



United States Department of Agriculture  
Natural Resources Conservation Service

## CSP Worksheet

### Air Quality Enhancement Activities: Carbon Sequestration Scenario Examination

**EAM40** Investigate various Greenhouse Gas (GHG)/Carbon sequestration scenarios by utilizing the Carbon Management Evaluation Tool for Voluntary Reporting (COMET-VR) online web tool. Producers will use COMET-VR to examine how land use management decisions result in consequent changes in carbon sequestration. Producers will receive a one-time incentive/enhancement payment of \$500 for their utilization of COMET-VR for carbon storage scenario examination under the NRCS Conservation Security Program (CSP). They will choose from relevant choices in land management options and conservation practices available for their land in COMET-VR.

#### Participation Guidelines:

The COMET-VR tool is a self taught, on-line web application and all documentation requirements are available at:

<http://www.cometvr.colostate.edu/>

A guide to using COMET-VR is attached with this document.

Participants shall run the COMET-VR tool using their current management(s) throughout the reporting period (future 10 years), and also make a minimum of three runs of COMET-VR using different management and conservation scenarios.

#### Documentation Required from Approved CSP Participants:

Use of the COMET-VR tool is documented by providing printouts of the results page, and filling out the following form to show how soil carbon changes with changes in crop rotations and tillage intensities. Please note: if printing directly from the output screen in COMET-VR, set your browser page margins to "0" to ensure the entire page will print to paper. Further instructions are available below under "**Printing**".

**Producer Name:**

**Address:**

**Describe the current management options on the land on which you plan to use COMET-VR to estimate current carbon trends. Include crop types (for example, corn, wheat, orchards, vineyards, vegetables, etc.) or grazing scenarios, tillage and planting methods, and acres for each management. This is called Base (Current Management) in step 5 of COMET-VR**

**Describe your planned changes in management (changes in tillage intensity, crop types, grazing scenarios, rotations) on which you plan to use COMET-VR to estimate changes in carbon trends. Include crop types (for example, corn, wheat, orchards, vineyards, vegetables, etc.) or grazing scenarios, tillage and planting methods, and acres for each rotation. This is called 2006 Report Period in step 5 of COMET-VR:**

**Please fill out the form on the next page, attach a printout of the carbon storage report for each of the current and planned managements identified above, and return this information sheet to your verifier.**

Projected Management for Reporting Period (next 10 years):	Number of acres:	Tons of carbon (in CO2 Equivalents) per year:	Change in tons of carbon (in CO2 equivalents) compared to maintaining current management:

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## **The Carbon Management Evaluation Tool (COMET-VR) is a New Tool to help Farmers and Ranchers Estimate Soil Carbon Sequestration**

An online management tool called COMET-VR provides a simple and reliable method for estimating soil carbon sequestration. Storing, or “sequestering,” carbon in soil as organic matter and in trees helps reduce the amount of carbon dioxide in the atmosphere. The concept of carbon sinks is based on the natural ability of trees, other plants and the soil to remove carbon dioxide from the atmosphere and store the carbon in wood, roots, leaves and the soil. COMET-VR delivers an estimate of annual soil carbon fluxes along with fuel and fertilizer use. This tool can aide a producer in making their management decisions. Producers insert their current and alternative farming and grazing practices into COMET-VR, which then estimates changes in fuel use, fertilizer and carbon storage from each alternative.

Farmers using no-till or conservation tillage and ranchers using grazing management practices provide a sink for carbon benefiting their farms and ranches and the environment. COMET-VR allows them to document their carbon changes and provides each individual the ability to evaluate their management and its impact on soil carbon. Each individual can also participate in the voluntary emission reduction registration program under section 1605(b) of the 1992 Energy Policy Act. USDA prepared the new accounting rules in the guidelines that will be used to estimate greenhouse gas emissions and carbon sequestration from forestry and agricultural activities and COMET-VR is one of the accepted methods to calculate carbon sequestration in agriculture systems.

COMET-VR is a web based interface that interrogates the user by asking a series of questions which usually takes less than 5 minutes. These questions are specifically about location, parcel extent, soil texture/hydric, cropping or grazing rotations and tillage. Once selected, the user then clicks on the ‘Get Carbon’ button and the results are provided within a few seconds. Detailed help instructions are available within the interface for each item as a user moves through the selection process. To start COMET-VR, go to the following web address, click on the COMET-VR button and let the system ask you questions.

<http://cometvr.colostate.edu/>.

### **COMET-VR Disclaimer**

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## **Users Guide for COMET-VR**

### **Introduction**

The Voluntary Reporting of Greenhouse Gases-CarbOn Management Evaluation Tool (COMET-VR) tool is a decision support tool for agricultural producers, land managers, soil scientists and other agricultural interests. COMET-VR provides an interface to a database containing land use data and calculates in real time the annual carbon flux using a dynamic Century model simulation. Users of COMET-VR specify a history of agricultural management practices on one or more parcels of land. The results are presented as ten year averages of soil carbon sequestration or emissions with associated statistical uncertainty values. Estimates can be used to construct a soil carbon inventory for the 1605(b) program.

### **Getting Started**

Before using COMET-VR, divide your land into parcels. A parcel is an area of land that has uniform soils and common historical and present day land management. You will need the following information about each parcel:

- The location (i.e., state and county where the parcel is located)
- The area in English or Metric units
- The soil surface texture and hydric condition
- The management history for four time periods

Start COMET-VR by clicking on the button "**COMET-VR Tool**" at the top of this WEB page. When you click on this button you will be asked a series of questions on seven input screens. Enter the requested information by typing in the form boxes, by clicking on the selection lists or by clicking on the appropriate buttons. Once all the information is entered for a screen, submit your information by clicking on the "next" button at the bottom of the page. Be sure to review the gray selection box on the right of the page as you enter information. Your inputs are summarized in the selection box. You can get help on any question by clicking on the ? button.

### **Selecting the State**

The first page of COMET-VR asks you to select the State in which your parcel is located. The state is used to determine which county your parcel is located in.

*Using the State list select a State and click the "next" button.*

### **Selecting the County**

The State and County are used to determine which MLRA (Major Land Resource Area) contains your parcel. The MLRA, in turn, determines the set of climate and land use information appropriate for your area. If your parcel is in more than one county/state, we recommend you produce reports for each parcel area separately, using the approximate area in each county/state.

*Using the County list select a County and click the "next" button.*

### **Selecting the Parcel Name**

Enter a parcel name that will appear on your report (optional). A name allows you to associate your report with a particular parcel. This is helpful if you are producing

estimates for multiple parcels by running multiple reports. The default parcel name is "parcel 1".

### ***Selecting the Units***

Select either English or Metric units. English units include acres, gallons, and tons. Metric units include hectares, liters, and tonnes. This is a required item. The default units are "English".

### ***Entering the Reporting Date***

The reporting year is the year for which you are reporting. Valid values range from 2000 through the current year. This year may be referred to as the Report Period in the management rotations and the report pages.

Enter the date in the following format: "Month/Day/Year". For example, 6/1/2004. This is a required item. The default date is "the current date".

### ***Selecting the Size***

Specify the size of your parcel, in the units you selected previously. The parcel size is used to calculate the change in the total amount of carbon stored within the soil of the parcel. This is a required item. The default parcel size is "1 acre (or 1 hectare if Metric units)".

*Click the "next" button and you will be taken to the "soils" screen.*

### **Selecting the Soil**

Specify the average or dominant soil texture in your parcel. Most soil types vary within their texture category, so you should specify the soil texture that best describes the soil in your parcel. The texture specified is for the top 7 inches (20 centimeters) of soil. If your parcel has two or more widely differing soil types like clay soil and sandy soil, we recommend you produce reports for each soil type separately, using the approximate area of each type as the parcel area.

This is a required item. The default surface texture is "Clay Loam".

The soil texture names used in the interface follow the standard soil textures used by the U.S. Dept. of Agriculture (USDA). For more details, see the texture triangle in the Soil Science Society of America Glossary. The following table shows the average sand, silt, and clay fractions for each soil texture.

Soil Texture Table

Soil Texture	Sand	Silt	Clay	Soils Included in Texture Category
clay loam	28%	41%	31%	clay loam
loam	40%	41%	19%	Loam
loamy sand	81%	14%	5%	fine sand, loamy coarse sand, loamy fine sand, loamy very fine sand, sand
sandy loam	61%	27%	12%	fine sandy loam, very fine sandy loam, coarse sandy loam, sandy clay loam

silty clay loam	7%	60%	33%	silty clay, clay
silt loam	12%	68%	20%	silt loam

**Select the hydric type of the surface soil in your parcel.**

This is a required item. The default hydric type is "No".

A hydric soil develops under moderate to poor drainage conditions. Soils that were frequently ponded or saturated from flooding during a significant portion of the year are most often classified as "hydric" soils. This means that some or all of the surface soil was anaerobic (i.e., oxygen is virtually absent from the soil) for some portion of the year. If the surface soil in your parcel has been tile drained, consider it to be hydric. To learn more about the technical criteria for determining a hydric soil, see the following information from the U.S. Dept. of Agriculture: Hydric Soils.

*Click the next button and you will be taken to the "Rotation History" screen.*

**Selecting the Rotation History**

Under the management history, specify the general cropping history for your parcel by selecting the rotation that comes closest to describing your management practice. Select crop rotations by clicking on the appropriate rotation from the selection list under the category "Choose Rotation" for each of the four time periods:

- Landscape Position and Historical Management,
- 1970's through mid-1990's,
- Base or Current Management, and
- Report Period Management.

If more than one rotation was grown during this time, select the system that was used for the longest time during that period.

Landscape position and historical management refers to either the landscape position (upland vs. lowland) or other long-term management practices for the parcel prior to the mid-1970's.

- Upland parcels are located on hill slopes or other lands above valley floors, and were generally cropped as continuous annual grains, cotton, or other crops.
- Lowland parcels are located in valley floors and were generally cropped as continuous annual grains, cotton, or other crops.
- Irrigated parcels are in upland or lowland areas that came under irrigation some time prior to the 1970's, and were generally cropped as high-value cash crops.
- Livestock Grazing refers to parcels that were grazed more or less continuously since settlement to the mid 1970's.

1970's through mid-1990's refers to the cropping rotation that most accurately describes the cropping or grazing system used on the parcel from the mid 1970's to the mid 1990's. If the parcel was enrolled in CRP after 1985 then select the appropriate CRP type from the list. The default CRP type is "None".

Base (Current management) refers to the cropping rotation that most accurately describes the cropping or grazing system used on the parcel over approximately the last decade.

Management over report period (next decade) refers to the crop rotation or grazing system that you either use or are considering using on the parcel for the reporting period (the next decade).

The four management histories are a required item.

*Click the "Next" button and you will be taken to the "Tillage" Input Page.*

### **Selecting the Tillage**

You can choose from the following tillage types (not all types may be available for the selected rotation):

- Intensive tillage: defined as multiple tillage operations and/or plowing every year. This type of tillage would result in <15% residue cover at planting.
- Moderate tillage: defined as 1-2 tillage operations each year with no occurrence of plowing or multiple tillage operations in one year and no tillage in the second year of a corn-soybean rotation. This type of tillage would result in 15-30% residue cover at planting.
- No tillage: defined as planting and injection of fertilizer as the only soil disturbance in the rotation or the use of strip tillage where only the surface area being planted is disturbed. This type of tillage would result in >30% residue cover at planting.

Specify the tillage for three time periods: 1970's through mid-1990's; tillage during Base period (current management); Tillage over report period (next decade). For a discussion on the time periods, refer to "Selecting the Rotation History".

If more than one tillage system was practiced during this time, select the system that was used for the longest time during that period.

Tillage over report period (next decade) refers to the tillage system which you either plan to use or are considering using on the parcel for the reporting period (the next decade).

The tillage management is used to calculate the change in the total amount of carbon stored within the soil of the parcel.

The three tillage management periods are a required item.

*Click the "Next" button and you will be taken to the "Submit Page".*

### **Running the Report**

Once all the user inputs are collected the carbon values are calculated dynamically by clicking on the "**Get Carbon**" button. When you click on this button you will be sending your information to the Century program to compute the predicted change in soil carbon for the parcel. This is a complex calculation and may take a few seconds. Before running the report, you are advised to verify the information you entered.

## Correcting the Report

The interface was developed to make it easy for the user to correct any input problems. If a problem is detected, it can easily be corrected by using the navigation links at the top of the interface page to jump back to the section needing correction.

For example, if the acreage/hectare value for your parcel is incorrect, just click on the link "Parcel". Then input the correct value and click on the next button at the bottom of the screen. Then review the Selection box to the right of the screen. The value should be corrected.

## Carbon Report

The Carbon Storage Report describes the change in soil organic carbon stocks over the report period (the next decade). This prediction is based upon the climate, soil type, and past and current management histories which you provided on the COMET-VR data collection screens. The table has three parts:

*Summary of the site location, description, and site history:* The average annual change in the amount of soil carbon stored on the parcel over the report period. This value is provided in units of soil carbon, and as CO<sub>2</sub> equivalent. The uncertainty is the percent uncertainty in the average annual change in soil carbon stocks and the associated CO<sub>2</sub> flux.

*Predicted results:* Predicted results are presented as ten year averages of potential soil carbon sequestration or emission with associated statistical uncertainty values for the 1605(B) reporting period, starting in the year following the current year and extending for one decade. One ton/tonne of carbon is equivalent to 3.67 ton/tonnes of carbon dioxide.

*The uncertainty calculation:* The uncertainty calculation is a percent value that indicates the reliability of the modeled carbon change estimate. Uncertainties are calculated using an empirically-based approach, in which model results are compared to field data. Differences between model output and field measurements were statistically analyzed using linear-mixed effect models. Uncertainty was applied to the carbon values based on the predictions from the statistical models and these estimates varied by management system and Land Resource Region (LRR).

A value of 0% indicates a perfect model fit, but this rarely occurs. As the percentage value increases more error is associated with the modeled carbon value. The uncertainty designates a range around the estimate defined by +/- the percentage of the value, within which the true value is likely to occur with 95% confidence.

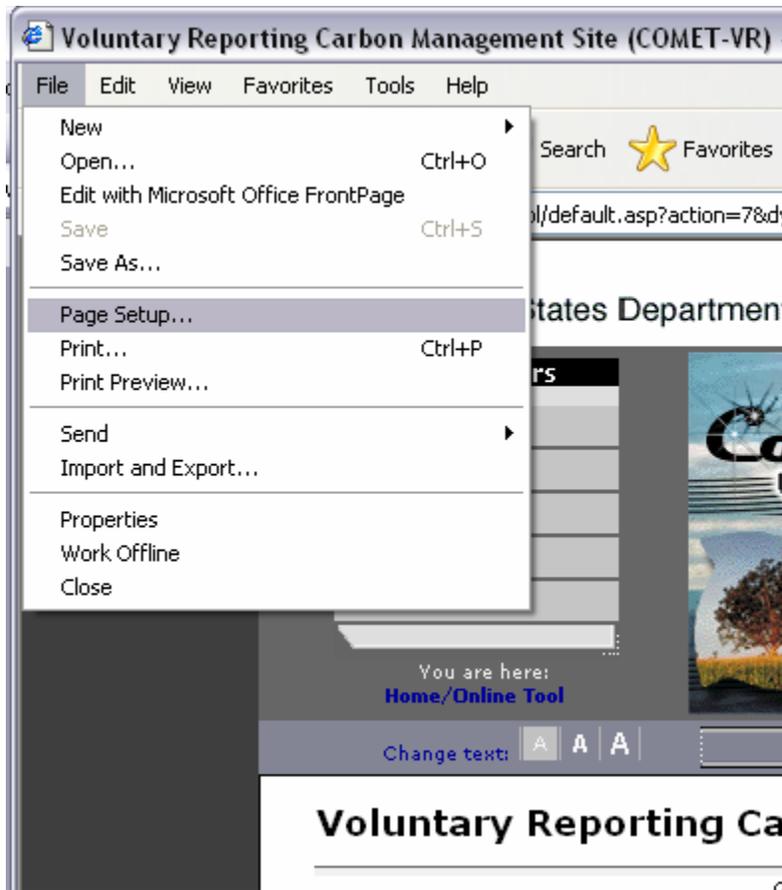
If the Summary Screen returns the following message highlighted in red "**The value "-9999.00" indicates that COMET-VR is unable to determine an uncertainty value for the management options selected**", COMET-VR is unable to calculate an uncertainty value which indicates there are insufficient field measurements to address uncertainty for your parcel based upon the location, soil type,

and the management information which you provided on the COMET-VR data entry screens.

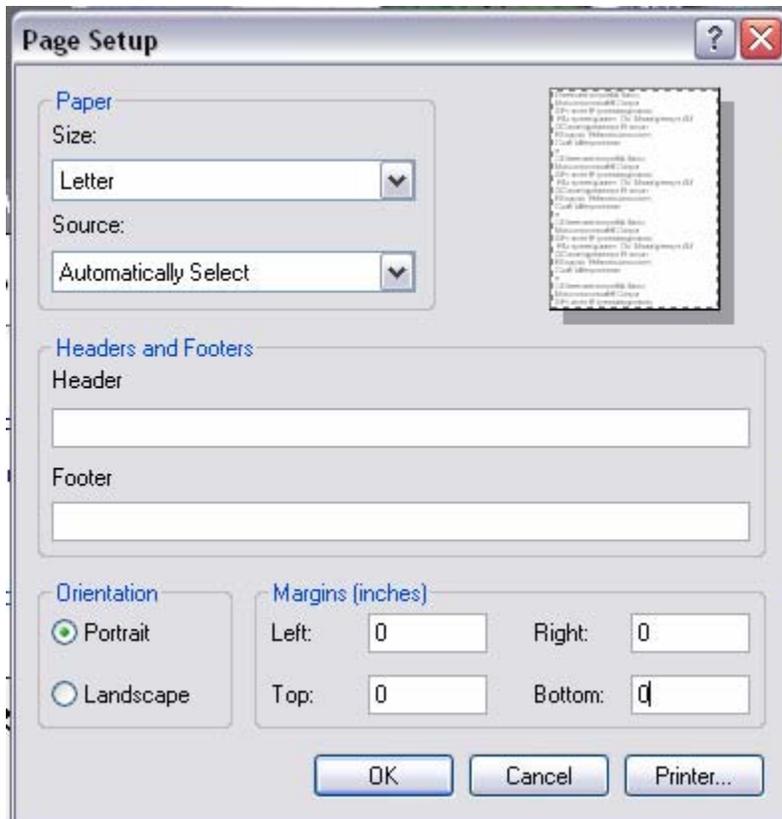
### Printing

If you wish to print this screen as part of your documentation, you need to set your internet browser page settings to ensure that the entire page will fit on an 8.5x11 inch paper. Follow these instructions to make these changes:

At the top of your browser, click on **File**, and then **Page Setup...**



In the Page Setup dialogue box, set all margins to "0" as shown in the figure below. This should ensure that all of the carbon storage report is contained on one page when printed out.



Please note: you can also choose to print out a text file which also contains the carbon storage information. To do this, follow the instructions under the “**Create an ASCII File**” heading below.

*Click the Next button and you will be taken to the "Fuel and Fertilizer" page.*

### **Fuel and Fertilizer Report**

The Fuel and Fertilizer Contribution Report describes the contribution of fuel use and fertilizer additions to the predicted soil carbon storage. The table has three parts:

*Summary of the parcel's location, soil, and management information:*

Fuel and nitrogen use calculated from the database, based upon the location, soil type, and the management information which you provided on the COMET-VR data entry screens.

*Actual fuel and fertilizer use:* If you wish to report actual changes in inputs for this parcel, enter only those values applicable for your parcel.

The fuel and nitrogen use is based upon the location, soil type, and the management information which you provided on the COMET-VR data input screens.

Fuel and fertilizer use constitute greenhouse gas emission sources. These emissions are affected by production practices such as irrigation, and the type and method of fertilizer and manure application. The adoption of better nutrient management and water management practices can reduce the emissions of greenhouse gases.

Fuel and fertilizer values from the database were obtained from USDA National Agricultural Statistics Service (NASS), the Carbon Sequestration Rural Appraisal (CSRA), and from other related datasets. The CSRA appraisal was conducted by NRCS from 2002 to 2004.

If actual records are available, the user can input the information into the appropriate boxes. Indicate by year the quantity of fuel/fertilizer used for the Base (Current management) and Report Period. Be sure to specify the units you are using to report this quantity. If your management achieves a reduction through the use of an alternative fuel, indicate the quantity and type of alternative fuel consumed.

*Click on the text next to the fuel/fertilizer category to change the units of the category.*

### **Create an ASCII File**

Click the button "Write File" at the bottom of the Fuel and Fertilizer page to create a report formatted as ASCII text. The report can then be printed to paper, or saved to your computer's hard disk and EMAILED to certify your parcel's Carbon Storage potential.

To save the file to your hard disk - right click on the link.

To view the saved output - left click on the link or click the "File" link at the top of the page. After viewing the file use your browsers "back button" to return to the COMET-VR Tool.

The "Write File" utility will produce a report similar to the following depending on the options input:

### **EMAIL the Report**

The EMAIL screen has two required fields: name and email address.

Enter the name of the parcel owner. For example: John N. Smith. The parcel owner name is only used to verify this information in the EMAIL message and is not stored in a database.

Enter the email address of the parcel owner. An example of the format of a valid email address is: name@address.com.

There must be a "@", and a "." character in the address. The name must be at least 7 characters long. If you want a copy of the email message, be sure to click the CC box.

*Click on the Next button to send the email.*

## **System Requirements for COMET-VR**

### **About the Dynamic Web Interface**

COMET-VR is a highly optimized, multi process, web interface developed using Microsoft VBScript, Microsoft SQL Server, PERL, PHP, Microsoft IIS and the Century Soil Organic Model executable.

The web interface collects the user's information and builds the required history details from the SQL database. This information is sent by the IIS WEB server via an APACHE WEB server to the Century Run Controller. The controller builds each user's unique history, then calls the Century executable to calculate the carbon changes and estimates the associated uncertainty.

The carbon numbers and uncertainty are returned to the comet database where the interface extracts the appropriate fuel carbon depending on the management information and returns the user results in the form of two tables. The entire process typically takes just 2-4 seconds to create a fully personalized report.

How it works!

The web interface is built in Microsoft VBScript. It uses an xml HTTP object to initiate contact and pass the user defined arguments to a PHP page running on an external APACHE server. The PHP page contacts the Dynamic Century program UNIX Run Controller running on an external LINUX CP using UDP packets and returns an information string back to the Microsoft VBScript program. This returned information is then processed and returned to the user.

### **Computer requirements**

The COMET-VR tool looks best using browsers that support the Document Object Model (DOM) Level 2 HTML specification like Microsoft IE 6.0 or Netscape 7.1. This tool requires that JavaScript be enabled. The font selection buttons located at the top of the page use cookies to store your preferred font setting.

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