Management

"Baseline" refers to a user's current management, or "business as usual" management before a change in management occurs in the scenario period. Please review the previous Baseline Years section of this manual for a detailed explanation. COMET-Farm requires at least one "crop" to be added to each year of the rotation. Grass, grass-legume, annual crop, cover crop, orchard/vineyard crops, and fallow are considered "crops" in the tool. Users may have up to three crops growing per calendar year within a single field; however, COMET *cannot* support multiple crops growing at the same time, except for predefined cover crop blends and cover crops grown in an orchard/vineyard system. Below is a map of the Baseline Management page.

3 Baseline Crops & Management: *Sample Field*

1. Using the dropdown menu for each year, or using the "Crop Template" button, add crop(s) that were **planted** for each year. COMET cannot support multiple crops growing at the same time, with the exception of predefined cover crop blends and cover crops in an orchard/vineyard system.
2. Using the "pencil" icon, edit or add management for each crop year.
3. If no crop is **planted** in a given year, select fallow as your "crop".
4. When applicable, use the to copy management from one year/field to another.



Back to Field Locations

Next

Baseline Management Page Layout guide	
1	Baseline Management section progress tracker. The checkmark will remain gray until each year in the defined baseline includes all required management activity data (at least one crop per year with a planting date or continued growth from previous year). The checkmark will turn green when all requirement management activity data for all baseline years is entered.
2	Crop Rotation Builder. This allows users to import crop rotations with predefined management. Users will be able to modify or remove most defaulted management activity data. See the **Selecting a Crop - Crop Templates** section for more details.
3	Crop selection drop down. All crops (annual, cover, grass, orchard/vineyard, and fallow) are included in this drop-down. Users are required to select from the COMET list of crops. To add crops using the dropdown, see the **Selecting a Crop - Manually** section.
4	Crop management activity edit. Use this button to make any management changes to the corresponding crop. The edit button refers to editing the crop to the left of the pencil icon.
5	Copy the year's management to other years and/or fields. This action will copy all crops and their respective management within a calendar year to other crop years and fields. See the **Copying Management** section for more details.
6	Crop progress tracker. Users are required to add at least one crop with a planting date, or a continued crop from the previous year, for every year. When users enter all required management activity data for a given crop, the gray check mark will turn green.
7	Review all entered management activity data for all crops in all years of a baseline for the working field. See the **Review Inputs** section for more details.
8	Copy Rotation to Other Field. This action will copy the selected field's entire crop rotation and all the associated management to another field in the user's project. Note that some crops (e.g., rice) will not be able to be copied to another field if it is not available in that field's location.

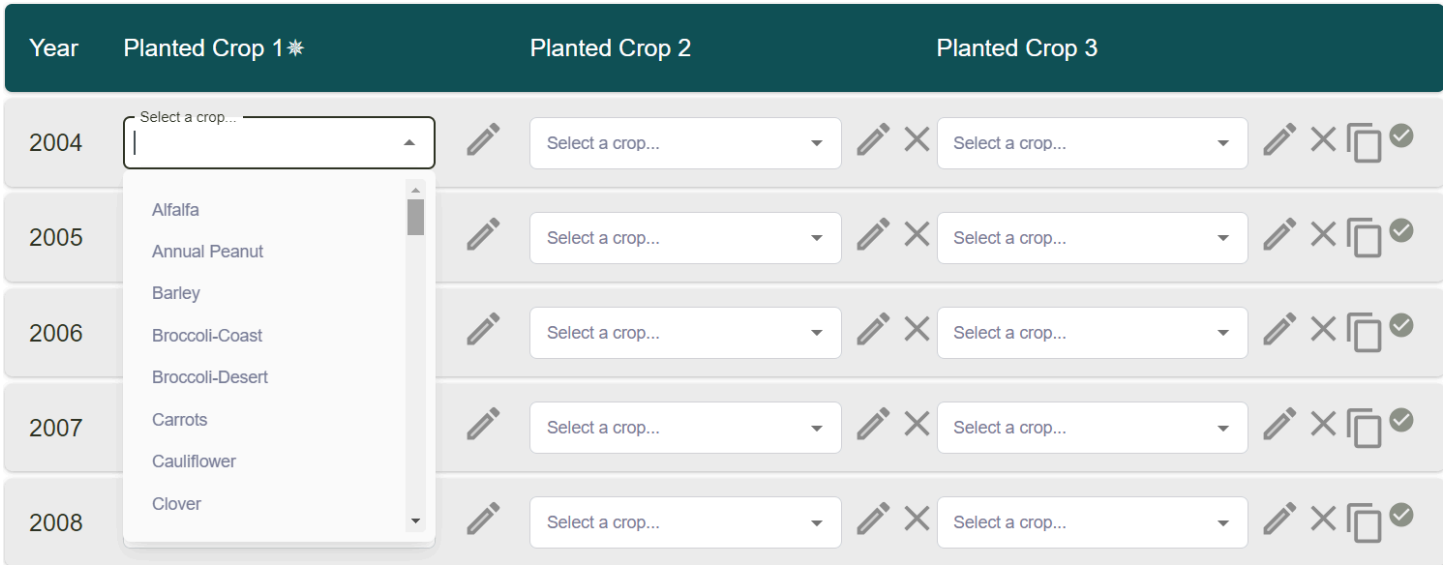
Selecting a Crop - Manually

Under step 3, next to each year in the baseline, users can click on the dropdown menu to *manually* add crops that were **planted** during that year (e.g., corn that was planted in 2013 but not harvested until 2014 would be selected for 2013). Perennial crops will have an option to *"continue crop from previous year"* after they have been planted.

COMET-Farm offers an extensive list of common crops grown throughout the United States. This list is based on crops that are included in Chapter 3 of the USDA Blue Book and/or have been parameterized in DayCent. For a full list of crops available in COMET-Farm, or if a desired crop is unavailable, please refer to the crop list in the appendix. For example, Winter Wheat is a crop that can be assessed through DayCent; Winter Wheat is the recommended surrogate for Triticale. ***Note***: COMET-Farm will generate an assessment of soil carbon and soil nitrous oxide for woody crops (orchard/vineyard), but will not assess biomass and litter carbon stock changes.

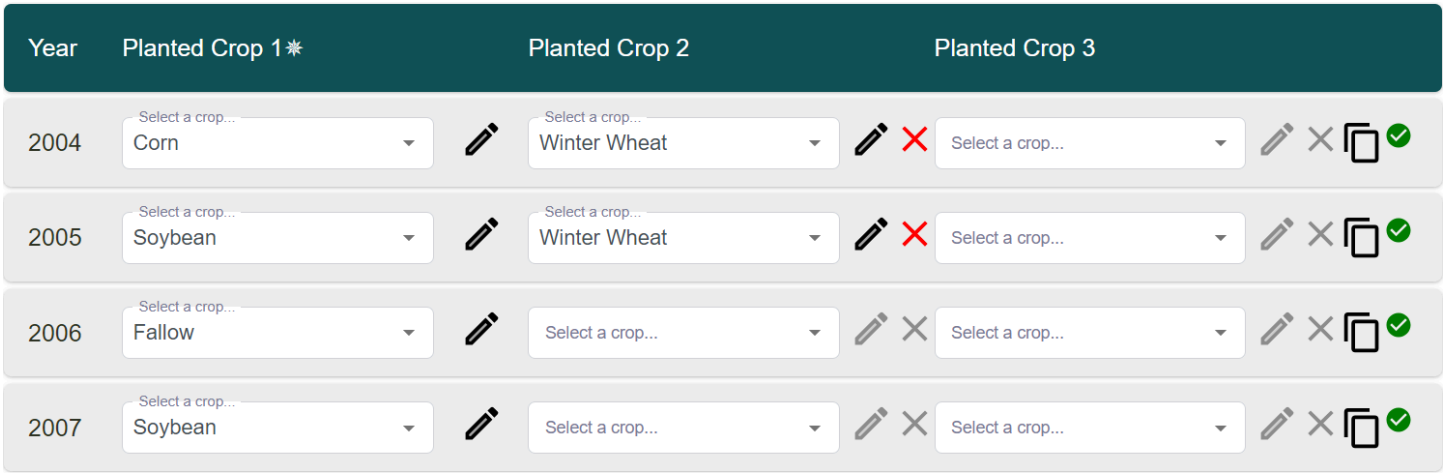
After a crop has been selected from the dropdown menu, the management window will automatically open. See the **Entering Management Details** section for more information.

See example crop rotations below.



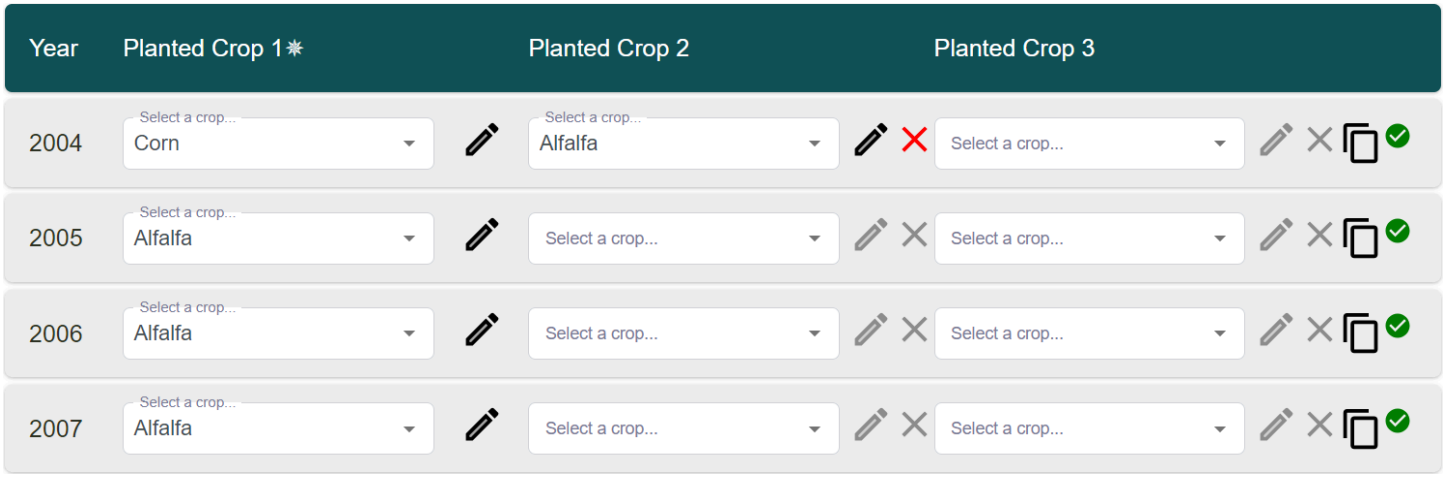
Example 1: Annual crop rotation:

- Year 1
  - Corn (spring plant/fall harvest)
  - Winter wheat cover (fall plant/spring harvest)
- Year 2:
  - Soybean (spring plant/fall harvest)
  - Winter wheat cover (fall plant/spring harvest)
- Year 3:
  - No crop planted- *Fallow* will need to be entered as a "crop" in this year because no crop was planted.
- Year 4:
  - Corn (spring plant/fall harvest)
  - Winter wheat cover (fall plant/spring harvest)



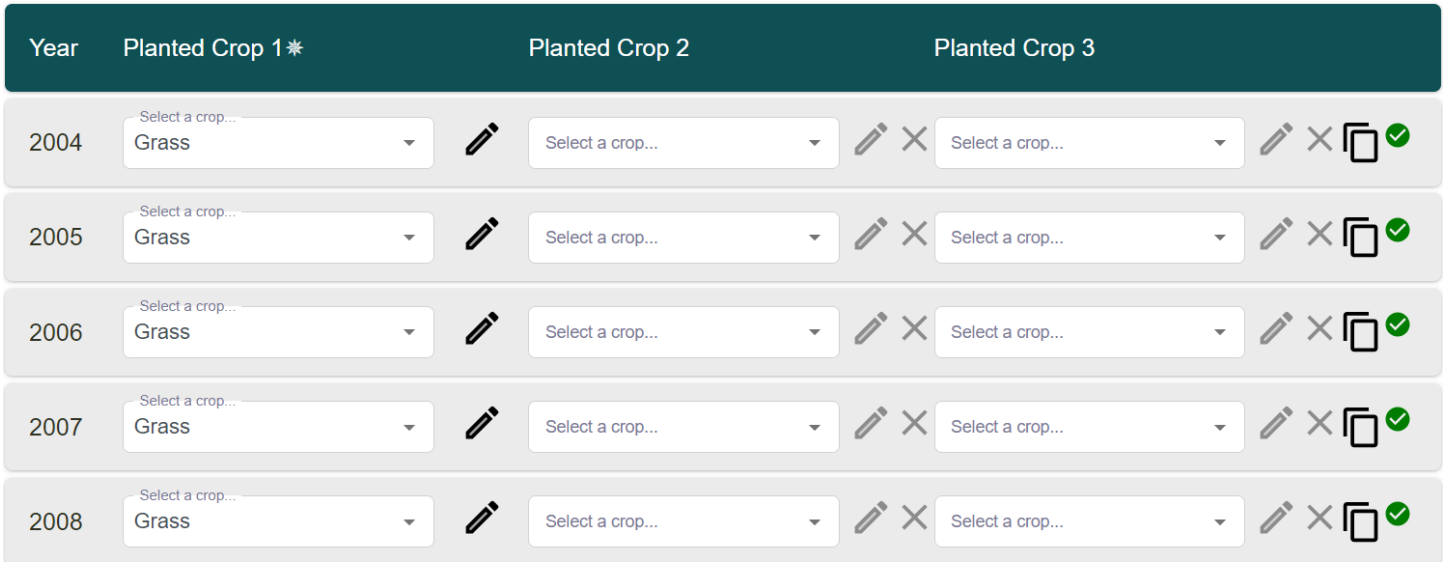
Example 2: Annual crop with alfalfa (multiple years) in rotation:

- Year 1
    - Corn (spring plant/fall harvest)
    - Alfalfa (fall plant/continued growth next few years of rotation)
- Year 2:
    - Alfalfa (continued growth from previous year; optional harvest throughout year)
- Year 3:
    - Alfalfa (continued growth from previous year; optional harvest throughout year)
- Year 4:
    - Alfalfa (continued growth from previous year; optional harvest throughout year; termination)



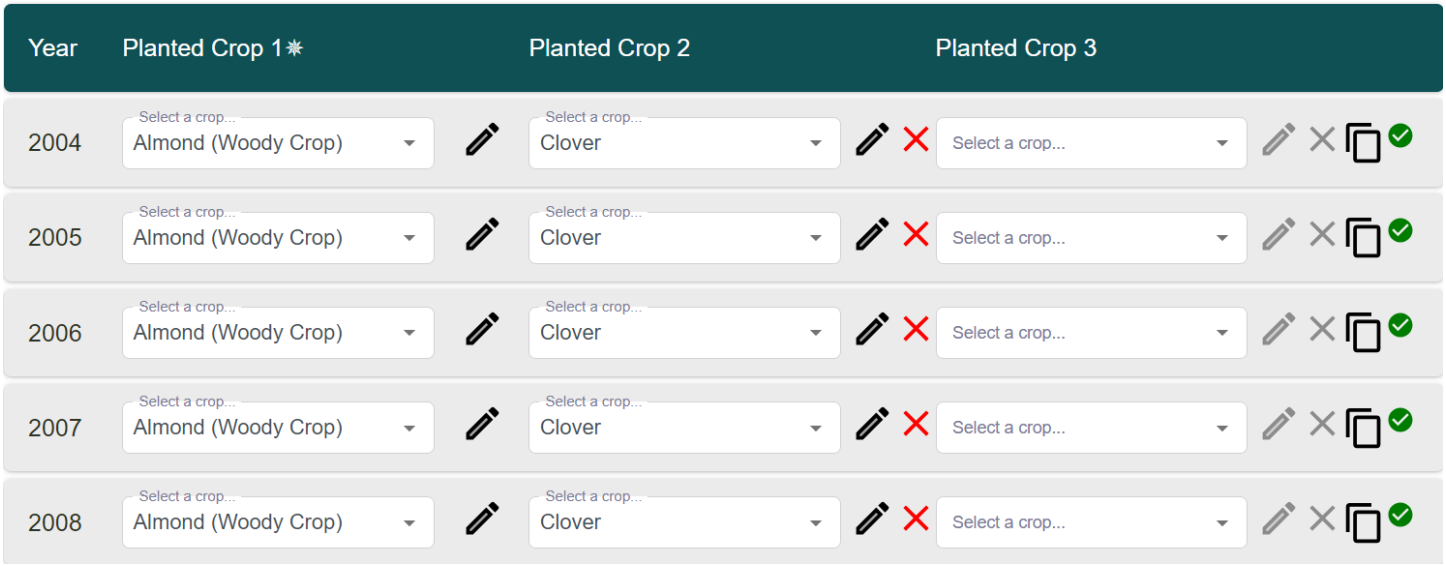
Example 3: Pasture or Rangeland- Perennial grass or grass-legume mix

- All baseline years- continued growth of perennial grass or grass-legume mix



Example 4: Orchard Crop with a cover crop

- All baseline years- continued growth of clover between Almond trees

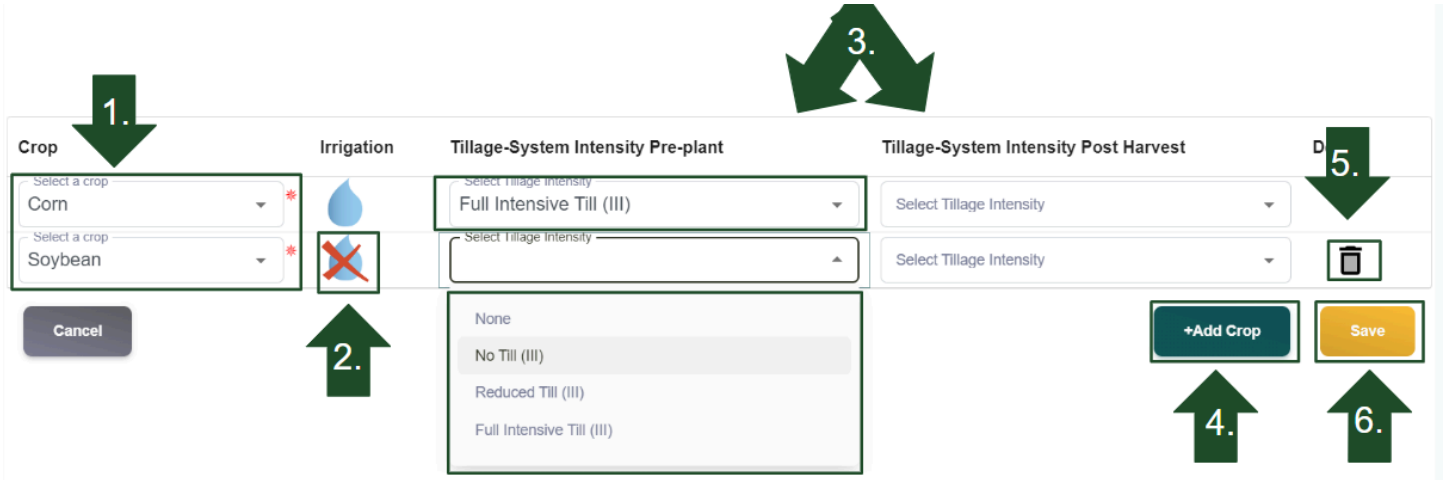


Selecting a Crop - Crop Rotation Builder

Crop Rotation Builder

COMET-Farm's Crop Rotation Builder feature allows users to create a baseline using a subset of crops that have "templates" pre-populated with typical management practices. These templates include data like standard planting and harvest dates and fertilizer application rates. Plus, when users add these template crops to their rotation, they are given the option to apply a standard tillage as well as a standard irrigation. Users can then modify or remove any default management applied by the crop template.

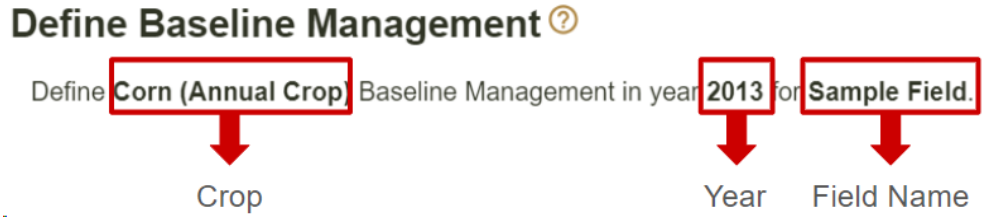
Using the crop rotation builder will populate the *entire baseline, overwriting any existing crop management* that was previously added to the field. Crops will populate the rotation in the order they are added. For example, in the below example, the baseline will be populated with a corn-soybean rotation. Cover crops, when selected, will be added as a second crop in the same year. Follow the guide below for more information.



Crop Rotation Builder Guide	
1	Crop Selection. Select at least 2 crops to include in the rotation. This subset of crops includes those populated with typical management practices, so not every COMET-Farm crop is available. To populate the baseline with a single crop (e.g., grass), select the same crop twice.
2	Irrigation. Indicate whether the selected crops are irrigated or non-irrigated. If “irrigated” is selected, typical irrigation rates will automatically be applied to the associated crop.
3	Tillage. Select pre-planting and post-harvest tillage system intensities for the selected crop. Options include No Till (III), Reduced Till (III), Full Intensive Till (III), and None. For information on what these tillage intensities mean, see the **Tillage System Intensity and Other Field Operations** section.
4	Optional: Add Crop. To include another crop in the rotation, click +Add Crop. The baseline rotation will be populated with crops in the order that they are listed. For example, if Corn, Winter Wheat, and Soybean are added to the crop rotation builder in that order, the baseline will populate as Year 1 - Corn with Winter Wheat as a cover crop; Year 2 - Soybean; Year 3 - Corn with Winter Wheat as a cover crop, and so forth.
5	Optional: Delete Crop. Use the trashcan icon to remove a crop from the rotation.
6	Save. By clicking this, the crop rotation will be applied to the *entire baseline, overwriting any existing crop management* that was previously added to the field. This action cannot be undone.

Entering Management Details

Once users select a crop from the dropdown menu, the baseline management window for that specific crop and year will automatically open to prompt users to enter management details.



This window is otherwise accessible by clicking on the pencil, , “edit” icon to the right of the crop dropdown menus. The checkmarks next to each crop indicate whether or not a user’s crop management is complete (gray = incomplete; green = complete).

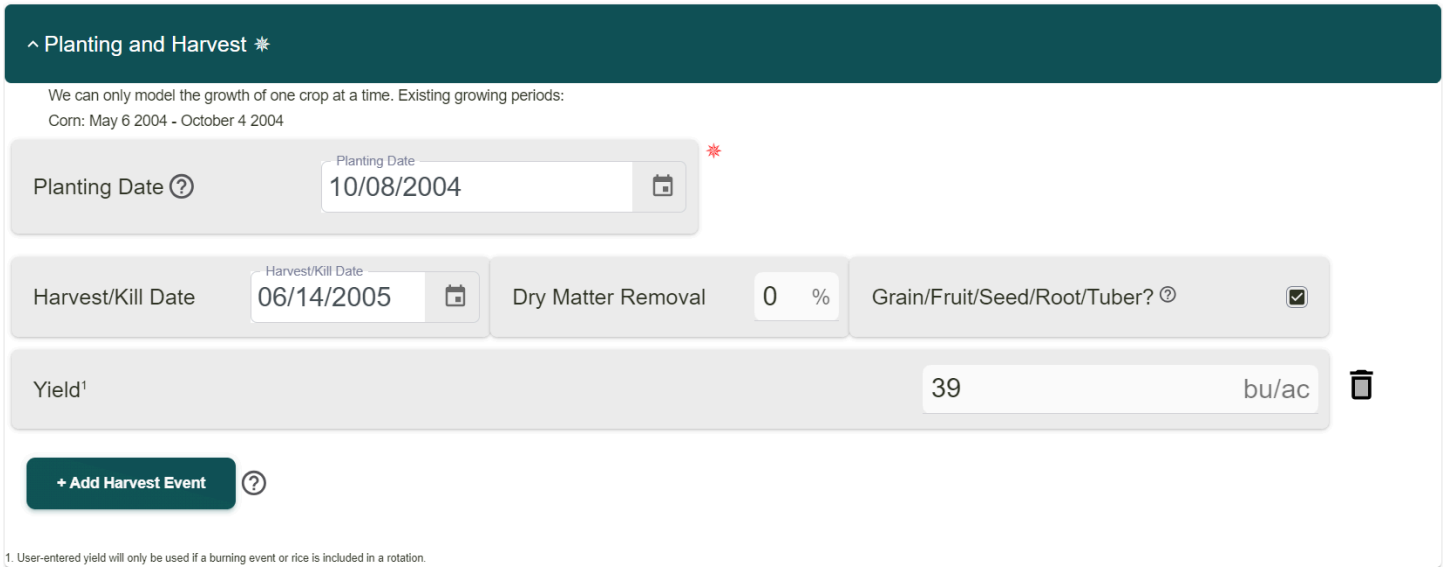
An annual crop’s management is considered “complete” as long as the user has entered a planting date. A perennial crop’s management is considered “complete” when either a planting date or “*continue crop from the previous year”* is selected. “Complete” means that the COMET system can execute the models with the minimum required data. COMET users are encouraged to enter all field management that is available within COMET-Farm, where applicable. Users can enter: planting events, harvest events, tillage system intensity (planting and harvest), other field operations (mow, herbicide, burn, or crimp events), fertilizer applications, manure/compost/other organic amendment applications, grazing events, irrigation events, and/or liming events.

What if I don’t know my exact management details?

When entering management details, users will be asked to enter specific information such as planting/harvest dates, fertilizer application rates, and more. It is best to enter accurate dates, especially regarding fertilizer additions and irrigation. If unsure, users are encouraged to enter details the best they can by narrowing down to the week and entering the date from the middle of the week when the event is estimated to have occurred.

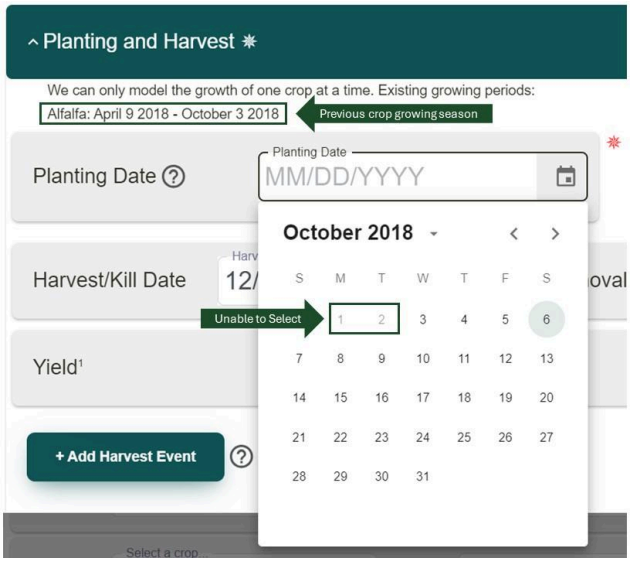
When exact dates are not entered, the uncertainty of the estimated emissions/reductions for scenarios increases. For example, if the user inputs a general planting date that is two weeks prior to the actual planting date, the estimates will indicate two additional weeks of plant growth that did not occur.

Planting and Harvest



Annual Crops Planting Dates- Within the *Define Baseline Management* window, users will first be prompted to enter the planting date for their selected crop, for their selected year, and on their selected field. Dates can be entered by either clicking the calendar icon and selecting the desired date, or by typing in values as MM/DD/YYYY. Planting dates are required for all annual crops.

COMET-Farm cannot support multiple crops growing at the same time, with the exception of predefined cover crop blends and cover crops growing between woody crops. The growing season (plant date to start date) for each previous crop will be listed above the planting for all crops except the first crop added to the rotation. If the previous crop in the rotation has an identified harvest date, users will be unable to select a plant date for the second crop until after the harvest event.



For example, when a user enters the planting date for their winter wheat in the following *Corn-Winter Wheat-Soybean* rotation, the dates before 8/04/2013 will be grayed out, requiring a user to enter the planting date after the corn is harvested.

Crop	Planting Date	Harvest Date
Winter Wheat	10/31/2012	4/22/2013
Corn	5/18/2013	8/03/2013
Winter Wheat	10/31/2013	6/12/2014
Soybean	6/18/2014	10/09/2014

If an annual crop follows a cover crop that does not have a harvest or termination date or an annual crop is sewn into a cover crop, COMET-Farm will terminate the previous crop the day before the annual crop is planted.

Perennial Crops Planting Date- If a perennial crop is planted in a given year in the scenario, enter the planting date. An option to select "*continue crop from previous year?"* is available for perennial crops in subsequent years. If a perennial crop, such as grass or grass-legume, was never "planted" but rather the "crop" of a pasture or rangeland, users may select "*continue crop from previous year?"* on the first year, and subsequent years, of the rotation.

Fallow Planting Date- If no crop is planted in a given year, please enter *fallow* as your selected "crop". Users will need to enter a "plant" date for their fallow; this should be the date on which the fallow began in that year. Using example 1 rotation under *selecting a crop manually*, the fallow "plant" date should be entered following the winter wheat harvest. Users will be able to add other management activity data for their fallow crop, except for harvest, grazing, pre-plant/planting season, and post-harvest tillage system intensities.

Harvest/Kill/Termination events-

Harvest/Kill/Termination dates should be entered when there is a harvest/kill/termination event. Select *Add Harvest Event* to add additional harvest events (ex: hay events, mowing, alfalfa harvest).

Harvest/Kill Table Input	Description
Date	When an annual or perennial crop is harvested/terminated
Dry Matter Removal %	If a silage crop or hay crop is being harvested (the grain/fruit/seed/root/tuber box is NOT selected), then the residue removal should contain the total amount of residue removed from the field. - If a crop is being harvested for its grain, fruit, seed, root or tuber (the grain/fruit/seed/root/tuber box IS selected), the residue removal should include any other residue removed *aside from* the G/F/S/R/T. See next row for more information on this option. - Ex: Corn harvest where only ears are removed, enter 0%; Silage event may have 85-95% residue removed; mid-season alfalfa harvest may have 50% residue removal
Grain/Fruit/Seed/Tuber/Root ☑	This separates if the whole plant or just part of it is being harvested (e.g. the top of the corn stalk vs the whole plant). In each case, checking this box will mean COMET-Farm and Daycent will assume a default value for "Residue Removal" (how much of the above ground biomass you removed at harvest). This should *not* be selected for silage crops. ● For grains, checking this box means you only harvested the grain and not the full plant. There is a default assumed value for "residue removal" for each crop when this is checked and you don't need to enter a value (e.g. 50-60% of a corn crop is assumed removed when only the grain is harvested). ● With barley or oats, they frequently grow it as a hay crop and will grow it really high and then harvest the whole plant. They won't remove just the grain. In this case, you would not check this box and instead would enter that 100% of the residue was removed (e.g. 100% of the above ground biomass was removed). ● For fruits, checking this box means you only harvested the fruit and not the whole plant. Again, there is a default assumed value for "residue removal" for each crop when this is checked and you do not need to enter a value (for most fruits, it is assumed that no residue is removed as the plant is left to grow fruit in the future). ● For root crops (potatoes, sugar beets, carrots, etc), checking this box means you harvested the tubers (roots) of the plant. The tuber is almost always the edible part of the plant. When roots are harvested usually none of the other aboveground biomass is harvested. There are some exceptions, however we generally assume 0% of the residual biomass is harvested and let the user change that if needed. Checking this box assumes 0% of the biomass was removed at harvest.
Yield	User entered yield will *only* be used in soil C and methane estimates if flooded rice is included in the rotation. With non-rice crops, yield will only be used in methane estimates if a burning event is also included in the management of the crop. COMET-Farm does *not* make predictive yield estimates.

Tillage System Intensity

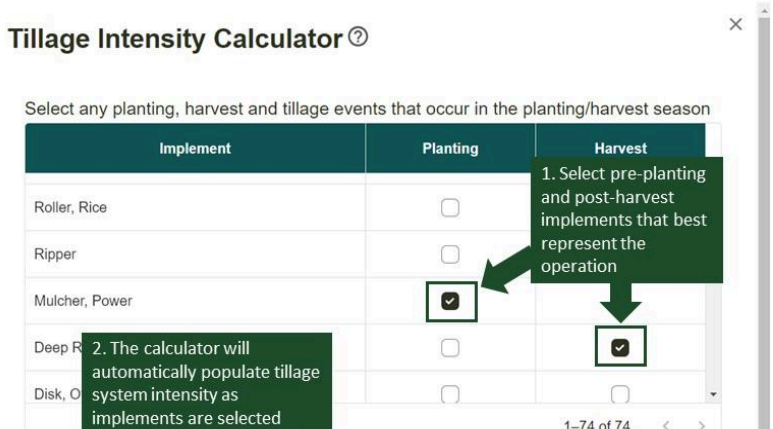
As outlined in Chapter 3 of the USDA Inventory Methods document, tillage implements and timing are required for the Tier 3 method using DayCent. Users are strongly encouraged to enter a tillage system intensity for all crops where a planting and harvest date is specified.

Tillage is categorized into full intensive tillage, reduced till, and no-till depending on the tillage implements and the number of passes. Tillage intensity is estimated for the planting period and the post-harvesting period. For the Tier 3 method, the intensities for each period are simulated with the model, using an intensity ranking from A to K (see Table 3-14 below). In COMET-Farm, these intensities are represented using values I through III. For example, Intensity H will appear in COMET-Farm as "Reduced Till (IV)", and Intensity A will appear as "No Till (I)."

Table 3-14. Tillage Categories, Intensity Categories for the Tier 3 Method, and Tillage Intensity Ranges

Tillage Category	Intensity Categories—Tier 3 Method	Tillage System Intensity Range
No-till	A	0.001–0.01
	B	0.011–0.04
	C	0.041–0.075
Reduced till	D	0.076–0.111
	E	0.112–0.144
	F	0.145–0.162
	G	0.163–0.202
	H	0.203–0.252
Full intensive till	I	0.253–0.268
	J	0.269–0.449
	K	0.450–1.00

If tillage implements are used during the *Pre-Planting/Planting Season* and/or *Post-Harvest/ Harvest Season* for the selected crop, please use the "Tillage Intensity Calculator" to populate the respective seasonal tillage system intensities. Per equation 3-13 in the USDA Inventory Methods document, the Tillage System Intensity Calculator will calculate the system intensity based on the mixing efficiency and tillage depth (cm) for all implements used. If users are unable to locate their exact implement from the list, please refer to Table 3-15 for each implement's respective mixing efficiency and tillage depth and select the closest implement.



The *Pre-Planting/Planting Season Tillage System Intensity* and *Post-Harvest/Harvest Season Tillage System Intensity* will update at the bottom of the calculator window as each implement is added. Selecting "Populate Intensity" will populate the intensities under the Tillage System Intensity and Field Operations section.

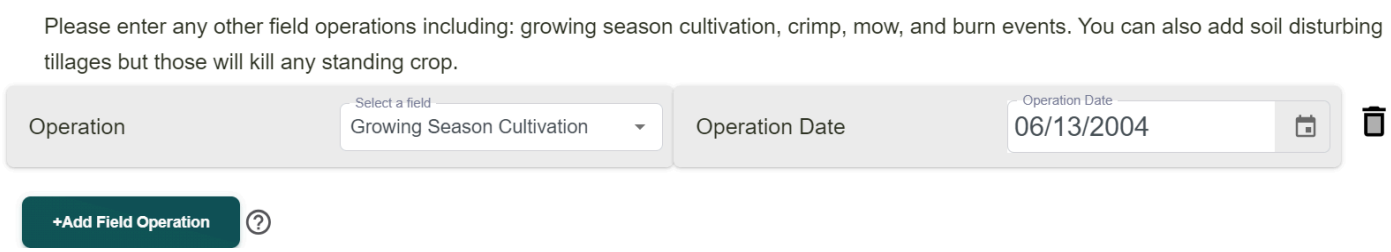
For crops with multiple harvest events in a year, users should add all implements used in any harvest event throughout the crop season. A single tillage system intensity will be added following the final harvest event of the year.

To update calculated system intensities, select the “Tillage Intensity Calculator” again, modify the selected implements, and select “Populate Intensity”.

Users will not be able to enter a *Pre-Planting/Planting Season Tillage System Intensity* when “Continue crop from the previous year?” is selected for perennial crops.

Users will not be able to add a *Pre-Planting/Planting Season Tillage System Intensity* or *Post-Harvest/Harvest Season Tillage System Intensity* to a “Fallow” crop. If a tillage event occurs during the fallow season, please enter these events under the “Other Field Operations” section.

Other Field Operations

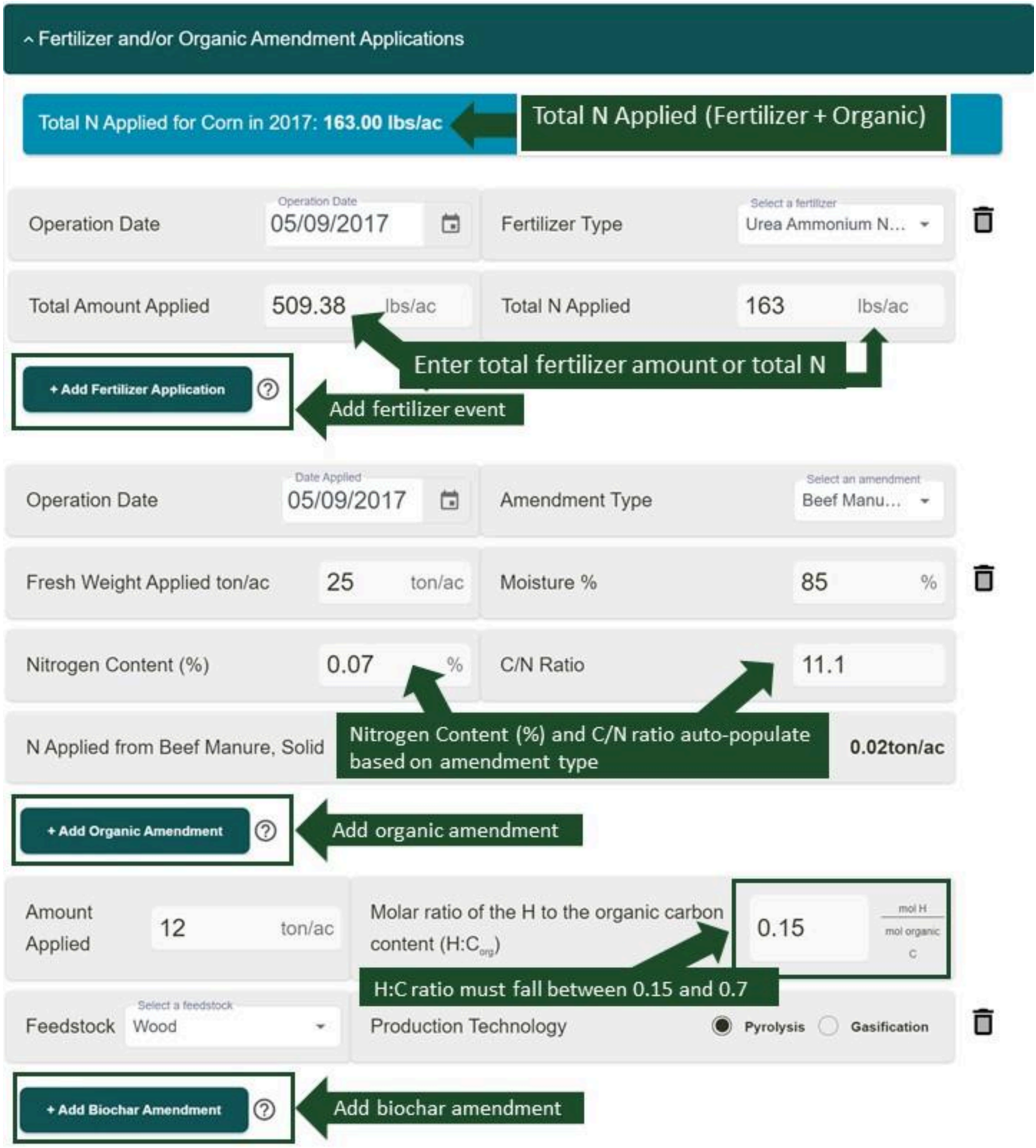


Other Field Operations provide users the opportunity to enter details about other field operations included in their management. This includes any tillage or cultivation events occurring during the growing season, crimp, mow, herbicide, or burning events. To include a field operation, click *Add Field Operation,* select the practice from the dropdown menu, and enter the operation date.

Field Operation	Description
Growing Season Cultivation	Weeds are killed and turned into the soil surface layer. Users should enter a growing season cultivation event if a cultivator is used during the crop growing season.
Mow	50-60% of standing live and dead plant biomass is cut and left lying as surface residue. The standing live plant is left alive to continue growing.
Crimp	100% of the standing live and dead plants are cut, chopped, and incorporated into surface residue. The standing live plant is killed in the process.
Broad-Spectrum Herbicide	Entering an herbicide event will result in terminating all standing crops within the defined field. Herbicide events should *not* be used for applying herbicide to kill only weeds between crop rows.
Burn Event	If a user elects to include a burning event, they will then be prompted to enter a burn date. While COMET-Farm will allow users to select to burn

	during a growing season, they will receive a warning as this action will result in the termination of their standing crop. Burn events should only be used for a fire burn event.
Tillage (No, Reduced, Intensive)	If a tillage event occurs during the growing season, please select No, Reduced, or Intensive Tillage and the date. Tillage events added through *Other Field Operations* will be applied as the highest intensity within a category (e.g., selecting Reduced Tillage applies Reduced Tillage (V)). If a tillage event occurs within the growing season of any crop, this will result in a crop growth disruption by the simulation of all aboveground live biomass being transferred to either standing dead, surface litter, or the topsoil. Adding a tillage event during the growing season is only recommended if a user is tilling a fallow crop or if the tillage event was used to turn a crop in.

Is a field operation not listed? COMET-Farm cannot support other field operations that are not listed in the dropdown. This includes but is not limited to fungicide or insecticide events.


Fertilizer and/or Organic Amendment Applications
Total N Applied for Corn in 2017: 163.00 lbs/ac
Total N Applied (Fertilizer + Organic)
Operation Date
Operation Date
05/09/2017
Fertilizer Type
Select a fertilizer
Urea Ammonium N...
Total Amount Applied
509.38
lbs/ac
Total N Applied
163
lbs/ac
Enter total fertilizer amount or total N
+ Add Fertilizer Application
Add fertilizer event
Operation Date
Date Applied
05/09/2017
Amendment Type
Select an amendment
Beef Manu...
Fresh Weight Applied ton/ac
25
ton/ac
Moisture %
85
%
Nitrogen Content (%)
0.07
%
C/N Ratio
11.1
N Applied from Beef Manure, Solid
Nitrogen Content (%) and C/N ratio auto-populate based on amendment type
0.02ton/ac
+ Add Organic Amendment
Add organic amendment
Amount Applied
12
ton/ac
Molar ratio of the H to the organic carbon content (H:Corg)
0.15
mol H / mol organic C
H:C ratio must fall between 0.15 and 0.7
Feedstock
Select a feedstock
Wood
Production Technology
Pyrolysis
Gasification
+ Add Biochar Amendment
Add biochar amendment

Users may add fertilizer, manure, compost, and biochar applications in the *Nutrient Management* activity data section. The total nitrogen (lbs/ac) applied to the crop will be calculated at the top of the panel when fertilizer and/or organic amendment events are added.

Fertilizer Applications

To include fertilizer application(s) as a part of management, select *+Add Fertilizer Application.* Users will be prompted to select the date of their application, as well as their fertilizer type from a dropdown menu. Once a value is entered for either Total Amount Applied or Total N Applied, the other value will update by default - and vice versa - based on the selected fertilizer type. For instance, if a user selects Urea Ammonium Nitrate (30-0-0) and enters 11 lbs of N applied, COMET will default the Total Amount Applied to 34.38 lbs/ac.

DayCent cannot support multiple fertilizer events on the same day. To accommodate for this limitation, users can either:

- Enter sequential dates for each fertilizer type. For example, if two fertilizer events occurred on May 15th, enter one event on May 15 and one event on May 14.
- Sum the total amount of nitrogen applied across fertilizer events and add it as one singular event on one day

The total amount of nitrogen being applied to the system is the most important variable included in the model, so if a certain fertilizer type is not included in the tool, users may select “Element-N” and adjust the input values until the desired amount of nitrogen is applied to the system.

Organic Amendment Additions

To add organic amendment application(s), click *+Add Organic Amendment.* Users will be prompted to enter information on their application date, select their manure type from a dropdown menu, and provide a value for fresh weight applied (lb/ac). Fresh weight applied can be entered as it is applied (wet or dry mass); slurry amounts are entered in increments of 1,000 gal/acre, and manure is entered as solid and organic fertilizers are entered as tons/acre. Default values will populate for moisture (%), nitrogen content (%), and C/N ratio (lbs N/ac), but users can edit these values if desired. Please review an amendment lab analysis if the parameters are unknown.

Organic Amendment Table Input	Description
Date	When the manure/compost is applied.
Amendment Type	Selection of common amendment types (manures, slurries, compost). When users select a type from the dropdown, COMET will default N%, C:N, and moisture % from the NRCS manure management handbook. Users may edit any defaults COMET provides. If an amendment is unavailable, please select “other manure” and enter the required details.
Moisture %	Moisture percentage of the fresh weight applied.
Nitrogen Content (%)	Percent Nitrogen content. Slurry analyses often present Lbs N/1000 gal instead of N%. Example 15.19 lbs N/1000 gal to %N content conversion: Average dairy slurry weight = 8.5lb/gal

	$\frac{15.19 \text{ lbs N}}{1000 \text{ gal slurry}} \times \frac{1 \text{ gal slurry}}{8.5 \text{ lbs slurry}} =$ $\frac{15.19 \text{ lbs N}}{8500 \text{ lbs slurry}} = \frac{0.00179 \text{ Lbs N}}{1 \text{lb slurry}} \times 100 = 0.179\% \text{ N}$
C:N Ratio	Ratio of total carbon to total nitrogen

This section uses a mass balance approach to ensure that total percentages of different portions do not exceed 100%. If users modify the default values to exceed 100%, they will get the following error message: *The data entered indicates the fractions of carbon, nitrogen, phosphorus, and water exceed 100% for this event. Please check the test report or product label and adjust the percentages to correct this issue.*

Example: a grower applies 10,000 gallons of dairy slurry on their field. The lab report indicates the slurry is 92% water, 0.13% nitrogen, and 0.06% P, with a C:N ratio of 7.7. A C:N ratio of 7.7 indicates that the carbon fraction is: 0.13 (from the nitrogen) x 7.7 = 1.001%. The remaining fraction (approx. ~6.8%) comprises potassium, calcium, hydrogen, and oxygen bound to carbon in the organic matter, and other trace materials.

Click here to view a sample soil analysis report, where each parameter asked for in COMET-Farm is indicated with a red asterisk.

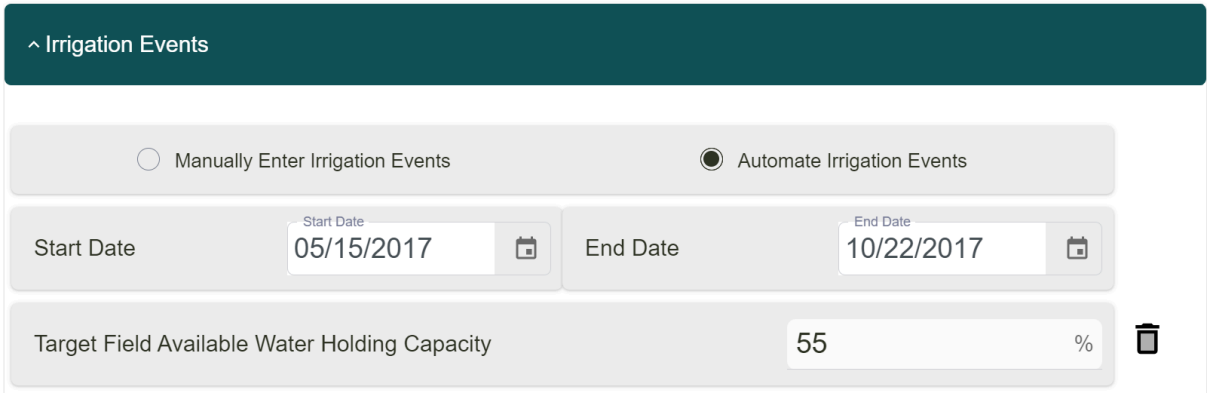
Biochar Amendment Additions

Biochar amendments are a new addition to COMET-Farm in 2024. Click *Add Biochar Amendment* to include biochar in the field's management practices. Users will be asked to enter the amount applied (ton/ac), the molar ratio of H to organic carbon content C (must be a value between 0.15 and 0.7), the feedstock type (manure, wood, herbaceous biomass, rice residue, biosolids, or nut shells, pits, and stones), and the production technology (pyrolysis or gasification). More information on biochar amendments can be found on page 3-34 of the USDA methods document.

Irrigation Events

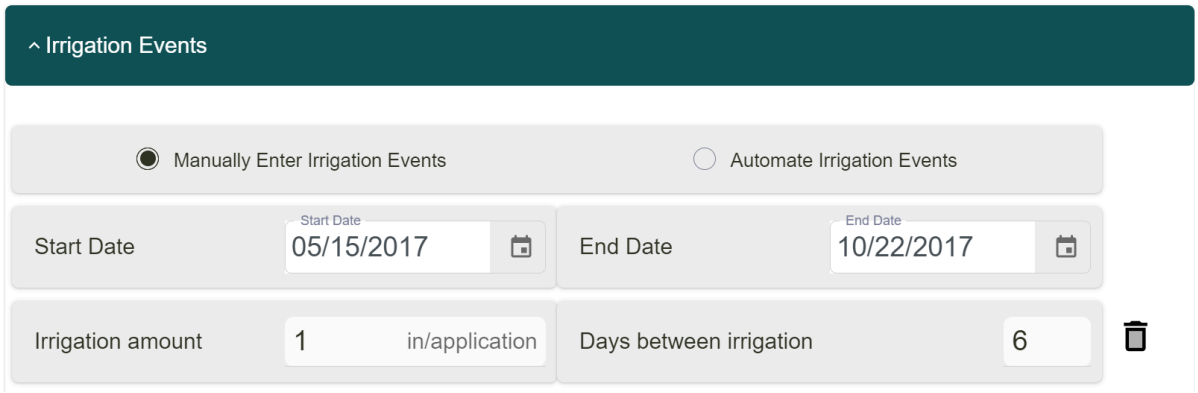
To include irrigation in crop management, click the *Add Irrigation Event* button. Users will first be prompted to indicate whether they want to enter their irrigation details manually, or auto-irrigate. At this time, COMET-Farm cannot estimate greenhouse gas emission changes as a result of irrigation method or type.

Automate Irrigation Events



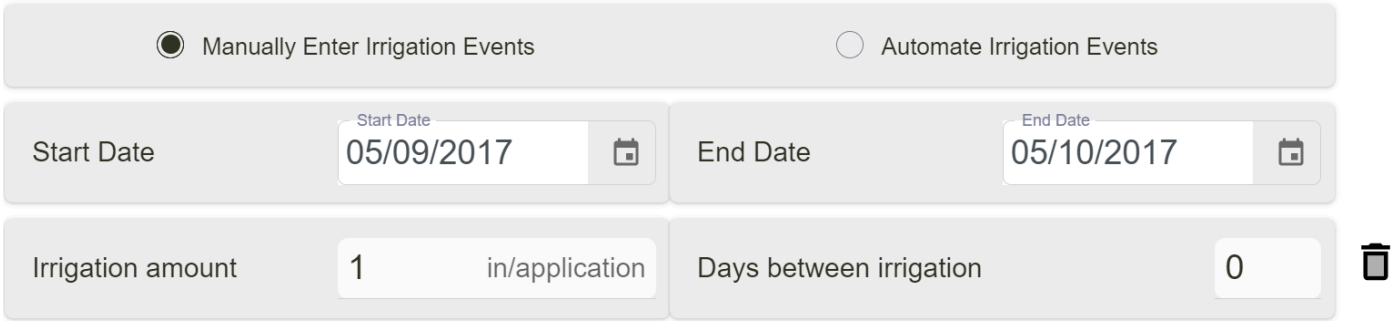
Users who select Automate Irrigation Events will need to enter the irrigation start and end date, and then COMET will default a value between 5%-95% for Threshold Soil Water Holding Capacity. Users can modify the defaulted threshold soil water capacity level. The threshold soil water holding capacity should be the level at which the moisture content of the soil should not fall below. COMET will irrigate to available water holding field capacity when the moisture percentage reduces below the user-indicated capacity percentage. Available water holding capacity (AWHC) is determined by soil texture and organic matter amount (SSURGO).

Manually Enter Irrigation Events



Users who select to Manually Enter Irrigation Events need to enter their start date, end date, irrigation amount (inches per application), and days between irrigation. Days between irrigations must be less than the total number of days between the start and end date (e.g. 0 days between irrigations = irrigation every day; 1 day between irrigations = irrigate every other day; 6 days between irrigations = irrigation once per week).

Single irrigation event: For single irrigation events, set the start and end dates on the same day, enter the irrigation amount (inches per application) and days between irrigations as zero.



Fertigation

COMET-Farm does not have an automatic fertigation option, so users are recommended to manually enter irrigation events with a start and end date, irrigation amount, and days between irrigation similar to the fertigation system. In the fertilizer activity data panel, users may enter a single application of the total fertilizer applied around the planting date or enter multiple smaller fertilizer events to align with the irrigation events.

To add multiple applications, users can select *Add Irrigation Event* again.

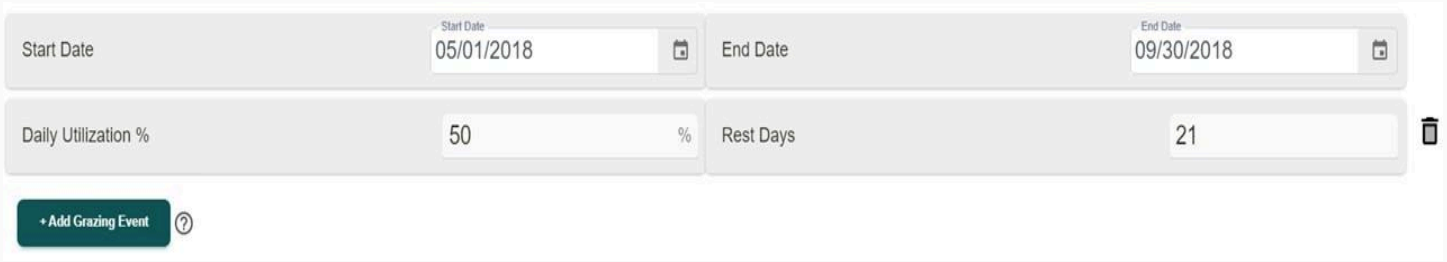
Grazing Events

To add a grazing event to crop management, click *Add Grazing Event.* The inclusion of a grazing event within the cropland/pasture/range/orchard/vineyard module means that soil-related emissions and removal as a result of grazing will be accounted for. **An assessment of the enteric or manure emissions associated with any grazing livestock will have to be accounted for separately in the Animal Agriculture module** (see the System Boundaries section).

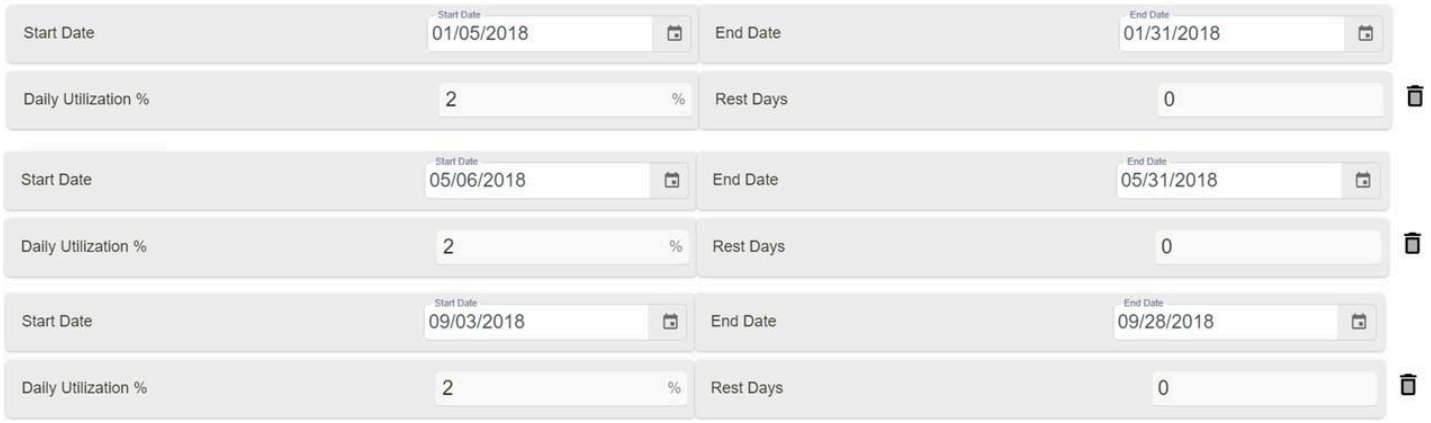
The *Start Date* refers to the date that the livestock are first put on the field to graze, and the *End Date* is the date the livestock are removed from the property and the day grazing ends. Daily utilization % allows users to enter the percent of aboveground forage utilized (chewed down) by the livestock during a given day of grazing.

Grazing *rest days* indicate the average approximate number of days before livestock return to graze an individual patch of ground within the field, either because they are free to roam in the field and the grass has regrown enough since it was last grazed to attract them back, or because they were moved back onto the field at that planned time interval. If rest days are entered in a grazing period that is longer than one day, the system will simulate one day of grazing followed by the number of rest days entered, and that sequence will repeat though the end date (see the Intensive Rotational example below). If no rest days are entered, it is assumed that the parcel will be continuously grazed between the start and end dates of a grazing period. Any days of the year not included in a grazing period are treated as rest periods (see the Extensive Rotational example below).

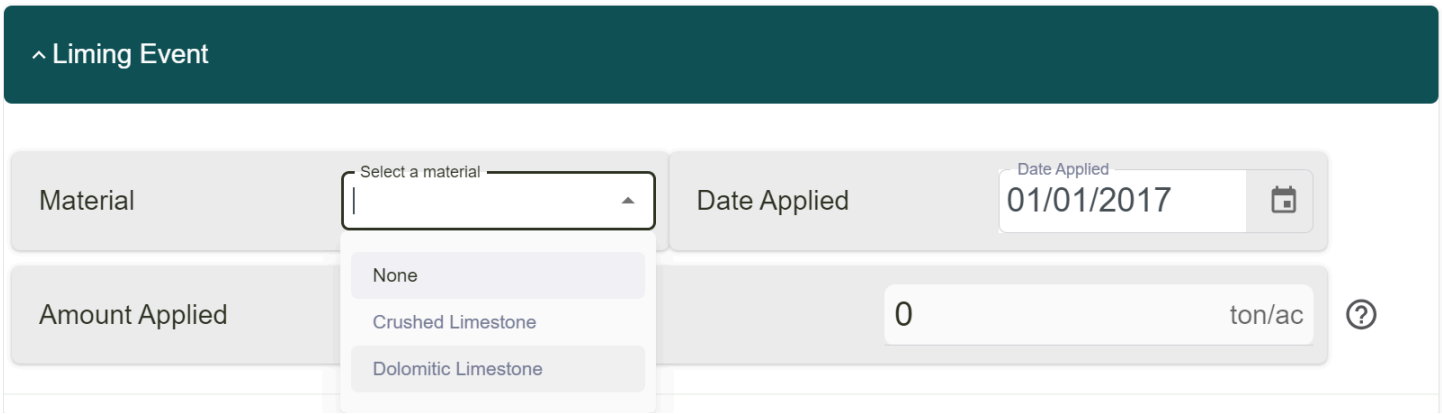
Intensive rotational example: Livestock graze for a single day on each parcel, separated by rest periods - for example, a pasture is separated into twenty-one paddocks and livestock rotate through the paddocks, grazing for only one day in each paddock and returning twenty-one days later to graze again.



Extensive rotational example: Year-round extensive rotational grazing with 1 month grazing periods followed by 3 months of rest.



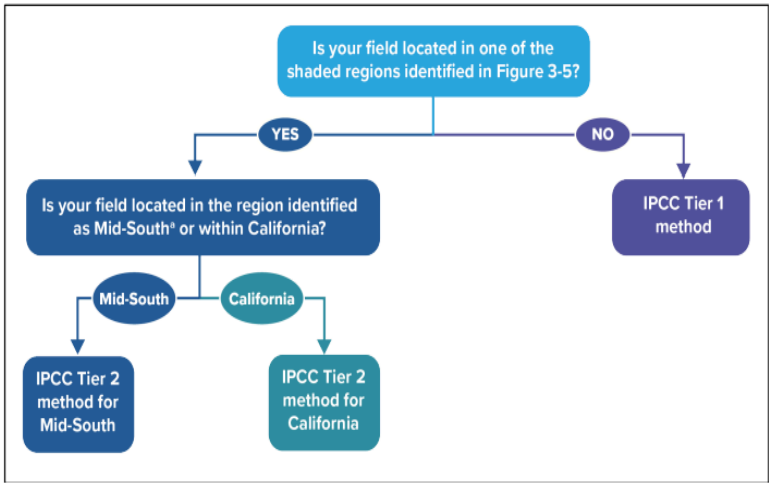
Liming Events

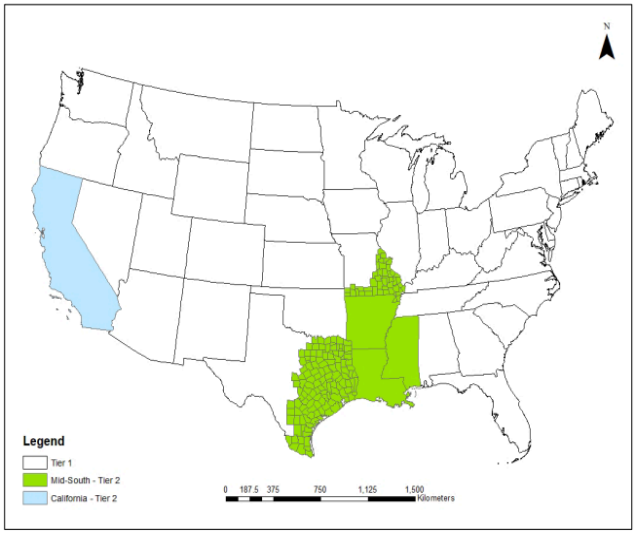


Users may add a single liming event per crop. Users will need to indicate the liming material, application date, and application amount (tons/ac). If no liming event occurs for a crop, *none* should be selected.

Rice Management

Rice accounting in COMET-Farm is unique because it is only available in certain regions and the location will inform the IPCC Tier 2 method that is used in the tool. Rice accounting in COMET-Farm is available in Arkansas, California, Louisiana, Mississippi, and certain counties in Missouri and Texas.





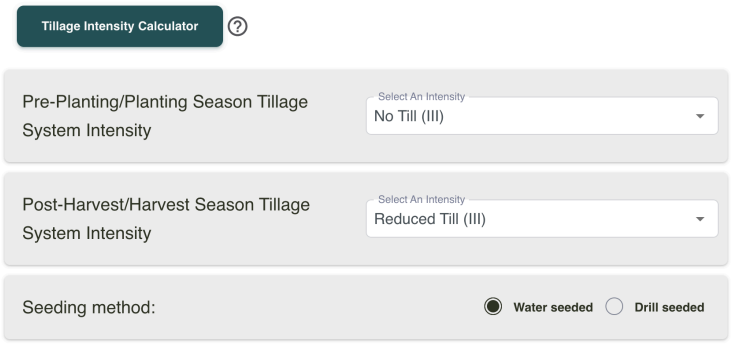
Figures 3-4 and 3-5 from the USDA methods document (page 3-66) can assist users in determining whether or not their rice crops can be accounted for in COMET-Farm.

While many of the data entry steps for rice align with the process for annual crops, this section will detail the variations in rice assessments.

Step 3: Baseline Crops & Management: Select “Rice-Flooded” from the crop list drop down menu. The Define Baseline Management window will automatically open. Proceed in entering management details as other crops with the following exceptions:

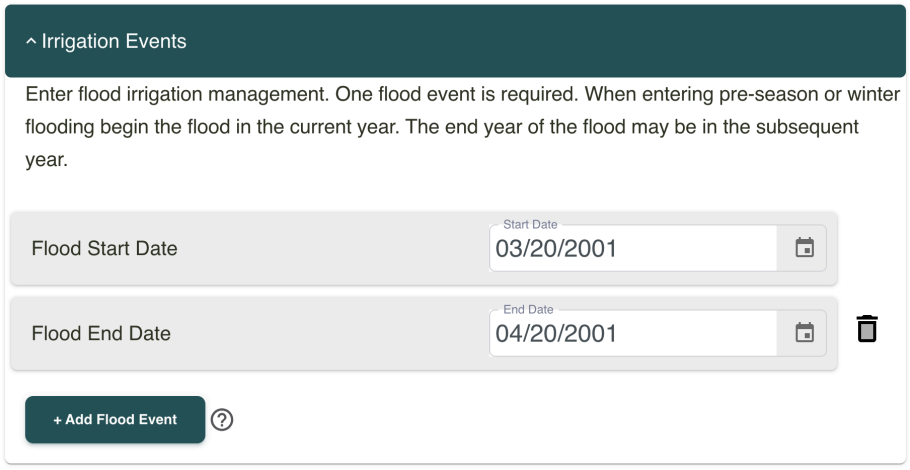
- **Planting and Harvest:** After entering a planting and harvest/kill date, a dry matter removal percentage, and selecting the check box next to Grain/Fruit/Seed/Root/Tuber, enter a value for Yield. For rice accounting, yield is used to estimate the rate of application of organic amendment types (e.g., straw incorporation). Yield should be entered in hundredweight per acre (cwt/ac). COMET-Farm will only utilize the user-entered yield if a tillage event is included in management or if the dry matter removal is less than 100%.

- **Tillage System Intensity and Field Operations:** *This section is specific to rice accounting in California*.* After entering a pre-planting and/or post-harvest tillage intensity from the drop-down menus (or using the Tillage Intensity Calculator), please select a Seeding Method.
  - Water-seeded: Rice seeds are broadcast into a flooded field.
  - Drill-seeded: Rice seeds are planted directly into the soil using a drill before the field is flooded. This requires careful management of water post-planting.



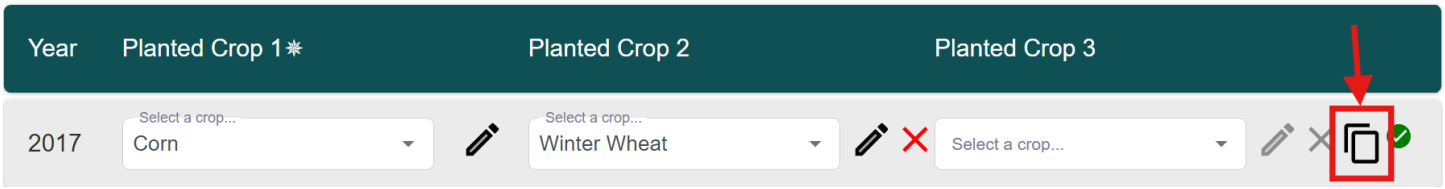
**In the mid-South regions, water-seeding is assumed for the seeding method*

- **Irrigation**: the only management style for rice that is parameterized in COMET-Farm is the flooded method. The tool requires at least one flood event, but more may be added if both pre-season flooding occurred as well as winter flooding. The flood event may end in the subsequent year.

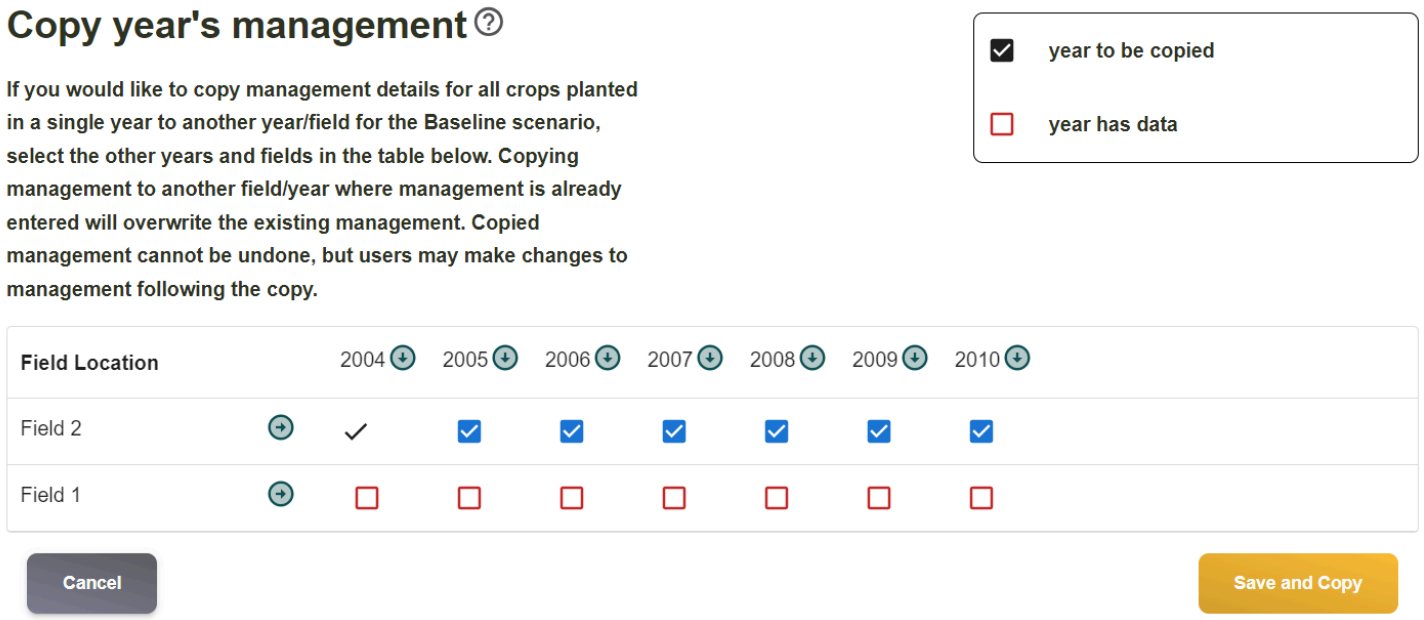


Copying Management

Users may copy all crops and their respective management from one field and year to another field(s) and year(s). Select the icon to the left of the green check mark, , indicated below.



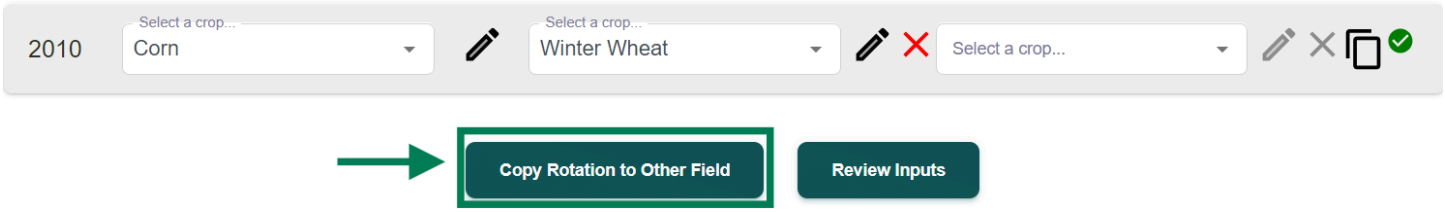
A popup window will appear prompting a user to select which field/year(s) they would like to copy the management to. Please review the copy window symbol descriptions below. Copying management to a field/year with existing management will overwrite the original management, and while copied management can be edited, *it cannot be undone.*



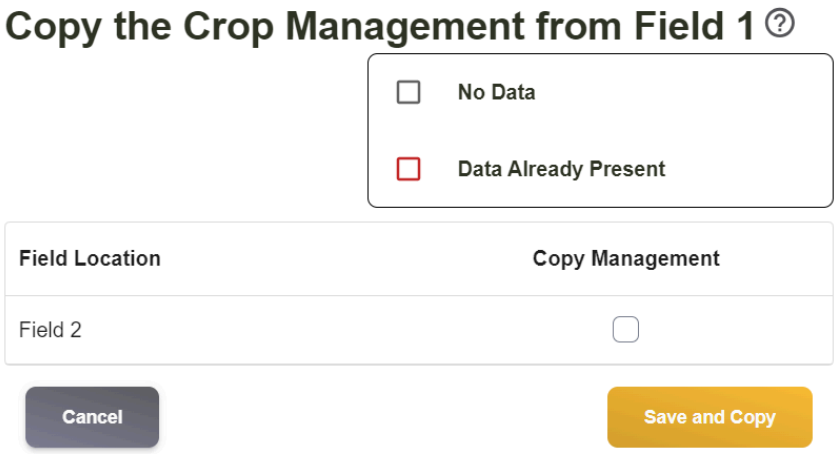
Copy Window Symbol	Description
✓	Year to be copied. All crops and their management will be copied **from** this year.
⊕	Select all years in this field. Click again to deselect all years. Users may deselect individual years.
⊕	Select all fields in this year. Click again to deselect all fields for this year. Users may deselect individual years.
☑	No existing management data in this year/field. Management data will be copied to this field/year.
☑	This year/field has management data. Management data will be copied to this field/year, overwriting the existing data. Users cannot undo this action once *Save and Copy* is selected.
☐	This year/field has management data. If it remains unselected, management data will not be copied to this year.
☐	This year/field has no management data. If it remains unselected, management data will not be copied to this year.

Copy Rotation to Other Field

Users may also choose to copy an entire rotation (including all management for all crops 1-3 and for all years in the baseline) to another field in their project. At the bottom of the baseline management, click Copy Rotation to Other Field.

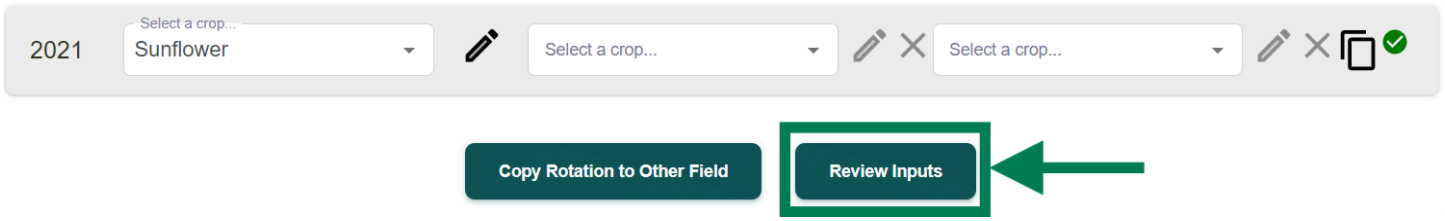


A popup window will appear, prompting users to select which field(s) they would like to copy the rotation to. A gray box indicates that the field has no existing data, while a red box indicates that the field is already populated with management. Copying management to a field(s) with existing management will overwrite the original management, and while copied management can be edited, *it cannot be undone.*



Review Inputs

At any point in entering management details, users can review *all* management activity data entered by selecting *Review Inputs* at the bottom of the scenario page. *Review Inputs* can be helpful to view all entered management for all crops for a given field in a given scenario.

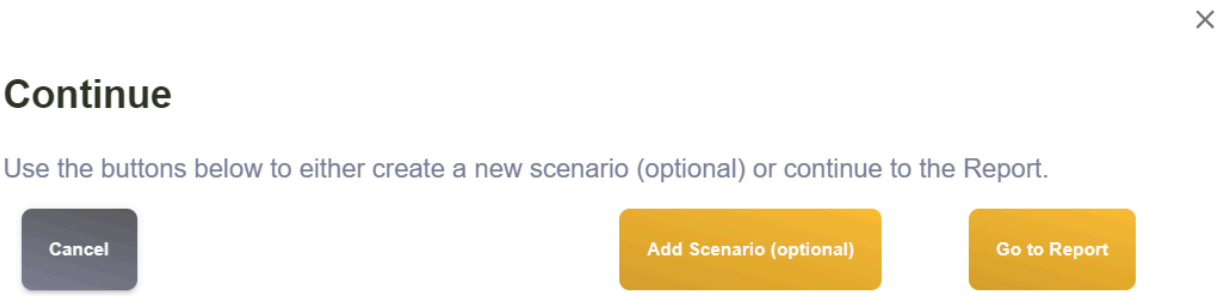


When *Review Inputs* is selected, a pop-up window detailing the field name, scenario name, and all entered management activity data will appear. Users may opt to download these inputs as a .csv by selecting *download CSV* in the upper right corner of the popup.

Users will *not* be able to upload this .csv back into the tool. A detailed report of all inputs for all fields and their respective estimated emissions/reductions is available on the Reports page.

Users must complete *all* required management activity data for all defined fields before proceeding to a scenario creation or generating a report. Required activity data includes historic management data, a crop selection (fallow does suffice), and a planting date or "continued planting from previous year" selection. Remember: while these are the only management data required to generate a report or create scenarios users are encouraged to enter management activity data as accurately as possible, within the limitations of COMET-Farm.

Click Next to select to either a) add a scenario or b) go to the report.

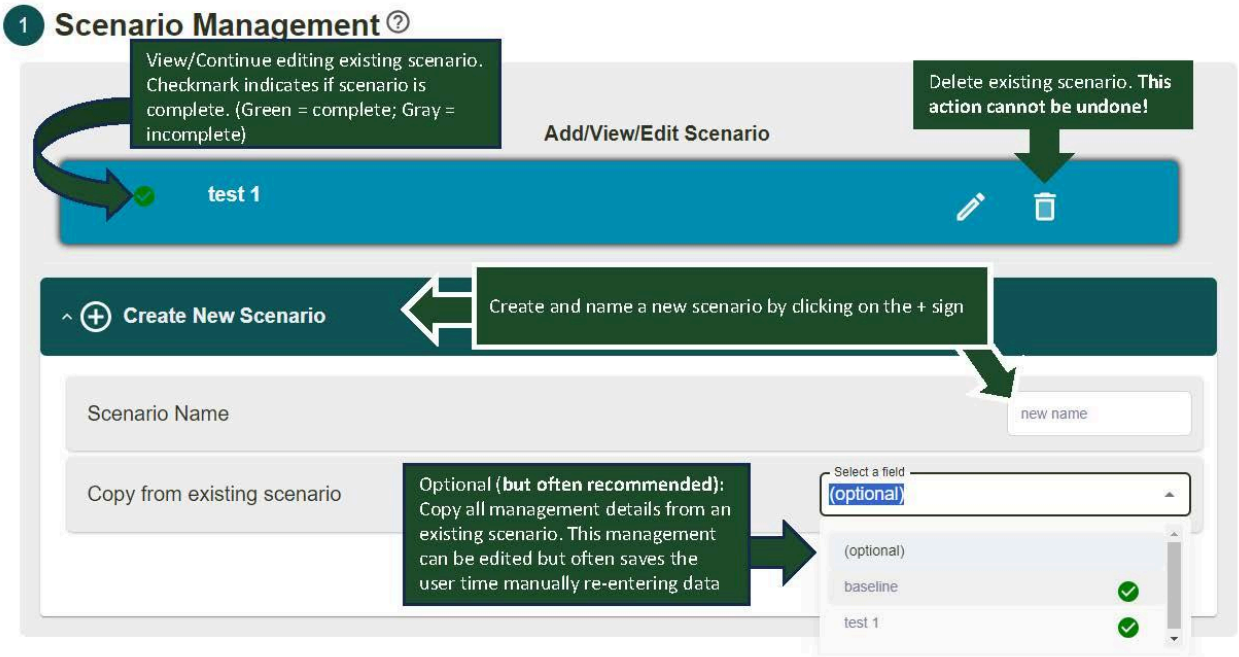


Scenario Management (optional)

As a new feature of COMET-Farm, users may choose whether or not they want to create a scenario to compare to their baseline management. While COMET-Farm is intended to perform conservation scenario analyses by simulating emissions resulting from a future or hypothetical change in management, users may choose to skip adding a scenario altogether, or may use scenarios to inventory emissions for a management change that was already made. The scenario period will always begin the year after the end of the baseline. For example, a scenario created for a 2014-2023 baseline will begin in 2024, but a scenario created for a 2004-2011 baseline will begin in 2012. Scenario years cannot be edited.

After selecting Add a Scenario, users will be prompted to create a new scenario by clicking the in the dropdown menu. Scenario names should make a detailed reference to management changes, such as "Convert to No Till" rather than "Scenario 1." At this time, users may also elect to copy management from an existing scenario. For scenarios with minor changes in management, **it is highly recommended to copy management from the baseline**. With this selection, rather than manually re-entering almost all of the same management, users can save time by instead making edits to the copied baseline.

Once created, scenarios can be edited or viewed using the pencil icon, and can be deleted using the trash can icon. **Once deleted, scenarios cannot be recovered!**

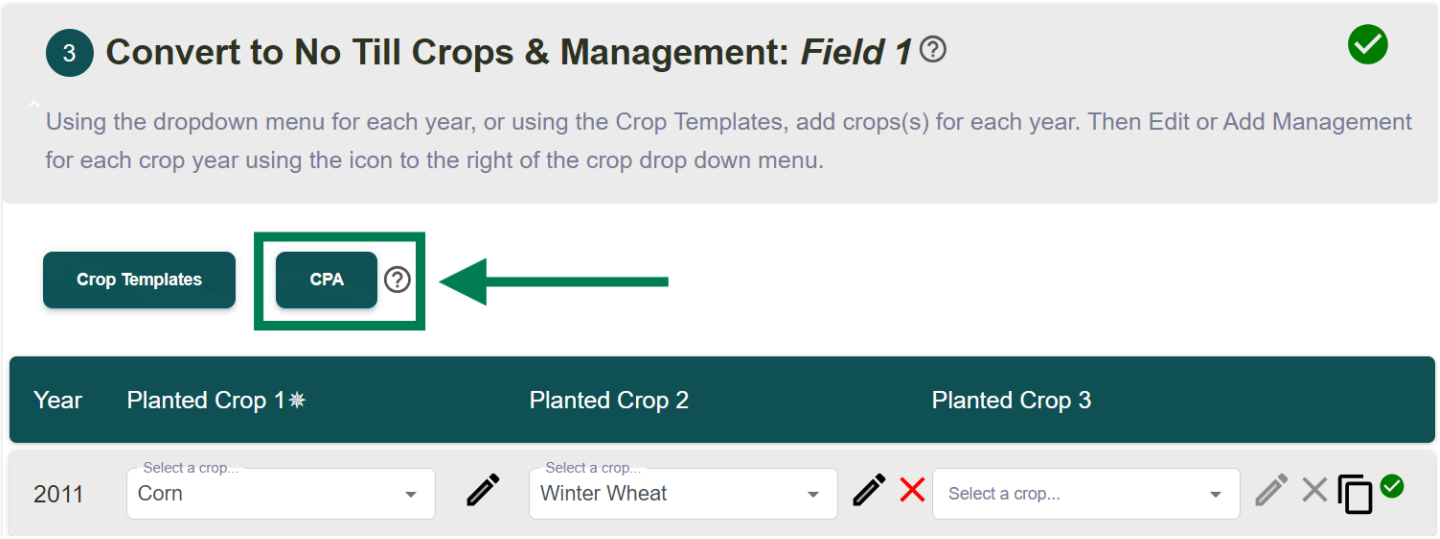


Click *Create New Scenario* to continue onto entering scenario management. Up to 10 scenarios can be created per project.

Conservation Practice Advisor (CPA)

Entering management into a scenario functions the same as baseline management. Just as with the baseline, crops can be added manually or using the *Crop Templates* button, management can be copied across years and fields, and management can be reviewed using *Review Inputs*.

The only added feature is the **Conservation Practice Advisor**, or CPA.

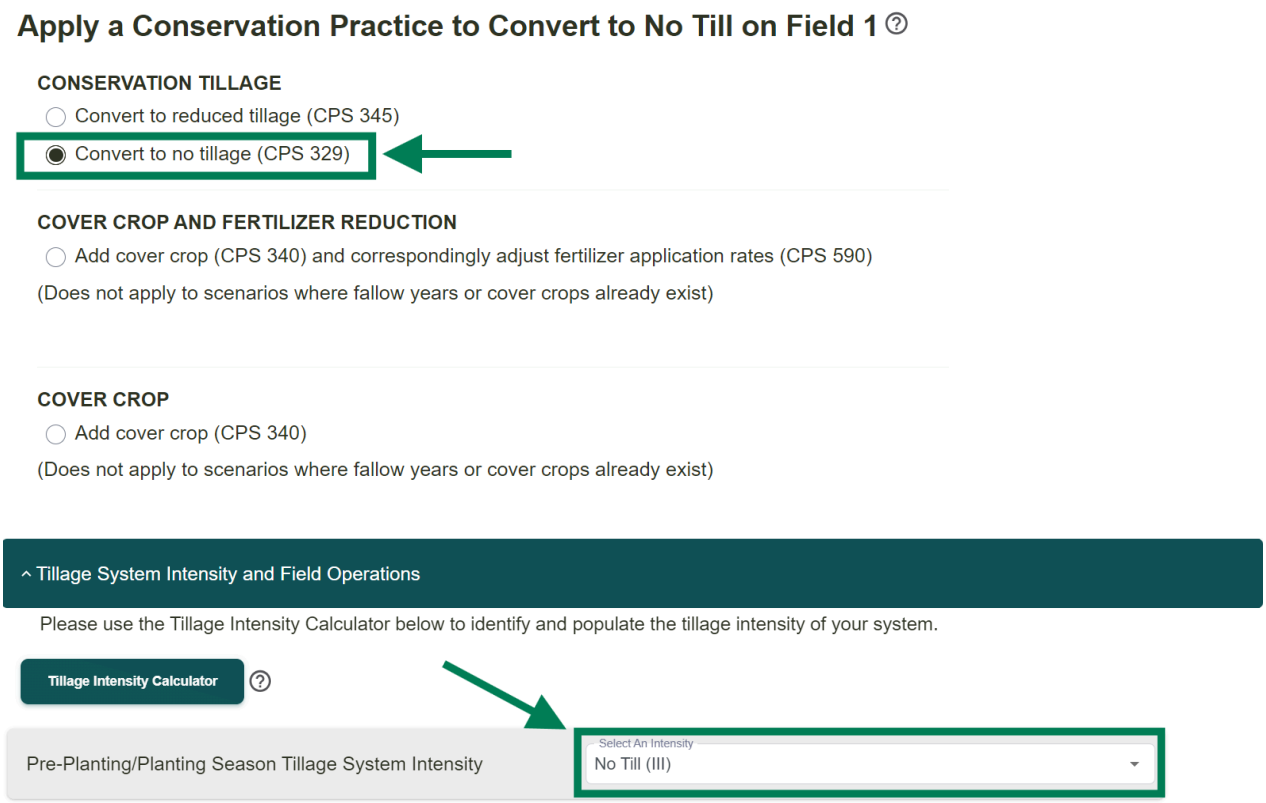


The Conservation Practice Advisor (CPA) is a feature that provides users with a starting point to apply USDA-NRCS Conservation Practice Standards (CPS) to scenarios. The CPS are based on the USDA-NRCS National Conservation Practice Standards. "The conservation practice standard contains information on why and where the practice is applied, and it sets forth the minimum quality criteria that must be met during the

application of that practice in order for it to achieve its intended purpose(s)" (Conservation Practice Standards). Users are encouraged to use the CPA as a template, and should be modified to reflect their unique management to meet the state and local criteria set by the USDA-NRCS State Office where the project is located. State conservation practices standards are available through the Field Office Technical Guide (FOTG). There are a limited number of available CPS on the COMET-Farm tool at this time. They include:

- CPS 345: Convert to reduced tillage
- CPS 329: Convert to no tillage
- CPS 340: Add cover crop
- CPS 340/590: Add cover crop and correspondingly adjust fertilizer application rates
- CPS 332: Contour buffer strips
- CPS 386: Field border
- CPS 390: Riparian herbaceous cover
- CPS 393: Filter strip
- CPS 412: Grassed water way
- CPS 601: Vegetative barrier
- CPS 327: Conservation cover

The CPA will apply selected practices to the selected scenario automatically, without the user needing to make manual changes. For example, when “Convert to no tillage” is selected, all tillage implements across years and crops will be replaced by no till (III) implements. However, the practices are only added to the selected *field*. In the example below, No Till is being applied to Field 1.



Only one conservation practice can be selected at a time. The selected conservation practice will overwrite existing management to be applied to *every appropriate instance* (all appropriate crops and all years in the

scenario). However, it will only apply to one field at a time. Click *Save and Copy* to apply the conservation practice. **This action cannot be undone!**

When finished entering scenario management, click Continue to Report. Proceed to the Reports section of the manual.

Creating an Animal Agriculture Project

Overview

Before creating any COMET-Farm projects, users must first create a COMET-Farm account and create a new project before proceeding.

Climate Zones

The *Animal Agriculture* accounting activity requires the user to enter their location (state and county) in order to determine the climate zone for housing and manure emission calculations.

Activity Data

COMET-Farm was created in parallel with and as a function of the USDA Methods for Entity-Scale Inventory document, and therefore, will only ask for activity data necessary to execute the empirical models outlined in the document. For a detailed list of required and suggested activity data for each accounting activity, we recommend users create a free COMET account to create sample projects or review the activity data entry spreadsheets. Required activity data will be noted for each accounting activity. These are intended as information guidelines and for organizational purposes. COMET-Farm does *not* support the upload of activity data via spreadsheets.

Housing Types

When entering management details for certain animal types, users will be asked to identify how much time their animals spend in each housing type. The following table provides definitions for each of these housing types.

Housing Type	Description
Covered Barn (Flushed, Scraped, Vacuum)	Manure is stored in pits below the animal housing. “Deep” pits are associated with slatted floor barns in dairy and swine systems whereas “shallow” pits are associated with caged laying hen systems.
Covered with Pit Storage	Manure is stored in pits below the animal housing. “Deep” pits are associated with slatted floor barns in dairy and swine systems whereas “shallow” pits are associated with caged laying hen systems
Covered with Deep Bedding	Bedded pack refers to the mixture of bedding, usually wood shavings or kiln-dried sawdust, and manure on the pen floor. Bedded pack barns

	combine housing and waste storage on the same surface area.
Covered Compost Barn	Also known as a compost bedded pack barn, covered compost barns refer to a loose housing system for cattle that use composting manure and organic bedding as a housing space.
Dry Lot	A confined area that has little to no grass or vegetation and is typically used as part of rotational grazing
Pasture Range	Land primarily used for grazing and producing forage for livestock.

Manure System Types

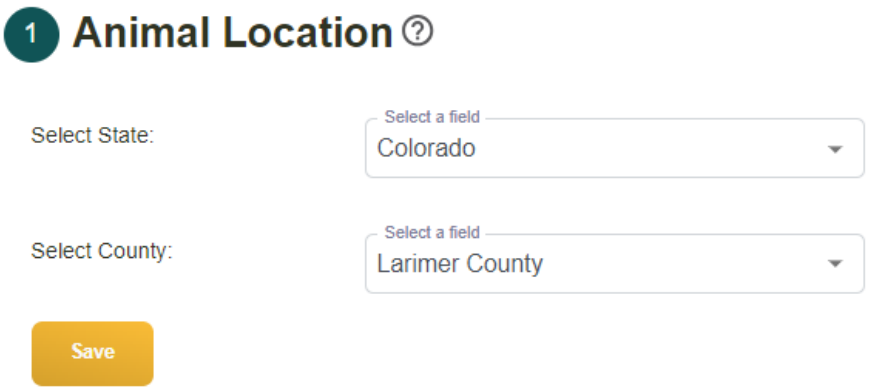
When entering management details for certain animal types, users will be asked to identify how manure is handled. The following table provides definitions for each of these manure system types.

Manure System Type	Description
Aerobic lagoon	Aerobic lagoons are typically uncovered earthen basins storing liquid or otherwise wet manure slurry, in which the manure is aerated to maximize biological oxidation of manure solids. Emissions are assessed for lagoons with natural and forced aeration.
Anaerobic digester	Anaerobic digesters are closed manure treatment systems designed to maximize conversion of organic wastes into biogas. These can range from covered anaerobic lagoons to highly engineered systems. Methane gas leakage is the main source of GHG emissions; very little nitrous oxide gas is generated.
Anaerobic lagoon	Anaerobic lagoons are earthen basins for anaerobic digestion and storage of animal waste. Lagoons may be covered, uncovered with a crust, or uncovered without a crust.
Composting	Composting involves the controlled aerobic decomposition of organic material and can occur in different forms. The tool estimates emissions from composting in vessels, static piles, intensive windrows, and passive windrows.
Runoff holding pond	Holding ponds are usually clay-lined earthen structures that store liquid runoff from feeding operations. They are commonly emptied using irrigation equipment.
Solid storage	Solid manure (80% or less moisture and 20% or

	more solids) can be assessed as stockpiles, covered or compacted, as a bulking agent, or as additives.
Storage tanks	Storage tanks and liquid/slurry storage ponds typically store slurry or wastewater that was scraped or pumped from housing systems. The tool estimates emissions from storage tanks that are covered, uncovered with a crust, and uncovered without a crust.
Land applied/removed offsite	Manure is removed from the animal agriculture “entity” and may be applied offsite, such as on a cropland field.

Animal Location

COMET-Farm requires users to tie their management details to a specific location via a selected state and county (Larimer County, CO in the example below). This information will only be used to determine climate zones for manure and housing related calculations. Using the dropdown menus, select the state and county of the general area of the operation being assessed. Click *Save* to verify and save this location.This selected location will be applied to all animal categories within a project. To assess an operation in another state/county, create a new project.



Select Animal Categories

COMET-Farm also requires users to tie their management details to specific animals. The Animal Categories dropdown menus allow users to define any animals involved in their greenhouse gas accounting. Each specific animal type is housed within a category: Cattle, Poultry, Swine, Other Ruminants, and Other Non-Ruminants.

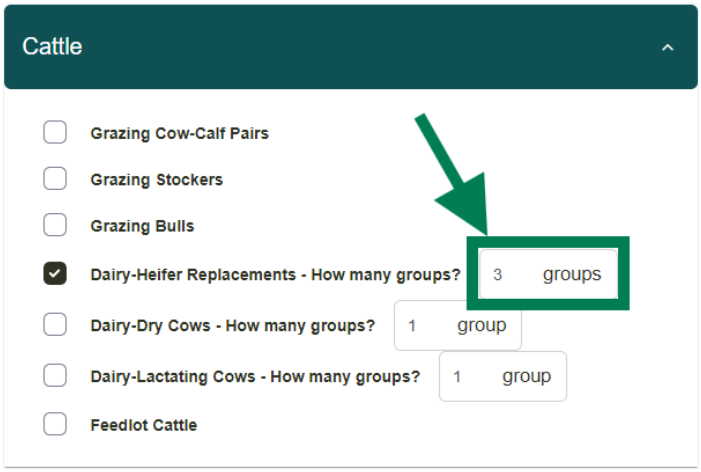
Animal Category	Animal Type	Description
Cattle	Dairy-Heifer Replacements	These are immature cows prior to their first calving and lactation period which are being raised to replace the mature, lactating cows currently in the herd.

	Dairy-Dry Cows	Mature cows not producing milk during the recovery period between lactation and calving fall in this category
	Dairy-Lactating Cows	Lactating bovines from which the milk produced is intended for human consumption, or is fed to calves and replacement dairy heifers.
	Grazing Cow-Calf Pairs	Previously categorized as Beef-Mature Cows/Cow-Calf, these are sexually mature female bovines that have calved at least once. Cow-calf pairs with suckling or weaned calves in a breeding herd fall into this category.
	Grazing Stockers	Weaned bovines (castrated if male) fed high-roughage diets (including grass hay and on pasture/rangeland) before going into a feedlot.
	Grazing Bulls	Mature bovine males of breeding age fall in this category.
	Feedlot Cattle	These are steers and heifers, and mature cattle fed concentrates in a feedlot, usually until market weight is reached.
Poultry	Broilers	Chickens, sometimes called “fryers”, reared primarily for meat.
	Ducks	Ducks reared for eggs or meat.
	Laying Hens	Chickens reared to lay eggs
	Turkeys	Turkeys reared for meat.
Swine	Growing Swine	Growing swine includes grow-finish pigs, male and female pigs being fed concentrate after nursery and before market. Growing swines’ function is to grow quickly and efficiently before market.
	Breeding Swine	Includes gestating sows, lactating sows, and weaning pigs; these are pigs raised to produce large litters of piglets

Other Ruminants	Sheep	Feeder or flock sheep
	American Bison	American “buffalo” raised for meat.
	Goats	Goats raised for meat or milk production.
	Llama & Alpaca	Camelids raised for fiber or as pack/guardian animals
	Deer	Cervids raised for meat or other commodity
Other Non-Ruminants	Rabbits	Domestic rabbits raised or bred as livestock for meat, fur, or wool
	Horses	Includes any horses raised on the operation, whether for field work, transport, or other tasks
	Mules/Asses	Includes any mules, asses, or donkeys raised on the operation, whether for field work, transport, or other tasks
	Other Fur Bearing	Includes animals which bear fur of marketable value such as foxes, minks, squirrels, etc.

To select an animal type, click on the animal category (e.g., Cattle) to expand the list. Then, use the checkboxes to select the animal type(s) to include in the assessment.

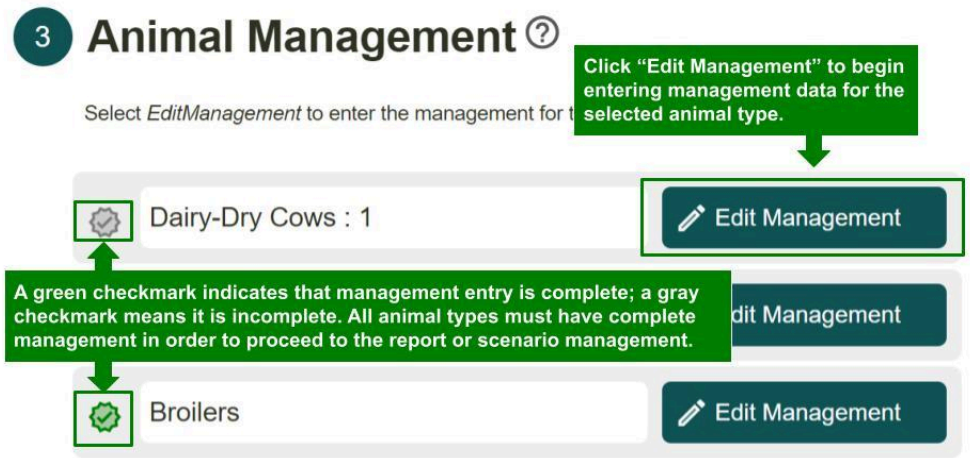
For dairy cattle (Dairy-Heifer Replacements, Dairy-Dry Cows, and Dairy-Lactating Cows), users also have the option to include up to 3 **groups** within each of these categories. Groups are defined as animals within the same category that are managed differently in terms of what they’re fed, where they’re housed, or how their manure is handled. For instance, if a user has 85 dairy-heifer replacements that spent the majority of their time in pasture and 32 that are housed primarily in a covered barn, these should be considered two separate groups within the same animal category. Groups are only available for dairy cattle.



Once animal categories have been selected, click *Save.*

Animal Management

The selected animal types will populate the Animal Management section of the module. Click on the *Edit Management* button next to each animal type to begin data entry. The checkmark to the left of each animal category indicates whether that animal has complete management data associated with it. A gray check means that management is incomplete; a green check indicates that it is completed. Management must be complete for each animal type in order to proceed to the report or add a scenario.



Entering Management: Grazing Cattle (Cow-Calf Pairs, Bulls, Stockers)

Grazing Cow-Calf Pairs

Expand the **Animal Details** section to begin entering cow-calf pair management. Here, use the entry boxes to enter the animal population and average live body weight (lbs) by month. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Under **Feed Characteristics**, first use the dropdown menu to select the monthly Forage Quality (Low, Medium, High), and then use the Forage Content (%) column to enter the percent of the diet that is consumed through grazing. In general, a lower forage quality should correspond with a lower percent forage content, and vice versa. See Table 4-5 in the USDA methods document for more information on forage quality. Use the blue arrows ⓓ next to the column headers to copy data across months.

Table 4-5. Estimated DMI of Beef Cattle Grazing Low-, Medium-, or High-Quality Pastures

Forage Type	Total Digestible Nutrients (%)	Example Forages	Forage DMI as % of BW	
			Dry	Lactating
Low quality	< 52	Dry winter forage, mature legume and grass hay, straw	1.8	2.2
Medium quality	52–59	Dry summer pasture, dry pasture during the fall, late-bloom legume hay, boot stage and early bloom grass hay	2.2	2.5
High quality	> 59	Mid-bloom, early bloom, prebloom legume hay, pre-boot-stage grass hay, lush, growing pasture, silages	2.5	2.7

Source: Lalman, 2004, as cited by NASEM, 2016. DMI is determined based on forage quality and is calculated as a percent of BW. For example, a lactating cow consuming medium quality forage would consume 2.5% of her BW. Assuming a BW of 600 kg, her DMI (used in equation 4-9) is 15 kg/day.

When applicable, users may also use the Feed Additive Type dropdown to select from the following additives: Feeding 3-NOP, Feeding Nitrates, Lipid Supplementation, Monensin, and Forage Supplementation. For each month with a selected feed additive, users should also include a dosage. Dosage units will appear once an additive is selected. Again, use the blue arrows to copy data across months.

Click *Save* and then *Close* to continue.

Grazing Bulls

To enter management, follow the same steps as **Grazing Cow-Calf Pairs** above.

Grazing Stockers

To enter management, follow the same steps as **Grazing Cow-Calf Pairs** above.

Entering Management: Dairy Cattle (Dairy-Heifer Replacements, Dairy-Dry, Dairy-Lactating)

Dairy-Heifer Replacements

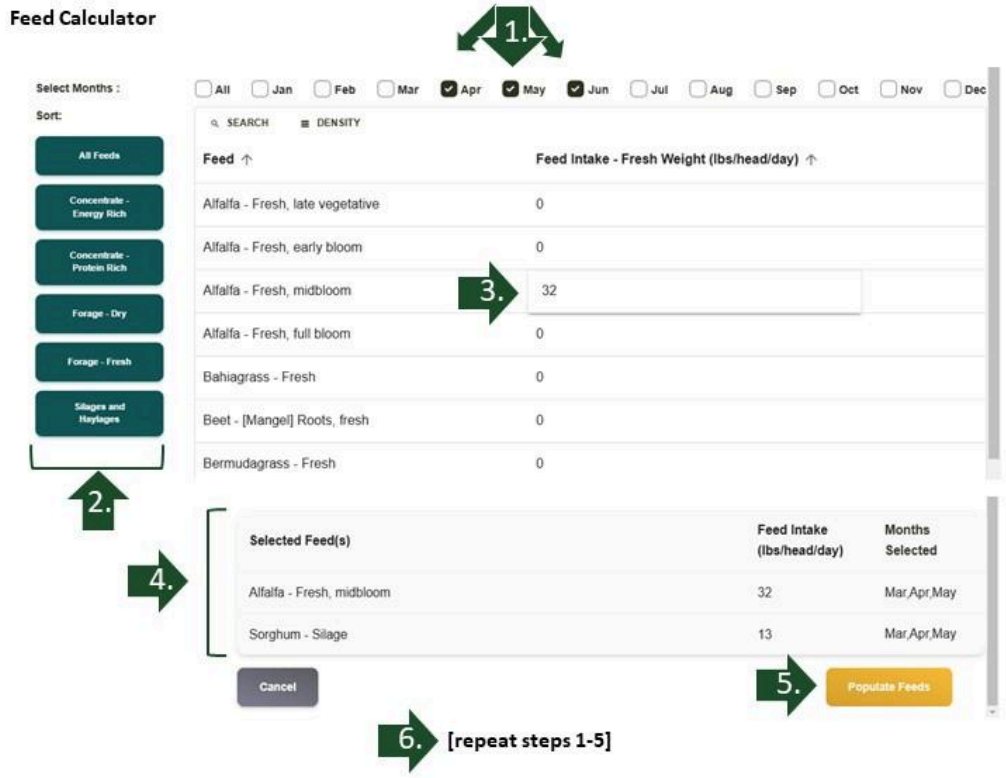
Expand the **Animal Details** section to begin entering dairy-heifer replacement management. Here, use the entry boxes to enter the animal population and average live body weight (lbs) by month. Users can click on the blue arrows ⓓ to copy data across months. Click *Save*.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Under Feed Characteristics, users have the option to either manually enter the monthly dry matter intake (lbs/day), crude protein (%), fat (EE) (%), and ash (%), or use the **Feed Calculator** below to populate these characteristics. If entering these inputs manually, use the blue arrows to copy data across months. Click *Save*.

Feed Calculator

The Feed Calculator allows users to populate feed characteristics by selecting from a list of monthly feedstuff and entering the feed intake as fresh weight (lbs/head/day). Users should enter the amount of feed per head in pounds per day on an as-fed basis for all feeds for the specified months.



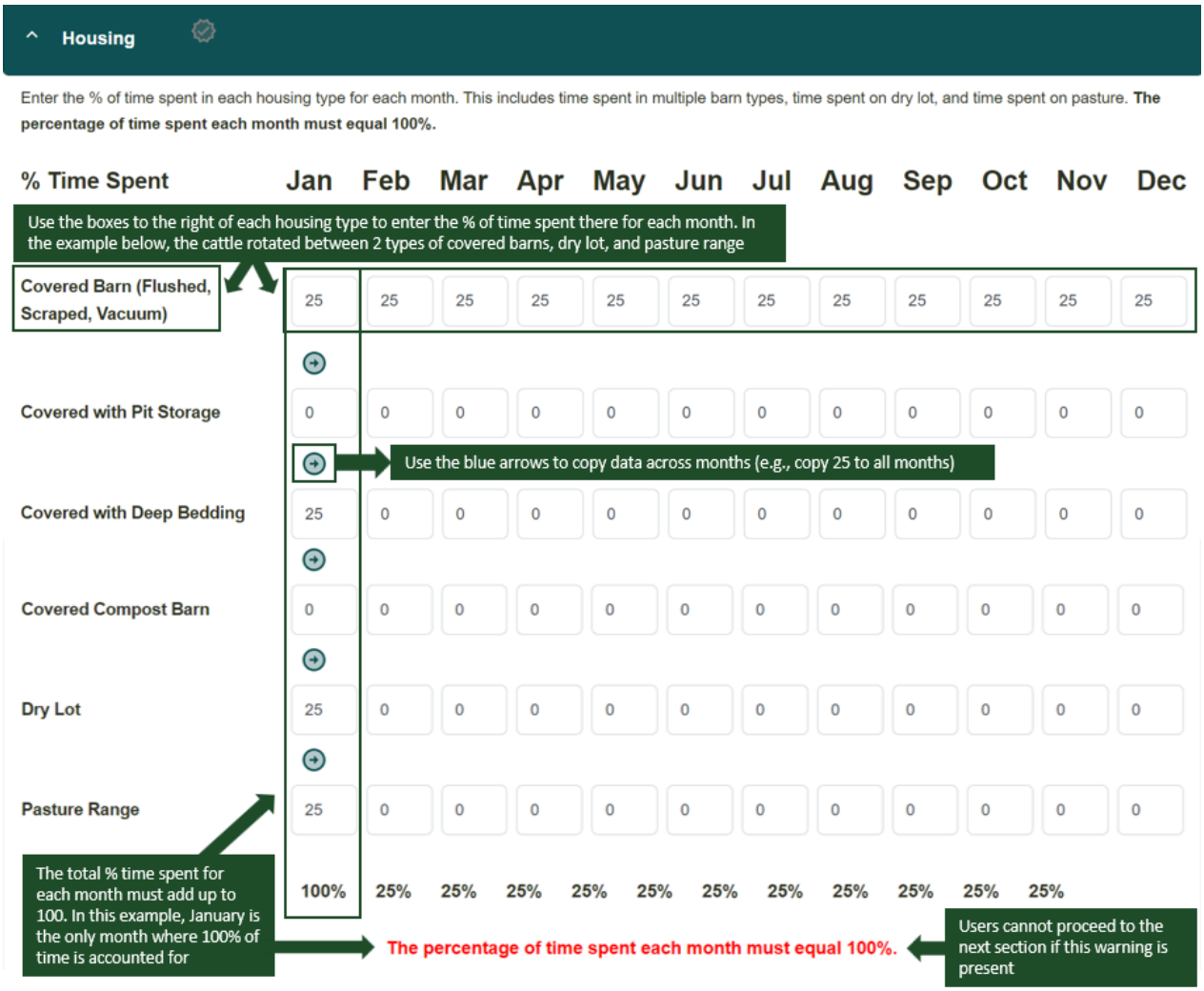
See the table below to use the feed calculator.

Feed Calculator Layout Guide	
1.	Select the range of months that the same feed types are fed to this animal category or group. To select the months, click on the box to the left of the month. If animals are fed the same feed types all year long, clicking on the box next to “Select All” with select all of the months. Clicking it again will undo this action. *In the above example, the animals are eating a certain feed type during the months of March-May.*
2.	Optional: Use the buttons at the top of the page, next to “Sort,” to easily locate types of feed. Users may also choose to search through feed types manually using the arrows at the bottom of the table. *In the above example, the feed table has been sorted using the “Forage – Fresh” option.*

3.	Enter the feed intake as fresh weight (lbs/head/day) for each feed type for the selected range of months. To do so, double click on the cell under Feed Intake (where the 0's are) and type in the fresh weight. Click outside the cell to save that entry. **Do not press Enter.** *In the above example, the animals are being fed 32 lbs of fresh alfalfa and 13 lbs of sorghum silage per head per day.*
4.	Review summary table at the bottom of the calculator to make sure entries are accurate for the selected months.
5.	Click "Populate Feeds" to apply these entries to the animal category. Users will be brought back to the main management window and will see the feed characteristics populated for the selected months.
5.	Repeat steps 1-5 for all months that animals are being fed a certain feed type.

Housing

Under **Housing**, enter the percentage of time spent in each housing type for each month. This includes time spent in a covered barn (flushed, scraped, vacuum), coverned barn with pit storage, covered barn with deep bedding, covered compost barn, dry lot, and pasture range. The percentage of time spent each month must equal 100%. The selections made here will determine if there are more specific follow-up housing questions.



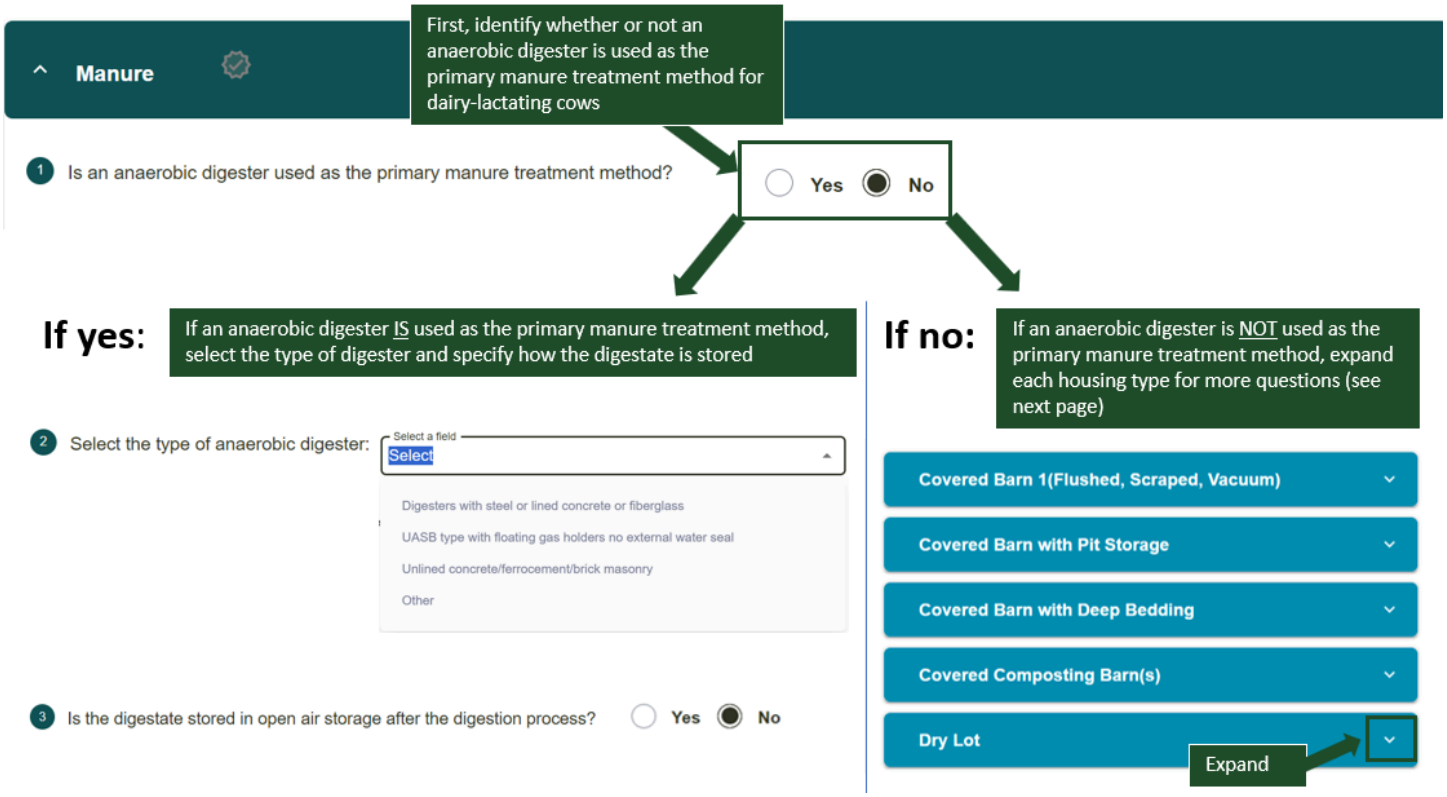
If the cattle spend any time in "**Covered Barns (flushed, scraped, vacuum)**," please indicate 1) how many barns are occupied, 2) the average surface area of the barn floor covered in manure (sq ft), and 3) the average daily temperature of the barn (°F).

If the cattle spend any time in "**Covered Barns with Pit Storage**," please select the storage length from the dropdown menu. Options include 1 month, 3, months, 4 months, 6 months, and 12 months.
*Note - if more than 1 group was included, repeat these steps for subsequent groups

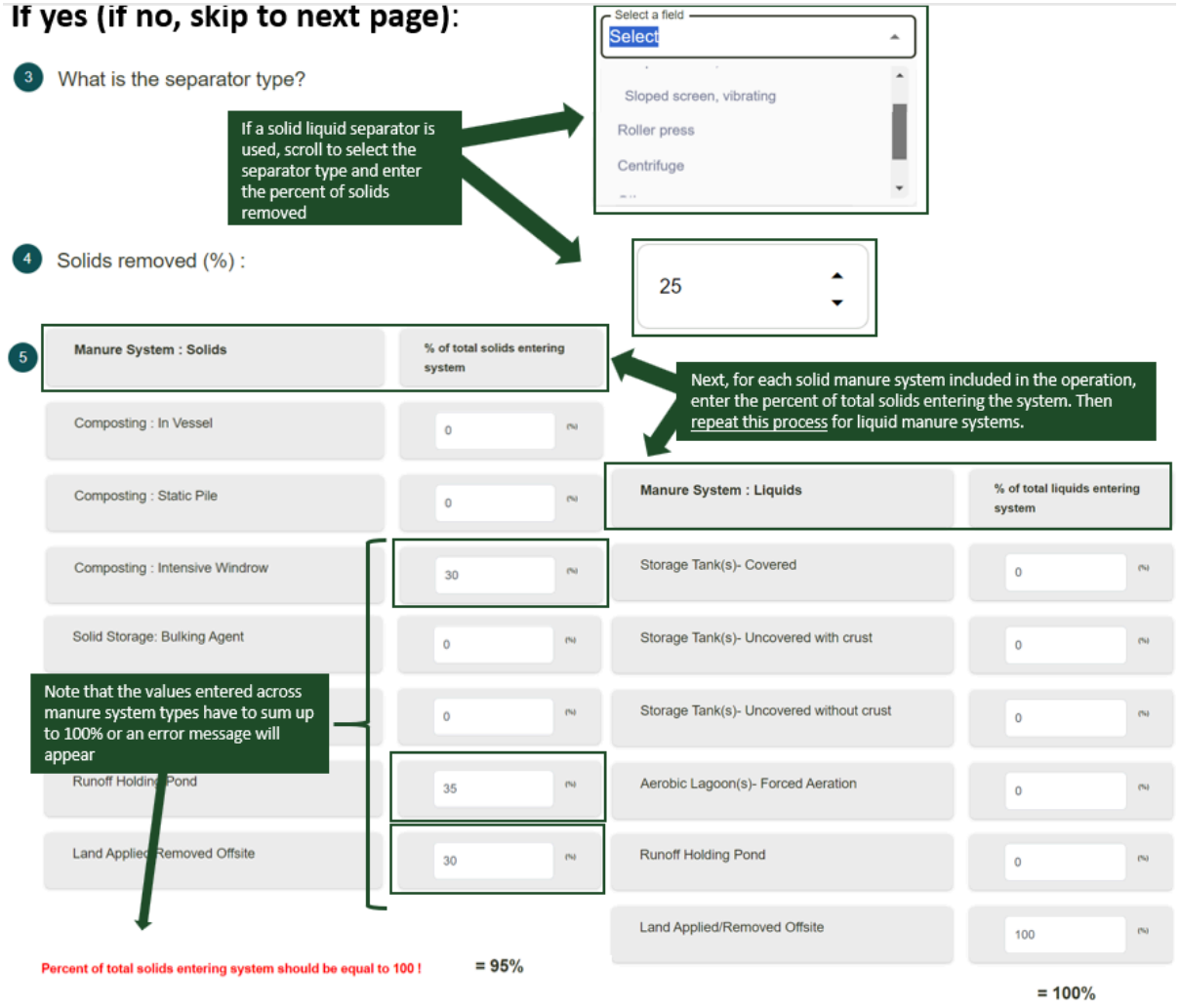
If the cattle spend any time in "**Covered Barns with Deep Bedding,"** please indicate whether that is with an active mix or no mix. Then select the storage length from the dropdown menu choosing between longer than 1 month or less than 1 month.

Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.

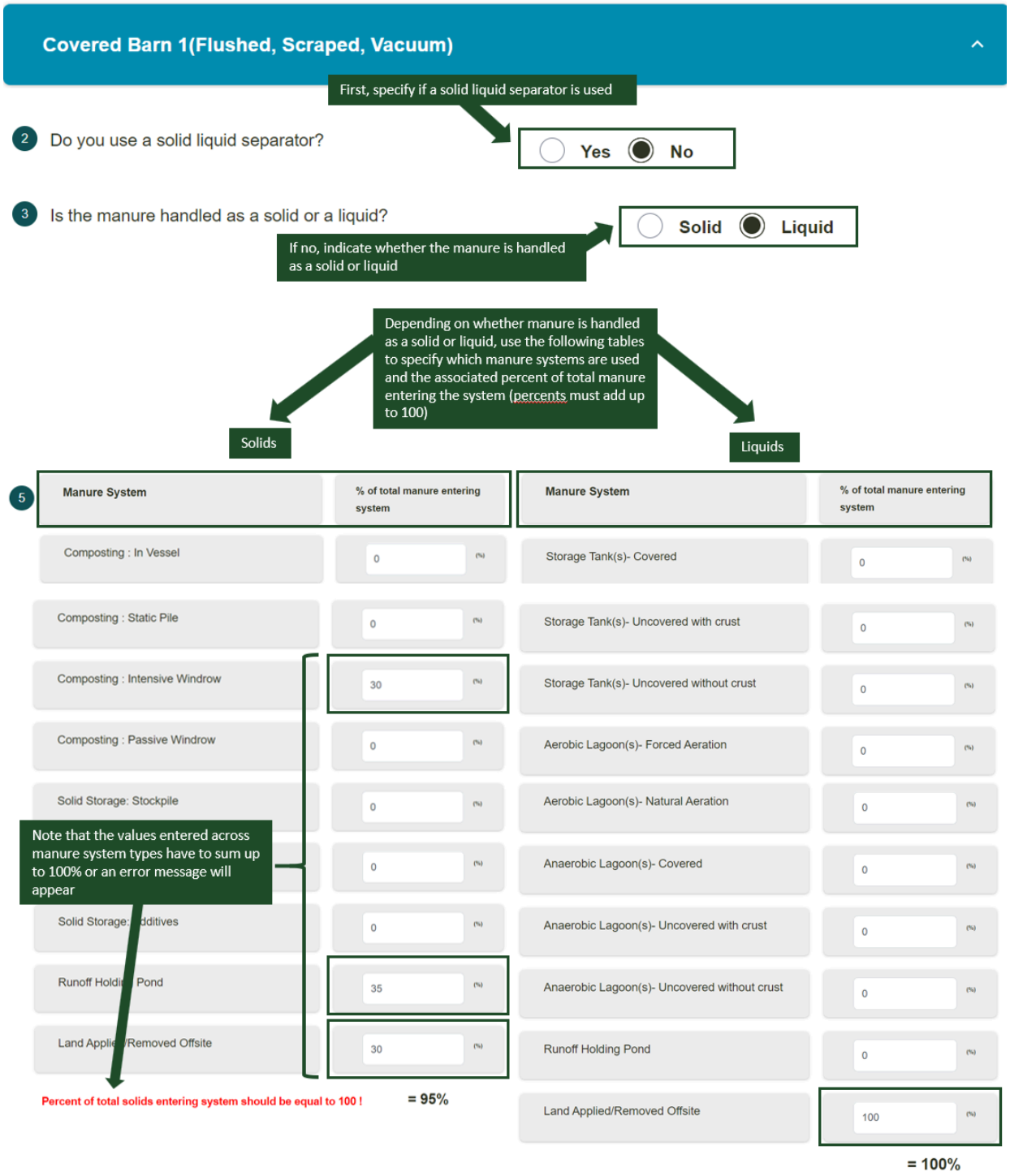


For '**Covered Barn (Flushed, Scraped, Vacuum)',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Repeat these steps for each selected housing type (i.e., 'Covered Barn with Pit Storage', 'Covered Barn with Deep Bedding', 'Covered Composting Barn', and 'Dry Lot').

Depending on housing and manure selections, users may need to answer [Manure Followup Questions](#).

Dairy-Dry Cows

To enter management, follow the same steps as **Dairy- Heifer Replacements** above.

Dairy-Lactating Cows

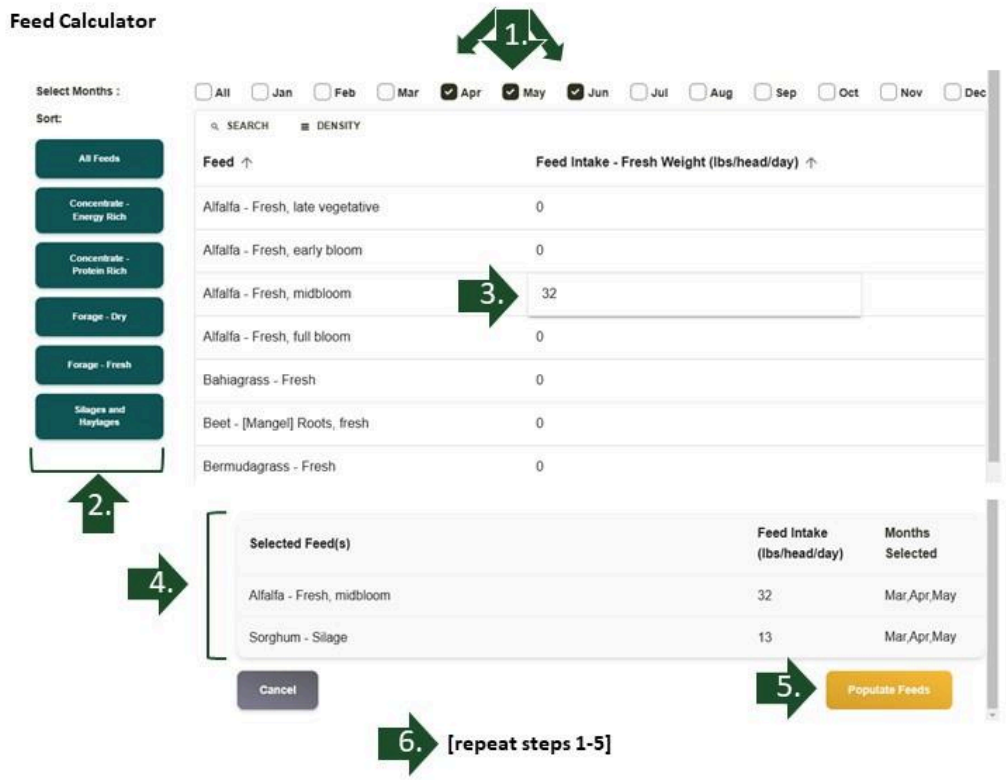
Expand the **Animal Details** section to begin entering dairy-lactating cow management. Here, use the entry boxes to enter the animal population, average live body weight (lbs), and percent milk fat (%) by month. Users can click on the blue arrows to copy data across months. Click *Save*.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Under Feed Characteristics, users have the option to either manually enter the monthly dry matter intake (lbs/day), crude protein (%), fat (EE) (%), and ash (%), or use the **Feed Calculator** below to populate these characteristics. Users may also choose to include any monthly feed additives and their associated dosage. After selecting either Feeding 3-NOP or Feeding Nitrates, the dosage units will auto-populate. If entering these inputs manually, use the blue arrows to copy data across months. Click *Save*.

Feed Calculator

The Feed Calculator allows users to populate feed characteristics by selecting from a list of monthly feedstuff and entering the feed intake as fresh weight (lbs/head/day). Users should enter the amount of feed per head in pounds per day on an as-fed basis for all feeds for the specified months. Feed additives cannot be added from the Feed Calculator.

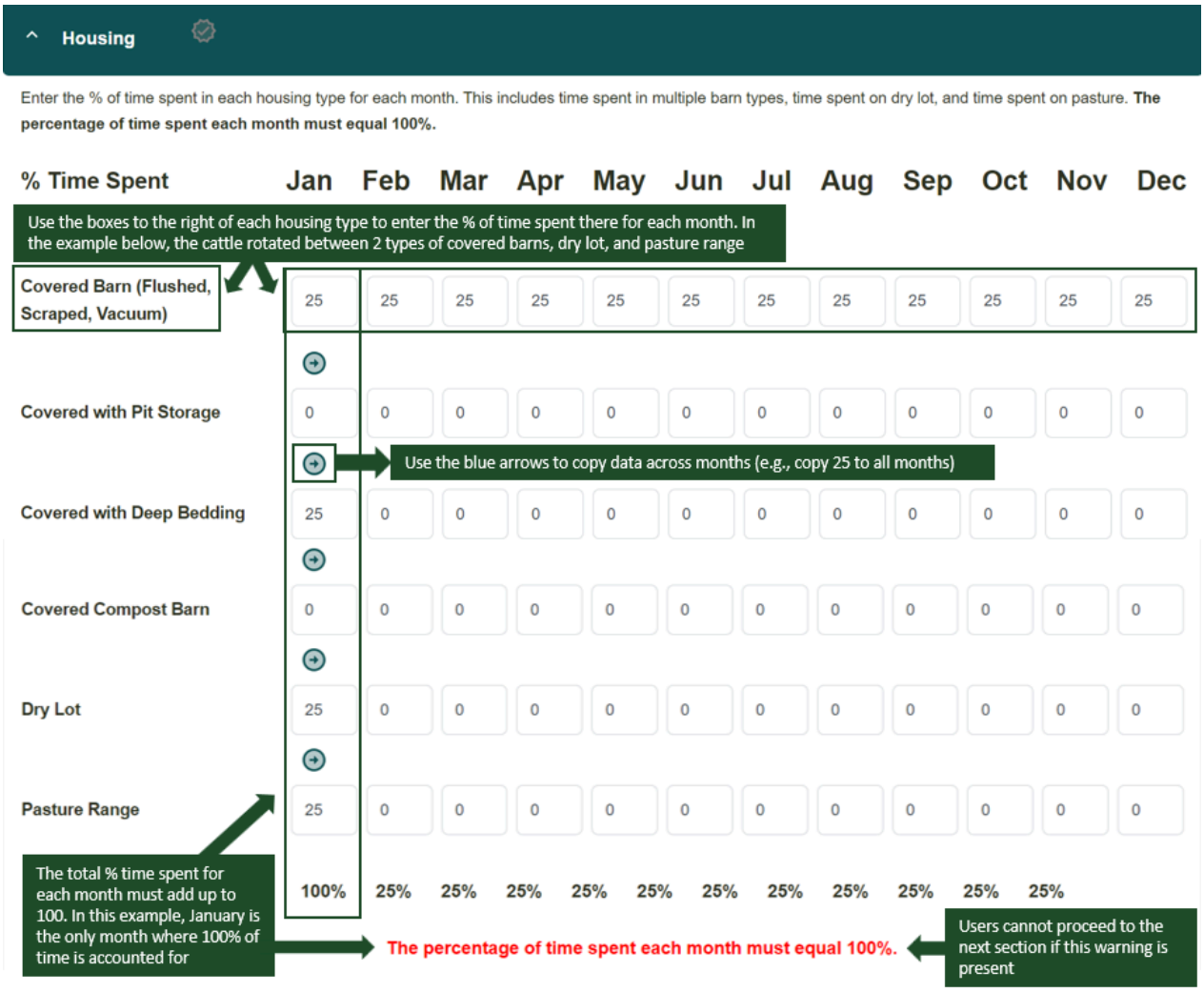


See the table below to use the feed calculator.

Feed Calculator Layout Guide	
1.	Select the range of months that the same feed types are fed to this animal category or group. To select the months, click on the box to the left of the month. If animals are fed the same feed types all year long, clicking on the box next to “Select All” with select all of the months. Clicking it again will undo this action. *In the above example, the animals are eating a certain feed type during the months of March-May.*
2.	Optional: Use the buttons at the top of the page, next to “Sort,” to easily locate types of feed. Users may also choose to search through feed types manually using the arrows at the bottom of the table. *In the above example, the feed table has been sorted using the “Forage – Fresh” option.*
3.	Enter the feed intake as fresh weight (lbs/head/day) for each feed type for the selected range of months. To do so, double click on the cell under Feed Intake (where the 0’s are) and type in the fresh weight. Click outside the cell to save that entry. **Do not press Enter.** *In the above example, the animals are being fed 32 lbs of fresh alfalfa and 13 lbs of sorghum silage per head per day.*
4.	Review summary table at the bottom of the calculator to make sure entries are accurate for the selected months.
5.	Click “Populate Feeds” to apply these entries to the animal category. Users will be brought back to the main management window and will see the feed characteristics populated for the selected months.
5.	Repeat steps 1-5 for all months that animals are being fed a certain feed type.

Housing

Under **Housing**, enter the percentage of time spent in each housing type for each month. This includes time spent in a covered barn (flushed, scraped, vacuum), coverned barn with pit storage, covered barn with deep bedding, covered compost barn, dry lot, and pasture range. The percentage of time spent each month must equal 100%. The selections made here will determine if there are more specific follow-up housing questions.



If the cattle spend any time in "**Covered Barns (flushed, scraped, vacuum)**," please indicate 1) how many barns are occupied, 2) the average surface area of the barn floor covered in manure (sq ft), and 3) the average daily temperature of the barn (°F).

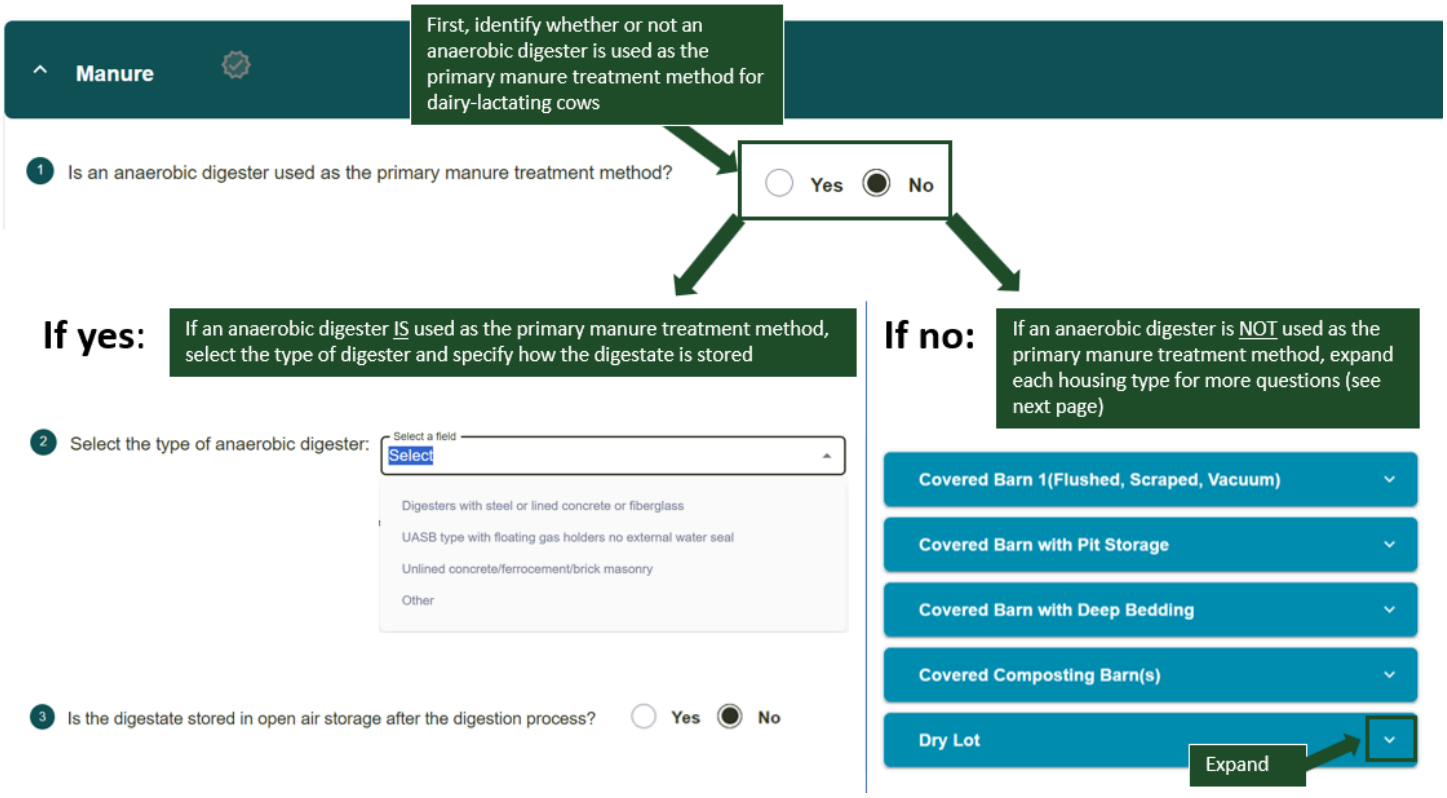
If the cattle spend any time in "**Covered Barns with Pit Storage**," please select the storage length from the dropdown menu. Options include 1 month, 3, months, 4 months, 6 months, and 12 months.
*Note - if more than 1 group was included, repeat these steps for subsequent groups

If the cattle spend any time in "**Covered Barns with Deep Bedding,"** please indicate whether that is with an active mix or no mix. Then select the storage length from the dropdown menu choosing between longer than 1 month or less than 1 month.

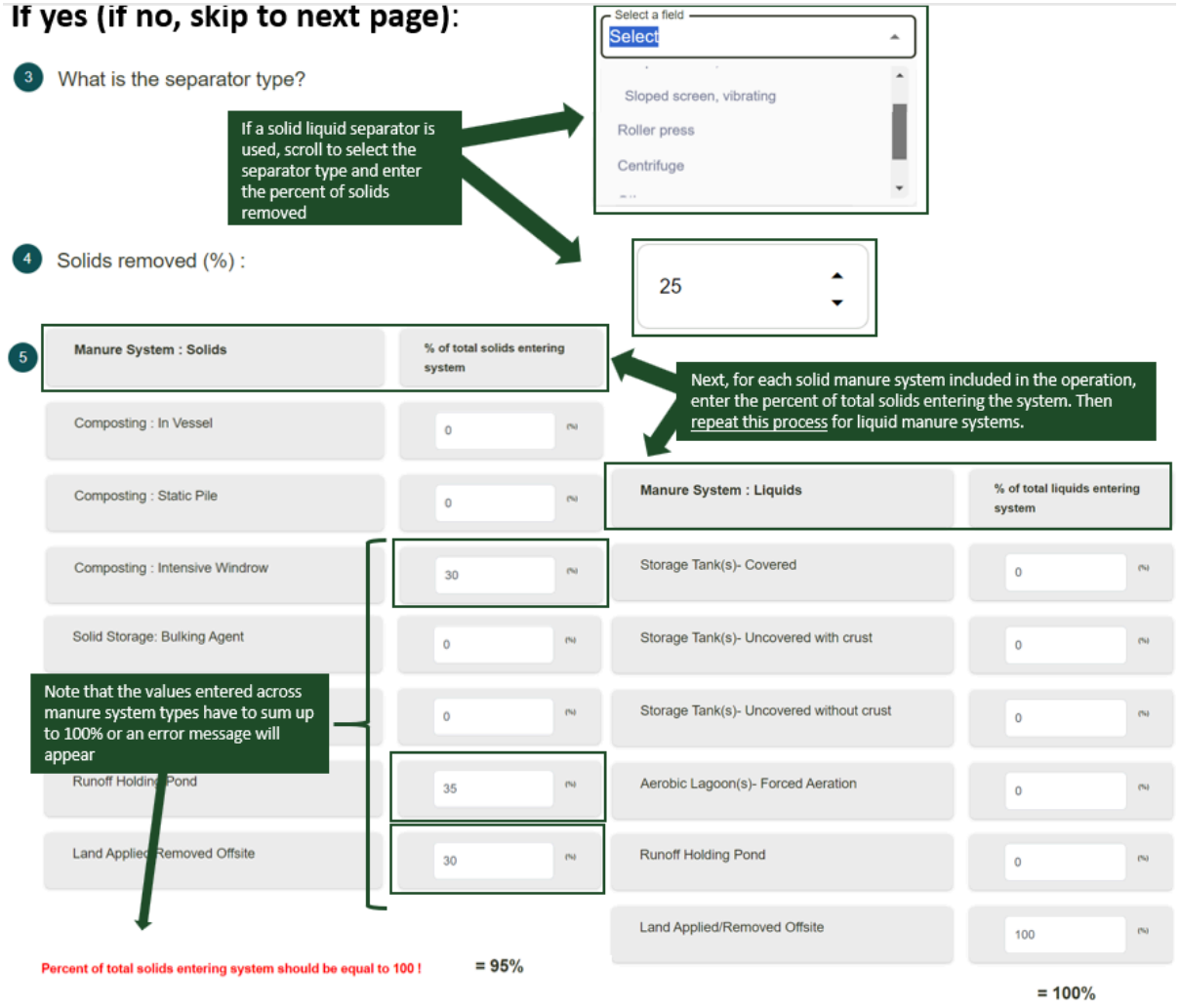
Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If**

‘No’, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.

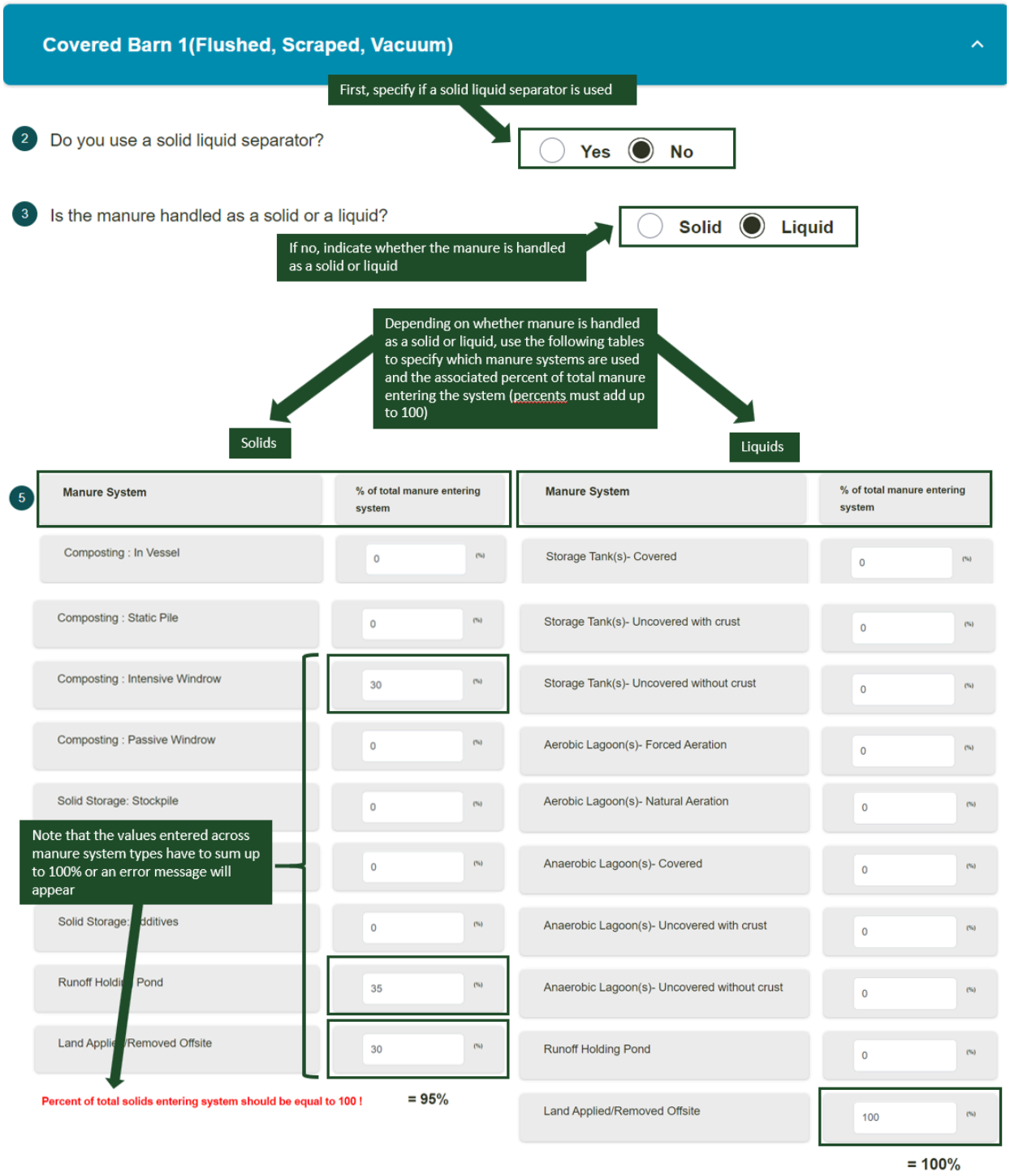


For ‘**Covered Barn (Flushed, Scraped, Vacuum)’,** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If ‘Yes’**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Repeat these steps for each selected housing type (i.e., 'Covered Barn with Pit Storage', 'Covered Barn with Deep Bedding', 'Covered Composting Barn', and 'Dry Lot').

Depending on housing and manure selections, users may need to answer [Manure Followup Questions](#).

Entering Management: Feedlot Cattle

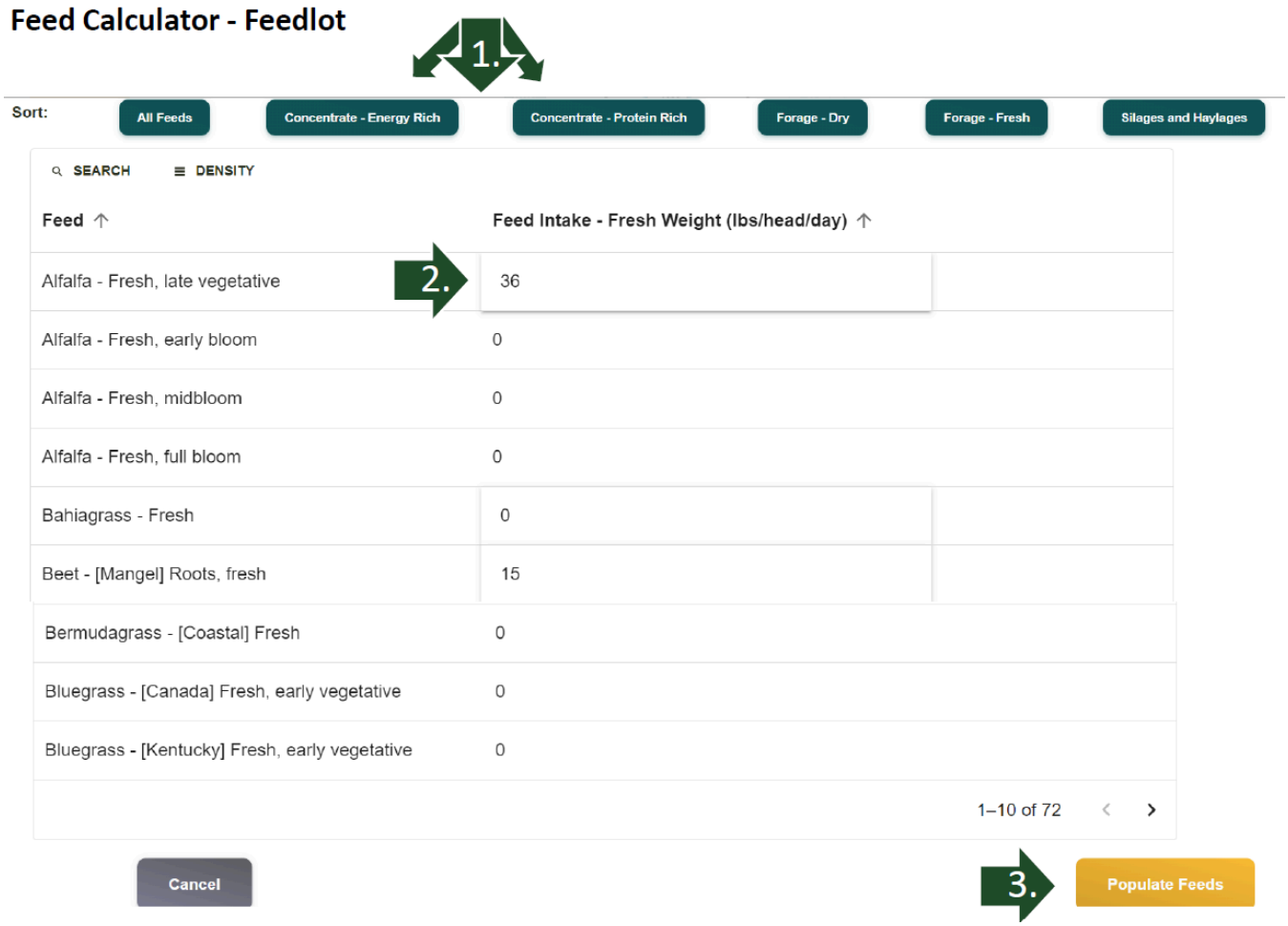
Expand the **Animal Details** tab, and then the Ration Group 1 tab, to begin to enter details for the first ration group population. Up to 5 ration groups may be entered for each feedlot by clicking *+Add Ration Group* at the bottom of the Animal Details panel. For each ration group, begin by entering the monthly population of steers and heifers fed this ration throughout the year. Users can click on the blue arrows to copy data across months. Click *Save*.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Under **Ration Feeds**, users have the option to either manually enter the monthly dry matter intake (lbs/day), crude protein (%), neutral detergent fiber (NDF) (%), digestible energy (%), starch (%), and days on feed, or use the **Feed Calculator** to populate these characteristics.

Feed Calculator

The Feed Calculator allows users to populate feed characteristics by selecting from a list of feedstuff and entering the feed intake as fresh weight (lbs/head/day). Users should enter the amount of feed per head in pounds per day on an as-fed basis for all feeds for the specified months. Feed additives and 'Days on Feed' cannot be added from the Feed Calculator. Use the layout guide below to enter feed details.



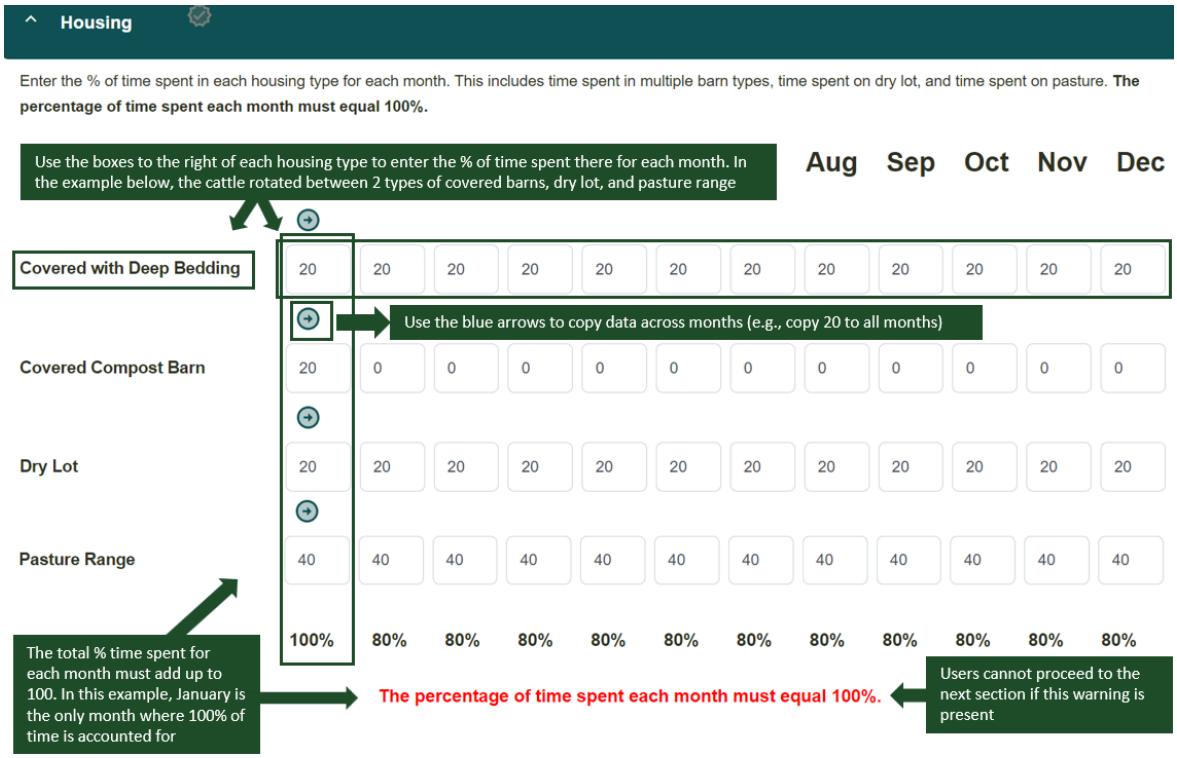
Feed Calculator (Feedlot) Layout Guide	
1.	Optional: Use the buttons at the top of the page, next to "Sort," to easily locate types of feed. Users may also choose to search through feed types manually using the arrows at the bottom of the table. *In the above example, the feed table has been sorted using the "Forage – Fresh" option.*
2.	Enter the feed intake as fresh weight (lbs/head/day) for each feed type for the selected ration group. To do so, double click on the cell under Feed Intake (where the 0's are) and type in the fresh weight. Click outside the cell to save that entry. **Do not press Enter.** *In the above example, the ration group is being fed 36 lbs of alfalfa and 15 lbs of beet roots per head per day.*
3.	Click "Populate Feeds" to apply these entries to the animal category. Users will be brought back to the main management window and will see the feed characteristics populated for the ration group. **They will still need to enter a value for Days on Feed.**

After entering typical feed characteristics, next indicate if the grain included in the select ration group's diet is unprocessed or dry-rolled corn or sorghum (Y/N). Users may then choose to include any monthly feed additives and their associated dosage. After selecting a Feed Additive Type (Feeding 3-NOP, Feeding Nitrates, Lipid Supplementation, Monensin, Ionophore), the dosage units will auto-populate.

For the ration group **body weight details**, enter the starting and end average live body weight per head for both steers and heifers. Then, enter data for other ration groups (repeat above steps) if applicable. Ration group management can be copied from one ration group to another using the Copy function. This will overwrite any existing data for the selected ration group, and management can then be edited and customized once copied.

Housing

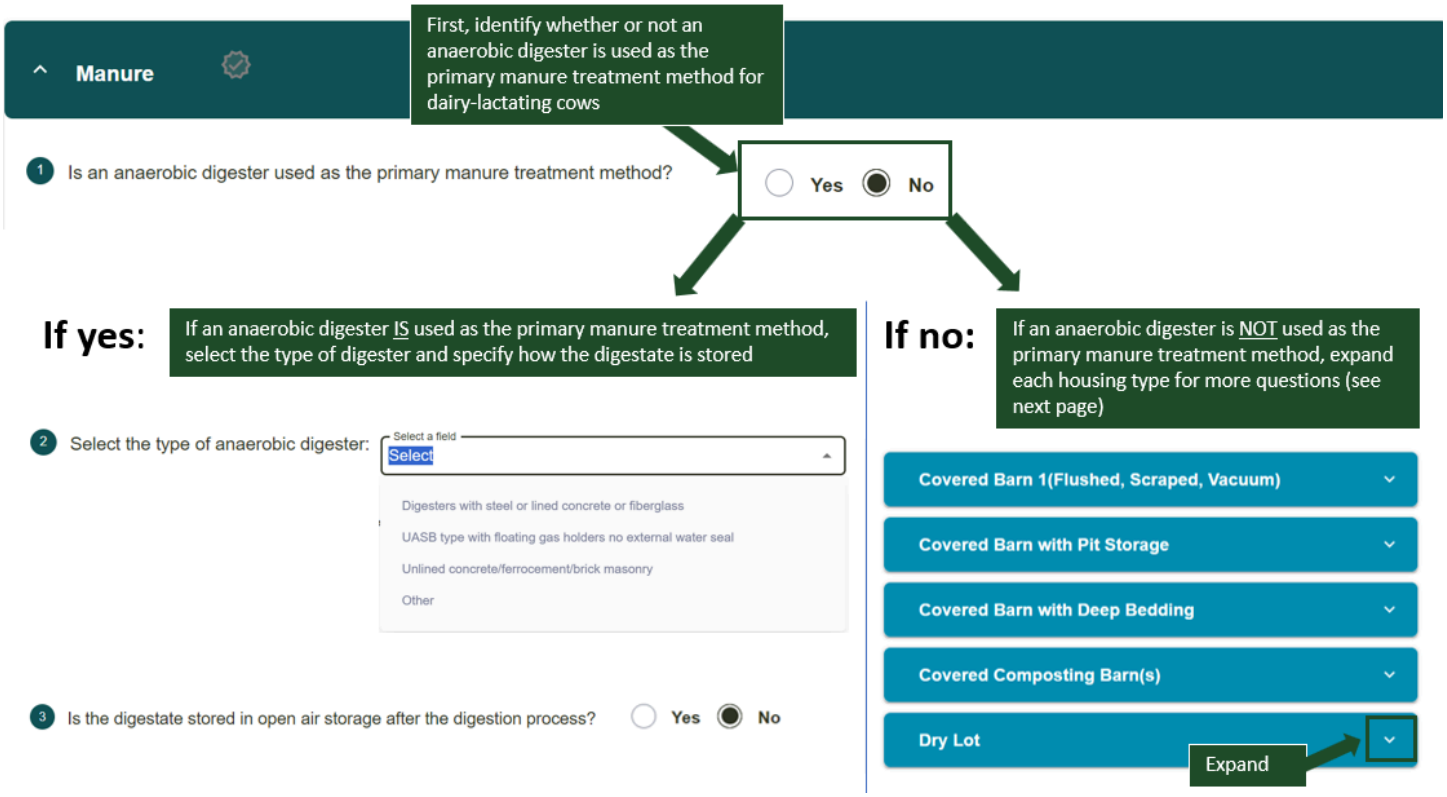
Under **Housing**, enter the percentage of time spent in each housing type for each month. This includes time spent in a covered barn with deep bedding, covered compost barn, dry lot, and pasture range. The percentage of time spent each month must equal 100%. The selections made here will determine if there are more specific follow-up housing questions. See image below.



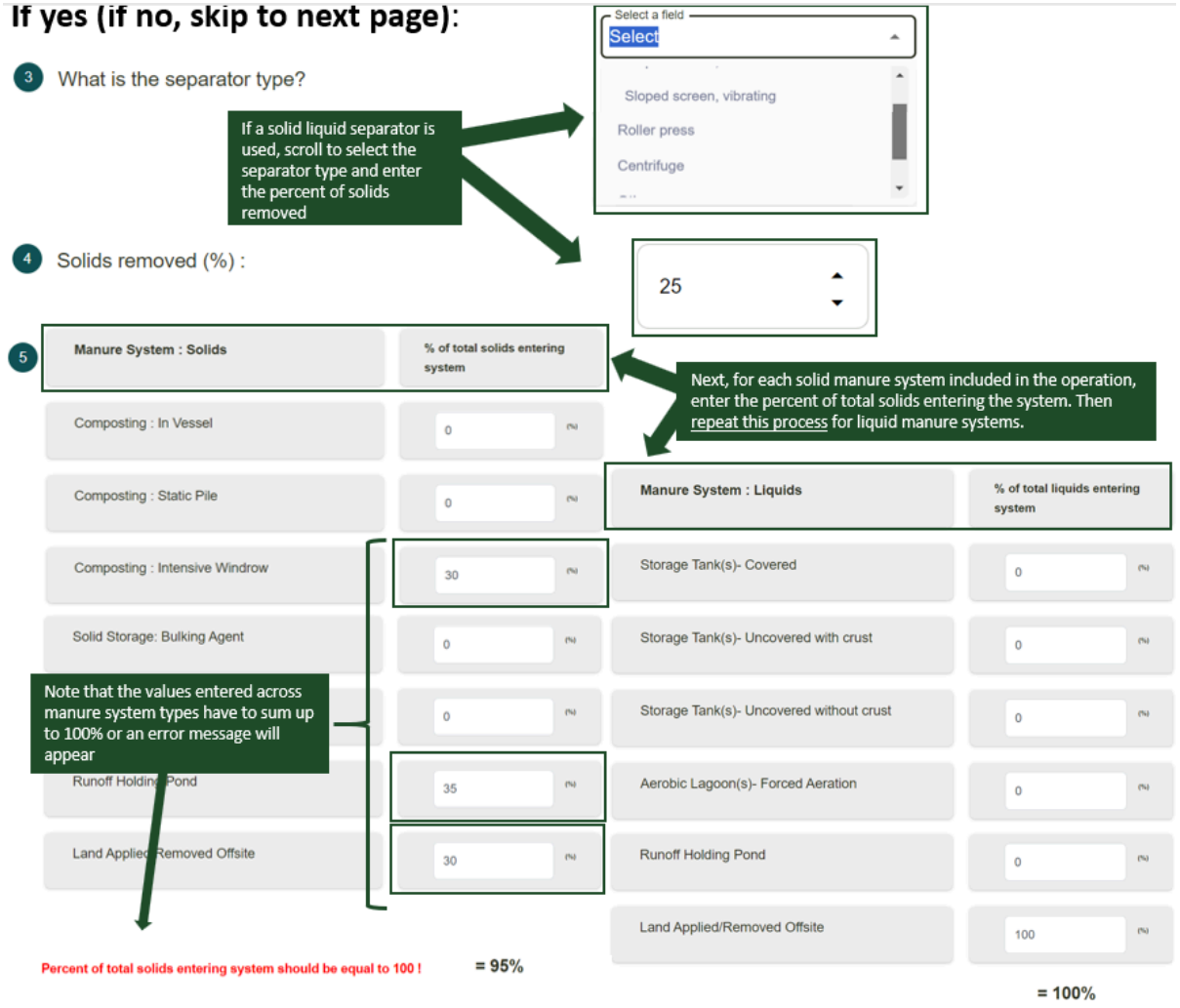
If 'Covered Barns with Deep Bedding' was selected as a housing type, users will be prompted to 1) select either active mix or no mix, and 2) select whether the storage length is longer than or less than 1 month.

Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.

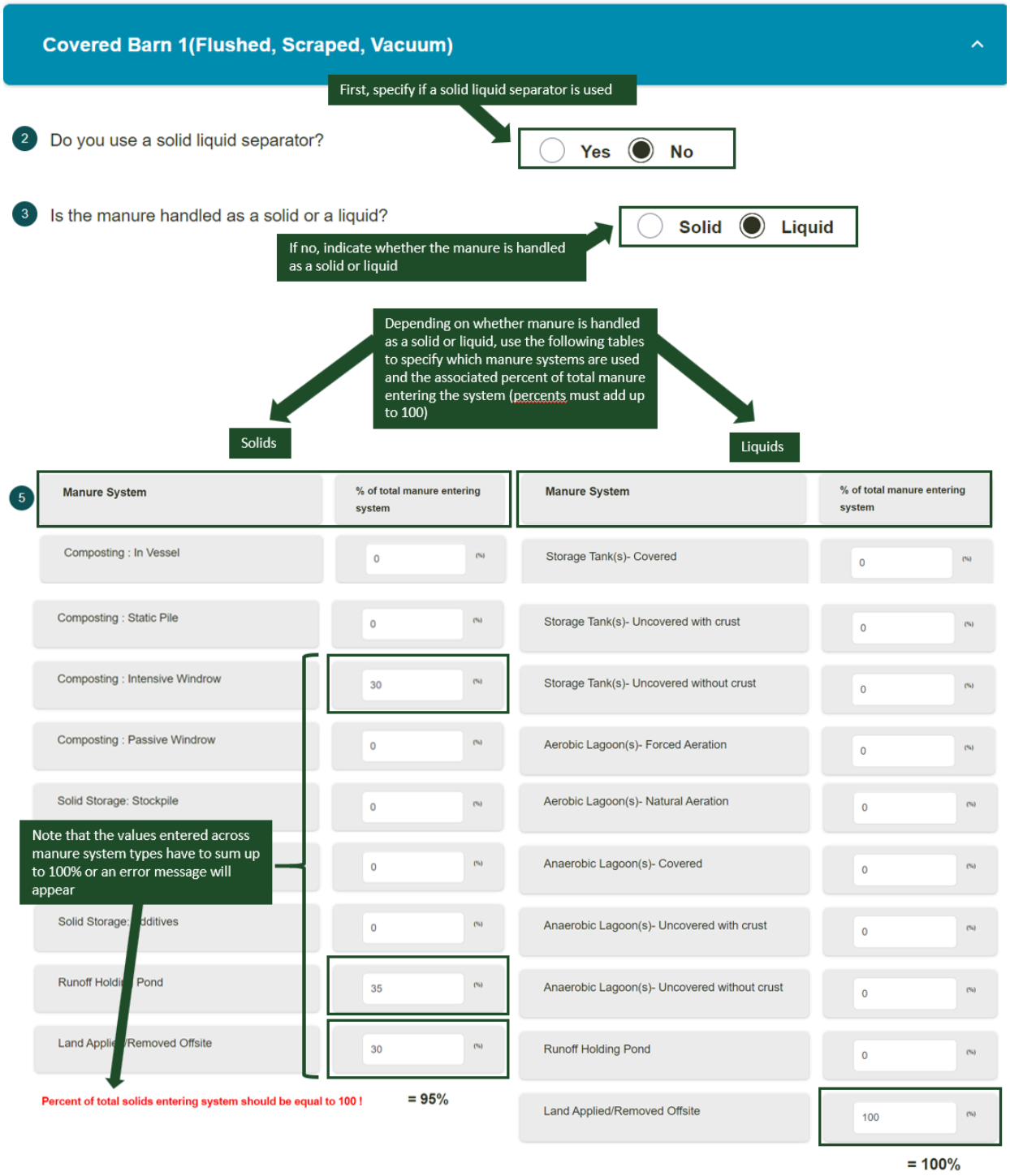


For '**Covered Barn (Flushed, Scraped, Vacuum)',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Repeat these steps for each selected housing type (i.e., 'Covered Compost Barn' and 'Dry Lot').

Depending on housing and manure selections, users may need to answer Manure Followup Questions.

Entering Management: Poultry (Broilers, Laying Hens, Turkeys, and Ducks)

Broilers

Expand the **Animal Details** section, and then the Flock Details section, to begin entering broiler management. Here, use the entry boxes to enter the average number of flocks per year, average number of birds per flock, initial body weight, final body weight (slaughter weight), and average number of days in each production period. Click *Save*.

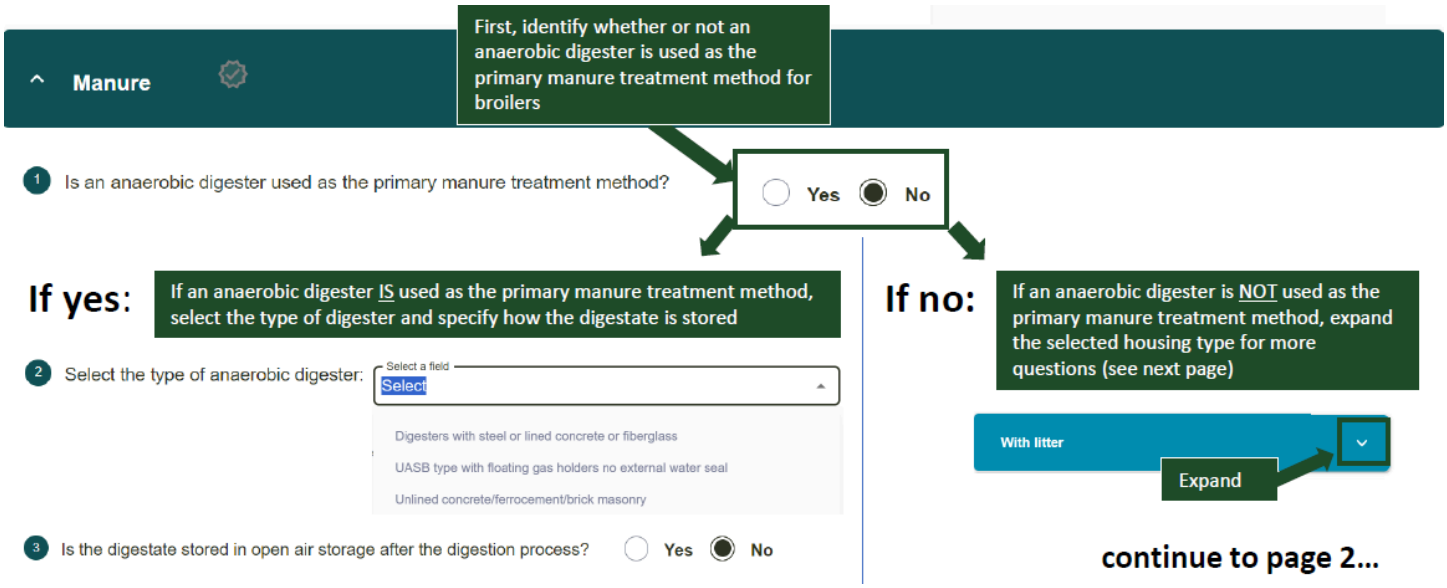
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Expand **Feed Details** to enter the average daily dry matter intake (lbs) and crude protein (%) for the flock.

Under **Housing,** users can select a poultry housing type from the following list: with litter, without litter, with litter and use of acidifying agent.

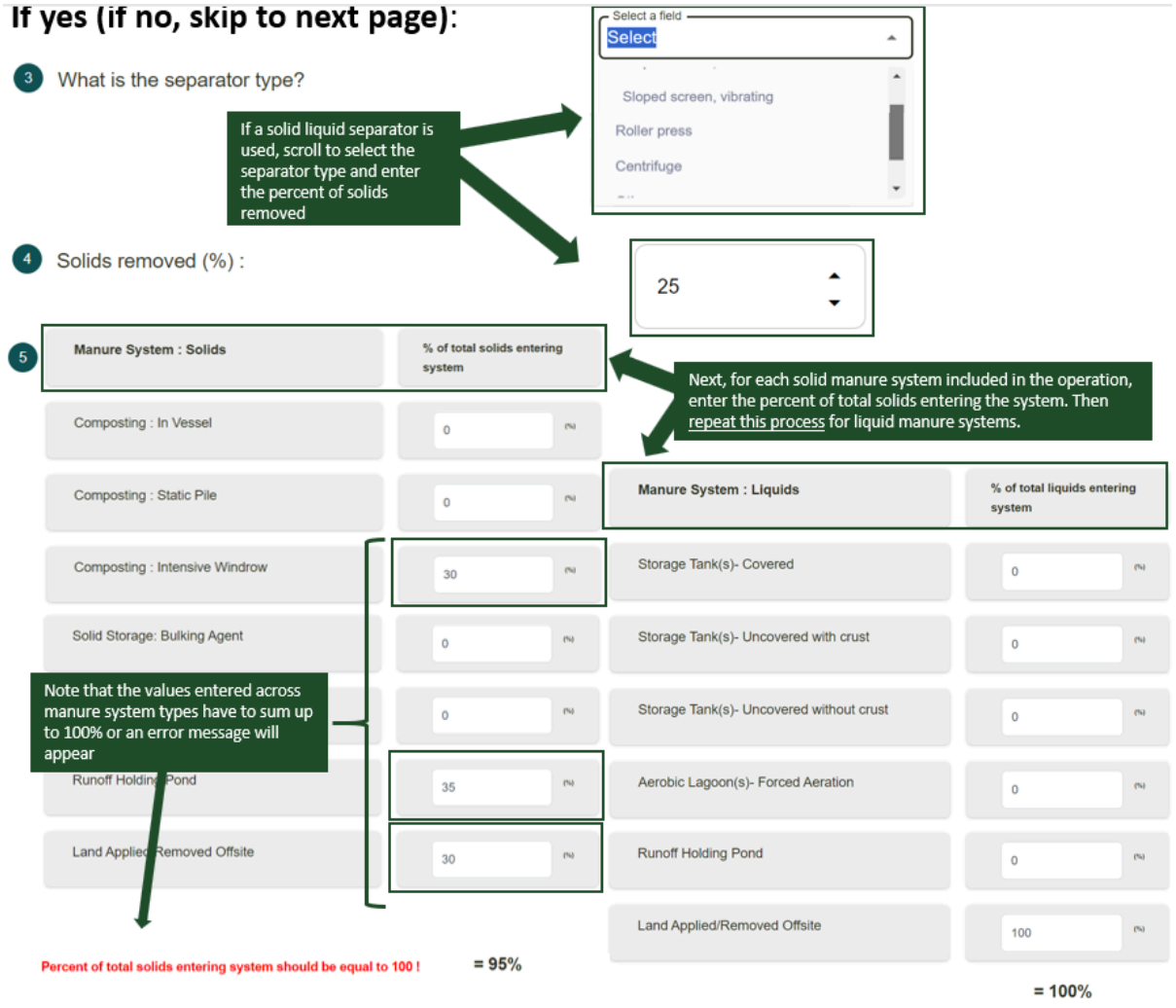
Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.



For the selected housing type (e.g., with litter in the above example), first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids,

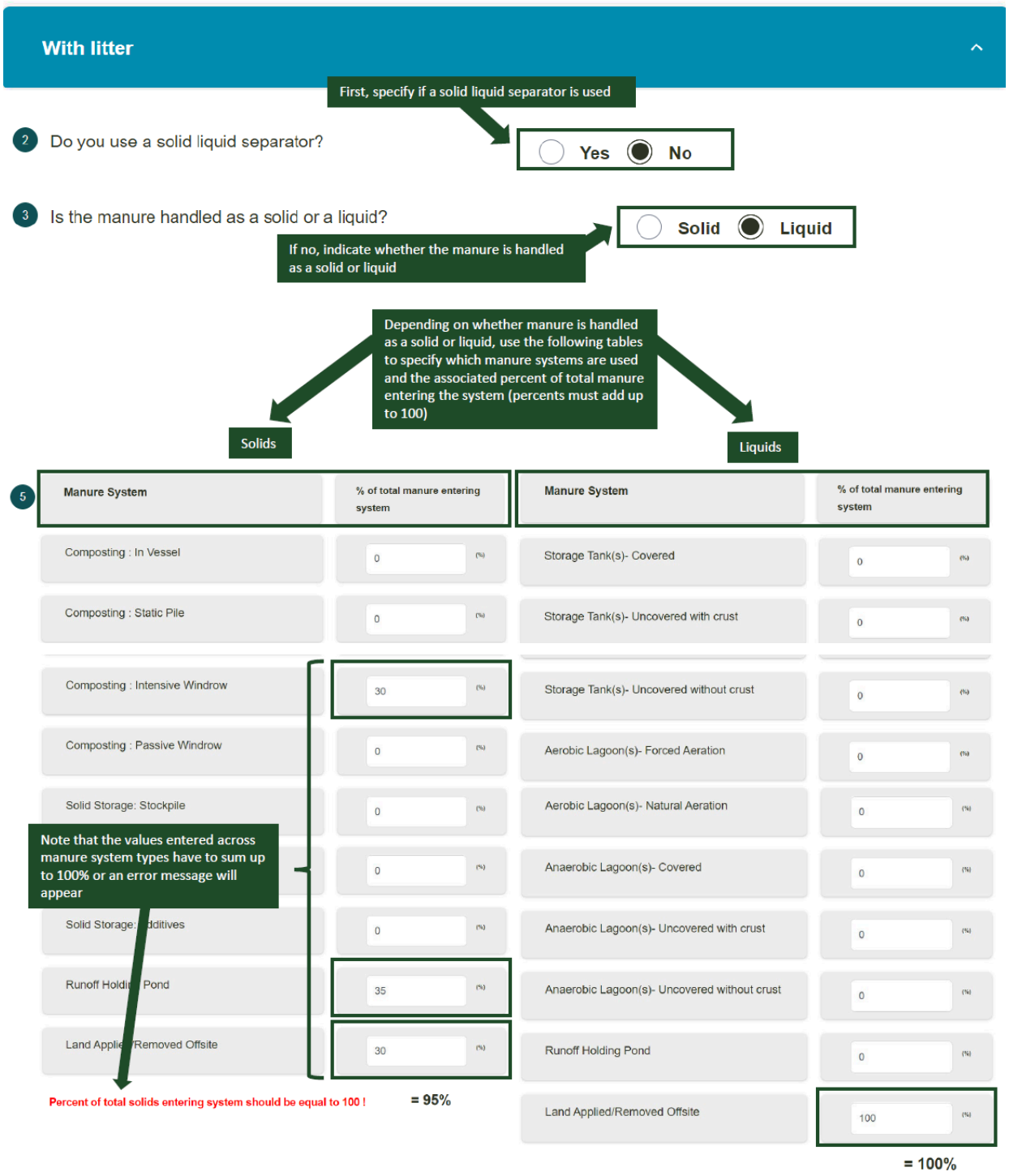
the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered

with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Depending on housing and manure selections, users may need to answer [Manure Followup Questions](#).

Laying Hens

Expand the **Animal Details** section, and then the Flock Details section, to begin entering laying hens management. Here, use the entry boxes to enter the average number of flocks per year, average number of birds per flock, initial body weight at beginning of production period, final body weight at the end of the

production period, average number of days in each production period, and whether the birds are heavy (H) or light (L) layers. Click *Save*.

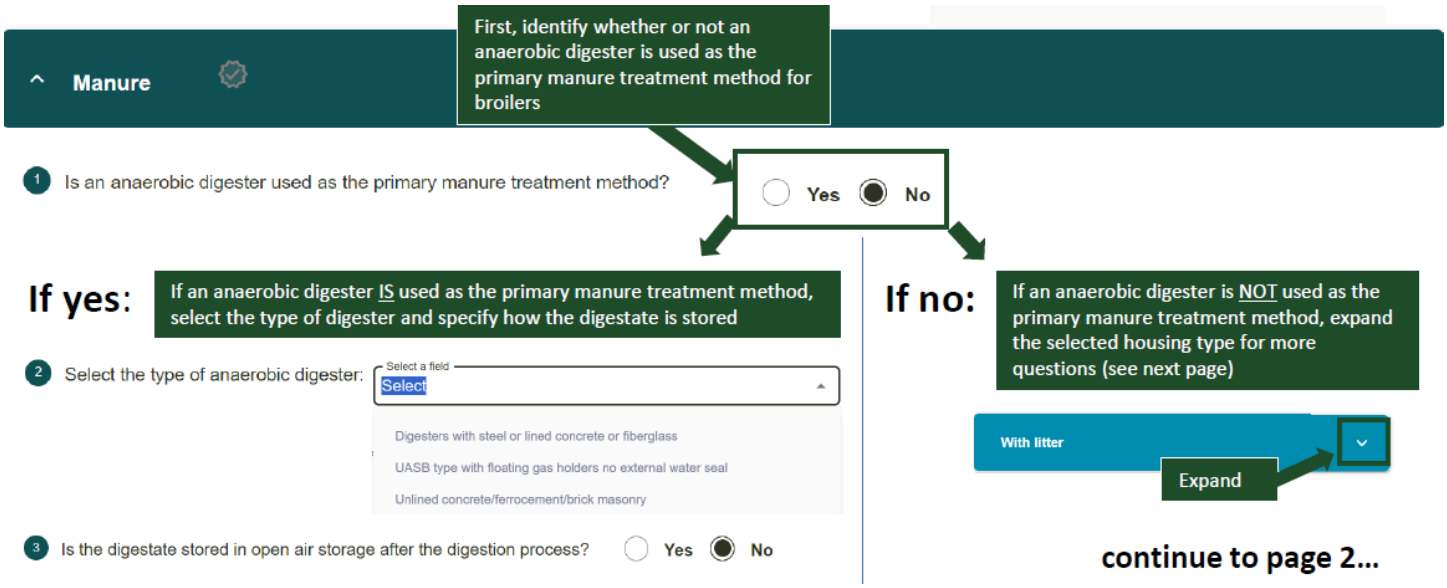
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Expand **Feed Details** to enter the average daily dry matter intake (lbs) and crude protein (%) for the flock.

Under **Housing,** users can select a poultry housing type from the following list: with litter, without litter, with litter and use of acidifying agent.

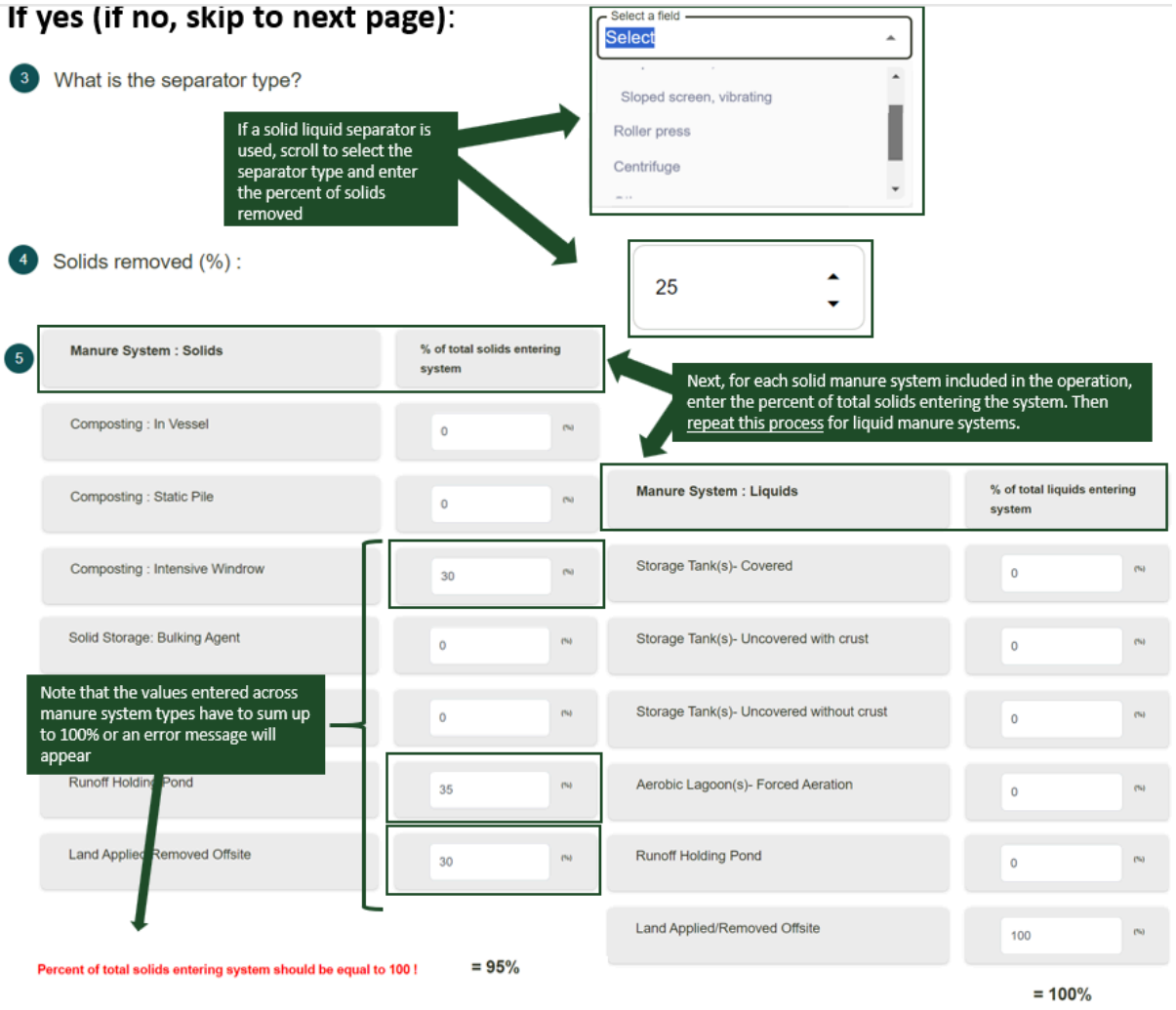
Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.



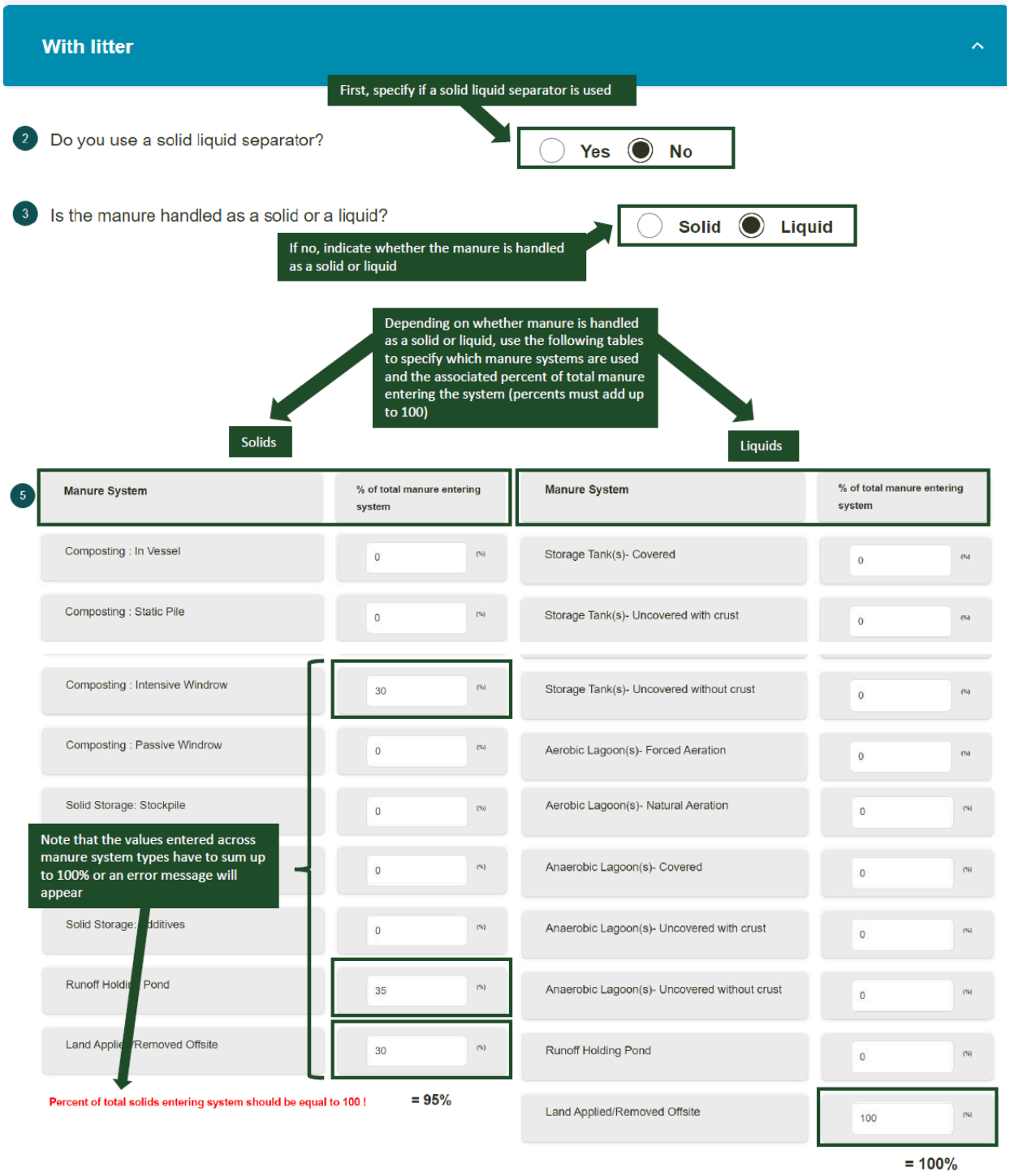
For the selected housing type (e.g., with litter in the above example), first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural

aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Depending on housing and manure selections, users may need to answer Manure Followup Questions.

Turkeys

Please refer to the **Broilers** section for all information regarding entering management for **Turkeys**.

Ducks

Please refer to the **Broilers** section for all information regarding entering management for **Ducks**.

Entering Management: Swine (Growing and Breeding)

Growing Swine

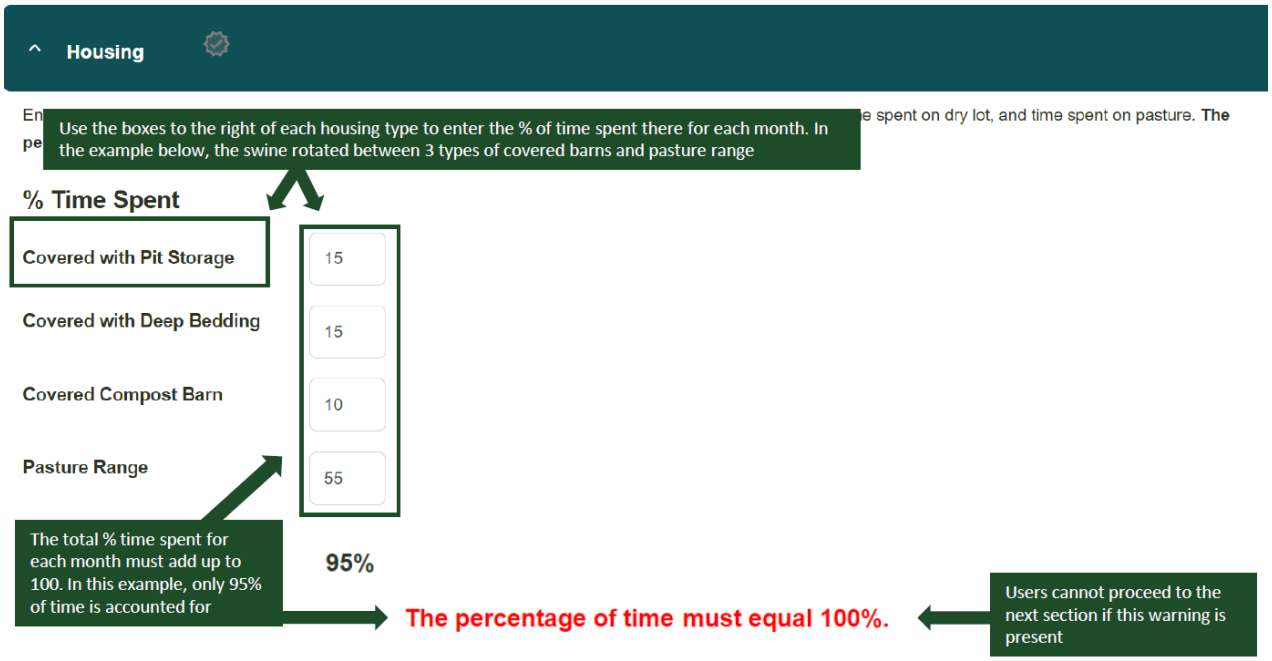
Expand the **Animal Details** section, and then the Herd Details section, to begin entering growing swine management. Here, use the entry boxes to enter the number of herds per year, average number of pigs per herd, number of days in growth stage, and the initial and final body weights. Click *Save*.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Expand **Feed Details** to enter the average daily dry matter intake (lbs) and crude protein (%) for the herd.

Housing

Under **Housing**, enter the percentage of time spent in each housing type. This includes time spent in a covered barn with pit storage, covered barn with deep bedding, covered compost barn, and pasture range. The percentage of time spent across housing types must sum to equal 100%. The selections made here will determine if there are more specific follow-up housing questions.

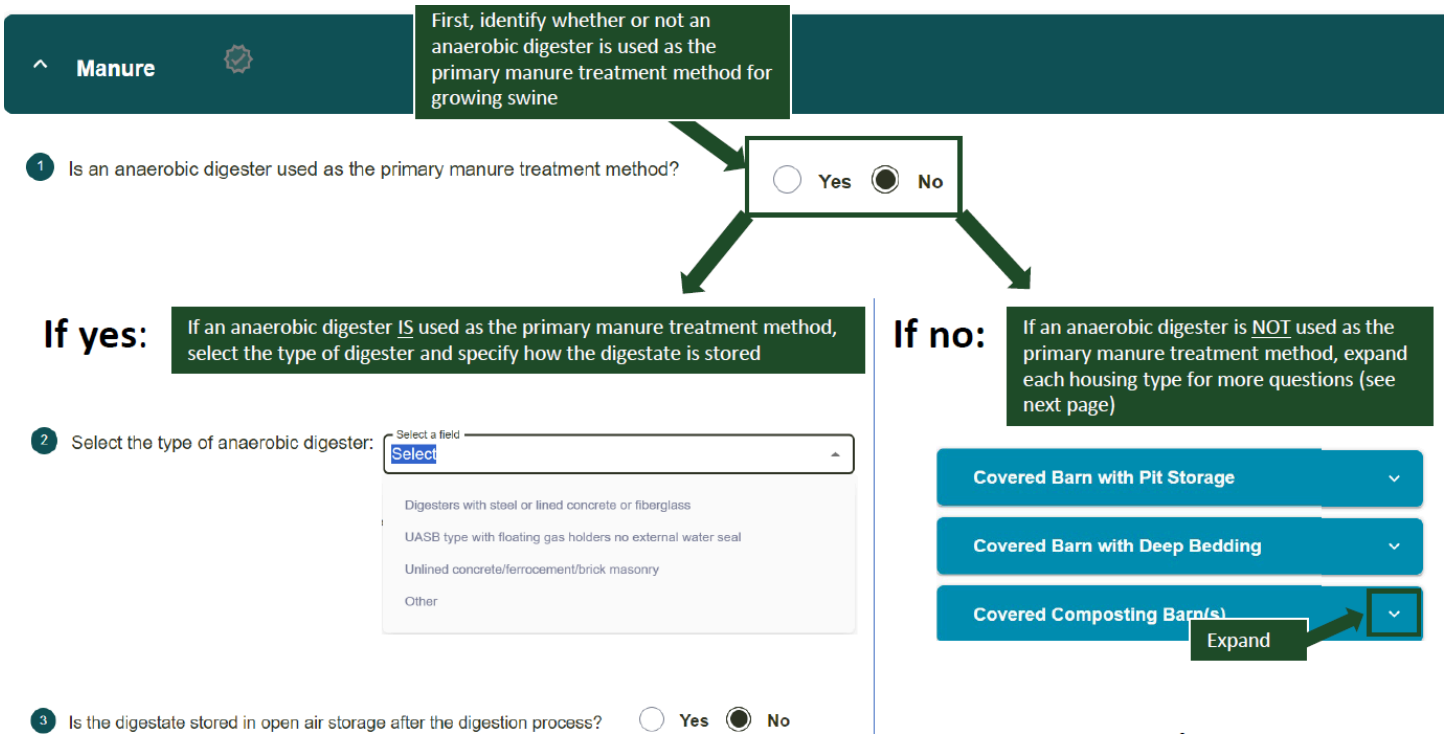


If the swine spend any time in "**Covered Barns with Pit Storage**," please select the storage length from the dropdown menu. Options include 1 month, 3, months, 4 months, 6 months, and 12 months.

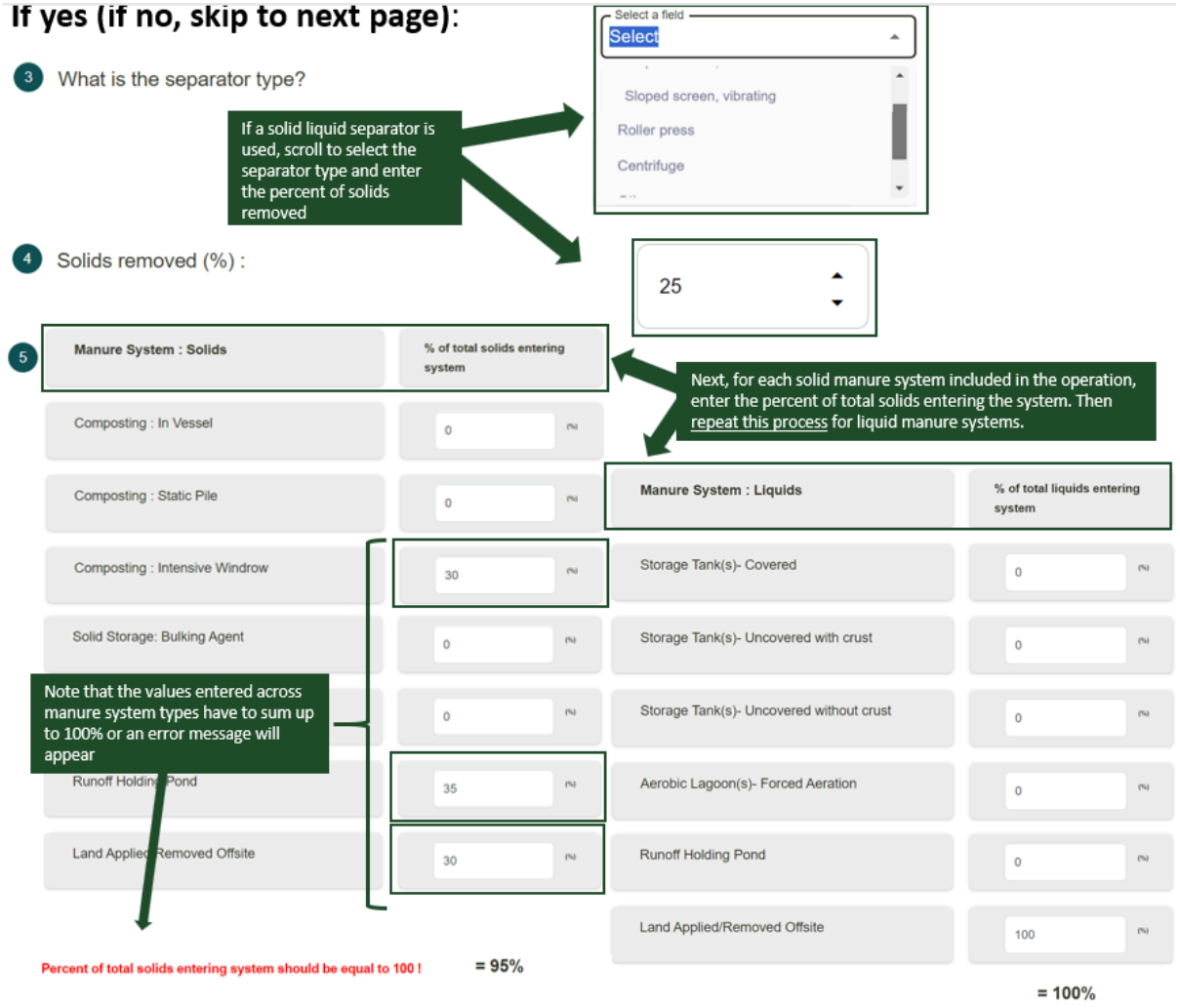
If the swine spend any time in "**Covered Barns with Deep Bedding,"** please indicate whether that is with an active mix or no mix. Then select the storage length from the dropdown menu choosing between longer than 1 month or less than 1 month.

Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.

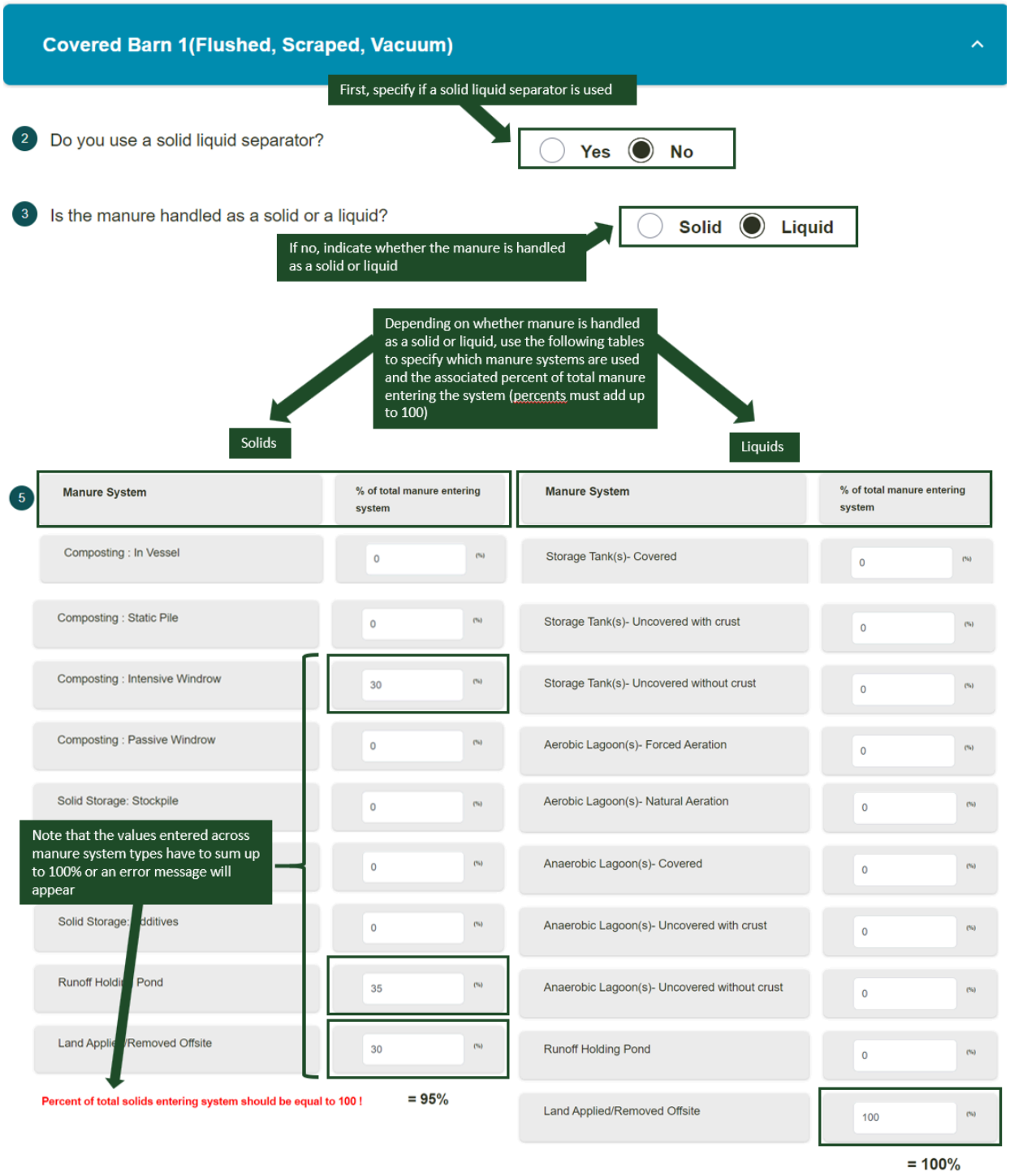


For '**Covered Barn with Pit Storage',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Repeat these steps for each selected housing type (i.e., 'Covered Barn with Deep Bedding' and 'Covered Composting Barn').

Depending on housing and manure selections, users may need to answer Manure Followup Questions.

Breeding Swine

Expand the **Animal Details** section, and then the Gestation Details section, to begin entering breeding swine management. Here, use the entry boxes to enter the number of gestation cycles per year, number of sows per gestation cycle, number of days per gestation cycle, average sow body weight during gestation period, and average sow weight gain during gestation period. Click *Save*.

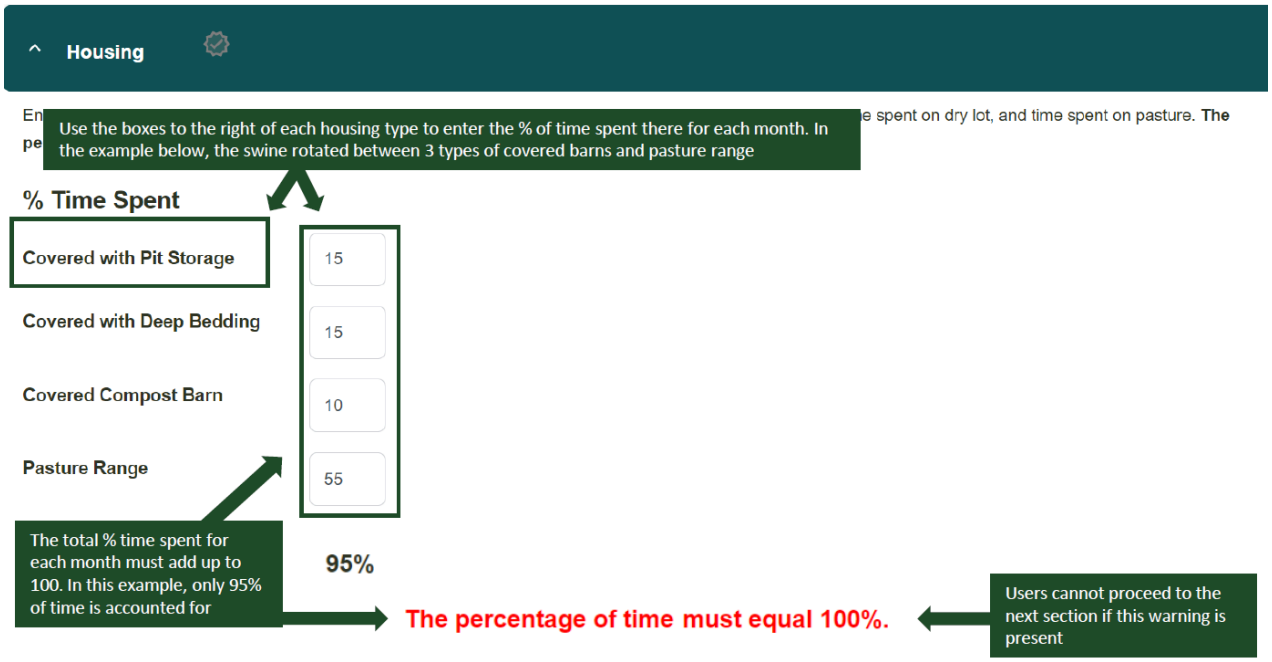
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Expand **Litter Details** to enter the average number of head per litter, average body weight of piglets at birth, and average body weight at weaning.

Expand **Feed Details** to enter the average daily dry matter intake (lbs) and crude protein (%) for the herd.

Housing

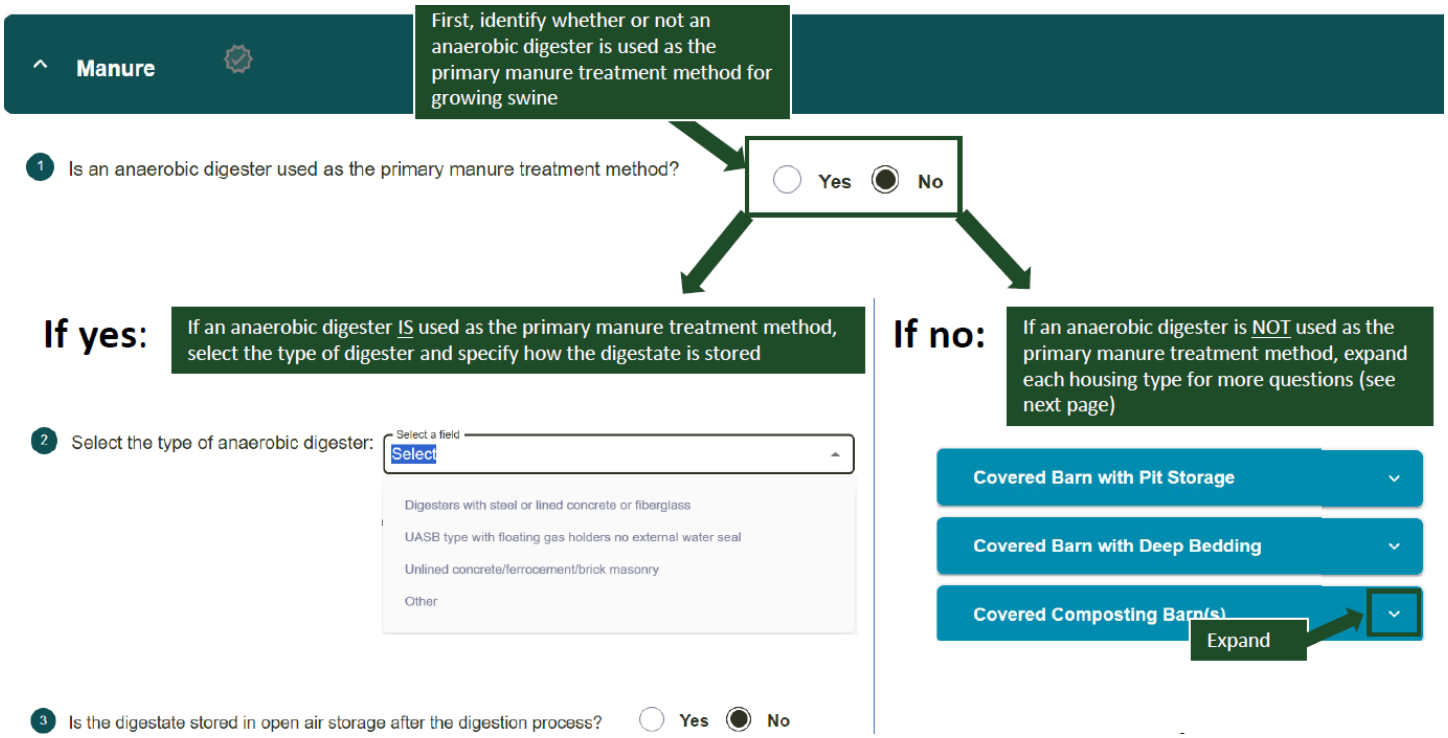
Under **Housing**, enter the percentage of time spent in each housing type. This includes time spent in a covered barn with pit storage, covered barn with deep bedding, covered compost barn, and pasture range. The percentage of time spent across housing types must sum to equal 100%. The selections made here will determine if there are more specific follow-up housing questions.



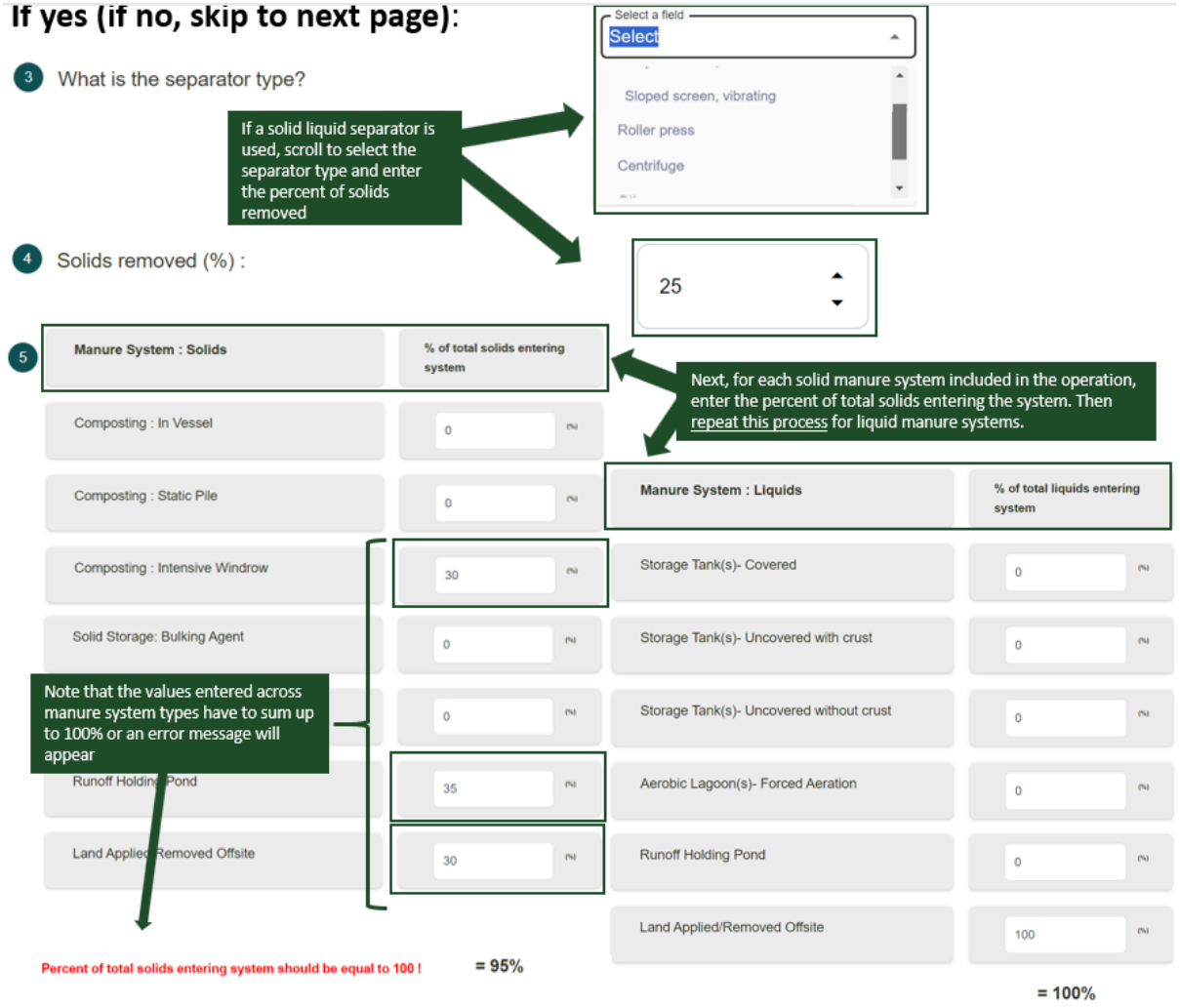
If the swine spend any time in "**Covered Barns with Pit Storage**," please select the storage length from the dropdown menu. Options include 1 month, 3, months, 4 months, 6 months, and 12 months.

If the swine spend any time in "**Covered Barns with Deep Bedding,"** please indicate whether that is with an active mix or no mix. Then select the storage length from the dropdown menu choosing between longer than 1 month or less than 1 month.

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.

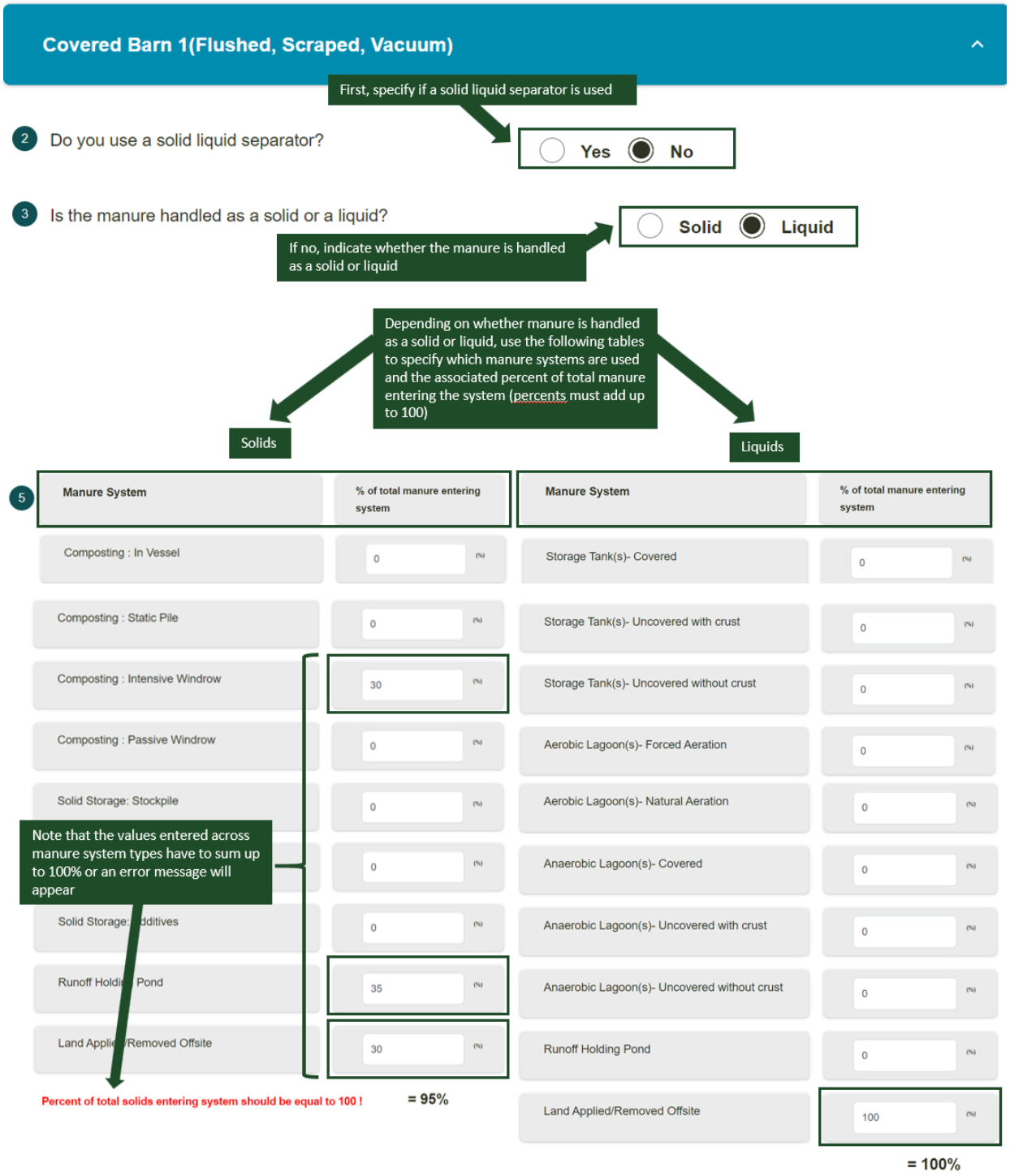


For '**Covered Barn with Pit Storage',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

If no:



Repeat these steps for each selected housing type (i.e., 'Covered Barn with Deep Bedding' and 'Covered Composting Barn').

Depending on housing and manure selections, users may need to answer Manure Followup Questions.

Entering Management: Other Ruminants (Sheep, American Bison, Goats, Llama & Alpacas, and Deer)

Sheep

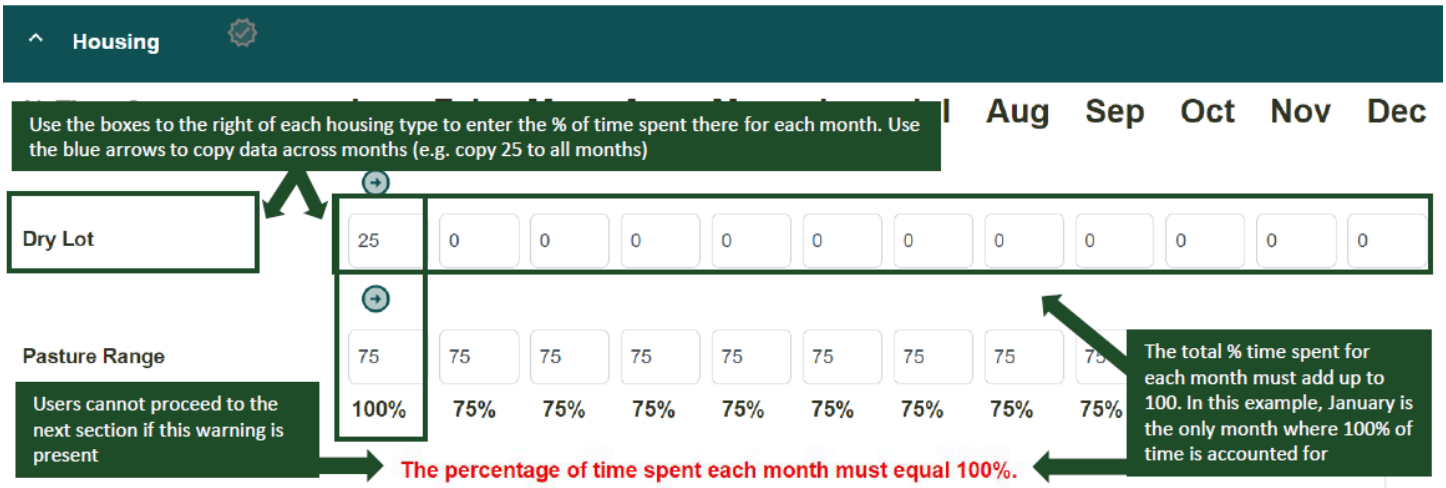
Expand the **Animal Details** section to begin entering sheep management. Here, use the entry boxes to enter the animal population by month and average body weight (lbs). Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

Under **Feed Characteristics**, enter the average daily dry matter intake in pounds (lbs).

Housing

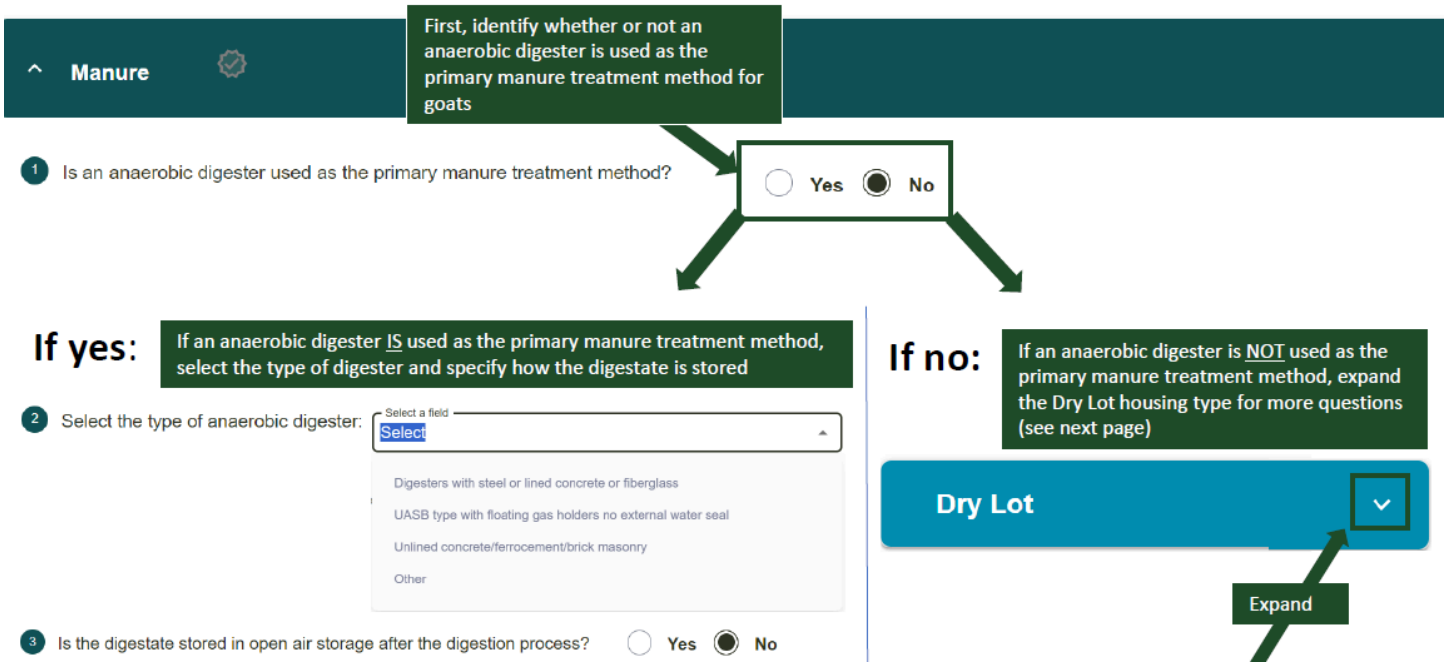
Under **Housing**, enter the percentage of time spent in each housing type. This includes time spent on dry lot and pasture range. The percentage of time spent across housing types must sum to equal 100%. The selections made here will determine if there are more specific follow-up housing questions.



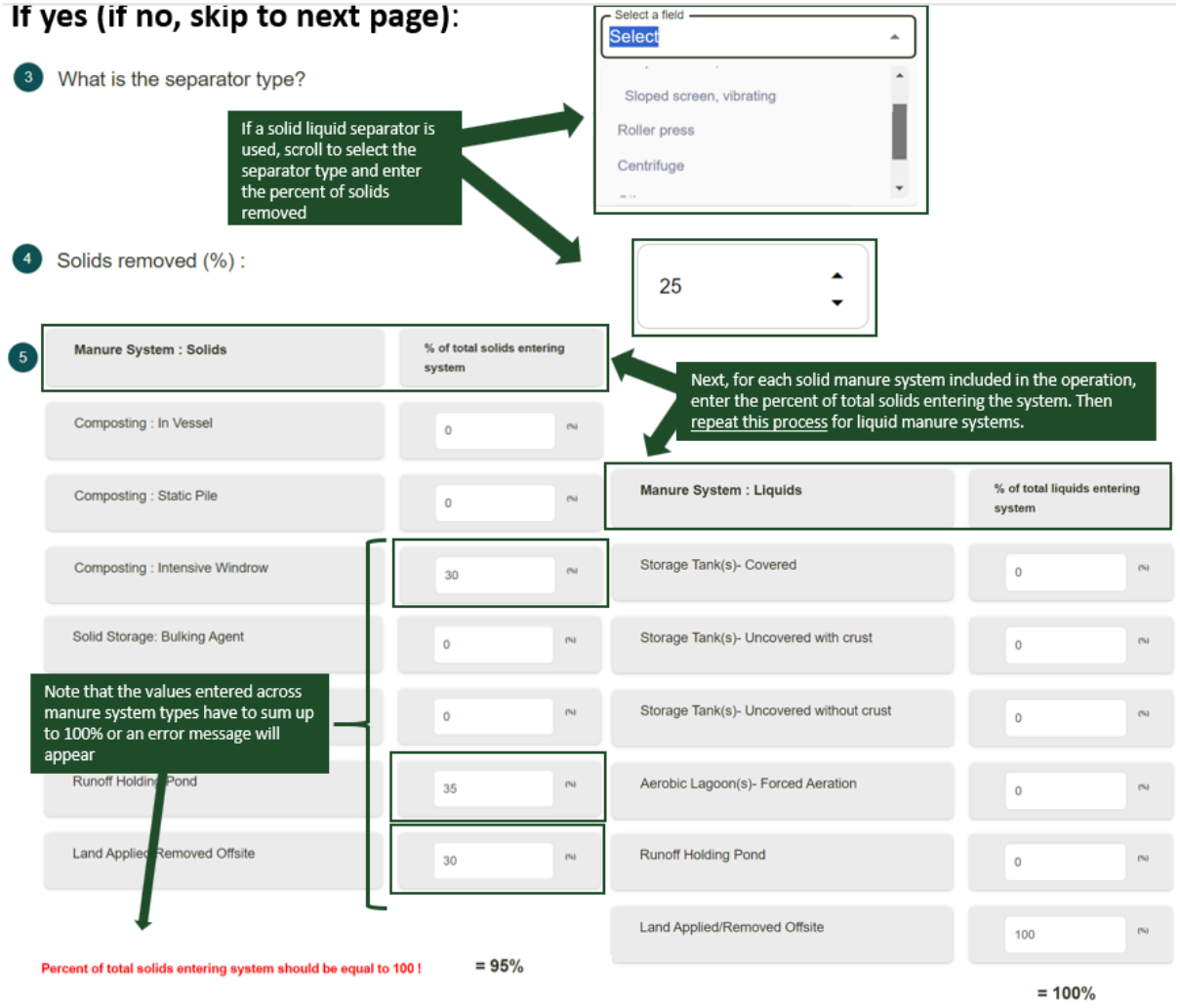
If the goats spend any time in "**Dry Lot,"** please proceed to the Manure section below.

Manure

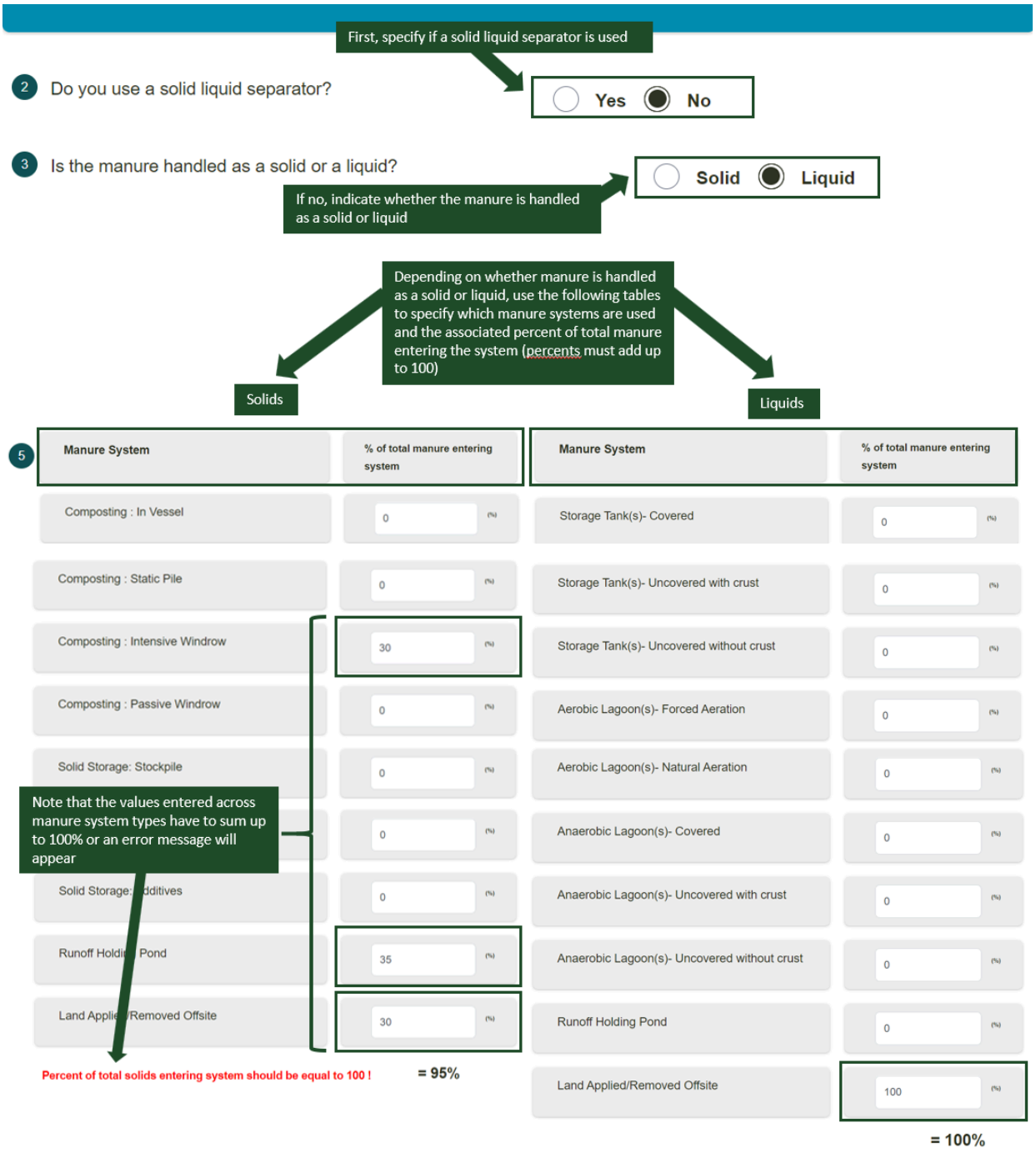
Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.



For '**Dry Lot',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen (vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



If 'No', a solid-liquid separator is *not* used, users will be asked to select whether the manure is handled as a solid or a liquid. Depending on whether manure is handled as a solid or a liquid, a table will appear where users can specify which manure systems are used and the associated percent of total manure (solid or liquid) entering the system. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

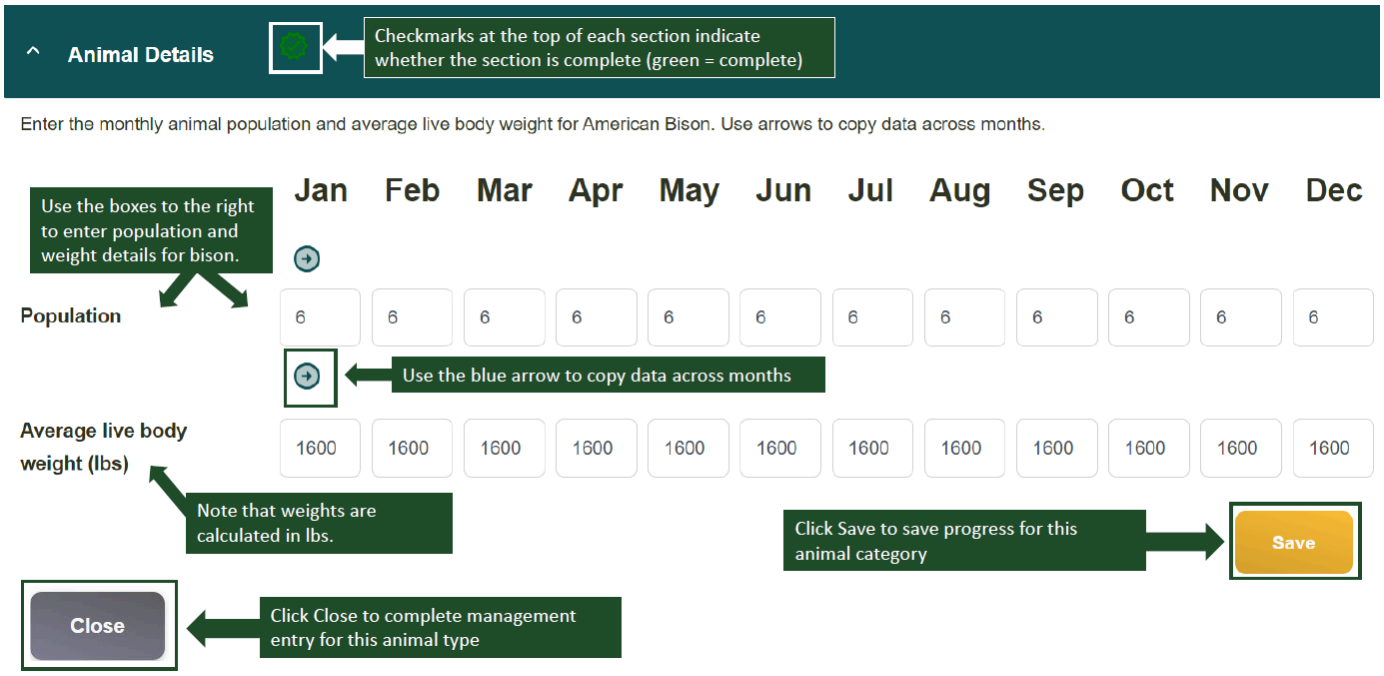


Depending on housing and manure selections, users may need to answer Manure Followup Questions.

American Bison

Expand the **Animal Details** section, then enter the animal population and average live body weight (lbs) across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.

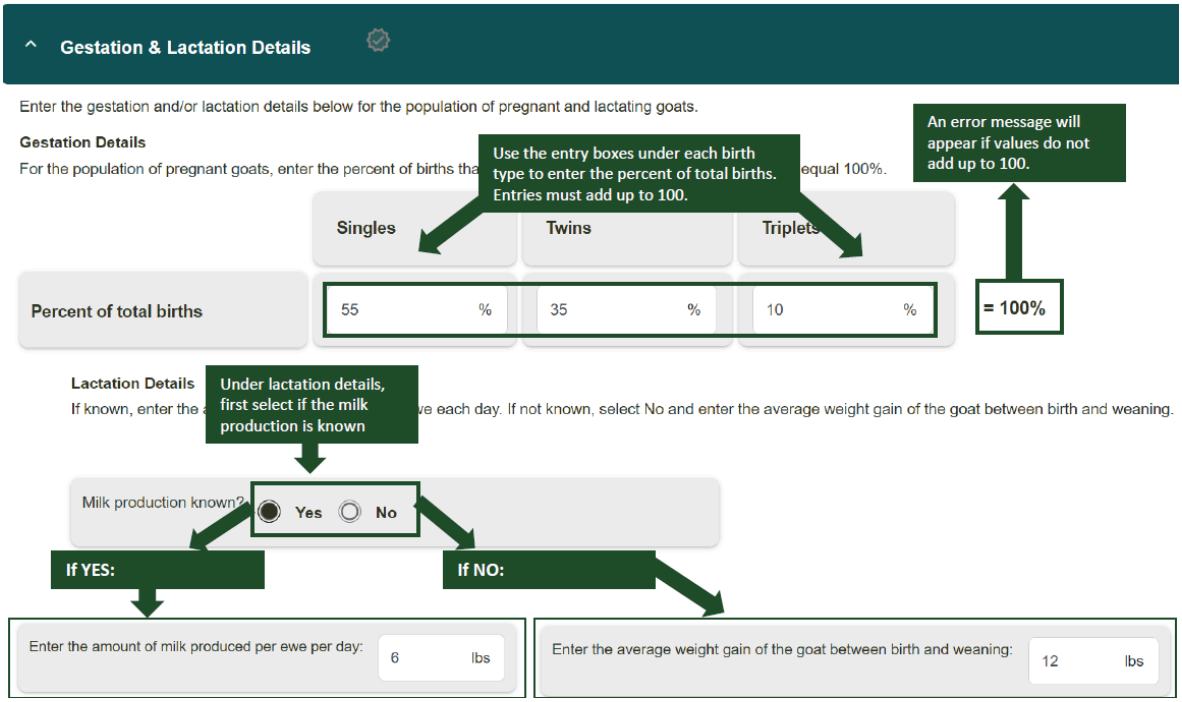


Goats

Expand the **Animal Details** section, and then the Male section, to begin entering goat management. Here, use the entry boxes to enter the number of males, their average live body weight, average body weight at weaning, and average body weight at 1 year. Repeat this process for females (not pregnant or lactating), females (pregnant), and females (lactating). Click *Save*.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed to the next section.

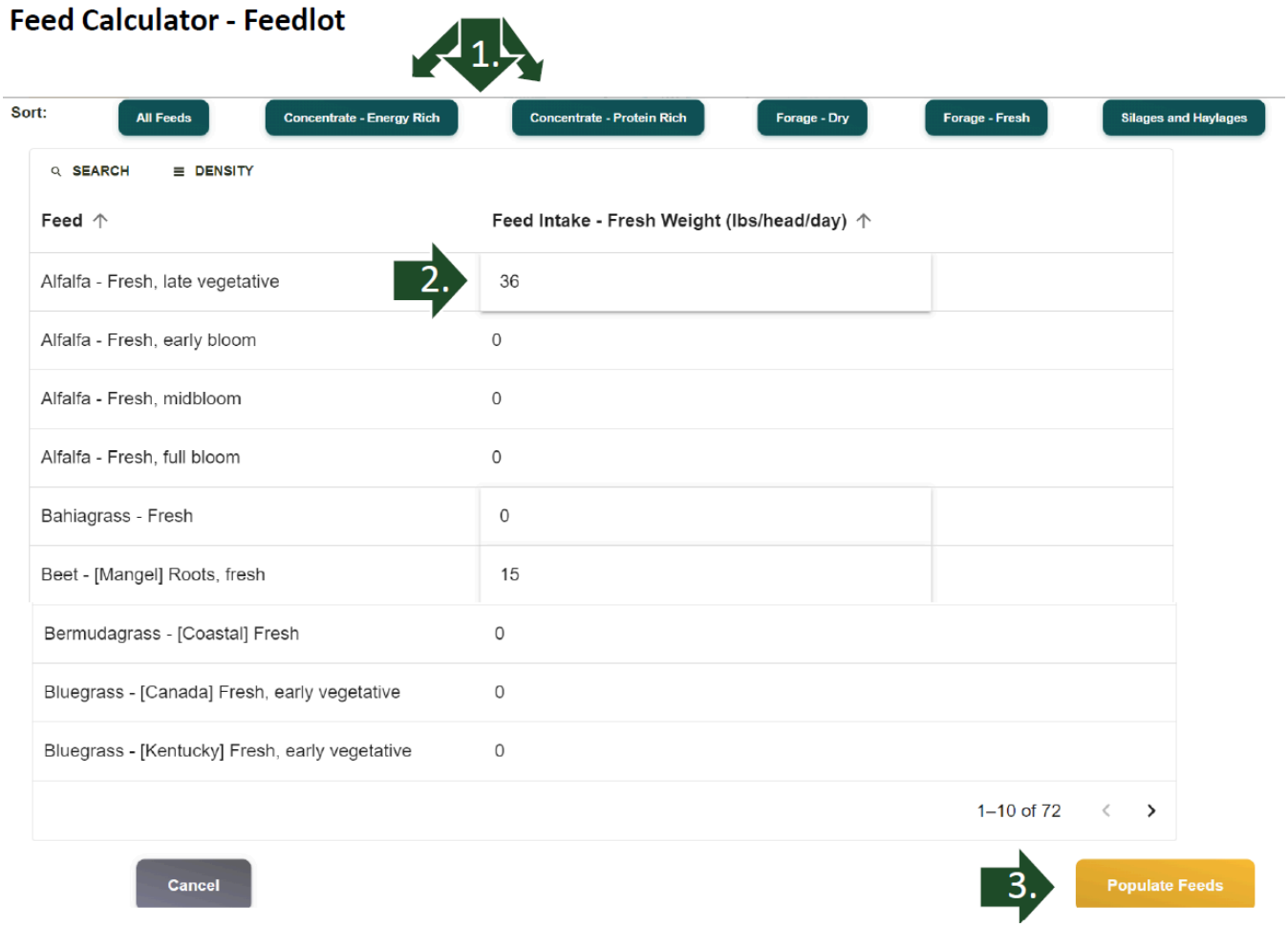
Expand **Gestation & Lactation Details** to enter the percent of total births that are singles, twins, and triplets. These values must add up to 100. Then, under Lactation Details, select (Y/N) if the milk production is known. If 'Yes', enter the amount of milk produced per ewe per day; if 'No', enter the average weight gain of the goat between birth and weaning.



Under **Feed Characteristics**, users can enter the average annual digestible energy (%) of the goat diet. If this value is not known, they can use the Feed Calculator to estimate digestible energy.

Feed Calculator

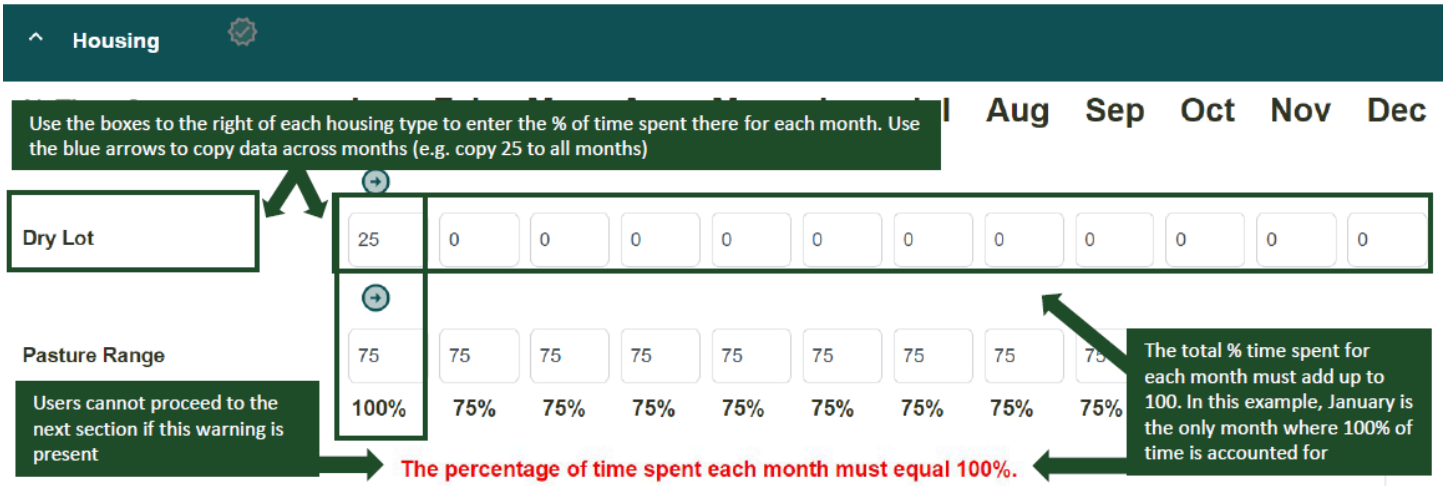
The Feed Calculator allows users to populate Digestible Energy (%) by selecting from a list of feedstuff and entering the feed intake as fresh weight (lbs/head/day). Users should enter the amount of feed per head in pounds per day on an as-fed basis for all feeds for the specified months. Use the layout guide below to enter feed details.



Feed Calculator (Feedlot) Layout Guide	
1.	Optional: Use the buttons at the top of the page, next to "Sort," to easily locate types of feed. Users may also choose to search through feed types manually using the arrows at the bottom of the table. *In the above example, the feed table has been sorted using the "Forage – Fresh" option.*
2.	Enter the feed intake as fresh weight (lbs/head/day) for each feed type for the selected ration group. To do so, double click on the cell under Feed Intake (where the 0's are) and type in the fresh weight. Click outside the cell to save that entry. **Do not press Enter.** *In the above example, the ration group is being fed 36 lbs of alfalfa and 15 lbs of beet roots per head per day.*
3.	Click "Populate Feeds" to apply these entries to the animal category. Users will be brought back to the main management window and will see the feed characteristics populated for the ration group. **They will still need to enter a value for Days on Feed.**

Housing

Under **Housing**, enter the percentage of time spent in each housing type. This includes time spent on dry lot and pasture range. The percentage of time spent across housing types must sum to equal 100%. The selections made here will determine if there are more specific follow-up housing questions.

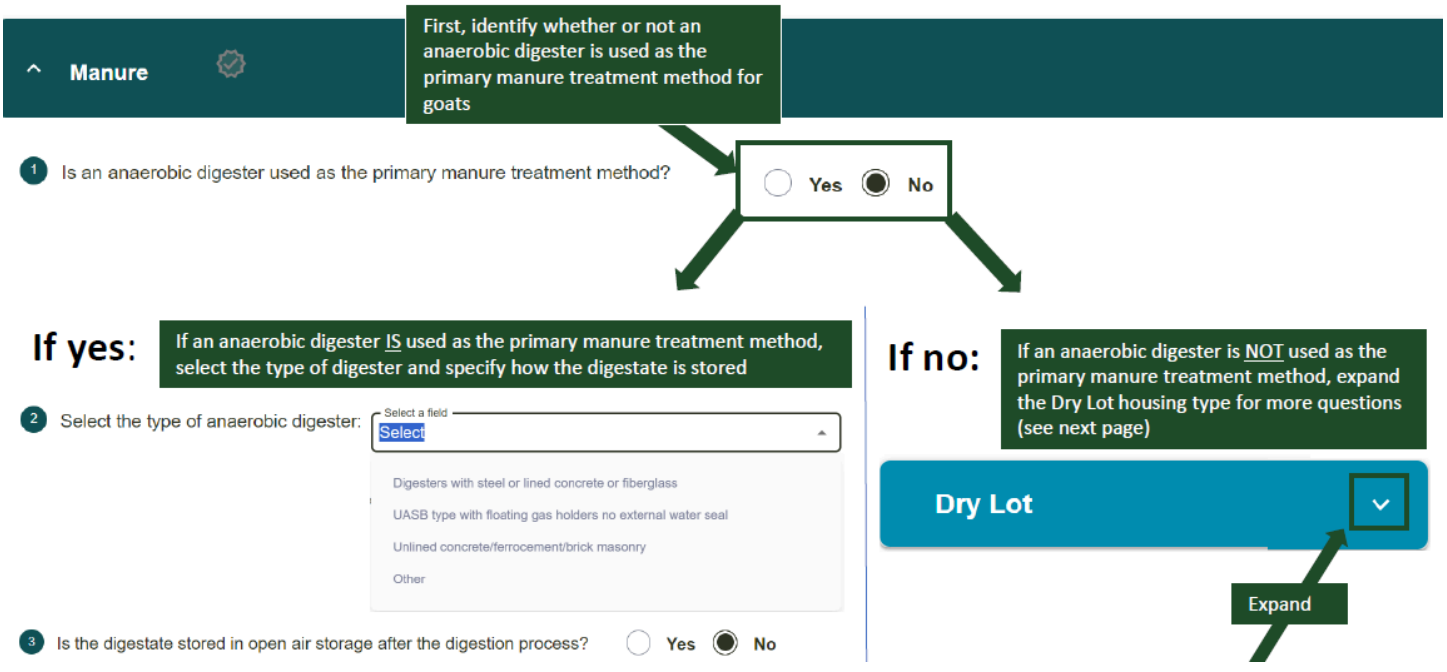


If the goats spend any time in "**Pasture Range**," please select the grazing landscape (Lowland or Hills/Mountain).

If the goats spend any time in "**Dry Lot,"** please proceed to the Manure section below.

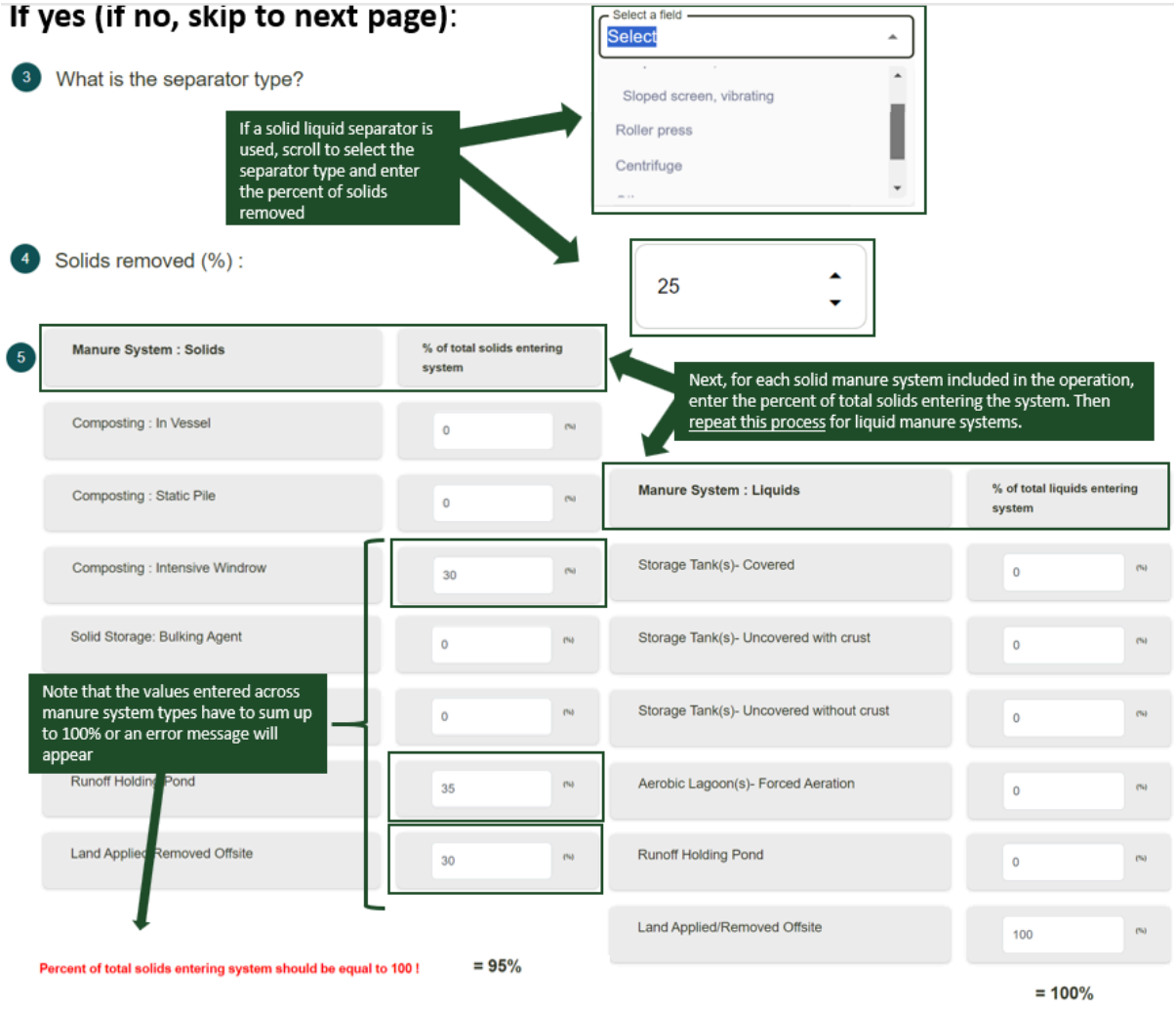
Manure

Under **Manure,** first select whether an anaerobic digester is used as the primary manure treatment method. **If 'Yes'**, then 1) select the type of anaerobic digester (Digesters with steel or lined concrete or fiberglass; UASB type with floating gas holders no external water seal; Unlined concrete/ferrocement/brick masonry; or Other), and then 2) indicate whether or not the digestate is stored in open air storage after the digestion process. **If 'No'**, an anaerobic digester is *not* the primary treatment method, then expand each housing type to continue entering management.



For '**Dry Lot',** first indicate (Yes/No) whether a solid-liquid separator is used for manure. **If 'Yes'**, then users will be prompted to select the type of separator used. Options include: sloped screen (static), sloped screen

(vibrating), rotary drum, screw press, belt press, roller press, centrifuge, or other. After choosing the type of separator, the system will default a value for percent of solids removed but users can edit that value. Lastly, users will be asked to use the tables to enter the percent of total solids and percent of total liquids entering the manure systems. For both Solids and Liquids, the percentage of total solids/liquids (displayed at the bottom of the tables) should be equal to 100. Otherwise, a warning message will appear in **Red.** The options for Solids are: Composting (in vessel), composting (static pile), composting (intensive windrow), composting (passive windrow), solid storage (stockpile), solid storage (covered or compacted), solid storage (bulking agent), solid storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.



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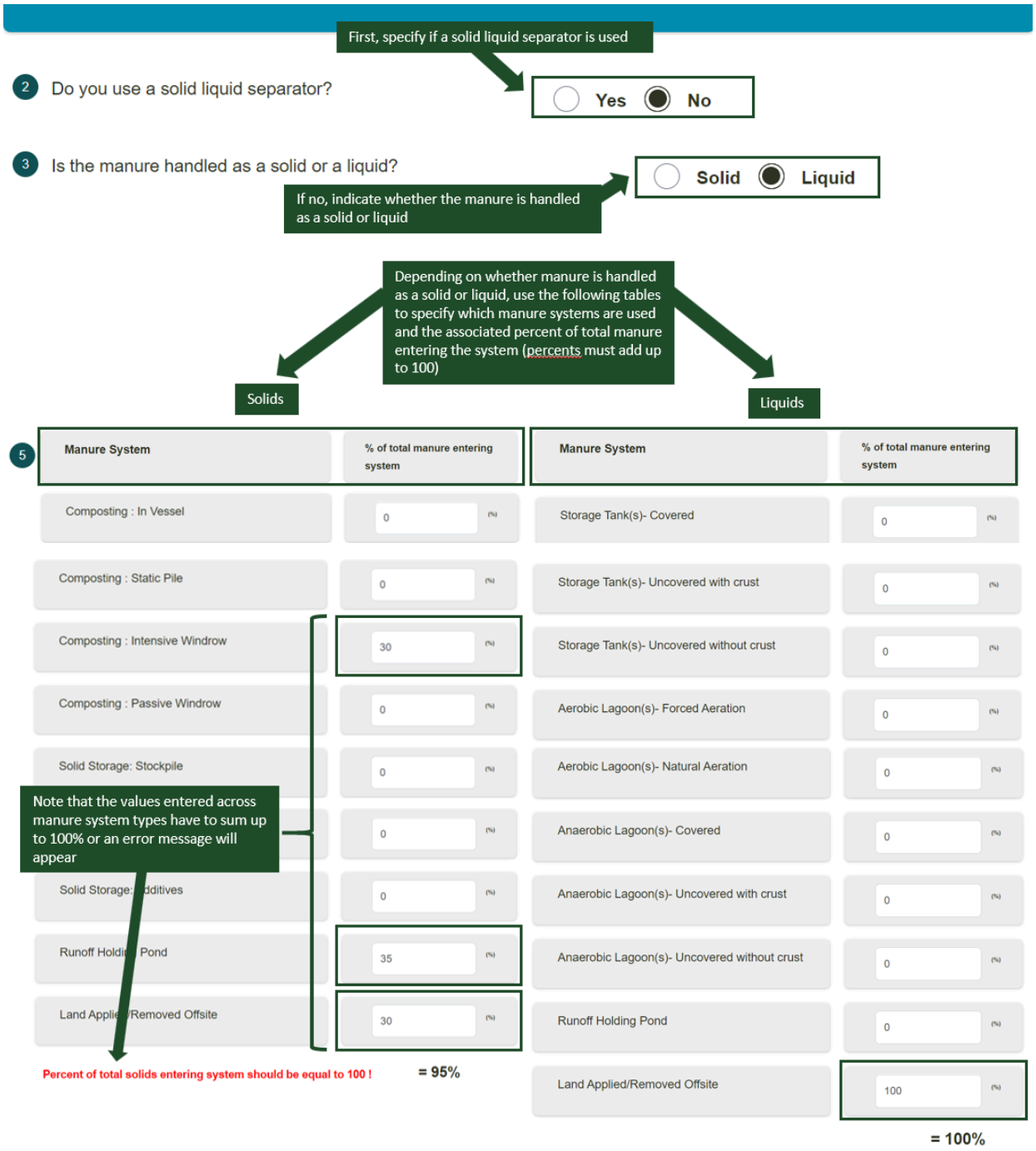
storage (additives), runoff holding pond, and land applied/removed offsite. The options for Liquids are: storage tank (covered), storage tank (uncovered with crust), storage tank (uncovered without crust), aerobic lagoon (forced aeration), aerobic lagoon (natural aeration), anaerobic lagoon (covered), anaerobic lagoon (uncovered with crust), anaerobic (uncovered without crust), runoff holding pond, and land applied/removed offsite. See image below.

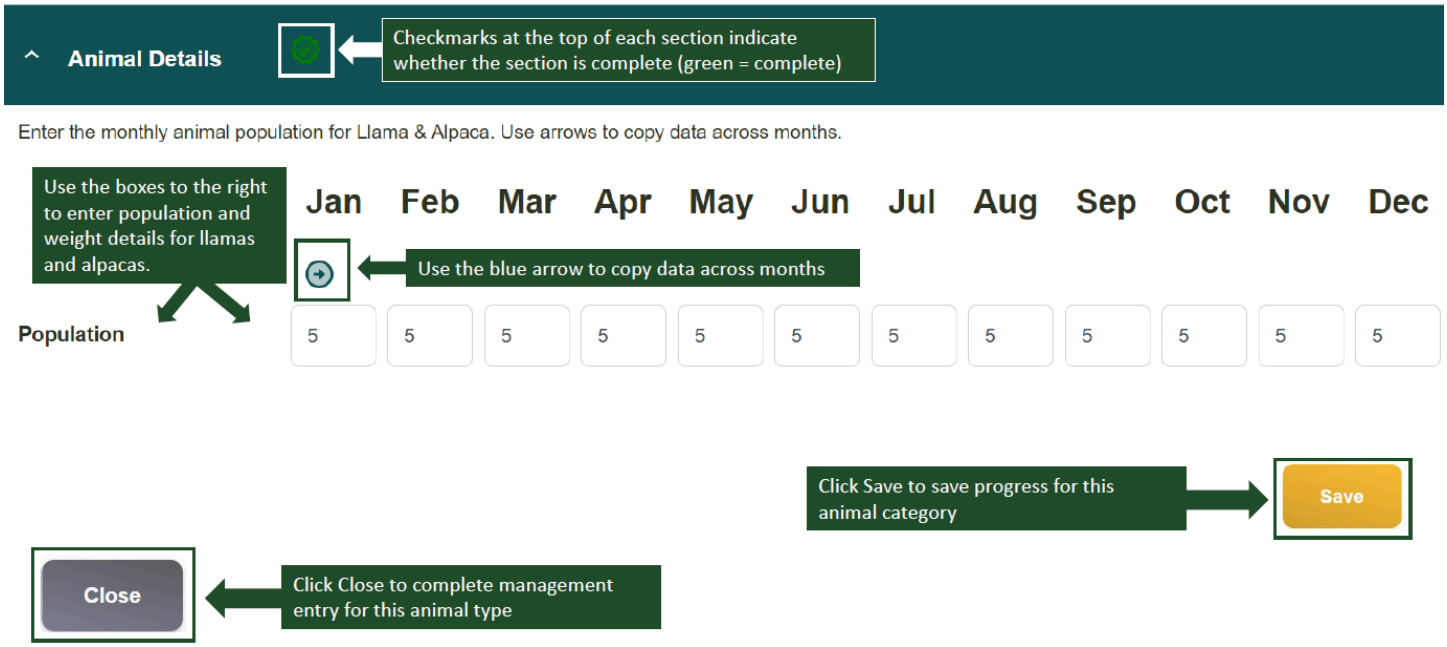


Depending on housing and manure selections, users may need to answer Manure Followup Questions.

Llama and Alpaca

Expand the **Animal Details** section, then enter the animal population and average live body weight (lbs) across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

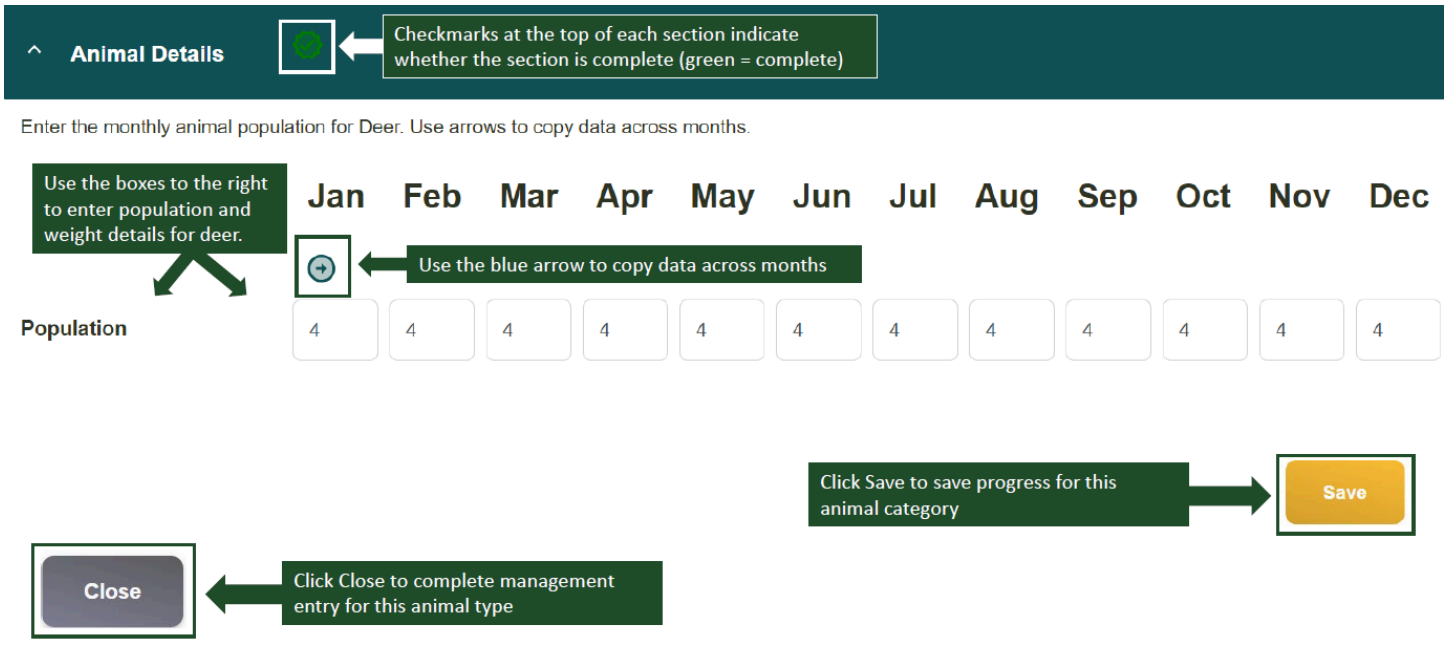
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.



Deer

Expand the **Animal Details** section, then enter the animal population across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.

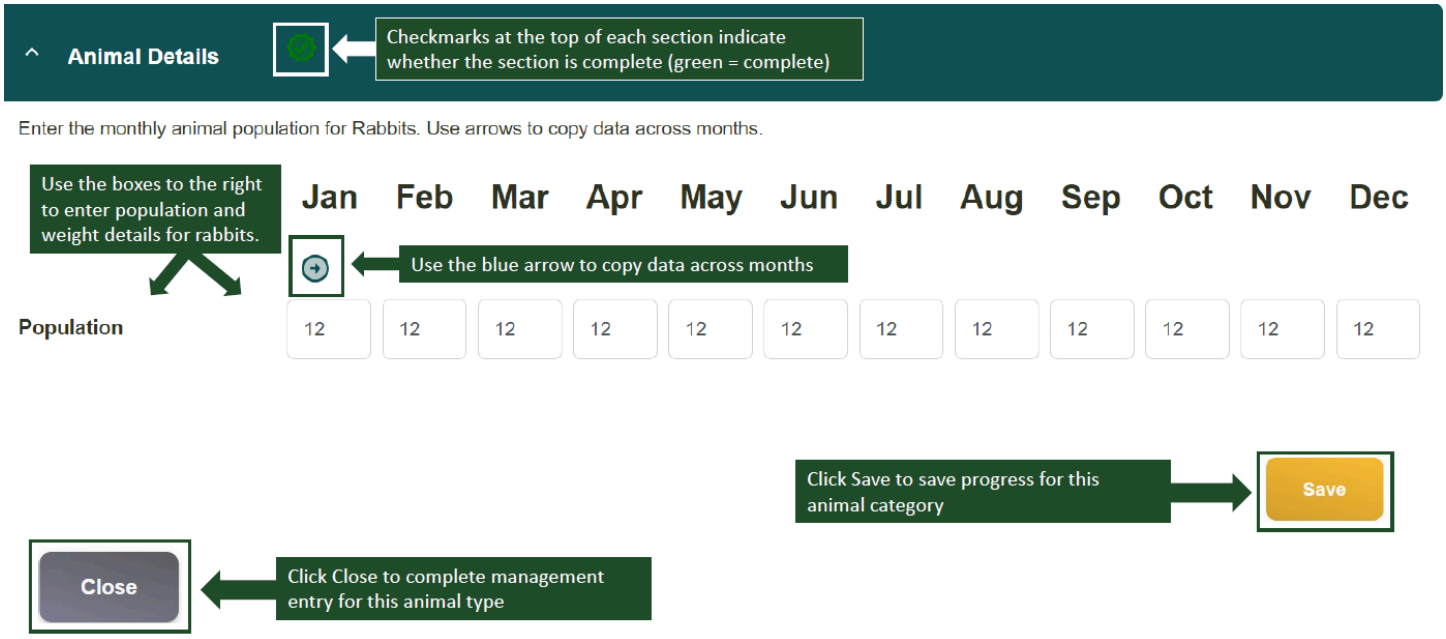


Entering Management: Other Non-Ruminants (Rabbits, Horses, Mules/Asses, Other Fur Bearing)

Rabbits

Expand the **Animal Details** section, then enter the animal population across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

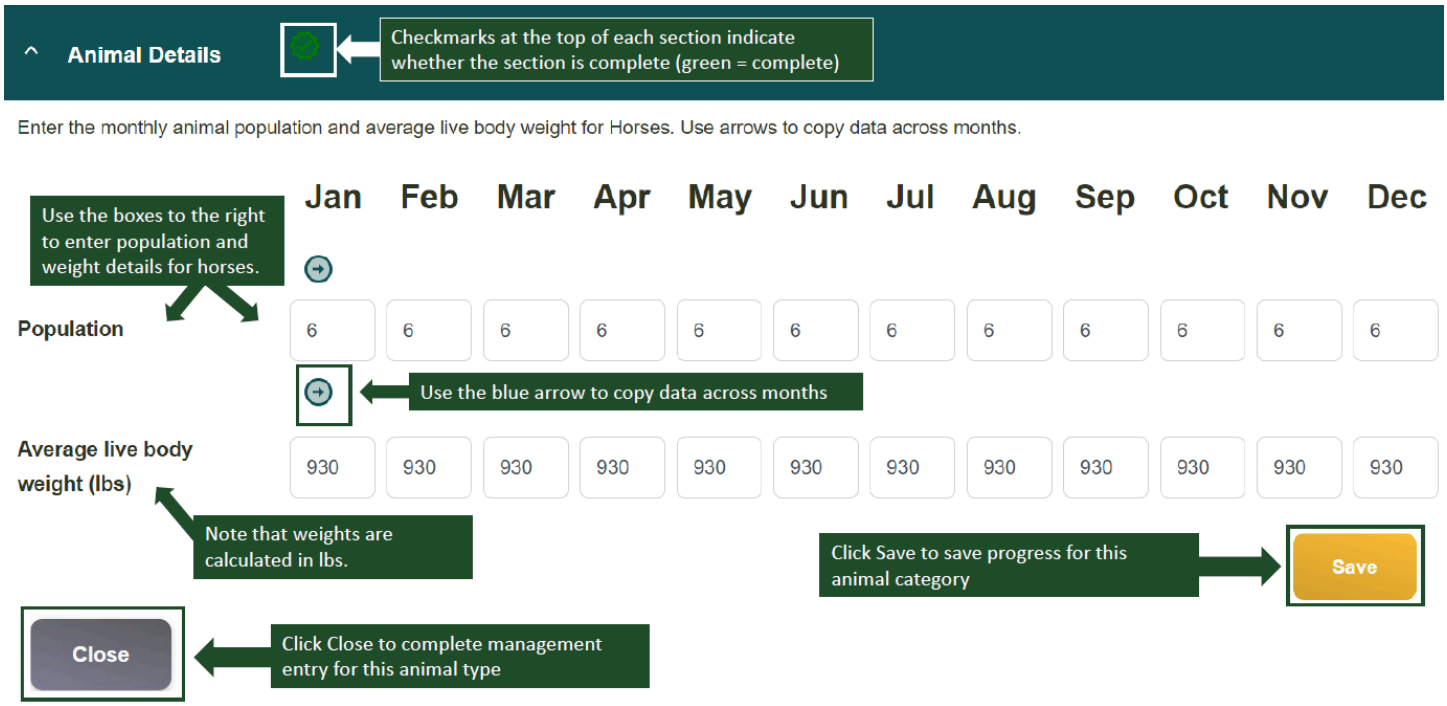
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.



Horses

Expand the **Animal Details** section, then enter the animal population and average live body weight (lbs) across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

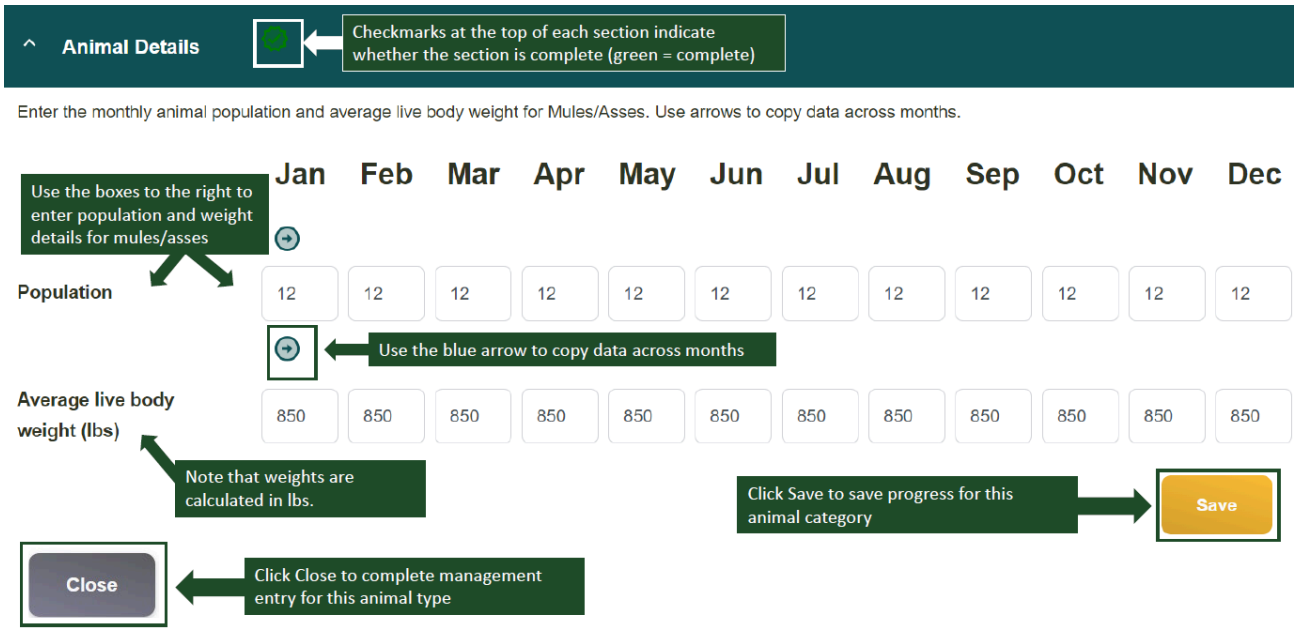
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.



Mules/Asses

Expand the **Animal Details** section, then enter the animal population and average live body weight (lbs) across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

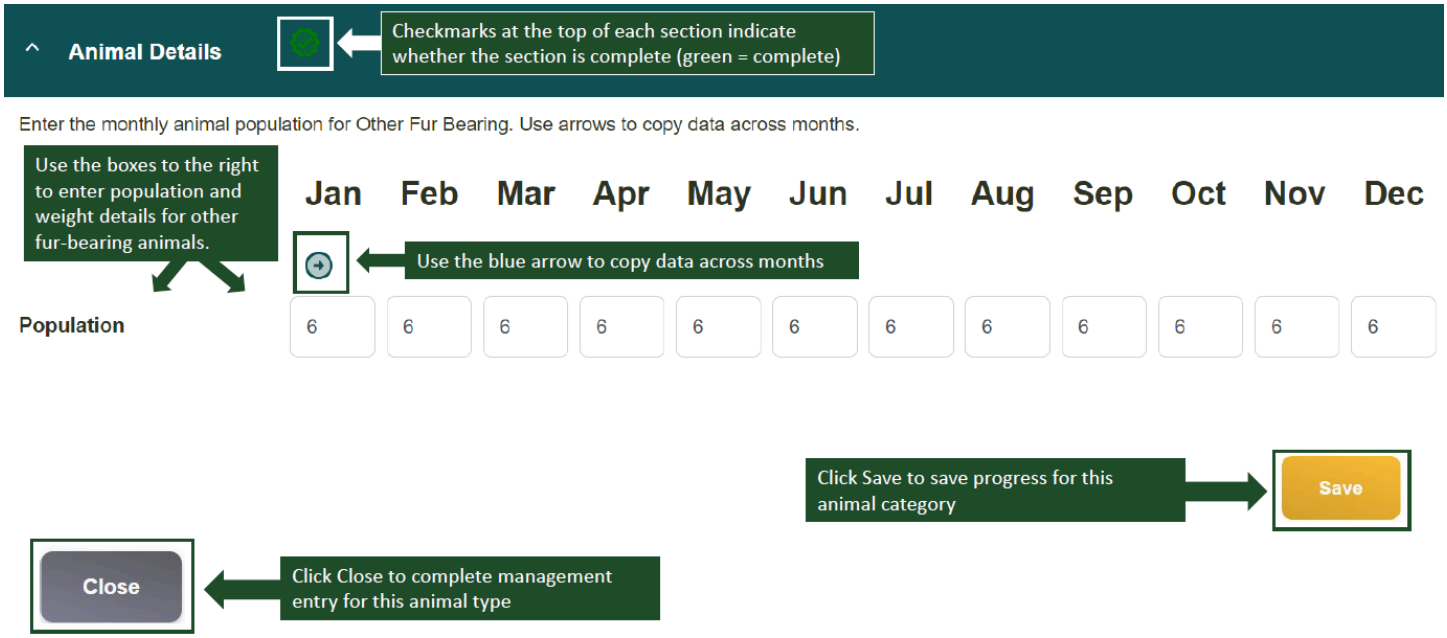
The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.



Other Fur Bearing

Expand the **Animal Details** section, then enter the animal population across months. Users can click on the blue arrows to copy data across months. Click *Save* to proceed.

The checkmark on each accordion section indicates the completeness of entered management. When the check marks are grayed out, the section is incomplete; when they are green, the section has complete management and the user can proceed.



Manure Followup Questions

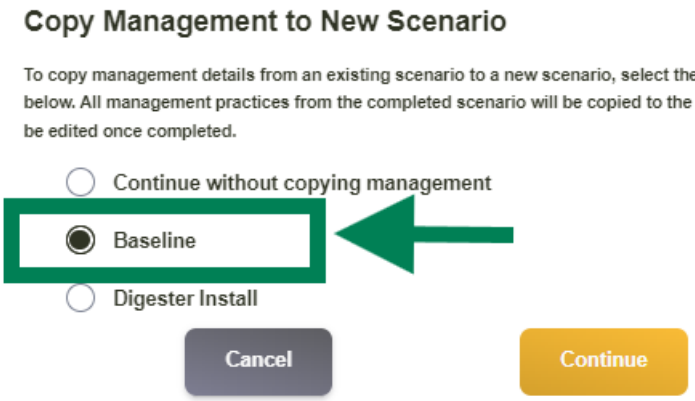
For the following selections for Manure System Types, users will be required to enter additional information.

Manure System Type	Follow-up Question	Options
Runoff holding pond(s)	What is the average length of time manure is stored in all runoff holding pond(s)?	1 month; 3 months; 4 months; 6 months; 12 months
Storage tank(s)	What is the average length of time manure is stored in all storage tank(s)?	1 month; 3 months; 4 months; 6 months; 12 months
Uncovered storage tanks with a crust	Enter the total exposed surface area of all uncovered storage tanks with a crust.	User-entered value
Uncovered anaerobic lagoons with a crust	Enter the total exposed surface area of all uncovered anaerobic lagoons with a crust.	User-entered value

Adding a Scenario (optional)

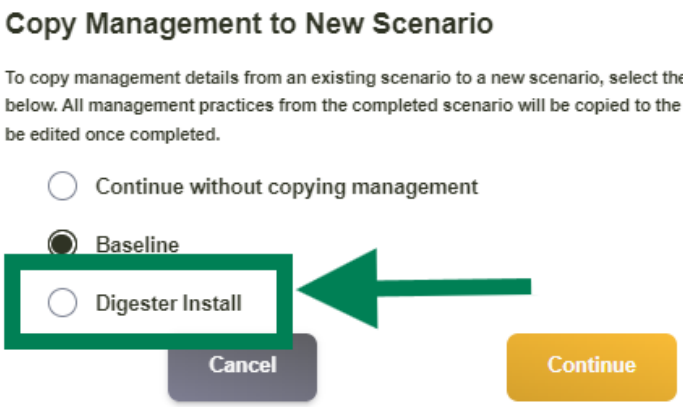
After entering all *Animal Management* details that establish the baseline for the farm entity (each animal category has a green checkmark next to their name), users may choose to proceed directly to the Reports page or add up to 10 scenarios. Click *Add Scenario* to include a scenario in the project.

Users will then be asked if they want to copy management to the new scenario. For the first scenario, the options will be to either continue to create a new scenario without copying management from the baseline (i.e., create a scenario from scratch), or to copy baseline management to the new scenario.



If the new scenario involves only changing *some* aspects of the baseline management (for instance, replacing an anaerobic lagoon with an anaerobic digester or adjusting feedstuff), **the COMET team strongly recommends copying management from the baseline.** This will minimize the data entry load for that scenario.

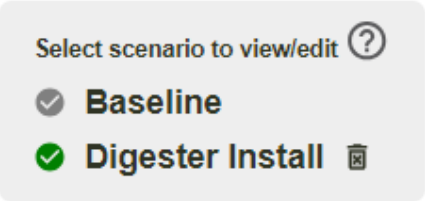
Once the user has created a new scenario(s), that scenario will also appear as an option to copy.



Click *Continue* to proceed with the selected option.

Next, enter a new scenario name. It is recommended to name the scenario something descriptive for reference, rather than a generic name like “Scenario 1.” Click *Save*.

Once the new scenario name has been saved, it will appear in the floating gray box in the upper-right corner of the page. This box will include the baseline scenario as well as any additional scenarios added by the user. Click on the names of the scenarios in this box to view/edit them or delete them using the trashcan icon. The green checkmark indicates which scenario is currently being edited.



Once the user is finished adding scenarios, they can proceed by clicking *Continue to Report*.

Creating an Agroforestry Project

Overview

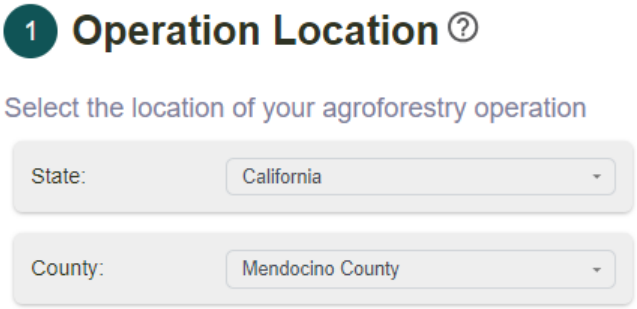
Before creating any COMET-Farm projects, users must first create a COMET-Farm account and create a new project before proceeding.

Unlike the cropland/pasture/rangeland/orchard/vineyard and animal agriculture accounting activities, where users can create scenarios to compare current and future/hypothetical management practices, the agroforestry module instead assesses **how much carbon, presented as CO2 equivalent, is stored over time** as a result of all the species or practices entered.

Operation Location

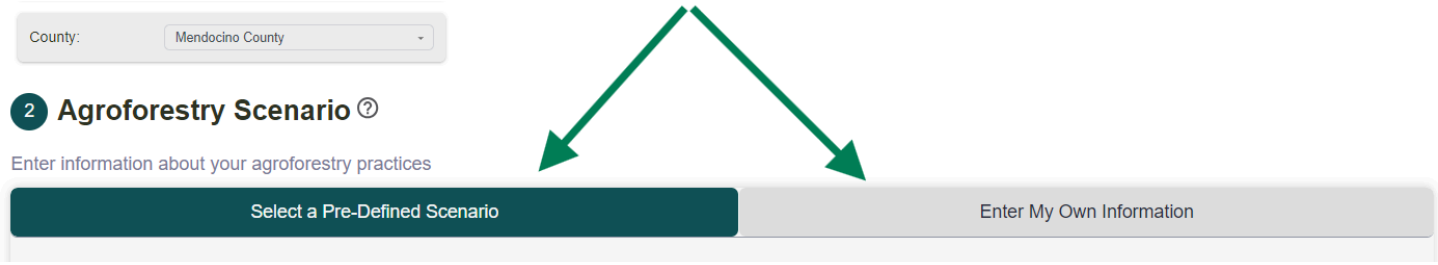
COMET-Farm allows for county-specific greenhouse gas (GHG) accounting. Management details entered by the user are thus being tied to that specific county. This information is used to select geographically-appropriate calculations and display agroforestry practices used in the selected area. Only one county can be selected in each agroforestry project; to include other counties, please create separate projects.

Use the dropdown menus to select the state and county of the agroforestry practice.



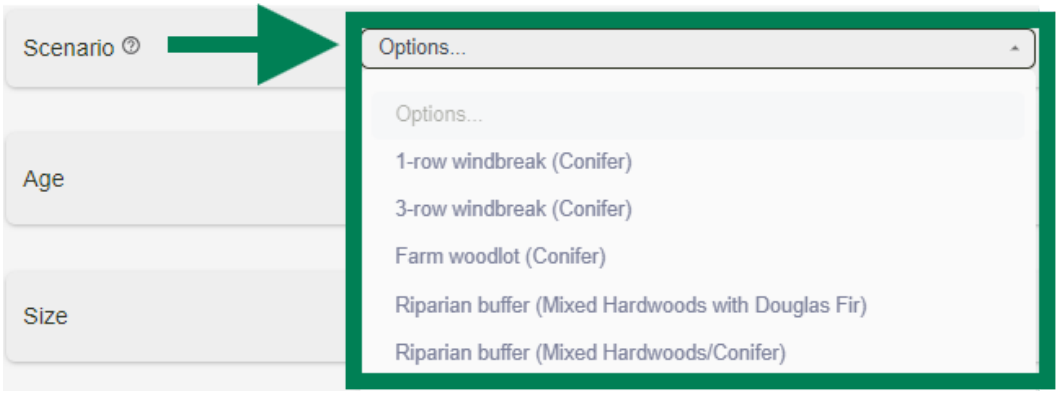
Agroforestry Scenario

There are two different ways to enter information and management details for the agroforestry practice(s): select a pre-defined scenario or manually enter information. Users can only use **one of these methods** per project. In other words, users cannot add a pre-defined scenario *and* enter their own information in the same project. Use the tabs at the top of the section to select the method for data entry.



Select a Pre-Defined Scenario

When users do not know the specifics of their agroforestry practice, they will have the option to “Select a Pre-Defined Scenario’. First, use the *Scenario* dropdown menu to select the scenario that best represents the agroforestry practices being assessed. The list of selections vary across states/counties and represent agroforestry management most practiced in that area. Please visit the “Cropland to Woody Cover” section of the COMET-Planner Report (pgs 61-76) for descriptions of the available practices.



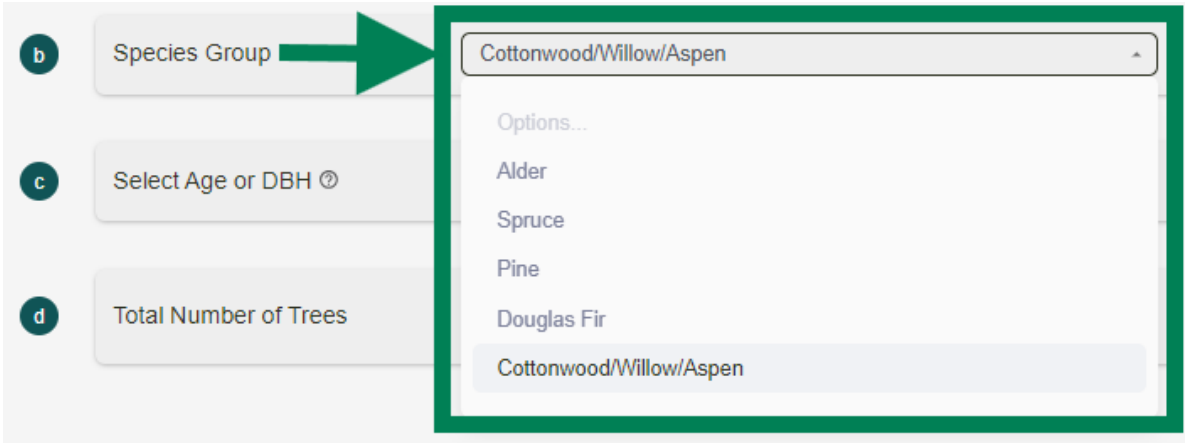
Next, type in the age (years) and arial size (acres) of that operation. Users can add multiple practices/scenarios by clicking *Add Scenario*. These scenarios will then populate the table below.

Scenario	Age	Size
Riparian buffer (Mixed Hardwoods/Conifer)	10	5
Riparian buffer (Mixed Hardwoods with Douglas Fir)	10	5

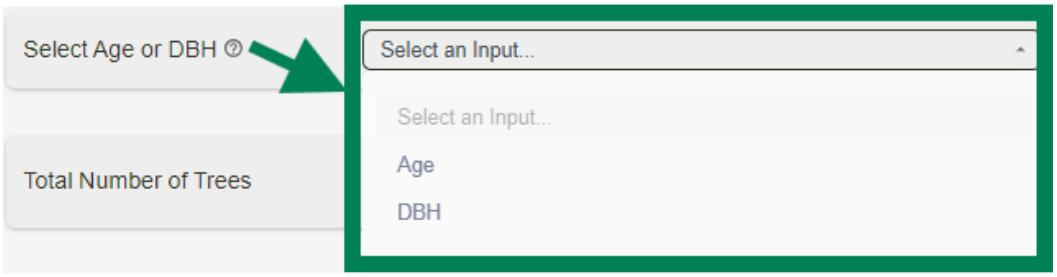
Once all desired scenarios are added to the table, click *Continue to Report.*

Enter My Own Information

To enter management manually, users will first be prompted to name their scenario. Click *Update Scenario Name* to proceed with data entry. Next, select a Species Group from the dropdown menu which will filter the available species by location (e.g., selectable species in California will be different than in Vermont).



Users will then have the option to *either* enter data for Age *or* DBH (diameter-at-breast height). Only one of these inputs will be required. These inputs are used to determine how much carbon is stored per tree.



Lastly, users are asked to enter the total number of trees included for the selected scenario and tree species. The Total Number of Trees input has a cap at 999. Once entered, click *Add Scenario*. This scenario will then populate the table below. Repeat the above steps, beginning with *Species Group*, for any additional species to include in the operation.

Species Name	DBH/Age	Total Number of Trees
Pine	15	15
Spruce	10	55

Once all desired species are added to the table, click *Continue to Report*.

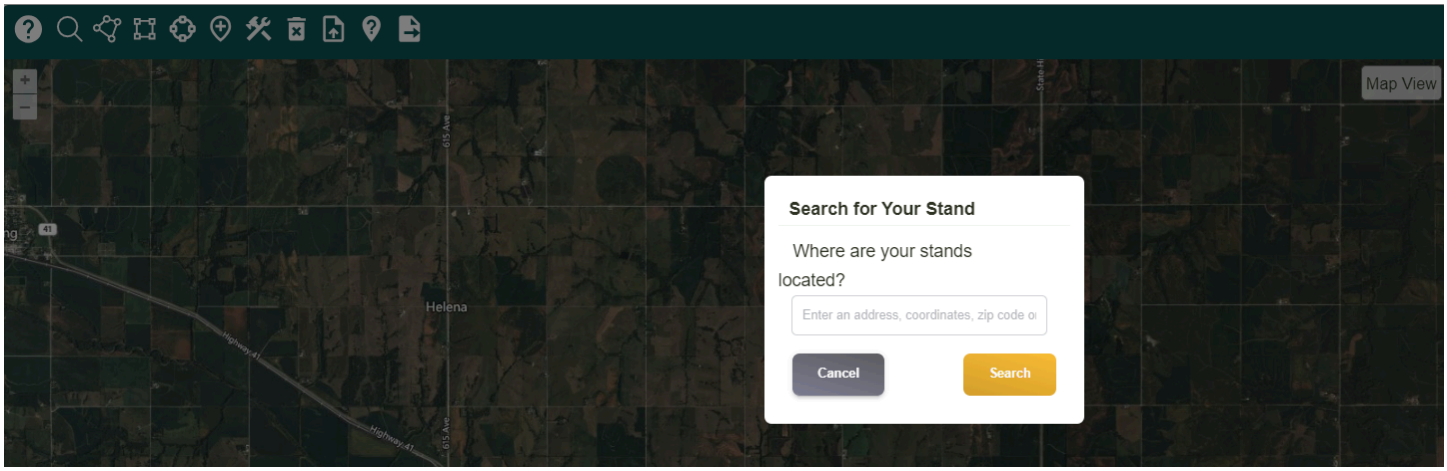
Creating a Forestry Project

Overview

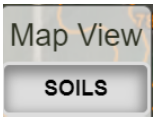
Stand Location

COMET-Farm requires users to define stand boundaries to link management activity data to a specific area for forestry accounting.

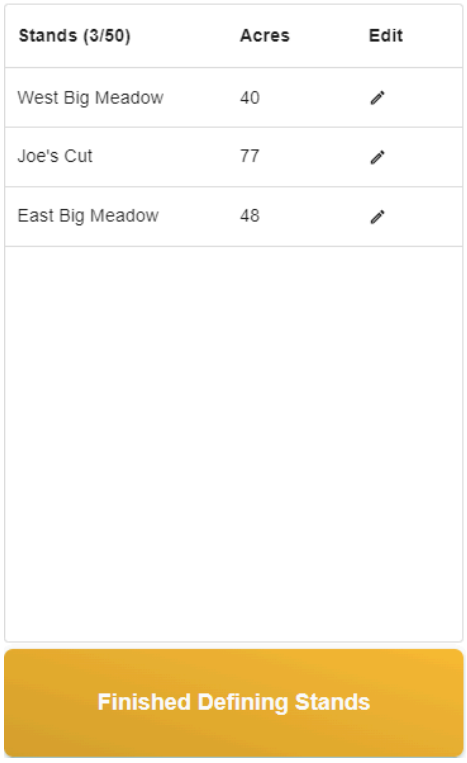
When users first enter the field definition page, they may either enter an address, zip code, or landmark in the search field and select “Search” to go directly to the location. They may also select “Cancel” and manually zoom to a desired location.



Once navigated to the desired location, users may use the tools listed below to identify their stand.

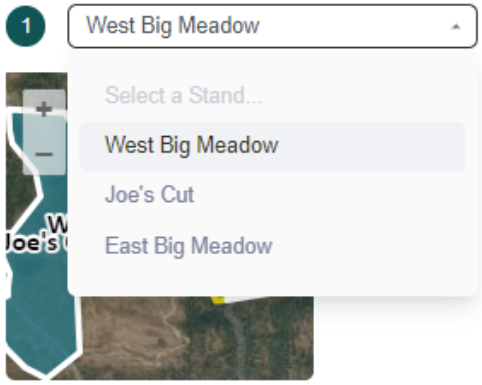
Symbol	Function
	Find location. Users may create projects with far-apart stands. Use the search function to enter an address, zip code, or landmark to jump to that location.
	Defining a stand by a polygon. Use this tool to define the stand boundary of an irregular stand shape. Left-click to drop a vertice. Connect the polygon to complete the shape. Double left-click at any time to “snap” the polygon closed.
	Defining a stand by a rectangular polygon. Left-click to begin the rectangular stand definition. Move the cursor to the edge of the stand boundary. Left-click again to close the rectangle.
	Defining a stand by circle. Left-click in the center of the stand. Move the cursor to the edge of the stand boundary. Left-click again to close the circle.
	Defining a stand by point. Left-click in the center of the stand. Enter the stand acreage when prompted. Using stand definition by point creates a circular boundary in the database.
	Delete a single stand. Select the stand to be deleted. Deleting a stand will erase the field boundary and respective management. Users *cannot* undo a stand deletion.
	Shapefile upload. Users may upload a shapefile (.shp) with a maximum of 50 field definitions. For upload instructions and file specifications, please review the shapefile upload section below or view the solution article**.**
	View soil by click. Select anywhere on the map within the contiguous United States to view soil information: map unit, texture, sand/silt/clay fractions, bulk density, and if the soil is hydric. COMET uses SSURGO soil data.
	Export soil data per field. A .csv file will download automatically and will include the “*view soil by click”* data by the defined stand.
	Modify stand. Select a previously defined stand to modify the boundary by adjusting the vertices and/or modifying the stand name.
	View SSURGO soil map units. The map units describe soils and other components that have unique properties, interpretations, and productivity. This soil map data is viewable via the Web Soil Survey.

Once defined, stands will populate the table on the right of the map. Click *Finished Defining Stands* to begin entering management data.

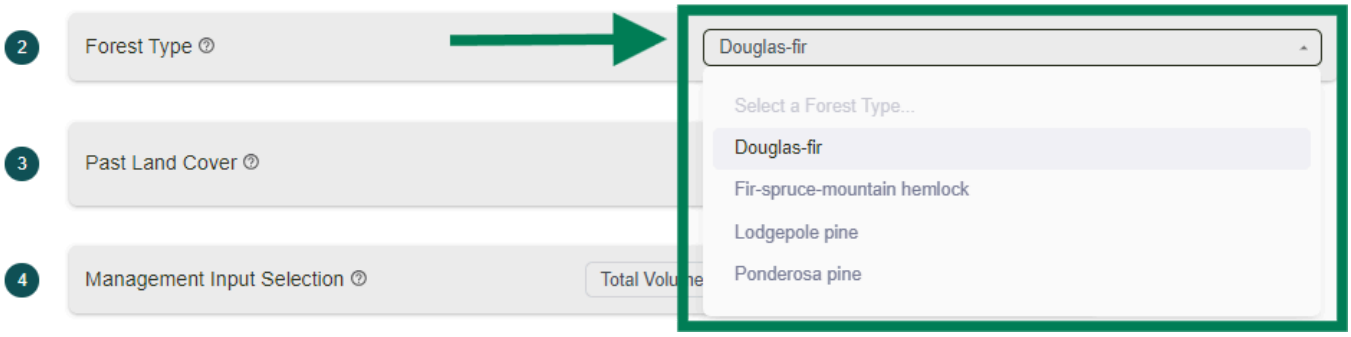


Stand Management

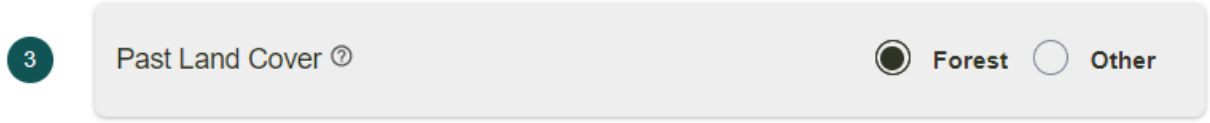
1. Using the dropdown menu or directly selecting a stand location on the small map, select a stand to begin adding management activity data.



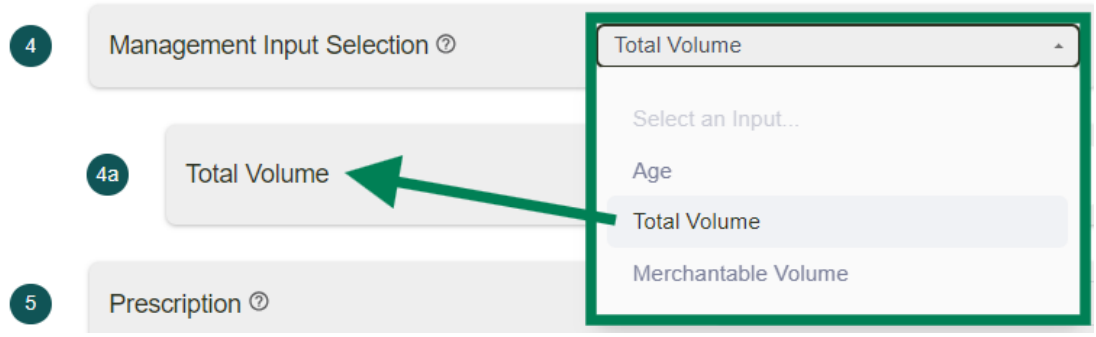
2. Select the Forest Type from the dropdown menu. Available options will vary based on the location of the stand.



3. Use the radio buttons to indicate if the stand's land cover could previously be defined as a 'Forest' or 'Other.'

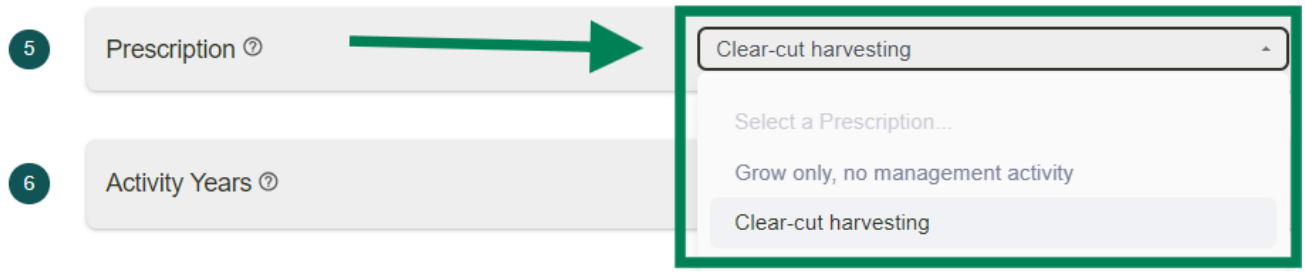


4. Make a selection for what type of management to input. Users can choose to enter data for Age, Total Volume, or Merchantable Volume. This is helpful for users who may not know all of their management information. The selection made here will dictate the date entered in the next step.

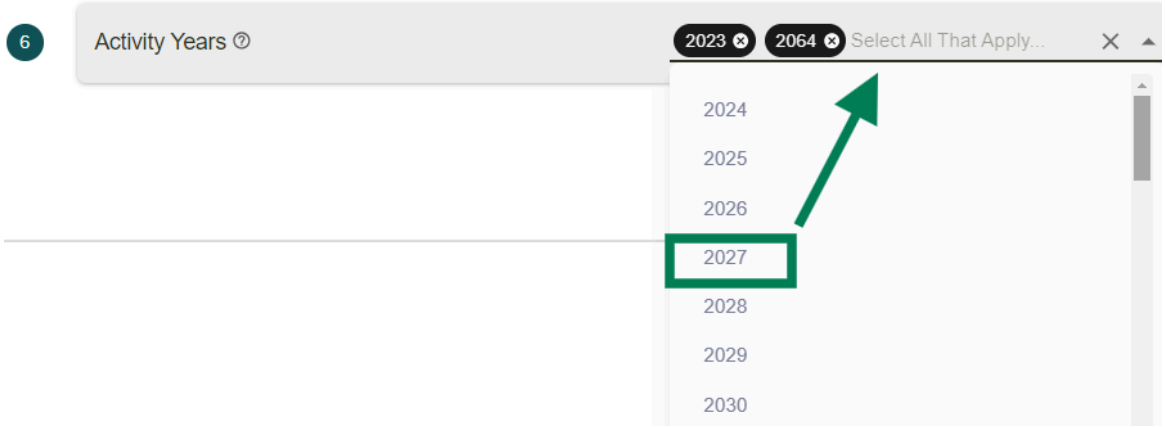


4a. Depending on the previous selection, enter Age (years), Total Volume (m^3/ha), or Merchantable Volume (m^3/ha).

5. Use the dropdown menu to select a prescription applied to the selected stand.



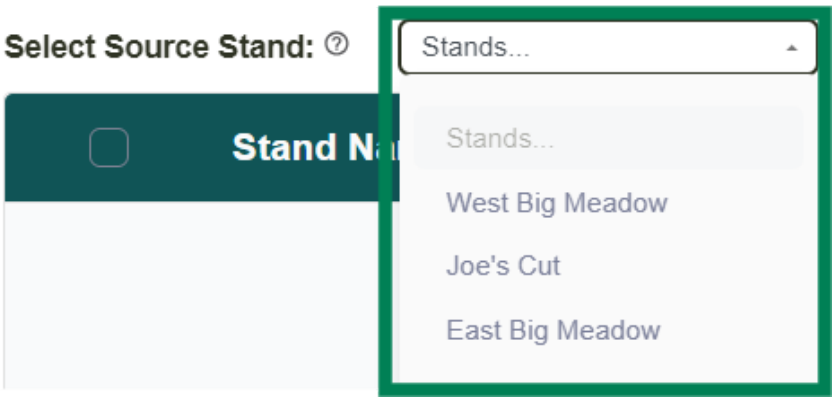
6. Select all Activity Years for which the previously-defined management was applied. Once a year is selected, it will populate above and can be removed by clicking the small X beside it. In the below example, 2023 and 2064 have already been selected as Activity Years.



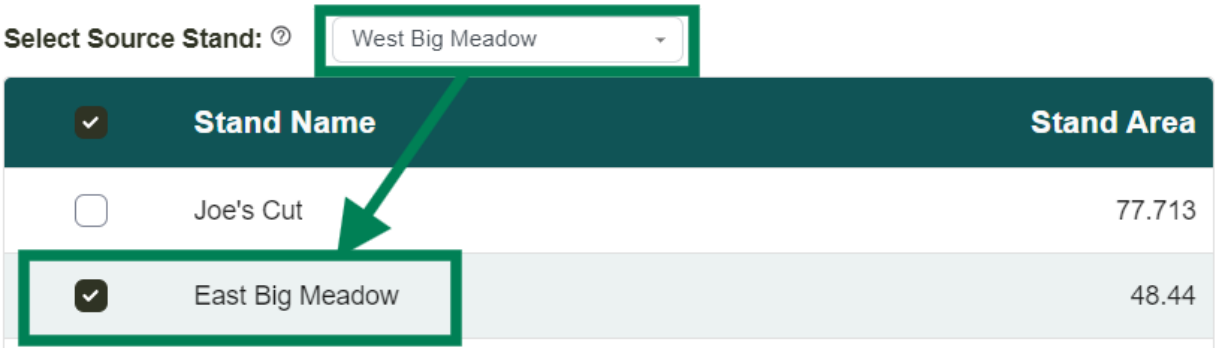
Copying Stand Management

For stands within the same county, management can be copied from one stand to another to minimize the data entry load for those that are managed similarly. Note that copying management will overwrite any existing data and the action cannot be undone.

Begin by clicking the Copy button at the bottom of a stand's management panel. Next, select a Source Stand. Use the dropdown menu to select from the list of stands with complete management details. If no stands are available, then no stands have complete management information to copy.



Once a stand is selected, all other appropriate stands will auto-populate the table below. Using this table, users can select which stand(s) they want the selected stand's management copied to. In the below example, the user has selected for West Big Meadow's management to be copied to East Big Meadow.



Click *Copy* to add management data to the selected stand.

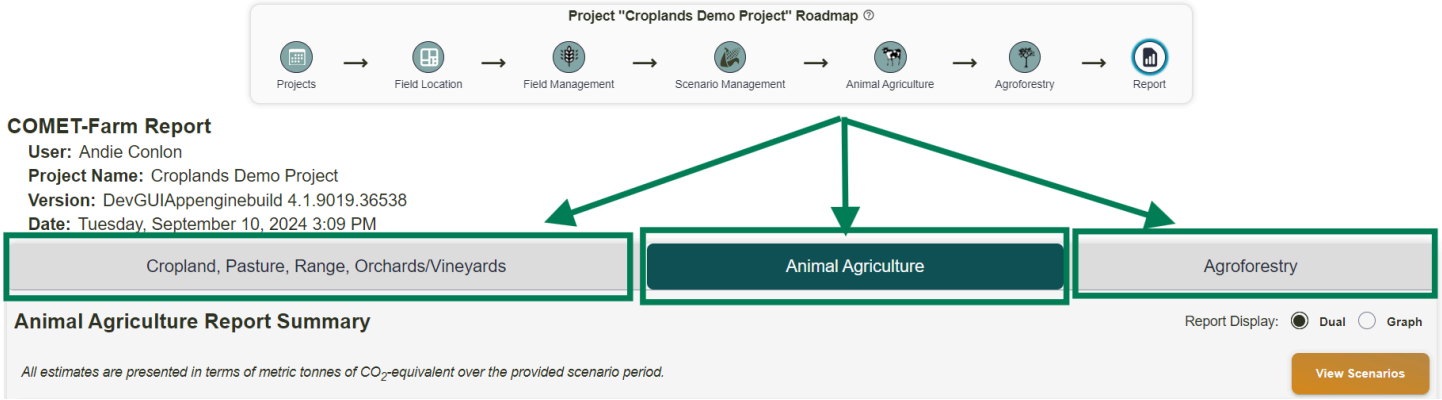
Once all stands have complete management data, click *Continue to Report*.

Reports

Reports Overview

All reported values in COMET-Farm are quantified as metric tonnes of CO2 equivalent, or CO2e. While cropland/pasture/rangeland/orchard/vineyard and animal agriculture reports allow users who have created scenarios to compare changes in their emissions as a result of changes in management practices, agroforestry and forestry reports simply demonstrate the amount of carbon stored over time as a result of selected practices.

Users who have created a multi-accounting project can view one report at a time by selecting the accounting activity from the Reports page header. The header shown in dark blue is the one being displayed below. In the example below, the user has selected to view the Animal Agriculture report (but cropland and agroforestry operations are also included in their project).



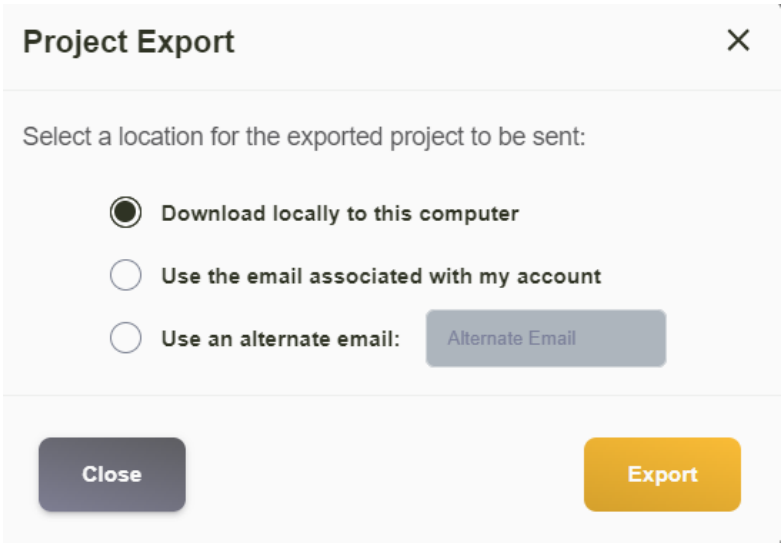
View the following guidance documents for each accounting activity to better understand how to interpret the reports and their values.

Report Options

At the bottom of each report, regardless of which accounting activity was selected, users will see the following options: export project, download report, interpret report, and GHG equivalencies calculator. This section outlines the function of each of these options.

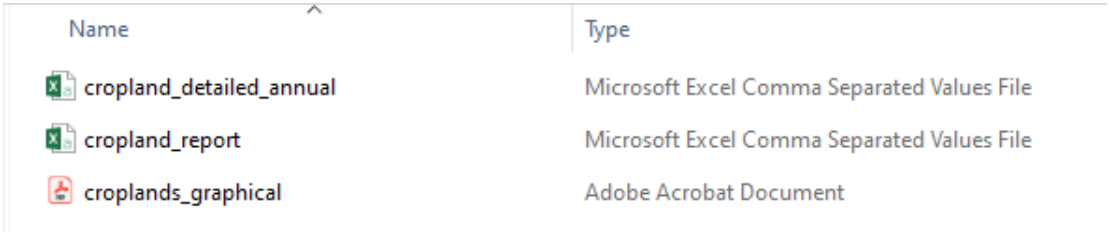
Export Project

Exporting a project allows users to either download or email a project file (.cmt). The .cmt extension references COMET files, however these also function as XML files and can be opened in any text or xml reader. Users will see options to either download the file locally, send the file to the email associated with the COMET-Farm account, or send the file to an alternate email. The emails should arrive within 5 minutes of exporting.



Download Report

When users download their report, a zipped folder is downloaded locally to their computer. This folder, named “COMET-Farm_Project_” with a unique numerical identifier, will include: 1) a .csv file with their report summary (same data as presented on the GUI report), 2) a .csv file with their detailed report including management inputs, and 3) a PDF with their graphical report.



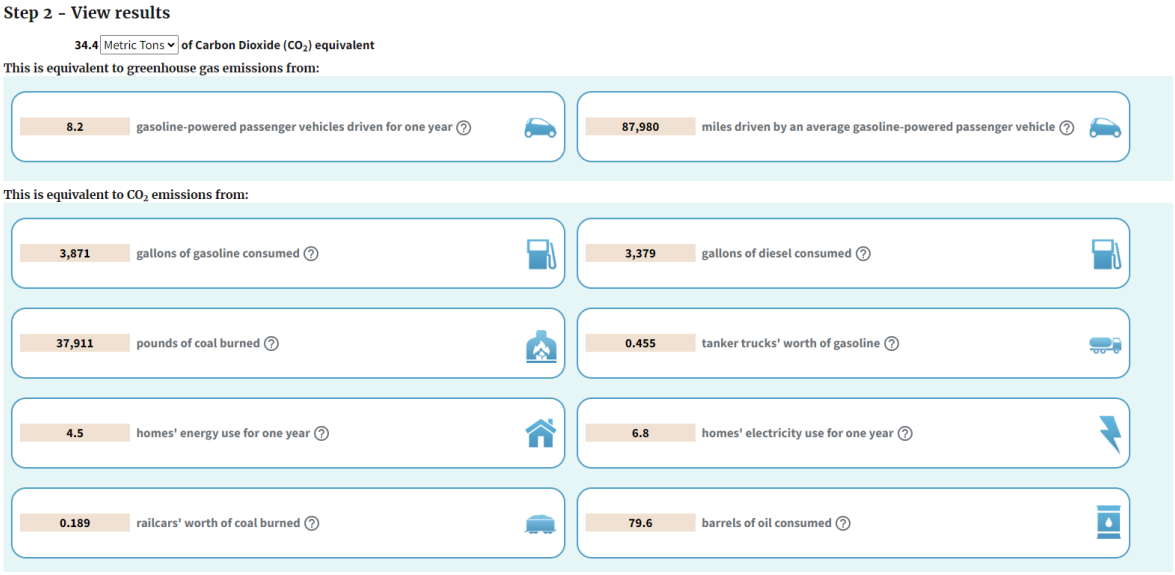
The report summary (“[activity]_report.csv”), as stated, will just include the same emission values reported on the GUI but in a spreadsheet format. The detailed report (“[activity]_detailed_annual.csv”), however, will include all the management inputs entered by the users. This may prove to be useful for reviewing user inputs or troubleshooting unexpected results. Learn how to interpret these detailed reports under each accounting activity listed below.

Interpret Report

By clicking on the Interpret Report button, users can find help documentation to better understand each report. These outline what each value means, how to customize their report display, and how to toggle between fields, stands, or animal categories. Copies of these interpretation guides are also available under each report type listed in the next section.

GHG Equivalencies Calculator

Each report also includes a link to the EPA’s Greenhouse Gas Equivalencies Calculator. This tool allows users to take their reported values from COMET-Farm (in metric tonnes of CO2e) and convert them into real-world, tangible outcomes. For instance, a farm that reduces their GHG emissions by 34.4 metric tonnes of CO2e is the equivalent of removing 8 passenger vehicles from the road for 1 year or conserving 7 homes’ electricity use for 1 year.



Cropland, Pasture, Rangeland, Orchard/Vineyard Report

Interpret Your Cropland Report.pdf

Detailed Report

Cropland Detailed Report Guide.pdf

Animal Agriculture Report

Interpret Your Animal Agriculture Report.pdf

Agroforestry Report

Interpret Your Agroforestry Report.pdf

Forestry Report

Interpret Your Forestry Report.pdf

Other COMET-Tools

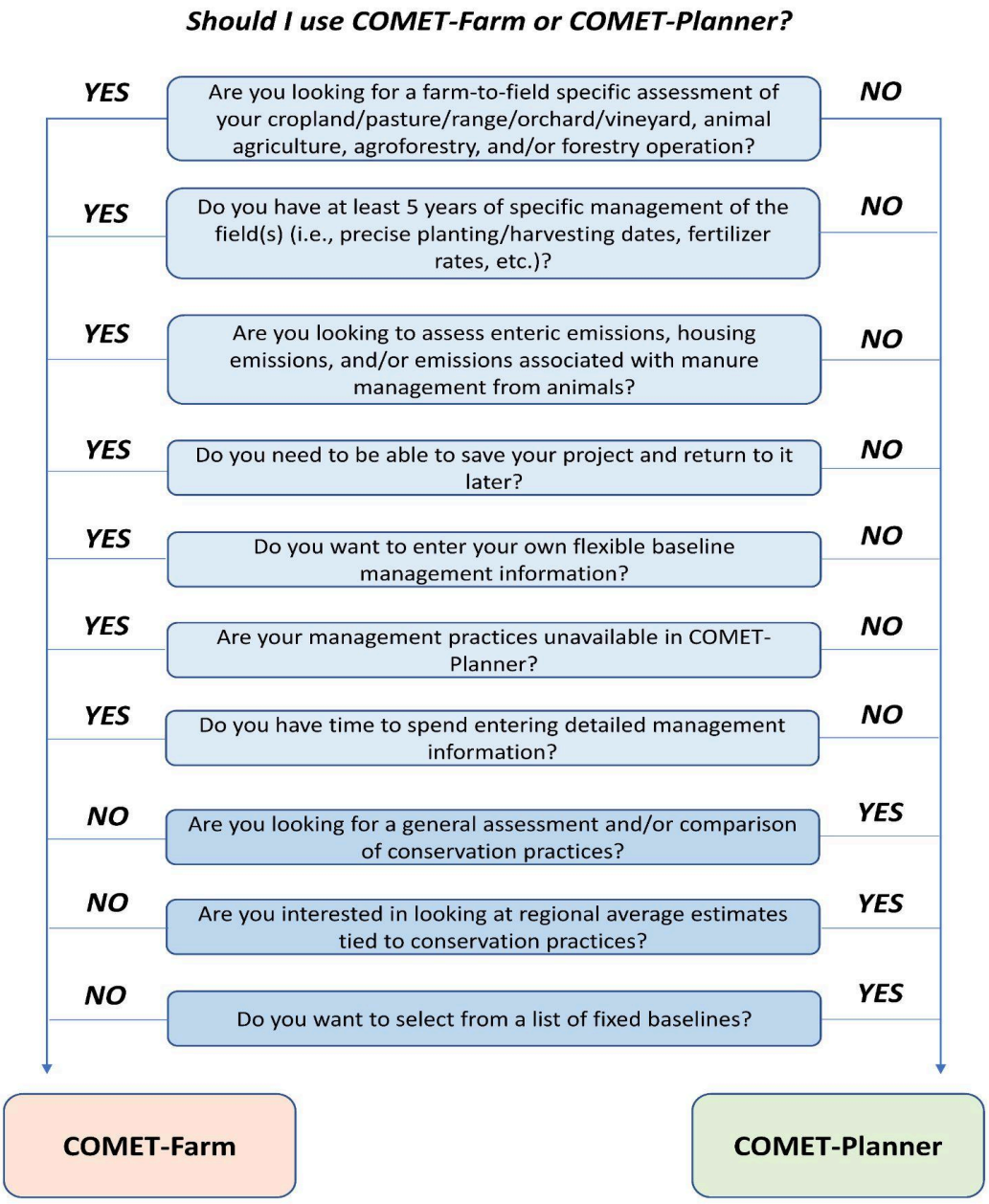
COMET-Planner

Following the launch of COMET-Farm in 2015, COMET-Planner was created as a simpler tool for regional assessments to visualize the general benefits of NRCS conservation practices at the regional scale (by county). Cropland and grassland conservation practices were modeled through the COMET-Farm API, so the same methods, models, soil and weather data is used across the tools. All users need to do is select a state and county, select from a class of conservation practices and fixed baselines, and enter the acreage they wish

to apply said practice to; on the fly, COMET-Planner will provide average regional impacts of conservation practice adoption.

COMET-Planner generates scenario estimates for 34 NRCS conservation practice standards within the contiguous U.S. and limited practices in Alaska and Hawaii. For more information, check out the [COMET-Planner Report].

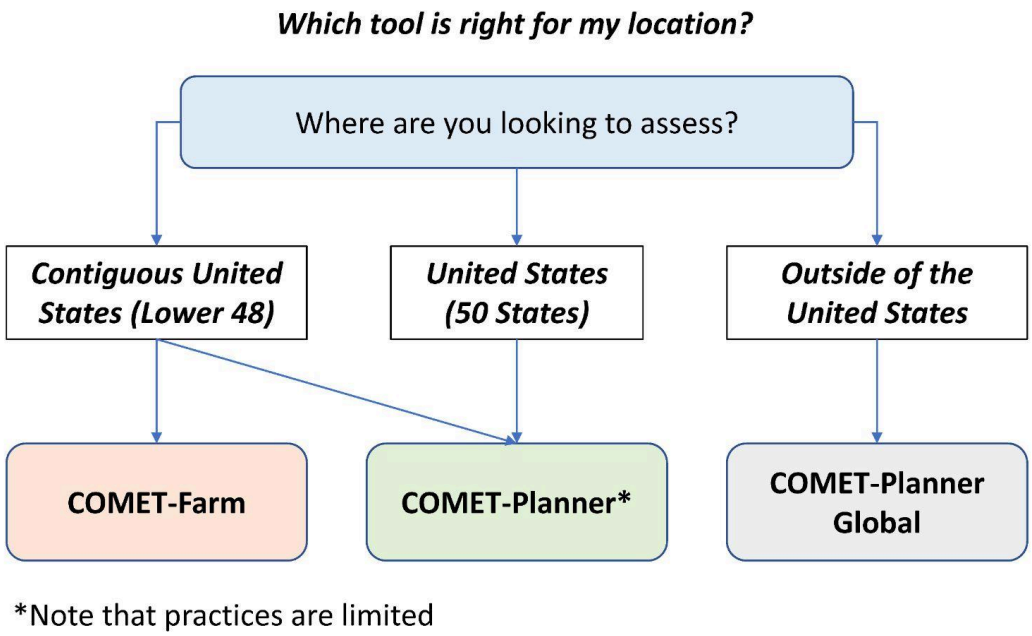
“Should I use COMET-Farm or COMET-Planner?”



COMET-Planner Global

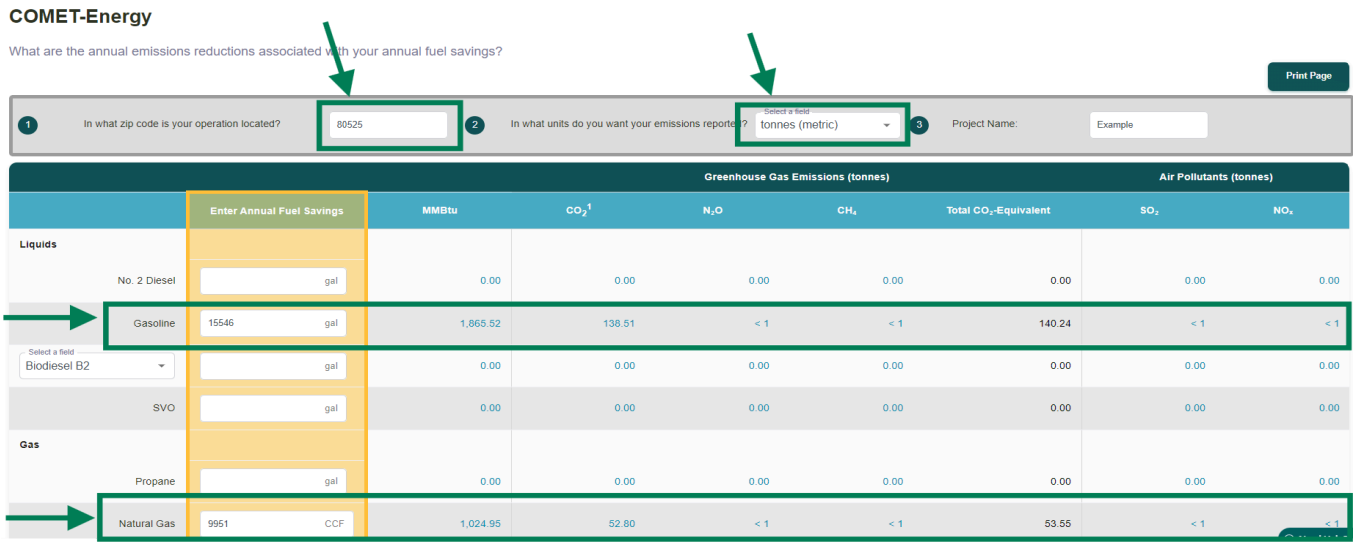
COMET-Planner Global was created as a tool to provide estimates of carbon sequestration and GHG emission reductions for common conservation agriculture practices across the world. Estimates were generated for broad climate and soil categories using UNFCCC Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories. Check out the user guide for help navigating COMET-Planner Global.

"Which tool is right for my location?"



COMET-Energy

Because COMET-Farm is not a lifecycle analysis tool and is unable to account for upstream or downstream emissions such as manufacturing or transportation costs, COMET-Energy can be used in conjunction with COMET-Farm to account for these emissions. Users first enter a zip code and select an emissions unit (tonnes or pounds), and then they can enter their annual fuel savings as liquids, gas, or electricity. On the fly, COMET-Energy will populate the table with conversions to both greenhouse gas emissions (CO2, N2O, and CH4, totaled as MMBtu) and air pollutants (SO2 and NOx). The tool also includes information on how these emissions were calculated and what emission coefficients were used, and users are able to download a printed version of their results.



Appendix

COMET-Farm Crop List

COMET-Farm Crop	Crop Type	Updated from old COMET*
Alfalfa	Annual Crop/Hay/Grass	
Almond	Orchard/Vineyard	
Annual Peanut	Annual Crop/Hay/Grass	
Barley	Annual Crop/Hay/Grass	
Broccoli	Annual Crop/Hay/Grass	✔
Cauliflower	Annual Crop/Hay/Grass	
Clover	Annual Crop/Hay/Grass	
Corn	Annual Crop/Hay/Grass	
Corn Silage	Annual Crop/Hay/Grass	
Cotton	Annual Crop/Hay/Grass	
Dry Field Beans	Annual Crop/Hay/Grass	
Dry Field Pea	Annual Crop/Hay/Grass	
English Walnuts	Orchard/Vineyard	
Fallow	Annual Crop/Hay/Grass	
Grape, Wine	Orchard/Vineyard	✔

Grass	Annual Crop/Hay/Grass	
Grass-Legume Mix	Annual Crop/Hay/Grass	
Lettuce	Annual Crop/Hay/Grass	✔
Millet	Annual Crop/Hay/Grass	
Oats	Annual Crop/Hay/Grass	
Peaches and Nectarines	Orchard/Vineyard	
Potato	Annual Crop/Hay/Grass	
Rice (California)	Annual Crop/Hay/Grass	✔
Rice (South)	Annual Crop/Hay/Grass	✔
Rye	Annual Crop/Hay/Grass	
Sorghum	Annual Crop/Hay/Grass	
Sorghum Silage	Annual Crop/Hay/Grass	
Soybean	Annual Crop/Hay/Grass	
Spring Wheat	Annual Crop/Hay/Grass	
Sugar Beets	Annual Crop/Hay/Grass	
Sunflower	Annual Crop/Hay/Grass	
Switchgrass	Annual Crop/Hay/Grass	
Tomatoes, Processing	Annual Crop/Hay/Grass	
Winter Wheat	Annual Crop/Hay/Grass	
Annual Rye	Cover Crop	
Annual Rye - Legume	Cover Crop	
Annual Rye - Legume - Radish	Cover Crop	
Austrian Winter Pea	Cover Crop	
Cereal Rye	Cover Crop	
Clover	Cover Crop	
Corn	Cover Crop	
Forage Radish	Cover Crop	
Millet	Cover Crop	

Oilseed Radish	Cover Crop	
Sorghum	Cover Crop	
Vetch	Cover Crop	
Winter Grain - Other	Cover Crop	
Winter Wheat	Cover Crop	

Don't see your crop?

COMET-Farm is limited in what crops are available in the dropdown menu based on what crops are or have been parameterized in DayCent.

*Some crops that were available in the old version of COMET-Farm are no longer available due to updates to the USDA methods document. Some of these include:

- Broccoli-Coast and Broccoli-Desert → combined into "Broccoli"
- Carrots → removed
- Lettuce-Head and Lettuce-Romaine → combined into "Lettuce"
- Strawberry → removed
- Tomatoes, Fresh → removed
- Avocados → removed
- Cherries → removed
- Grapefruit → removed
- All wine grapes → combined into "Grape, Wine"
- Lemons and limes → removed
- Olives → removed
- Oranges → removed
- Pistachio → removed
- Tangerines and Mandarins → removed

If a desired crop is unavailable, users may try to find a surrogate that is modeled similarly (e.g., winter wheat as a surrogate for triticale). Some crops are unfortunately just not available for accounting because they are not parameterized nor do they have a surrogate (e.g., onions). The COMET team maintains a "wish list" of crops that users request for inclusion in the tool, so please reach out to appnrel@colostate.edu to request the addition of a parameterized crop.

We cannot currently offer a surrogate for: apples, hemp, herbaceous wetland, hops, zucchini, squash, asparagus, garlic, cantaloupes, honeydew, mint, onions, pears, pumpkins, watermelons, kale, fennel, chard, turnips, spinach, peppers, ginger, bok choi, okra, rutabaga, and collards.

Citations

1. Paustian, K., Easter, M., Brown, K., Chambers, A., Eve, M., Huber, A., Marx, E., Layer, M., Stermer, M., Sutton, B., Swan, A., Toureene, C., Verlayudhan, S. and Williams, S. (2017). Field- and farm-scale assessment

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