Nitrogen Index 4.4
User Manual

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i. General Introduction

The following pages explain how to use Nitrogen Index 4.4. Both the N and P indices are included in this Index; however, as of this writing the P-Index is still in development and is not yet functional.

Nitrogen Index 4.4 is written in the programming language Java and includes the N index for California, Mexico and the Caribbean. These indices were originally developed as separate software programs that work within Microsoft Excel® 2003. All three indices are now available in Nitrogen Index 4.4 in both English and Spanish versions. This version also includes two choices for measurement units: English and metric. Additionally, the Nitrogen Index and Sustainability Index have been developed for Bolivia and Ecuador.

For related information not included in this manual, as well as additional applications for the N Index, please review Delgado et al. (2006 and 2008), De Paz et al. (2009), and Figueroa et al. (2011). For additional information about the N Index, please review Shaffer and Delgado (2002), Delgado et al. (2006 and 2008) and other selected references listed at the end of this manual. This tool is designed to help nutrient managers quickly assess N loss risk related to agricultural N management. For detailed descriptions of the advantages and disadvantages of previous indices, please review Shaffer and Delgado (2002). This manual will use an example scenario to demonstrate how to use the N Index. A more advanced version of the Index that integrates the N and P indices with GIS databases is currently in development.

Note: *Nitrogen Index 4.4 User Manual* is a revision of the user manual titled, *California Nitrogen Index* by Delgado et. al (2009). This manual includes previous material from the Delgado et. al (2009) *California Nitrogen Index* manual and data from the Delgado et. al (2009) Mexico N Index. This manual has been revised to account for differences in the graphical user interface between the California Nitrogen Index and Nitrogen Index 4.4, as well as the inclusion of the N indices for the Caribbean, Mexico, Ecuador, and Bolivia.

Note: The Nitrogen Index 4.4 requires the user to install the latest version of Java, which is provided by Sun Microsystems at the following link: http://www.java.com/en/download/. Java is provided as a free download.

We look forward to hearing your comments, feedback, questions, and suggestions for improvements, which can be directed to:

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ii. Nitrogen: Essential for Agricultural Systems Worldwide

Agricultural systems are necessary to produce food, biofuels, and other products for the continuously growing world population. Maximization of agricultural production has long been important in order to meet demands for food and fiber, but is now also important to meet the emerging demands for biofuel energy. Since most agricultural systems are nitrogen (N) deficient, N management will always be key for maximizing yields, especially under irrigated systems and high biomass-producing bioenergy systems. However, higher than necessary N inputs contribute to increases in reactive N losses that can impact groundwater, surface water, and air quality. These unnecessarily high N inputs can also increase the emissions of trace gases that contribute to global warming. There are increasing concerns about water demands, water quality, climate change, and the relative impacts of these conditions on food production security. Management of N will be important on local, regional, and global scales since it has been so widely demonstrated that N management plays an important role in our biosphere's conservation.

Nutrient managers, conservationists, and other professional field personnel have traditionally been interested in quick and easy ways to assess environmental impacts likely to result from different N management practices (**Fig. 1**). Shaffer and Delgado (2002) presented the framework for a Tier One approach to nitrogen management (**Fig. 2**). This approach uses simple assessment tools to

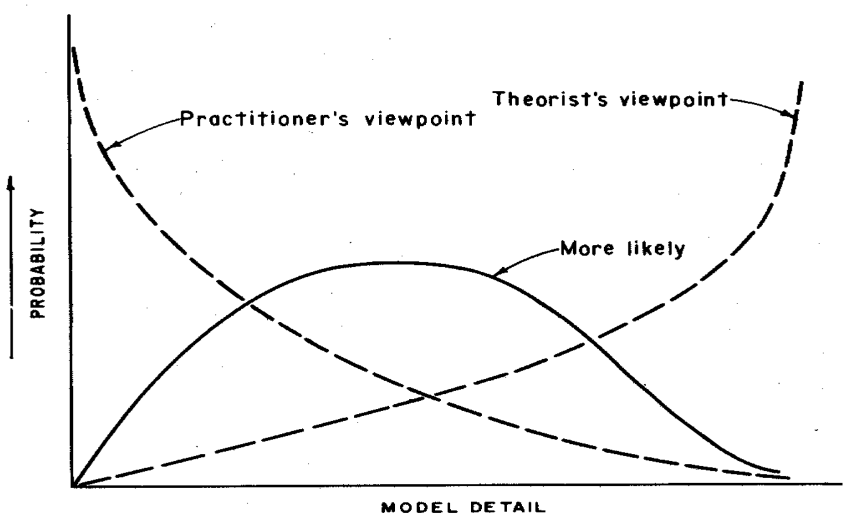

Figure 1. *Probability of selecting the best tool for a project (From Shaffer and Delgado, 2001).*

quickly separate scenarios with N loss risk rankings of very low to medium from those systems with high or very high risk rankings. On a Tier One level, conservationists and nutrient managers can rapidly conduct initial qualitative/quantitative screenings to separate the effects of best management practices from those of given baseline practices, such as conventional management. A new Tier One N Index tool was developed to quickly assess a management scenario's potential for N losses (Delgado et al., 2006, 2008a). Researchers and theorists have traditionally been more interested in more complicated analysis tools with greater degrees of detail (**Fig. 1**). As the tier level increases to Tier Two and Tier Three, the complexity of the tool and the need for more input information also increase.

A Tier Two tool requires daily computation of nitrogen dynamics and integration of daily weather and management events to assess nitrogen management. A Tier Three tool needs very detailed information with supportive field studies to provide soil and plant samples.

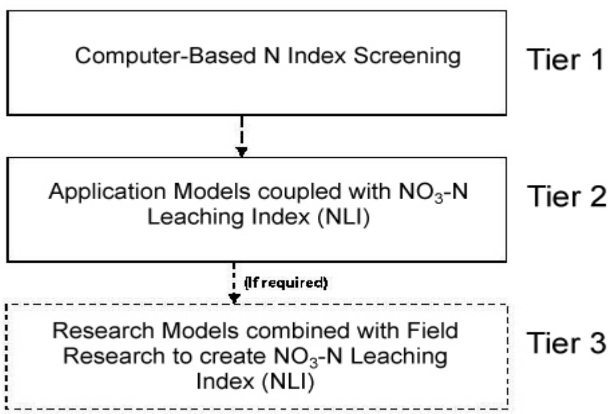

Figure 2. *Tier structure for N Index analysis (From Shaffer and Delgado, 2002).*

iii. Examples Covered in this Manual

The Nitrogen Index 4.4 User Manual is designed to help you become accustomed to the software environment in which the N Index runs. This manual will use an English unit example scenario for California to demonstrate how to use the N Index to assess nitrogen losses. The objective of this theoretical example is to guide you toward other potential applications of the N Index. This manual walks you through N management for a California forage system receiving manure applications. Although not discussed in the instructional portion of this manual, Nitrogen Index 4.4 also provides six English units scenarios for this cropping system that consist of very high, high and low manure inputs for irrigated forage systems grown on both clay and sandy soils: (3 management scenarios) X (2 soil types) = (6 forage system scenarios).

Nitrogen Index 4.4 also includes English and metric examples for a California irrigated vegetable system. The four provided scenarios for this cropping system are back-to-back lettuce with and without cover crops grown on both clay and sandy soils: (2 management scenarios) X (2 soil types) = (4 vegetable scenarios).

In addition to these examples, Nitrogen Index 4.4 also includes six English unit example files from Mexico, two English and metric files from the Caribbean, and four English and metric examples from Bolivia. Like the other five California examples, these examples are not discussed in the instructional portion of this manual, but have been provided within the software.

Forage Systems - Assessment of Risk as a Function of Liquid Manure Inputs

There are an infinite number of possible data combinations that can be used to assess liquid manure inputs. However, to assess the nitrogen loss risk from liquid manure N inputs, we will set up a series of assumptions and conduct a simplified case evaluation to assess liquid manure N input effects on a forage corn system that can be compared to other included example scenarios, including both sandy and clay soils. You can then develop your own set of assumptions using site-specific input values to conduct N loss risk assessment of manure (liquid or dry) and/or chemical fertilizer management practices.

The assumptions presented in the training example are used simply to assess the N loss risk from liquid N manure inputs while introducing you to N Index functionality. Note: It is true that a scenario with zero initial soil N, zero mineralization from soil organic matter and zero crop residue is not realistic; however, these assumptions have been set to simplify the training example. Please assume in the forage system scenarios that the only N inputs are from liquid manure.

Assumptions:

1- The forage yield for the clay soil system is 15% higher than for the sandy soil.

2- The liquid manure N input ranges were set at:
   a. **Very High** (1500 lbs N $acre^{-1}$)
   b. **High** (1000 lbs N $acre^{-1}$)
   c. **Low** (640 lbs N $acre^{-1}$)

3- The rate of N mineralization per year from the organic N added as liquid manure is 100%. In other words, we assume that manure N inputs are in steady state and that the applied manure N will be 100% available to the crops.

4- Liquid forage manure systems receive manure applications every year.

5- Zero N input from:
   a. Soil organic matter
   b. Crop residues
   c. Initial soil inorganic N content
   d. Inorganic fertilizer N
   e. Background N in irrigation water
   f. Atmospheric N inputs

   (We only want to assess the effects of liquid manure on N loss risk.)

Procedure

1. Getting Started with Nitrogen Index 4.4

When you open Nitrogen Index 4.4, the first window you will see is the *Driver* window (**Fig. 3a**). If you notice that fields on the screen seem to be off the screen and do not match the screenshots in this manual, please read Appendix 5 at the end of the manual. From the *Driver* window you can see two sets of radio buttons labeled *Language* and *Units*. The Nitrogen Index 4.4 is fully bilingual and can be used in either *English* or *Spanish,* and can use either *English* or *Metric* units of measurement. Note that no matter which language a file is created in, it can be opened in either of the languages. This is not the same for units, however; an *English* unit file cannot be opened when the Index is set to *metric* and vice versa. After selecting your preferred language and units, your next step in the *Driver* window is to decide whether to open a previously saved 4.4 index file or start a new one from scratch. For the example we are using in this manual, we will be using an *English* unit file named ***CA_dairy_LM_VHN_Clay***. To access it, click *Open* in the *Driver* window, locate the file, and open it (**Fig. 4**). This file can be found in "C:\Program Files\USDA-ARS-SPNR\Nitrogen Index\Example Files & Manual\Examples_English Units\Examples_California\Examples_Manure_Liquid" for a 32-bit computer. For a 64-bit computer, the Index is located in "Program Files (x86)".

If you would like to create your own N-Index file for the California region, you will need to select *California* from the first (top) dropdown menu and click the *N-Index* button. You also have the option to select the Mexico, Caribbean, Bolivia, or Ecuador region to make your own N-Index file (**Fig. 3b**).

Note: the second (bottom) dropdown menu next to the *P-Index* button corresponds to the P-Index and can be left alone for the time being, as the P-Index is still in development.

Note: The Nitrogen Index 4.4 **cannot** open 4.3.2 or other previous version Index (.nin) files.

Figure 3a

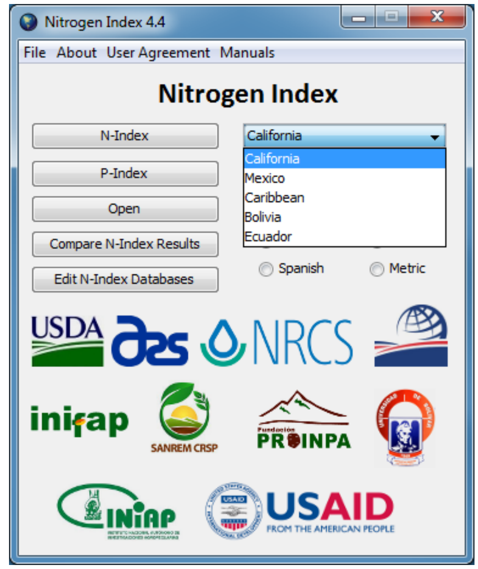

Figure 3b

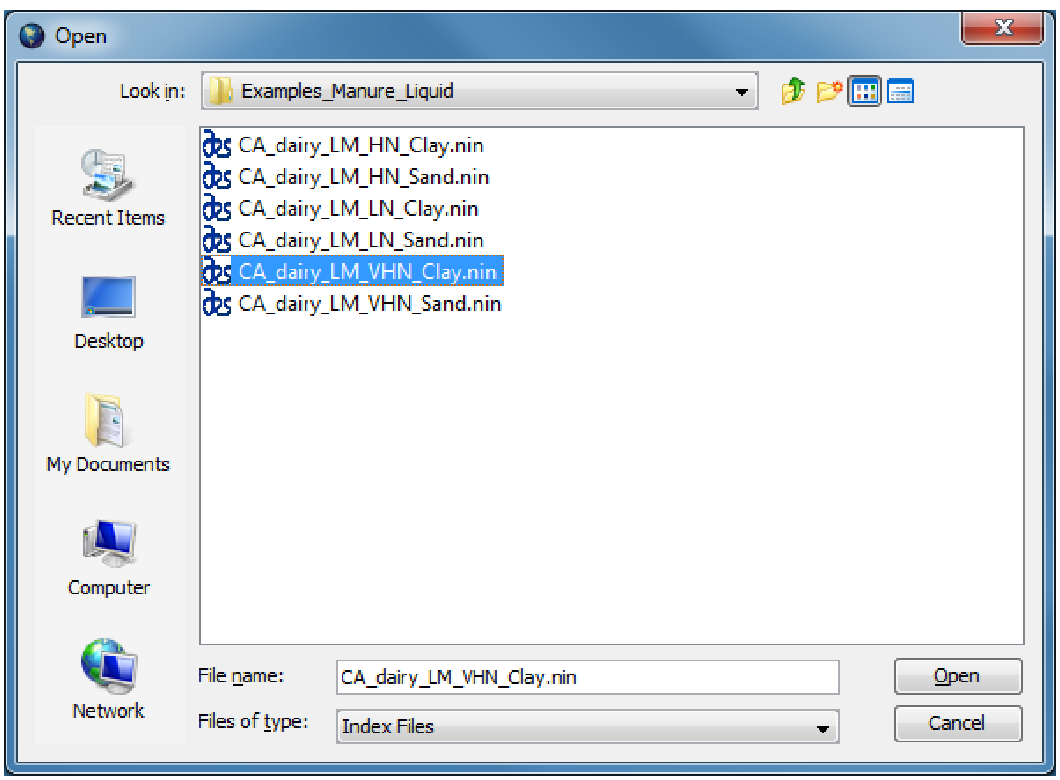

Figure 4

Two windows will appear. The taller window is a navigation window (**Figs. 5a and 5b**) that will help you move quickly between screens as you enter information for the index. You can return to a previous screen by selecting the name of the desired window and clicking the *Go To* button, but it is recommended that you save the work in your current window before doing so by clicking the *Save* button. Note that if you do not click the *Save* button on a screen but instead click *Go To*, the information that you entered in that screen will not be saved. . When you first create a new index file, only the name of the first window (*Basic Information*) will show in the navigation window (**Fig. 5a**). However, as you work your way through the screens, more options will appear in the navigation window (if you are working with the example file or another previously saved/completed file, you will immediately be able to access all of the windows that were used in that file from the navigation window). **Figure 5b** shows how the navigation window will appear if you open the example file "CA_dairy_LM_VHN_Clay". Note that **Figure 5b** does not show all possible windows; some windows are optional and users can elect whether to include them for a particular file. For example, in the case of the "CA_dairy_LM_VHN_Clay" file, the Fertilizer screen and Dry Manure screens do not appear in the navigation window because when the file was created these windows were not chosen. (You will see this firsthand momentarily.) **Figure 5c** shows how the navigation window will appear when you receive a message indicating that the denitrification coefficient has changed. In Nitrogen Index 4.4, examples and new files are set to a default denitrification coefficient. Changes to certain values can cause the default denitrification coefficient to change. When this happens, you will see a red message similar to the one in **Figure 5c** (though the value your coefficient has changed to may be different). Note, however, that if you use a custom denitrification coefficient, the value of the coefficient will not change, regardless of changes you make to any of the other data. Also, take notice of the blue text at the top of the navigation screen (**Figs. 5a, b, c**). This text indicates which units of measurement are being used for the current Index simulation.

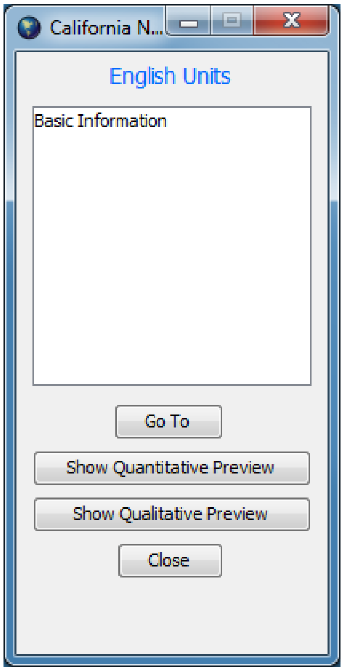

Figure 5a

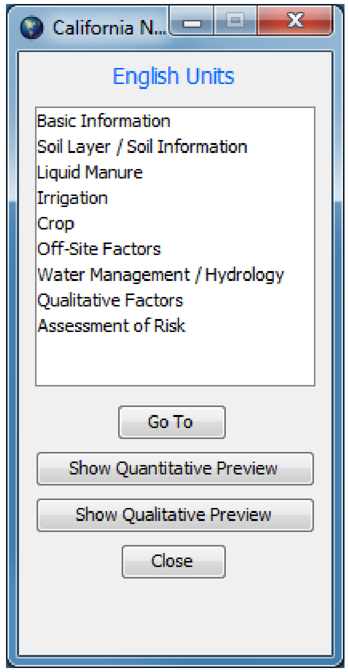

Figure 5b

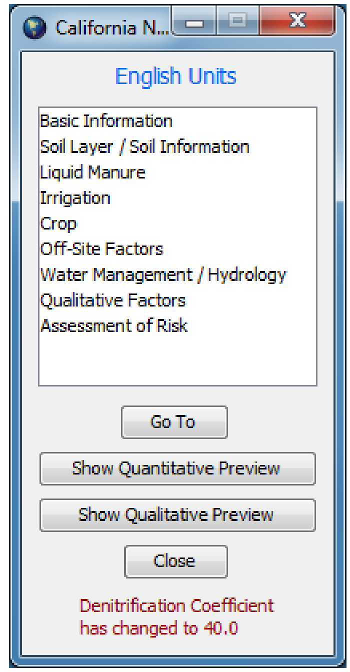

Figure 5c

There are two other buttons in the California navigation window to be aware of: *Show Quantitative Preview* and *Show Qualitative Preview*. Clicking these buttons will bring up the *Quantitative Preview* and *Qualitative Preview* windows, respectively (**Figs. 5c and 5d**). When these windows are opened, the names of the buttons in the navigation window change to *Hide Quantitative Preview* and *Hide Qualitative Preview*. Clicking these buttons will now close the windows.

Note: You may have noticed that when you click on the button with a red X in the upper-right corner of the window, the window does not close as one might expect. This button has been disabled in all of the Nitrogen Index 4.4 screens, except for the *Driver* window. You will need to use the button labeled *Close* to get rid the screen, or navigate to a different screen, depending on the particular screen you are at.

The preview windows are very useful for seeing how the data you enter for each window are affecting your Assessment of Risk values as information is entered. If you have started a new file from scratch, you may find it handy to periodically check this window as it will update as new data is entered. However, the example file already includes a complete set of data, so if you are using the example file no changes will be observed in the values for each of these previews as you move to new screens. (Note: we highly recommend that you do **not** change data in the example file unless you are specifically instructed to do so in this guide).

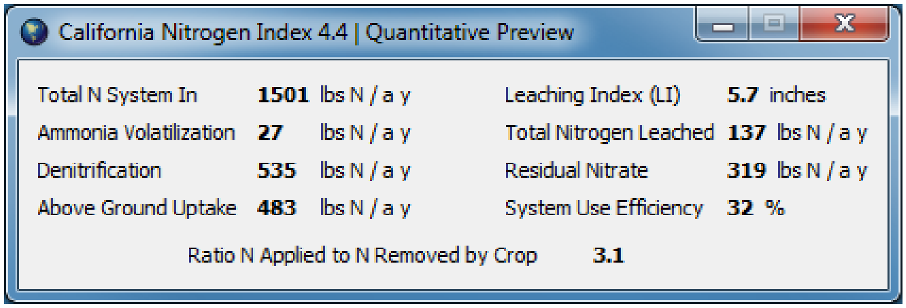

Figure 5c

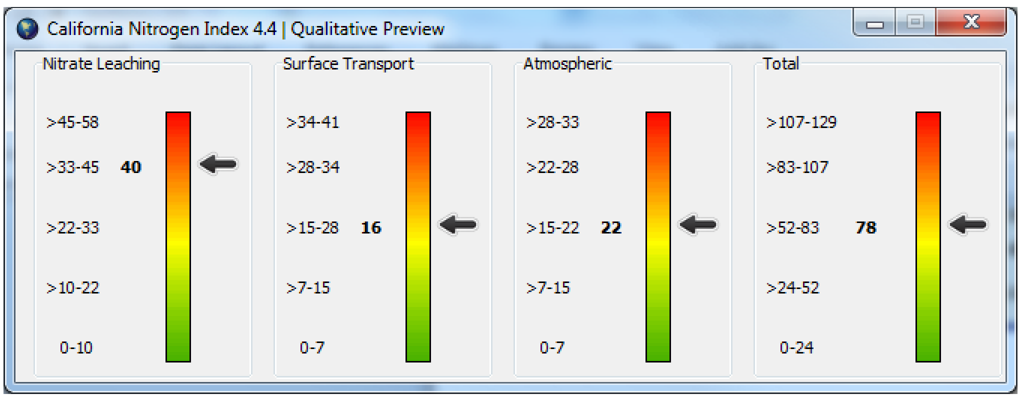

Figure 5d

In addition to the navigation window, there is a second window that appears when you first open a new or saved file: the *Basic Information* window, or your first input screen (**Fig. 6**).

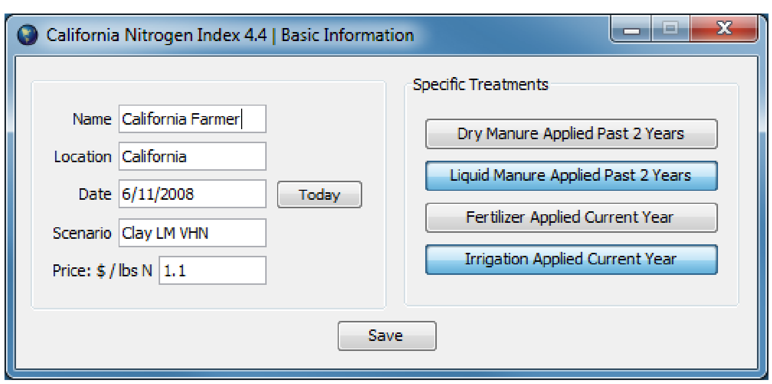

Figure 6

If you're using the example file, the Name, Location, Date, Scenario, and Price of N/lbs ($) have already been entered in the fields and the Specific Treatments *Liquid Manure Applied Past 2 Years* and *Irrigation Applied Current Year* have already been selected (**Fig. 6**). The four buttons under the Specific Treatments correspond to the four optional windows that are available in Nitrogen Index 4.4. In the example file, the *Fertilizer Applied Current Year* and the *Dry Manure Applied Past 2 Years* buttons are **not** selected, so these windows will not appear in the navigation window and will not show up as you work your way through the screens.

If you are creating your own file, you will need to enter the data for these fields manually. Note that by clicking the *Today* button, you can have the current date automatically entered in the Date field for you.

Confirm that your screen looks like **Figure 6** and click the *Save* button at the bottom of the window. The *Save* button is available in this same location for each of the data entry screens you encounter. By clicking the *Save* button, you will automatically be taken to the next screen (in this case, the *Soil* window). Note that this button will allow you to keep your changes between screens, but it is not until after you have navigated through all of the screens and saved the file using the *Save File* button in the Assessment of Risk screen that the changes are permanent in the file and will be accessible after you close the Nitrogen Index 4.4 program. Further details on permanent saves can be found in section 11: Assessment of Risk Screen.

Remember that if at any point you need to return to a window you have already completed, you can select the name of the desired screen in the navigation window (**Figs. 5a, b**) and click *Go To*.

2. Soil Information Screen

The next screen that you will encounter in the N Index is the *Soil Layer / Soil Information* screen (**Figs. 7a and 7b**). The following section explains the process of entering data into the *Soil Layer / Soil Information* screen (**Fig. 6a**) and how this data is used by the N Index to calculate and assess the annual N budget.

Notice that by default, the first Soil Layer tab (*#1*) is selected. For this example, enter the information as shown in **Figure 7a** (or simply confirm it if using the example file) and select the second tab (*#2*).

If using the example file, confirm the data shown in **Figure 7b** and click *Save*. If you are manually entering your own data, you will need to check (click) the box next to *Enter Layer #2 Data* (**Figure 7b**), enter data for another soil layer, and then click *Save*.

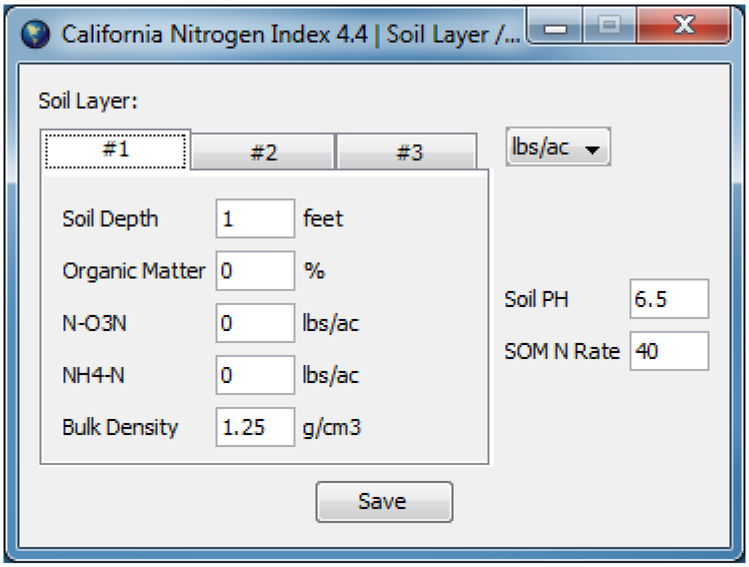

Figure 7a

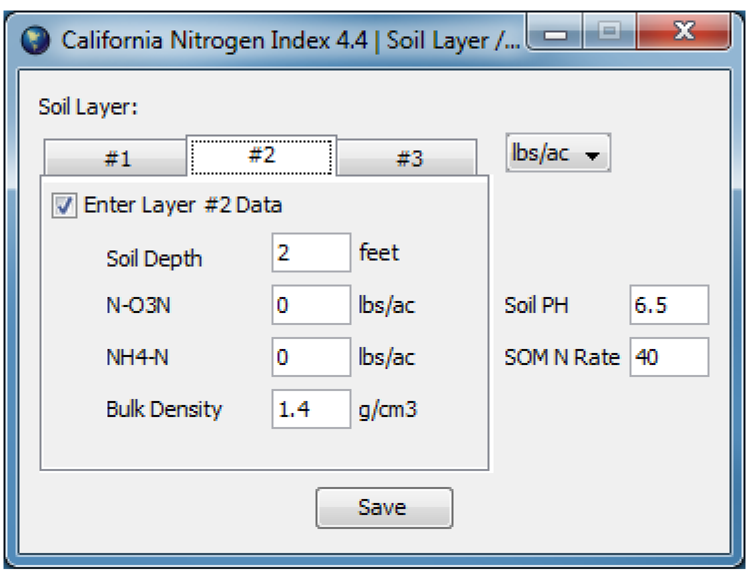

Figure 7b

3. Dry Manure Screen

The *CA_dairy_LM_VHN_Clay* file does not include dry manure input data; however, the following section explains the process of entering dry manure data into your own N Index assessments. If you are working through the training example, you may wish to see the Dry Manure screen so that you can practice entering data in that screen. If so, use the navigation window to return to the Basic Information window, click the *Dry Manure Applied Past 2 Years* button, click *Save,* and then use the navigation window to go the Dry Manure screen, which is now available. You can then practice entering applications as described below. Once you are finished, you'll want to clear this screen of any dry manure data you enter (see **Fig. 9**) and then click *Save*. Note that by saving this window with a manure amount of zero entered, you are instructing the Nitrogen Index 4.4 to calculate with a value of **zero** as your dry manure application. This has the same effect on the risk assessment as choosing not to include the Dry Manure screen (which was the original setting of the *CA_dairy_LM_VHN_Clay* file). *In other words, you have made no meaningful change to the file's data.*

Note: Values for dry manure, liquid manure, and crops have been entered in the example files. <u>These values provided in the examples are based on data collected from various sources. After collecting this data, some of the values may have been adjusted to more accurately reflect a particular scenario.</u> If needed, users can edit these values for site-specific values. It is the responsibility of the user to decide if the provided values or their own values most accurately represent their specific scenario.

3.1. Entering Dry Manure Applications: The Dry Manure screen allows you to enter up to two different types of dry manure applications for the test year, as well as two different types applied during the previous year. More than two applications can be entered, however, by summing the applications of like types of dry manure and entering these sums as if they were single applications. If there is only one type of dry manure applied in a given year, though in multiple applications, it may be distributed between the two entry boxes for each year, or may be entered as a year-long sum in a single box. The N Index will calculate either entry method the same way.

3.2. Manure Type: To begin entering data, activate a data entry box by checking one of the *Applied Application* checkboxes under the Current Year box at the top of the screen. Select a manure type from the dropdown box below the checkbox. **Figure 8** shows what this screen would look like were you to select *Dairy Fresh*. Selecting a manure type will populate the other data fields in the data box except for *Wet Weight (ton/ac)*; unless you are working with a saved file that already has a saved application amount (*Wet Weight (ton/ac)*), you will have to enter this amount yourself. If you have site-specific data about your manures, you can edit the percent moisture, percent release, and N content amounts.

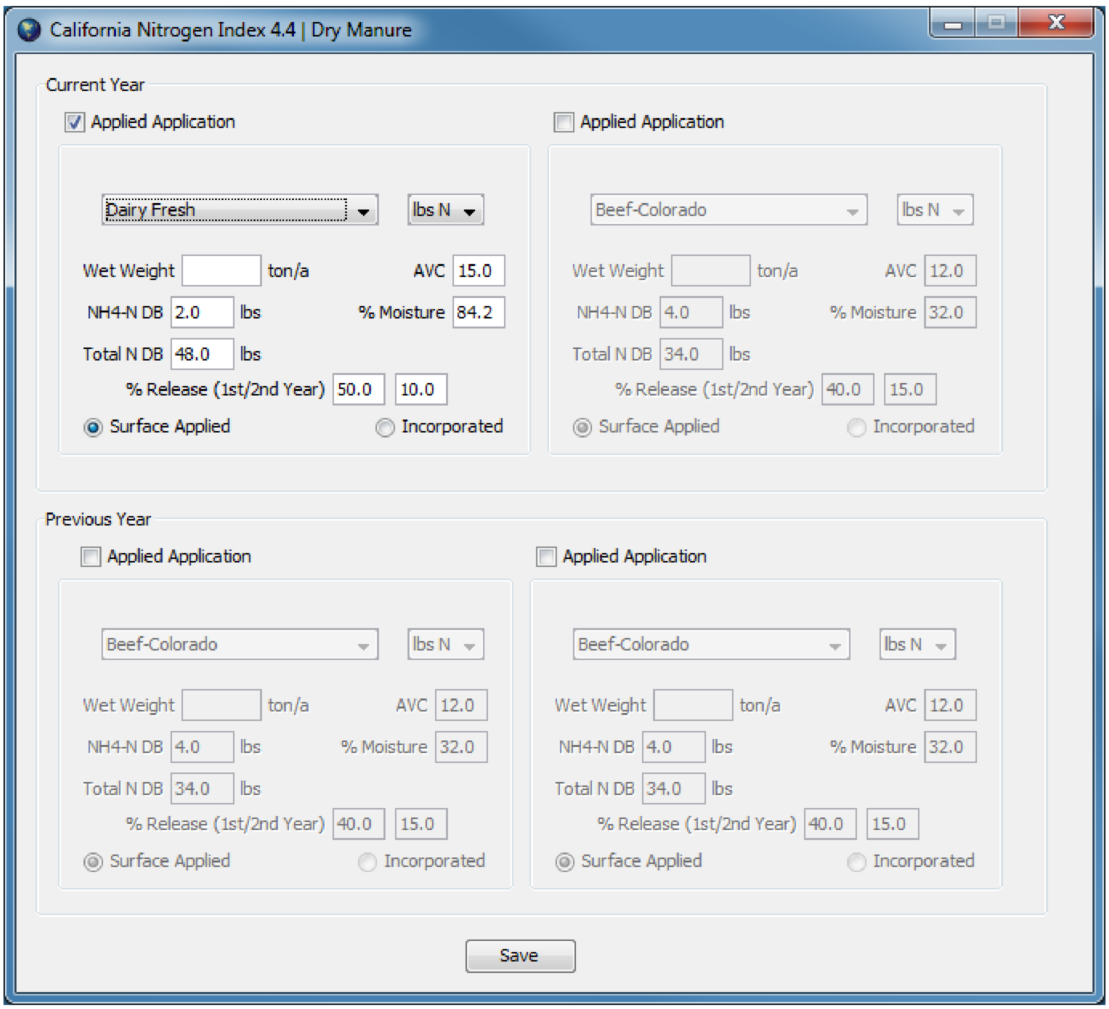

Figure 8

3.3. Units: You may choose between the units *%N* and *lbs N* to express *NH_4-N DB* and *Total N DB* amounts present in the dry manure (**Fig. 8**). Notice that the values will automatically change if these fields are populated and you switch the units with the unit drop down menu directly above the *AVC* field. Note: "DB" stands for "Dry Basis." Be sure to enter NH_4-N and Total N by their dry weights.

3.4. Incorporated / Surface Applied: At the bottom of each data box appear the options, *Incorporated* and *Surface Applied*, with radio buttons next to each (**Fig. 8**). Switching between these options affects the AVC, which can be found to the right of the field for Wet Weight. The amount of change in this value due to selection of either incorporation or surface application is specific to manure type. The AVC only applies to the amount of inorganic NH_4-N applied with the manure. This value can be changed to a site-specific value as well.

Reminder: If you are using the example file, be sure to deactivate any activated data boxes by un-checking the *Applied Application* checkboxes and clicking *Save* (**Fig. 9**). You will automatically be taken to the Liquid Manure screen (**Fig. 10**).

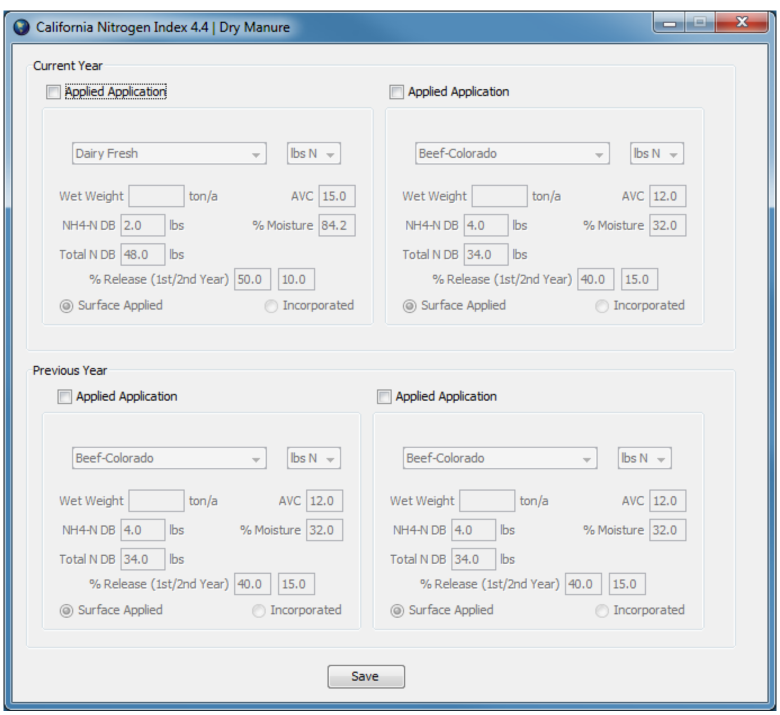

Figure 9

4. Liquid Manure Screen

The next screen you will encounter in the Index is the Liquid Manure screen. You can enter one or two liquid manure applications for the current year and one or two applications from the previous year. Sections **4.1-4.4** describe the different parts of this screen and how to enter your own data using a new file. If you are using the *CA_dairy_LM_VHN_Clay* training file and would like to practice entering data, you can also follow these steps, but remember to confirm that your screen looks exactly like **Figure 13** before clicking *Save* or moving to a new screen.

4.1. Entering Manure Applications: There are a couple of ways you can enter data in this screen, depending on your specific management scenario. If you only have one or two applications, they can be entered individually as described below. If you want to assess more than two applications in a given year, you can use each entry box to sum several applications of an identical type of manure. This approach allows you to enter two different types of liquid manure and can account for multiple applications within these two types.

For example, suppose you have two liquid dairy manure applications of 11,000 gal/acre. One of your options is to enter two 11,000 gal/acre events individually (**Fig. 10**). If you are using the training file, this is the option you will see.

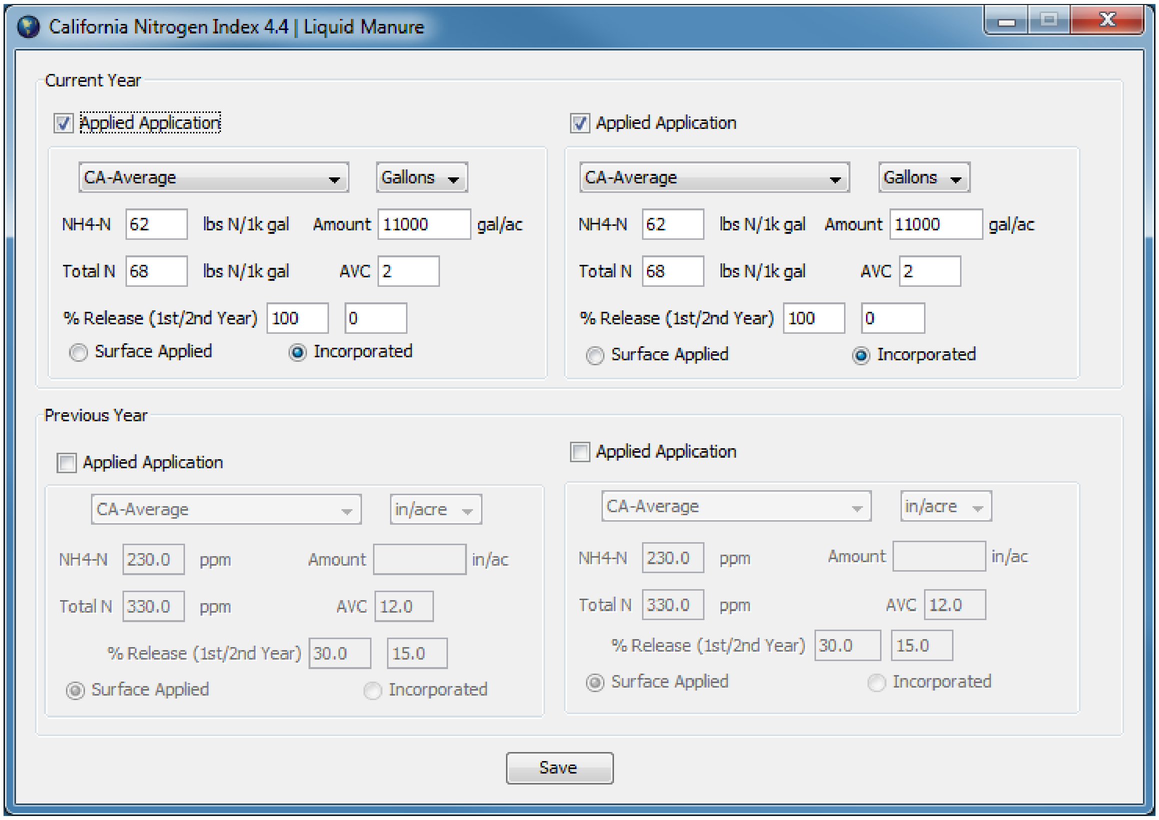

Figure 10

If, however, you were to apply the same two applications at one concentration and also applied a third application of 1,000 gal/acre at a higher concentration of N, you could enter 22,000 gal/acre at a low concentration in one data box and 1,000 gal/acre at a higher concentration in the second data box (**Fig. 11**).

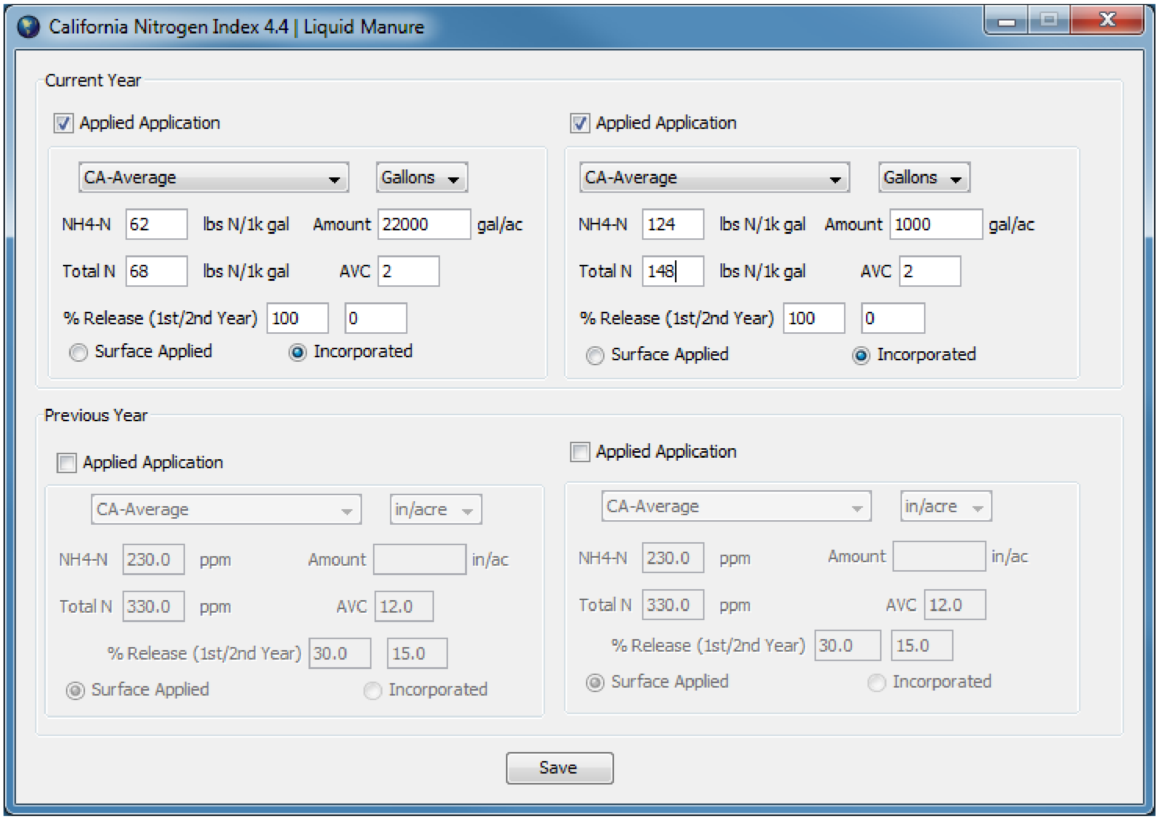

Figure 11

4.2. Units: Be sure to keep track of which liquid manure units you use (inches/acre or gallons/acre). Notice that if you switch units back and forth between in/acre and gal/acre, NH_4-N and total N *concentration* units will automatically switch between ppm and lbs 1000 gals^{-1}, respectively. The automatic conversion process is sensitive to .01 in/acre or 271 gallons/acre. However, if a more specific lower value is to be entered, that can be achieved by entering the value without using the conversion process.

Technical Note: The same assumptions and equations used to calculate the N loss risks associated with liquid manure applications are used to calculate the N loss risks associated with dry manure, except that the units change with the manure form.

4.3. Entering Preloaded Data: Currently, the Nitrogen Index is preloaded with three levels of liquid manure application data: *CA Minimum*, *CA Average*, and *CA Maximum*.

You can select from these choices in the top-left drop-down menu that is available for each application you apply (**Fig. 12**).

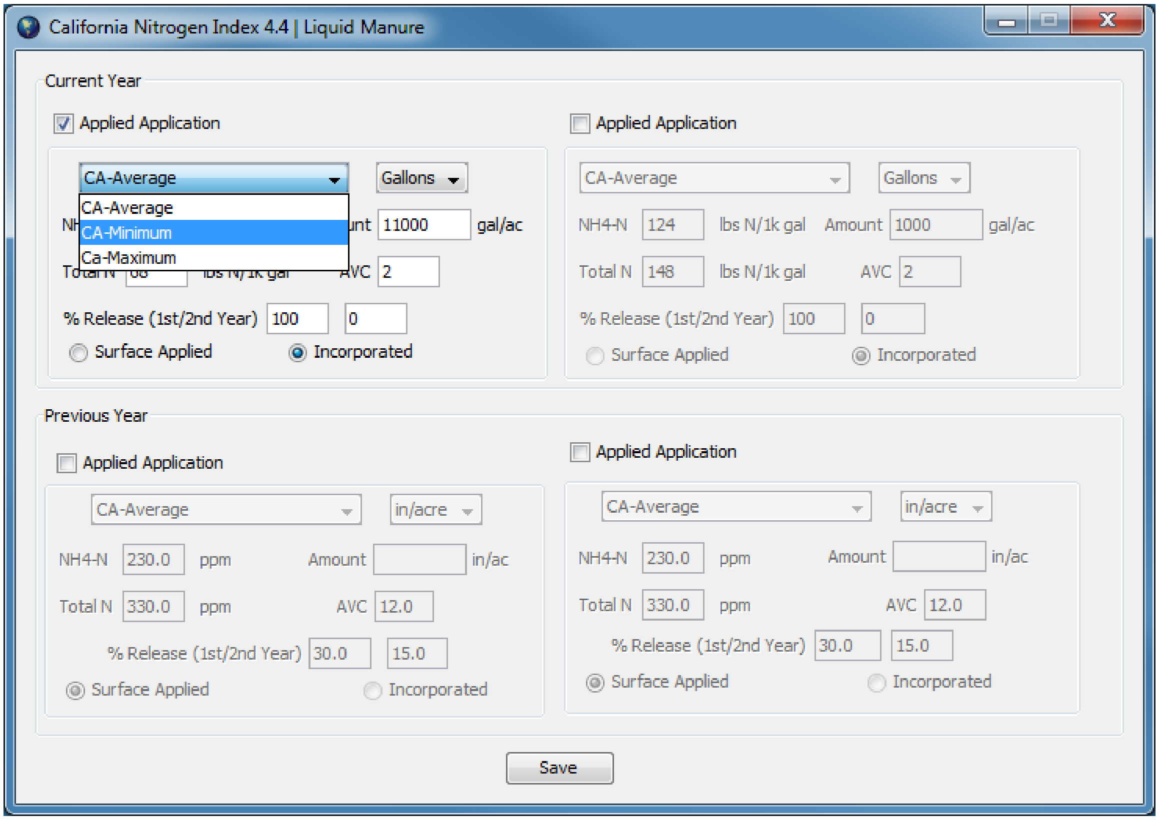

Figure 12

If you are working with an example file, all manure data has been entered, including volume. However, if you have not opened an example file, you will need to enter the volume of manure applied. The rest of the liquid manure data will be filled in for you if you choose one of the three preloaded levels of manure application data mentioned above. Any of these values, however, can be adjusted according to your specific conditions. If using one of these preloaded levels without modification, NH_4-N values should be 62, 230, and 642 ppm for *CA Minimum*, *CA Average* and *CA Maximum* levels, respectively. Total N concentrations values should be 74, 330, and 2284 ppm for *CA Minimum*, *CA Average* and *CA Maximum* levels, respectively.

4.4. Entering User-Defined Data: To create a custom manure application, you'll need to provide volume, NH_4 and Total N concentrations, percent release ($1^{st}/2^{nd}$ years) and indicate whether it is incorporated or surface applied. As noted above, it does not matter which of the preset levels (for example, CA-minimum) is selected when you are creating a custom application, as long as you enter the desired values and you change any that do not match your situation. More manure data may be preloaded into the Index in the future upon request. All current preloaded data uses the units *inches/acre* and *ppm*.

Note: If the liquid manure is diluted with irrigation water, be sure to factor that into the volume applied and adjust the concentration values to retain the same total amount of N.

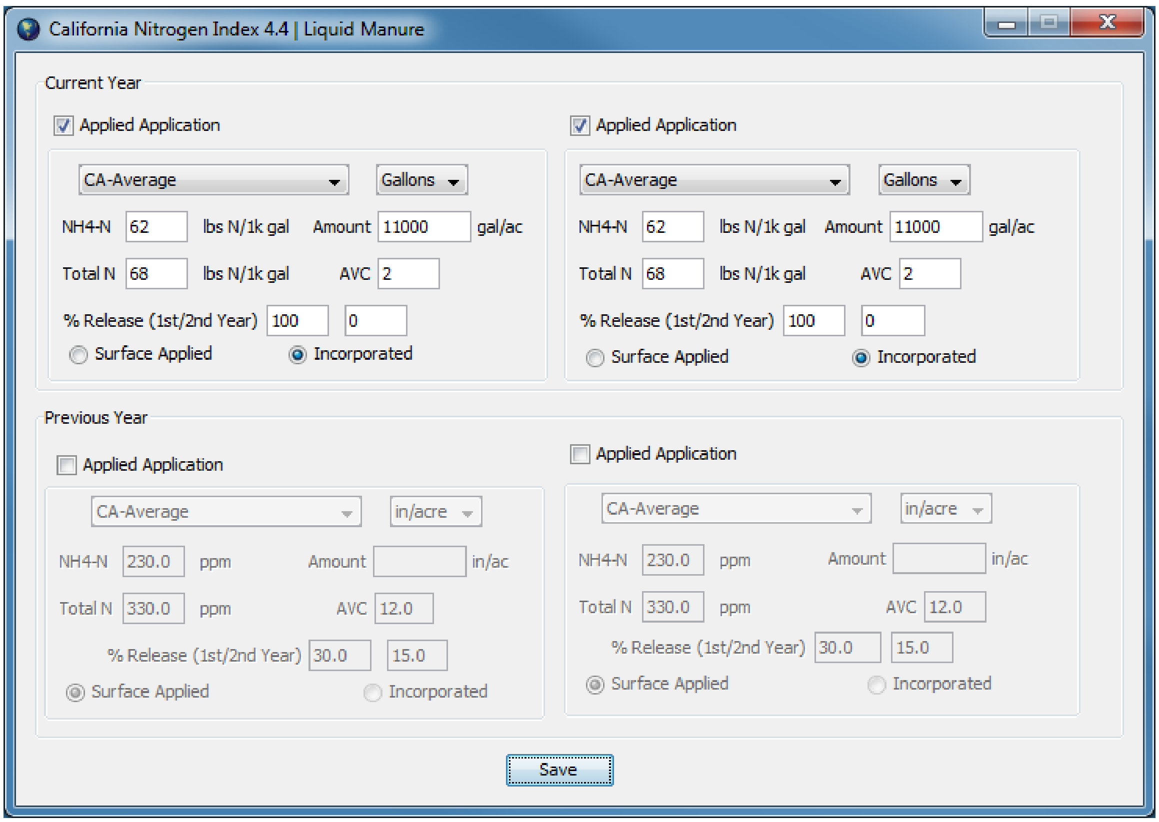

Figure 13

Reminder: If following along with the example file *CA_dairy_LM_VHN_Clay*, be sure that values match those entered in **Figure 13** before clicking *Save*.

5. Fertilizer Screen

You will encounter the Fertilizer screen (**Figs. 14a, b**) if you selected the *Fertilizer Applied Current Year* button in the Basic Information window. The CA_dairy_LM_VHN_Clay example file does **not** have this button selected, so the Fertilizer screen does not appear in this file. If you are following this user manual using the example file, you may wish to navigate back to the Basic Information window and click the *Fertilizer Applied Current Year* button (and the *Save* button) so that you can view the Fertilizer screen and practice entering your own applications. However, when you have finished practicing, you'll want to be sure that your Fertilizer window looks like **Figure 14a** before clicking *Save* in the Fertilizer window and proceeding to the next screen. Note that in **Figure 14a** that the checkbox for *Applied Application* is **<u>not</u>** checked. By saving the window as shown in **Figure 14a**, you are instructing Nitrogen Index 4.4 not to apply fertilizer; your data will be analyzed just as if you had not included the fertilizer window at all (which is how the CA_LM_VHN_Clay example file was originally saved). If you decide to practice entering data for Applications 2-5, you will want to make sure that the *Applied Application* checkbox is **<u>not</u>** checked for those applications as well, before clicking *Save*.

5.1. Entering Custom Inorganic Fertilizer Applications: To enter an application you must first check (click) the *Applied Application* box. The drop-down menu allows you to choose a custom NH_4-N type of fertilizer and the amount of rain or irrigation. In the Fertilizer window you can also enter your own AVC. You can enter a new AVC for any of the fertilizer choices if you have site-specific information that would affect this value. Additionally, you can enter up to five separate fertilizer applications by clicking on each of the tabs; note that you do not need to click *Save* until you have entered the data for all desired applications. If you need to enter more than five fertilizer applications, recall from Section 4 of this manual (Liquid Manure) that you can enter multiple applications of the same concentration and type as a single application. **Figure 14a** shows how Application 1 will appear when you first see the window; **Figure 14b** shows how your Application 1 would look if you checked the *Applied Application* box without changing any of the values (note that you will be prompted to enter a value for the application amount if you try to *Save* the window as shown in **Figure 14b**).

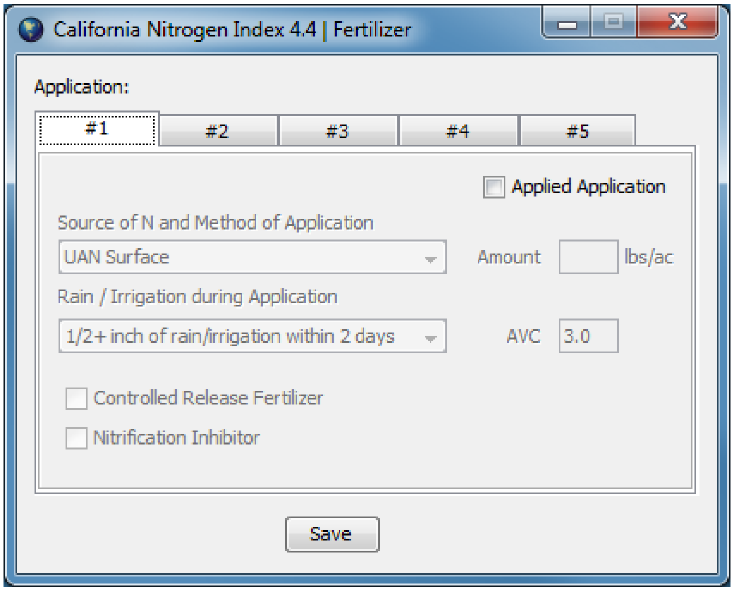

Figure 14a

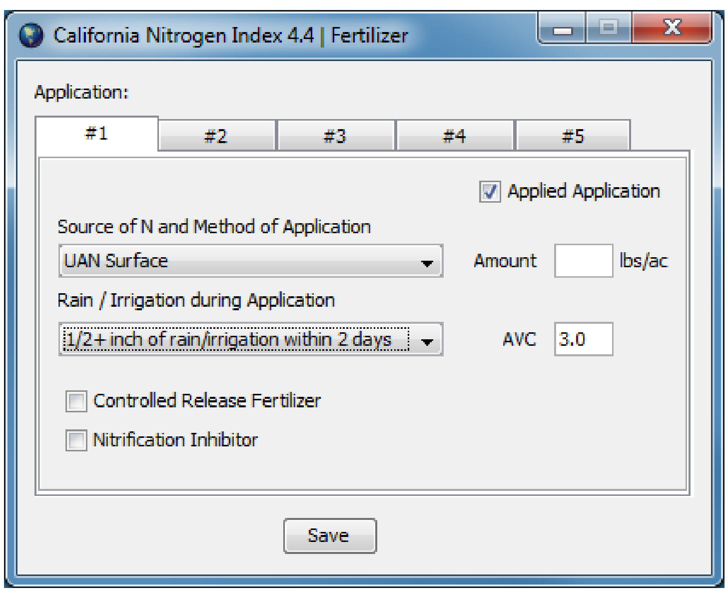

Figure 14b

6. Irrigation Screen

You will encounter the Irrigation screen if you selected the *Irrigation Applied Current Year* button in the Basic Information window, or if you are following this guide using the CA_dairy_LM_VHN_Clay example file (**Fig. 15**).

If entering irrigation data, you can choose to enter NO_3-N and organic N concentrations in irrigation water as *ppm* or *lbs N acre*$^{-1}$. Irrigation amount should be entered in inches. Pre-planting irrigation is irrigation water applied with no crop growing, and post-planting irrigation is applied while a crop is growing. Again, if you have site-specific data, you may adjust the water coefficient (WC) for irrigation water but we highly recommend leaving it at "1.0". The water coefficient can only be used when using *lbs/ac* or *kg/ha*. If you have a *Concentration of Organic N*, you will need to enter an *Expected N Release from Organic N*. If you have no organic N concentration, simply leave the *Expected N Release from Organic N* percentage at zero.

Note: Fertigations can be entered here by combining fertigation and other irrigation. Simply factor the volume of fertigations and the N present in any fertigations into the total inorganic N concentration already present in irrigation, and enter this combined value as the *Concentration* NO_3*-N*.

> **Important: The water volume entered as part of any liquid manure application(s) will not be considered in the overall water balance unless entered as an irrigation event. It is important to enter the amount of water added from a liquid manure lagoon or similar application on this screen to account for total water inputs to the system.**

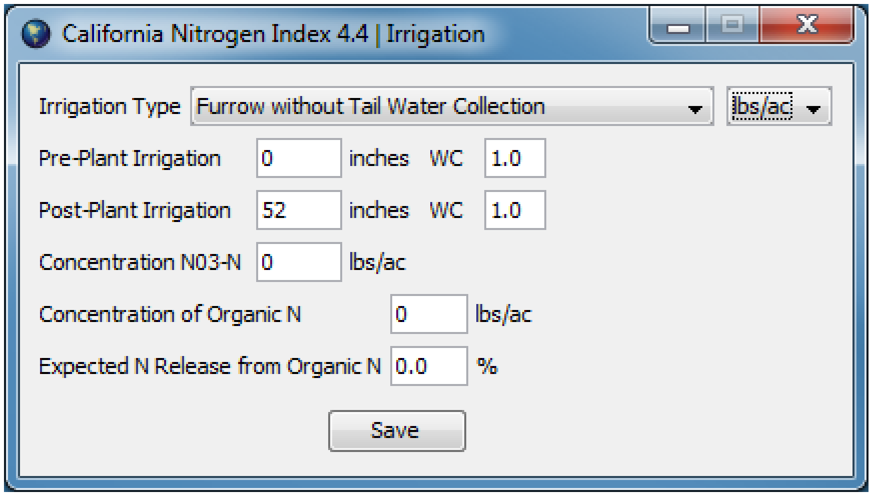

Figure 15

If you are using the example file, please check that your screen matches **Figure 15** above before clicking *Save* and proceeding.

7. Crop Screen

After the Irrigation screen is the Crop screen (**Fig. 16**). If you are entering data for a new file, you will first need to check (click) the box next to *Crop* for each crop you wish to enter data for. If you are instead using the training file, the data will already be provided; please confirm that your window looks like **Figure 16** before clicking *Save* and moving to the next screen if using this file. Following is a brief description of each factor you need to consider when entering data for the Crop screen.

7.1. Crop Type: The N Index will calculate up to three current crops and will also consider a subsequent crop's N cycling contributions to each current crop within a 12-month period. Crop Type for each of these can be selected using their corresponding drop-down menus in each data entry box (**Fig. 17**). Notice the *C/N Time of Incorporation* heading on the right side of this screen. Here, you can select whether the C/N ratio of the crop is greater than or less than 30 at the time of incorporation, for each crop you have applied.

The N Index adds all the N sources from subsequent crop residues and all the current crop N sinks, so the order of current crops and subsequent crops is not important. The order of crops will not affect N Index calculations.

After you have selected a crop, you can view the basic crop data (unit of yield, weight in lbs per unit of yield, water content of the harvested unit, and NUI). The NUI is an average for a given crop that represents the total N uptake in aboveground biomass ÷ total yield.

To enter site-specific NUI data, follow the instructions in section 15: Custom Crop Values.

NUI is equal to total aboveground N uptake per unit of yield. It is important to enter the "straw" version of a grain crop when entering grain crops as residue. This will ensure that the appropriate NUI is used in calculating N contributed by the residue. These straw NUIs are expressed in lbs of N per ton of straw.

7.2. Yield: Be sure to enter yields of all crops entered on this screen on a wet weight basis.

7.3. Root Depth: One of the most influential values for calculating nitrate leaching risk is the depth of the deepest rooted crop. Be sure to enter this value.

7.4. Forage Crops with More than Three Harvests: For forage grass crops with more than three cuts, the yields can be added and entered as a single value.

7.5. Leguminous Crops: The index automatically determines whether or not a crop is leguminous.

7.6. Crop Residue with Minimum and Zero Tillage: If your scenario involves minimum or zero tillage, you may enter a fraction of the green manure crop residue to estimate the portion of crop residue that will decompose on the soil surface.

7.7 Custom Crops: Please refer to section 15: Custom Crop Values, for more information on entering site-specific, custom crops.

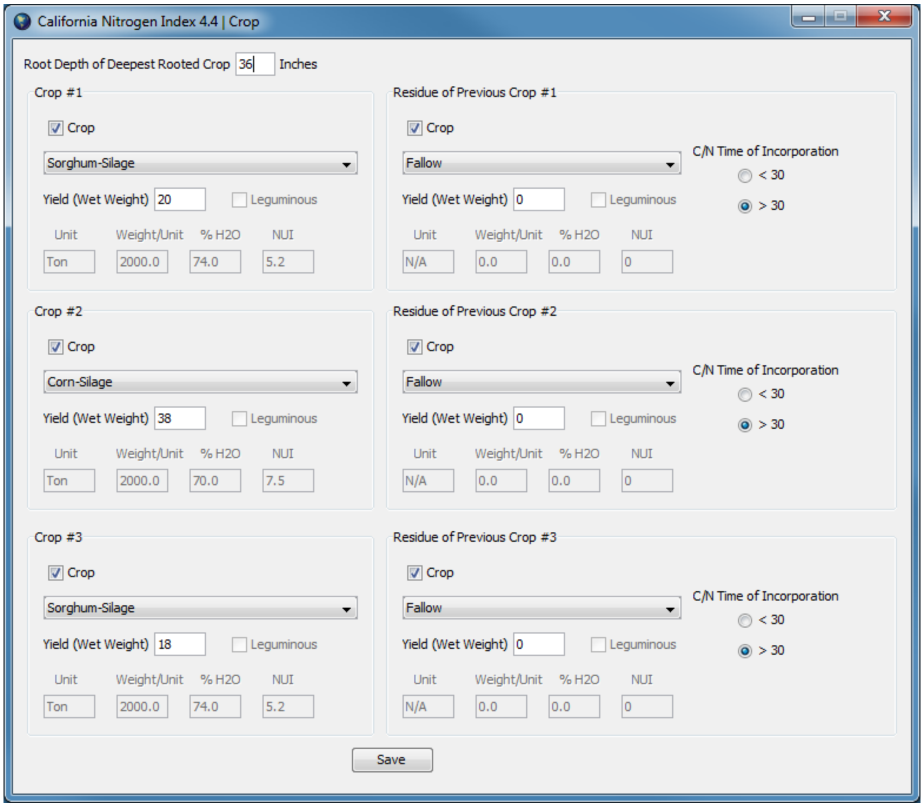

Figure 16

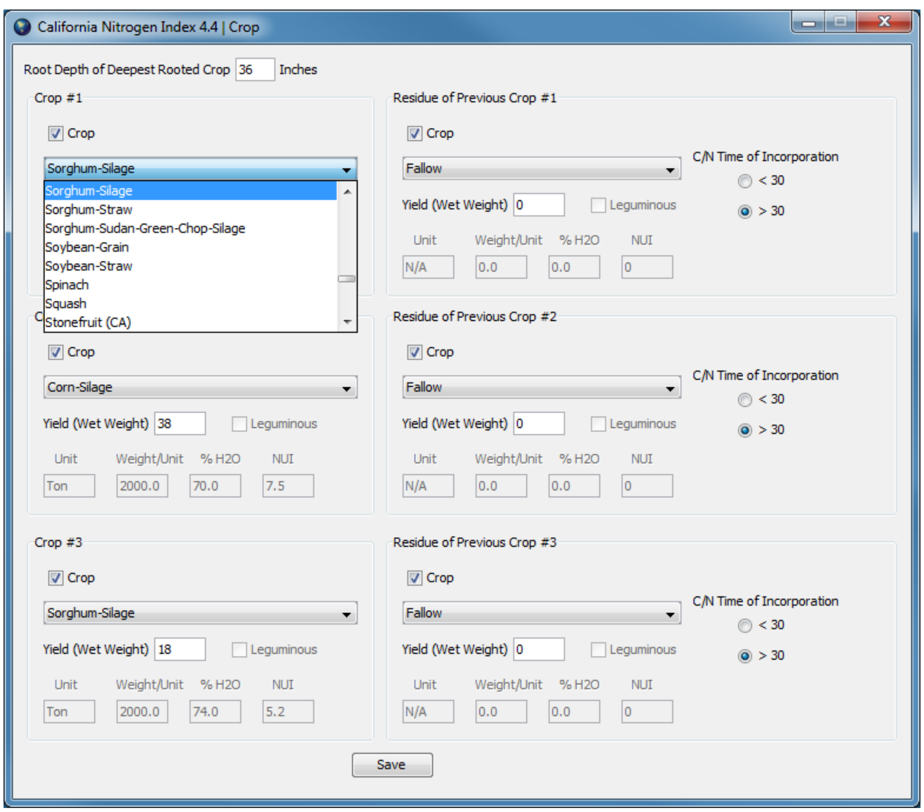

Figure 17

8. Off-Site Factors Screen

This screen covers aquifer conditions, annual atmospheric wet and dry N deposition, and other off-site factors. Following is a description of each of them. **Figure 18** at the end of this section corresponds with the training example's settings for the Off-Site Factors screen; if using this example, please confirm that your screen is the same as the figure before clicking *Save* and continuing to the next screen.

8.1. Aquifer Conditions: The *position*, *vulnerability* and *travel time to aquifer* can be selected individually on this screen. Increasing travel time to aquifer and deepening the position of the aquifer will reduce the aquifer leaching risk and the overall leaching risk of the system. Though the importance of an aquifer for drinking water (represented here by *Vulnerability of Aquifer*) does not technically increase the leaching potential, it does make it more of a health and environmental concern. Therefore, as *vulnerability* increases, so does the qualitative leaching risk rank reported by the N Index.

8.2 Denitrification Coefficient: The N Index uses the denitrification rates published by Delgado et al. (2008), which were adapted from Meisinger and Randall (1991). The denitrification coefficient is affected by soil organic matter content, hydrology characteristics, manure applications, tile drainage, precipitation and irrigation. For sites with tile drainage, the denitrification rate is adjusted. If a field has tile drainage, selecting *Yes* for *Tile Drainage* will divide the denitrification rate by two (tile drainage can be selected in the Hydrology screen, which is the next screen). For a dry climate without irrigation, the denitrification rate is divided by two. If manure is applied under any of the previous scenarios, the denitrification rate is doubled. If you enter a custom denitrification coefficient, the above interaction is bypassed, and you must account for these factors by adjusting your own coefficient.

8.3. Annual Atmospheric Wet and Dry N Deposition: Atmospheric N is not available for ammonia volatilization or denitrification, but will enter the pool that is available for leaching. The default value is 5 lbs N acre^{-1}, but this value can be changed to a site-specific value, especially for fields that may be close to confined animal operations that may have a higher ammonia volatilization. This N will be available for crop uptake.

8.4. K constant: The K constant at the lower right corner of this screen is used as a data adjustment to help the N Index run accurately. This should only be changed by advanced users who understand the implications of such a change (see De Paz et al. (2009) for an example of such a situation).

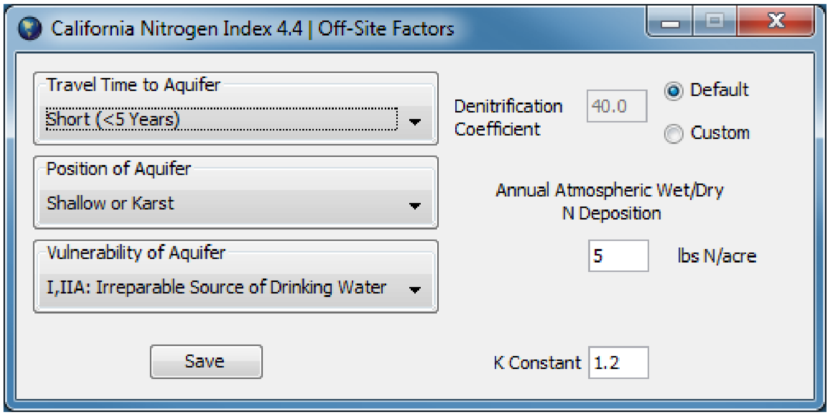

Figure 18

9. Hydrology Screen

This screen covers climate, precipitation, and other hydrological factors (**Fig. 19**). Note that there are some interactions that are involved while entering data into the Nitrogen/Water Management and Hydrology Screen, which are discussed in the following section.

It is important to remember, that as with other screens, the final values that the user accepts before hitting *Save*, are the values used to assess the level of risk. If using the example file, please check that your Hydrology window matches the one in **Figure 19** before clicking *Save* and going to the next screen.

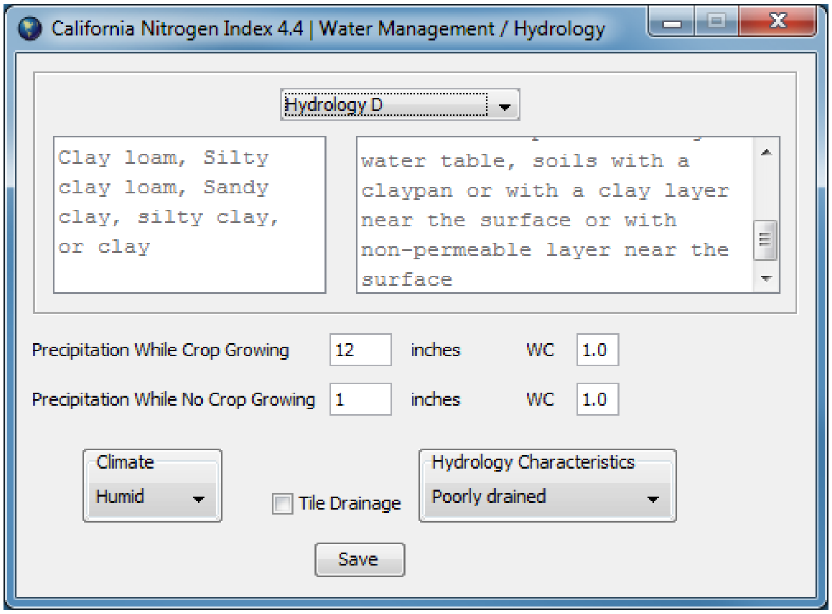

Figure 19

10. Qualitative Factors Screen

The qualitative factors screen asks you to provide nine pieces of information that are used to create the N Index management rankings (Nitrate Leaching, Surface Transport, Atmospheric and Total). When running your own scenarios, you will select the options in the dropdown menus that best correspond to your situation. If using the example file, be sure the values shown in **Figure 20** are selected before clicking the *Save* button.

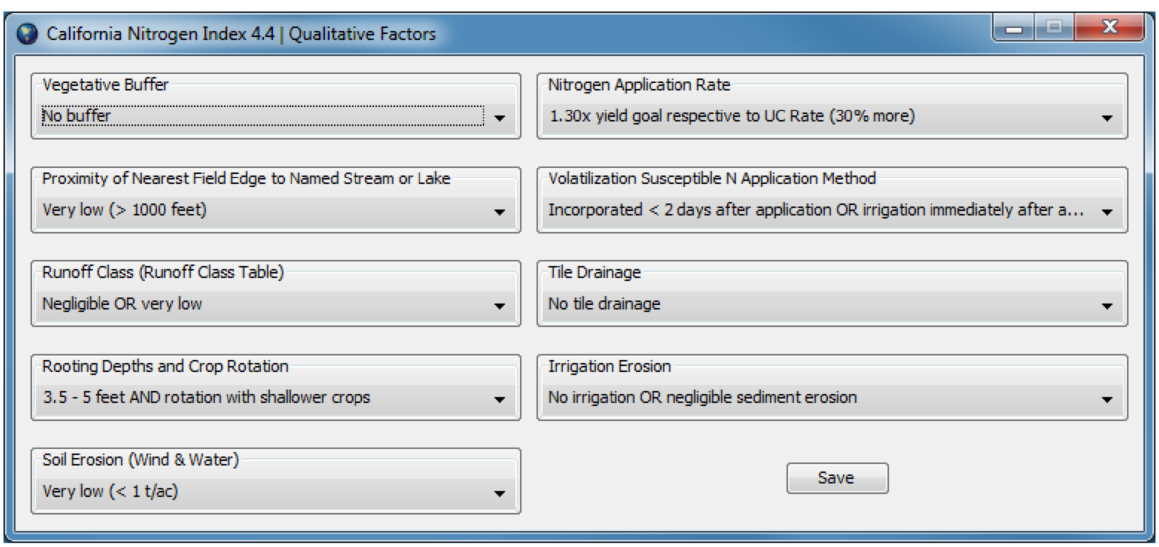

Figure 20

The responses to the questions on the Qualitative Factors screen will be combined with all the data previously entered into the N Index to create the matrix found on the Individual Rankings screen (**Fig. 22**). The way site characteristics relate to nitrogen loss risk subcomponent calculations has changed slightly from that described in Delgado et al. (2006). The current relationships are shown in Table 1 below.

Site Characteristic	Affected Nitrogen Index Rating		
	Nitrate Leaching	Surface Transport	Air Quality
Irrigation System	X		
N Available to Leach Potential	X		
Estimated Nitrate leaching	X		
Aquifer Leaching Risk	X		
NH_3 Volatilization			X
Nitrogen Application Rate	X	X	X
Proximity of Field Edge to Named Stream or Lake		X	
Denitrification			X
Volatilization-Susceptible N Application Method			X
Rooting Depths and Crop Rotation	X		
Soil Erosion (wind & water)		X	
Tile drainage	X		
Runoff Class (Runoff Class Table)		X	
Irrigation Erosion		X	
Vegetative Buffer		X	

Table 1

It is important to note that, if no irrigation is applied, the *irrigation erosion factor* is **not** considered in the final N Index ranking. However, if irrigation is applied, the *irrigation erosion factor* **is** considered and the *soil erosion factor* is **not** considered in the final N-Index rankings.

Click on *Save* to continue to the Assessment of Risk screen.

11. Assessment of Risk

The Assessment of Risk screen displays the final qualitative scores for the subcategories Nitrate Leaching, Surface Transport and Atmospheric, as well as the Total N-Index score (**Fig. 21**). Below these scores, you will find specific numerical data about the N dynamics of your scenario. Each of these will be explained in the pages that follow. When you are running your own N Index assessments, you will want to save these results in a file by clicking the *Save File* button on this screen (see section 11.1 below for details).

<u>For visual reference throughout the following section, please refer to **Figure 21**, unless another figure is specified.</u>

Figure 21

Note: After looking at the results in the Assessment of Risk screen, you may decide that you would like to change some of the data in your file, to see how it affects the risk assessment. Keep in mind that you must save any changes by clicking *Save* in the window the changes were made, in order for the values to be updated in the Assessment of Risk screen. For example, if you make a change in the Liquid Manure screen, you must click *Save* in the Liquid Manure window for the changes to be applied. As another example, if you decide to add or remove a window (such as Dry Manure) from the Basic Information window, after doing so you must click *Save* in the Basic Information window. Otherwise, the values in the Assessment of Risk screen will not be updated.

11.1. Saving an Index: In order to use the *Compare N-Index Results* feature (accessible from the *Driver* window), you must save any scenarios you wish to view or compare. To save an index file for your scenario, click on the *Save File* button on this screen and select a location and name for your index file. (Recall that the *Save* button in previous windows saves the data you change within a window as you navigate through the various screens, but to access the data for all of the windows after closing the Index, you must use the *Save File* button in the *Assessment of Risk* screen and save it as a ".nin" index file.).

11.2. Qualitative Scores: The N Index generates qualitative scores for Nitrate Leaching, Surface Transport and Atmospheric Loss Management, and these are summed to create a Total N Index Score. The Qualitative Factors are the most influential inputs into the equation used to calculate these scores. The values are calculated mostly by the qualitative factors entered on the *Qualitative Factors* screen and indicate the level of nitrogen loss mitigation employed in a model scenario, rating management decisions according to their effect on nitrogen losses. **Lower** numbers here indicate more proactive conservation management.

11.3. Numerical Data: Below the qualitative scores, you will find the numerical estimates for specific N dynamics.

a) Total N System In: All sources of N in the system are added together to arrive at this number. Calculated by adding the following:

- -Inorganic fertilizer inputs
- -Initial root zone inorganic N in the top soil horizon or down to the depth of the deepest rooted crop
- -Top horizon N mineralization
- -Atmospheric N deposition
- -Initial manure NH_4-N and mineralized N
- -N mineralized from last year's manure
- -Crop residue mineralization
- -NO_3-N present in irrigation water
- -Organic N present in irrigation water

b) Ammonia Volatilization: The amount of N lost to the atmosphere as ammonia. Calculated by: (inorganic N inputs susceptible to NH_3-N volatilization × fertilizer AVC÷100) + (organic NH_4-N inputs susceptible to NH_3-N volatilization × manure AVC÷100)

c) Denitrification: The amount of N lost through denitrification processes. Calculated by: (fertilizer N + initial NO_3-N in top soil horizon + inorganic N present in organic inputs – ammonia volatilization) × denitrification coefficient

d) Above Ground Uptake: Total amount of N used by the crop(s). Calculated by multiplying crop yield by the amount of N each crop uses per pound of yield. For non-leguminous crops the crop N uptake cannot be more than the N available for uptake. The N available for uptake is equal to the total system N minus atmospheric N losses (sum of ammonia volatilization plus denitrification). If the maximum N uptake is more than the N available for uptake, the system will be deficient and the total crop uptake will be equal to the N available for uptake. If a leguminous crop is in the rotation, the legume will take up N from the atmosphere if there is not enough N available in the soil for uptake.

e) Leaching Index (LI): This index relates to the climatic conditions that affect leaching. Calculated by: Leaching Index = Percolation Index * Season Index. The Percolation Index = [(average annual precipitation + annual irrigation) – constant)^2 / ((average annual precipitation + annual irrigation) + constant)]. The season Index = [(2 × (non-growing season precipitation + pre-plant irrigation) / (average annual precipitation + annual irrigation))$^{1/3}$]. The annual irrigation = pre-plant irrigation + post-plant irrigation.

f) Total Nitrogen Leached: The total amount of nitrogen lost through leaching. Calculated by: Nitrate available for leaching × (1.0 – exp $^{(-k \times LI/\ soil\ porosity)}$). Soil porosity = (1-(bulk density / particle density)) * (leaching depth * unit area). The leaching depth = to the root depth of the deepest rooted crop (**Fig. 16**).

g) Residual Nitrate: The amount of NO_3-N leftover. Calculated by: Total N inputs – total removal pathways.

> **Important: A residual nitrate value less than 20 lbs N acre^{-1} year^{-1} indicates that the system may be deficient in N. At this point, you should evaluate the inputs and removal pathways in your scenario to determine if the system is truly N deficient, or if you have leguminous crops that maintain N sufficiency through atmospheric uptake.**

h) System Use Efficiency: This represents how much of the N available is being used by crops. Calculated by: Total Crop Uptake ÷ Total N System In.

i) Ratio of N Applied to N Removed by Crop: This is a reflection of how much organic or inorganic N applied to the system is being used by crops. The

California ratio is calculated by: (N applied in manure + N applied in fertilizer + N in background water) ÷ N crop uptake.

11.4. N-Index Rankings Interpretations: You can view the following interpretations by clicking on the *Interpretation of Rankings* button.

VERY HIGH AND HIGH RISK: We suggest that those fields with **very high and high risk** rankings necessitate re-evaluation of N management practices by farmers/managers. N budgets (N_{min}) should be used as a basis for practice modification, which will reduce the N inputs that increase the risk of N losses to the environment. A very high or high risk assessment suggests that N is being over-applied and/or the potential for reactive N losses to the environment is of concern. Nutrient managers should conduct N management practices following University and State recommendations. It is suggested that inputs of organic and inorganic N should be reduced and/or managed to better synchronize N applications with N uptake by the crop. Users should talk with technical service providers, extension agents and NRCS personnel to develop nutrient management and conservation plans. These new plans may include any of the following Best Management Practices, though the list is not exhaustive: soil testing, analysis of irrigation water, analysis of fertilizer input (organic, inorganic or both), crop rotation, use of scavenger crops and N budget accounting for any other sources of N including background N in groundwater, residual N in soil and green manure contributions. In the case of forage systems, nutrient managers should consider intensifying cropping systems to two and three forage crops, if possible, to increase synchronization of N uptake and sink.

MEDIUM RISK: We suggest that those fields with **medium risk** for nitrogen losses are being managed adequately, perhaps using current Best Management Practices. A **medium risk** assessment suggests the potential for reactive N losses to the environment is of minor concern. However, at a medium risk there may still be potential for N loss reduction and improvement of N use efficiencies. We recommend that nutrient managers consider evaluating their practices to further improve N use efficiencies following University and State recommendations to minimize losses.

LOW AND VERY LOW RISK: We suggest that those fields with **low and very low risk** for nitrogen management are being managed very well, probably using current Best Management Practices. If anything, nutrient managers should evaluate the N budget to determine if there are any N deficiencies (if not a leguminous crop). The assessment suggests that these systems may be able to receive additional N inputs, improving crop performance without increasing potential for N losses to the environment.

The following quote is from:

Delgado, J.A., P. Gagliardi, M.J. Shaffer, H. Cover, E. Hesketh, J.C. Ascough, and B.M. Daniel. 2010a. New tools to assess nitrogen management for conservation of our biosphere. p. 373-409. In Delgado, J.A., and R.F. Follett (eds.) Advances in nitrogen management for water quality. SWCS, Ankeny, IA.

The Nitrogen Index assesses the risk of nitrogen losses via different pathways. The following are interpretations of the general risk. These interpretations should also be considered for each individual pathway such as leaching, surface and/or atmospheric loss. Even if the general risk (the risk across all pathways) is ranked as medium or low, one of the pathways may still show a high risk, so practices that reduce the risk of losses to specific pathways should be considered. In addition even if the individual pathway such as leaching, surface and/or atmospheric loss is ranked as medium, users should check the Estimated Potential Nitrate Available to Leach (Residual Soil Nitrate Risk) value to see how much risk there is of high residual soil nitrate, irrespective of the general risk ranking and the estimated amount of nitrate leached. For example, it is important to check this risk value because even if the general risk of nitrate leaching into the environment is ranked as medium for soils with low permeability and hydrology class D, there may be management scenarios that still have great risk of having high levels of residual soil nitrate when excessive amounts of N fertilizer or excessive amounts of manure are applied. This red flag of a high risk of residual soil nitrate available to leach will show especially under low precipitation and/or no irrigation. This specific condition will be indicated by a large value for Estimated Potential Nitrate Leaching in the N Index (Delgado et al., 2006, 2008a). Although soils with these conditions may have a low general risk of nitrogen movement (low leaching), they will still be susceptible to N losses if they have a high residual soil nitrate and unpredictable high storm event occurs. In cases of medium nitrate leaching potential, the Nitrogen Index will still show a great risk of having a very high residual soil nitrate; the Nitrogen Index may still show the need to improve nitrogen management practices to reduce the risk of having large quantities of residual soil nitrate available to leach.

11.5. N-Index Economic Assessment: If you entered a cost of fertilizer in the Soil screen, you may view your economic assessment by clicking on the *Economic*

Assessment button. This value represents the economic value of N losses from denitrification, leaching, ammonia volatilization and the economic value of the residual N in the soil.

11.6. N-Index Report: You can generate a PDF document that includes all N Index assessment data and the economic assessment by clicking on the *Generate Report* button. Adobe® Acrobat® or some other software capable of reading .pdf format must be installed in order to view this report (**Fig. 22**).

California Nitrogen Index

Calculation Detail Report

United States Department of Agriculture
Research, Education, and Economics
Agricultural Research Service

Basic Information

California Farmer
6/11/2008
California
Clay LM VHN

Assessment of Risk

Total N System In (lbs N / a y): 1501
Ammonia Volatilization (lbs N / a y): 27
Denitrification (lbs N / a y): 535

Above Ground Uptake (lbs N / a y): 483
Leaching Index (inches): 5.7
Total Nitrogen Leached (lbs N / a y): 137

Residual Nitrate (lbs N / a y): 319
System Use Efficiency (%): 32
Ratio N Applied to N Removed by Crop: 3.1

Economic Assessment

Ammonia Volatilization($ / a y (Loss)): 30.01
Denitrification($ / a y (Loss)): 588.16
Total Nitrogen Leached($ / a y (Loss)): 151.03
Residual Nitrate($ / a y (Loss)): 351.04

Rankings

	Very Low	Low	Medium	High	Very High
Nitrate Leaching				40	
Surface Transport			16		
Atmospheric Quality			22		
Total			78		

For questions:

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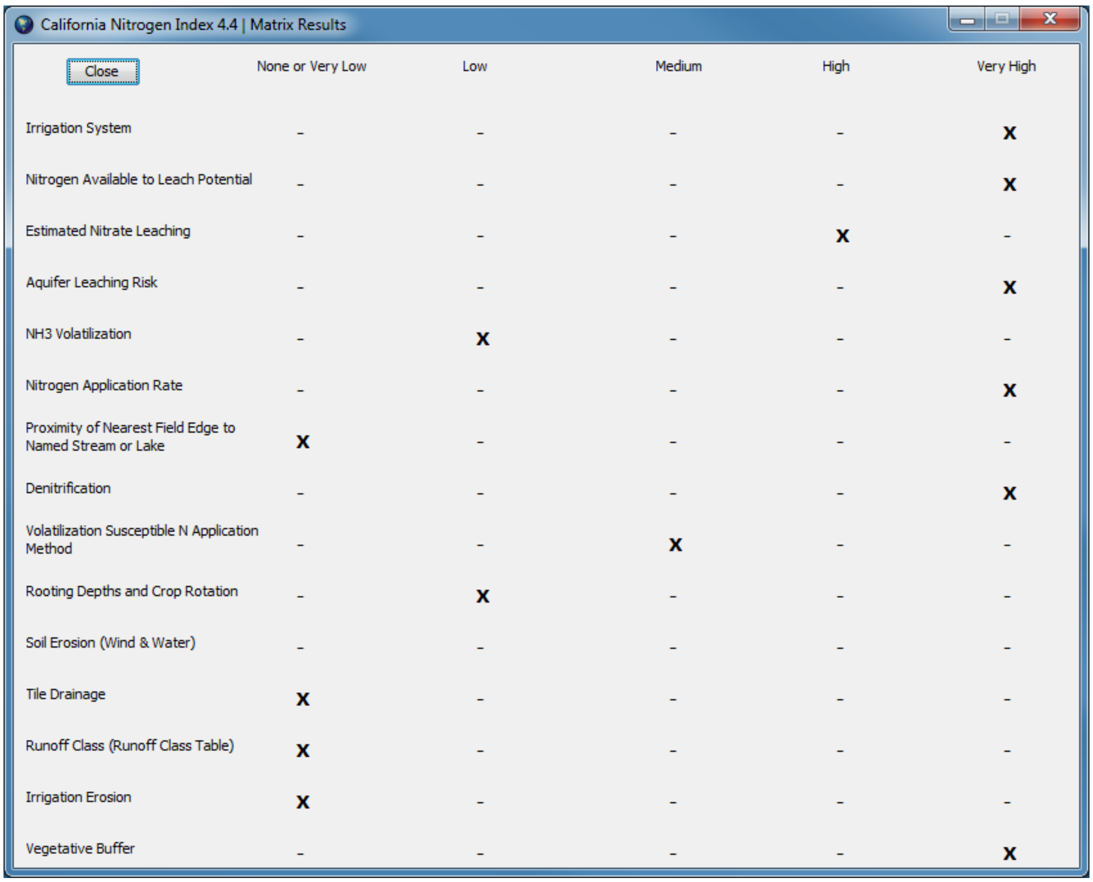
Figure 22

12. Matrix Results Screen

The Matrix Results screen can be accessed by clicking on the *Ranking Matrix* button in the Assessment of Risk window. This screen displays the rank and score for each management category, generated from the values entered throughout the previous screens (**Fig. 23**). The overall N Index rankings and scores are determined directly from this matrix. When you're finished viewing the rank and score matrix, you can click on *Close* to return to the Assessment of Risk screen.



California Nitrogen Index 4.4 | Matrix Results

Close	None or Very Low	Low	Medium	High	Very High
Irrigation System	-	-	-	-	X
Nitrogen Available to Leach Potential	-	-	-	-	X
Estimated Nitrate Leaching	-	-	-	X	-
Aquifer Leaching Risk	-	-	-	-	X
NH3 Volatilization	-	X	-	-	-
Nitrogen Application Rate	-	-	-	-	X
Proximity of Nearest Field Edge to Named Stream or Lake	X	-	-	-	-
Denitrification	-	-	-	-	X
Volatilization Susceptible N Application Method	-	-	X	-	-
Rooting Depths and Crop Rotation	-	X	-	-	-
Soil Erosion (Wind & Water)	-	-	-	-	-
Tile Drainage	X	-	-	-	-
Runoff Class (Runoff Class Table)	X	-	-	-	-
Irrigation Erosion	X	-	-	-	-
Vegetative Buffer	-	-	-	-	X

Figure 23

13. View Index Results

To view index results in comparison with other saved indices, first be sure you have permanently saved your index results as an index file, as described previously. Then click on the *Compare N-Index Results button* in the *Driver* window. In the *View Index Results* window (**Fig. 24a**), you can compare up to six saved files at a time. These files must be of the same units but can be from different regions. Please take note, the units *lbs N* (or *kg N*) actually represents *lbs N / a y* (or *kg N / ha y*).

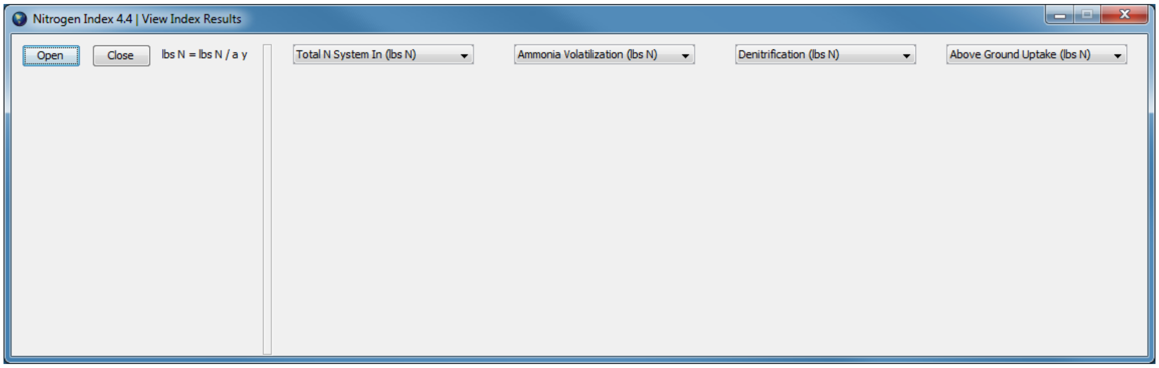


Figure 24a

Click on the *Open* button in the upper left corner of the *View Index Results* window to select the first N Index you would like to view or compare (**Fig. 24b**). You can continue selecting up to a total of six index files by clicking the *Open* button each time you want to add an additional set of index data (**Fig. 24b**). You can select up to four variables/categories from the dropdown menus to use for comparing the indices to each other (**Fig. 24c**).

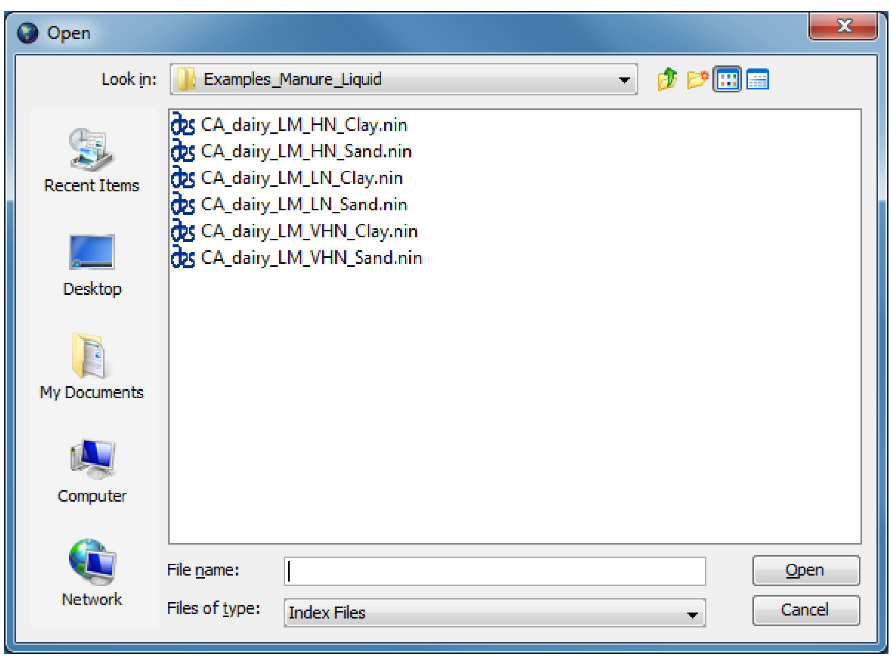
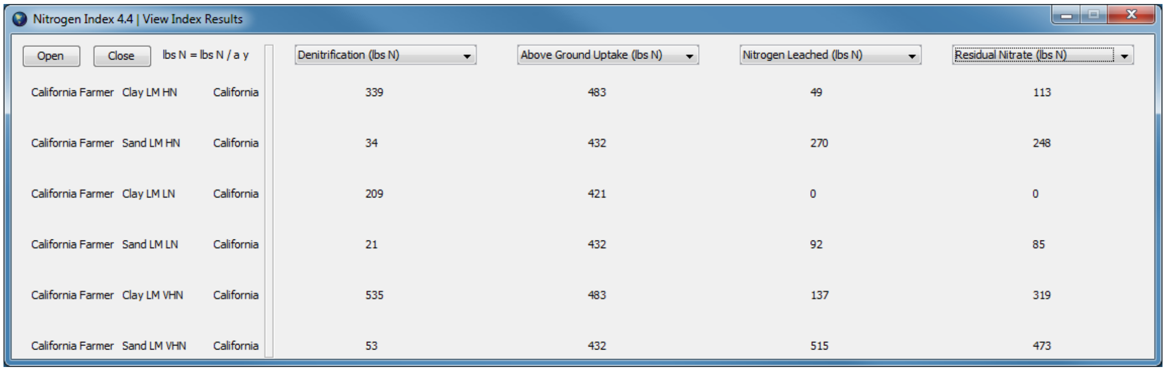


Figure 24b



			Denitrification (lbs N)	Above Ground Uptake (lbs N)	Nitrogen Leached (lbs N)	Residual Nitrate (lbs N)
California Farmer	Clay LM HN	California	339	483	49	113
California Farmer	Sand LM HN	California	34	432	270	248
California Farmer	Clay LM LN	California	209	421	0	0
California Farmer	Sand LM LN	California	21	432	92	85
California Farmer	Clay LM VHN	California	535	483	137	319
California Farmer	Sand LM VHN	California	53	432	515	473

Figure 24c

14. Vegetable Examples

In addition to the already mentioned example files included with this software, you will find four vegetable system example files. These may provide useful initial data to get you started if you are using the N Index with vegetable systems. The examples are designed around lettuce, both with and without winter rye cover crops. Comparing these files in the N Index shows how cover crops can affect N dynamics in a system like those presented on both sandy clay and clay loam soils.

Because the procedure for these examples is the same as the example used throughout this manual for forage systems, please refer to earlier sections for specific operating procedures when using the N Index for vegetable systems.

Vegetable File Names: CA_2x_Let_CLAYLOAM
CA_2x_Let_CLAYLOAM_CC
CA_2x_Let_SANDY
CA_2x_Let_SANDY_CC

15. Custom Crop Values

You can create site-specific crop values in the index database by using the "custom" crops on the crop screen.

15.1. Creating a Custom Crop: In the crop drop down menu, there are four types of custom crops: fruit, forage, grain, and vegetable (**Fig 25a**). While you can select any of the four, the types are meant to serve as a reminder of which type of custom crop you are simulating. When you select a custom crop, the "Unit", "Weight/Unit", "%H2O", "NUI", and "Leguminous" fields become editable (**Fig 25b**). Here you can enter custom values for these fields to model your site-specific crops. **Note:** for *English* Units, only "Ton" or "Bu" is accepted for crop units while *Metric* Units, only "Mg" is accepted for crop units.

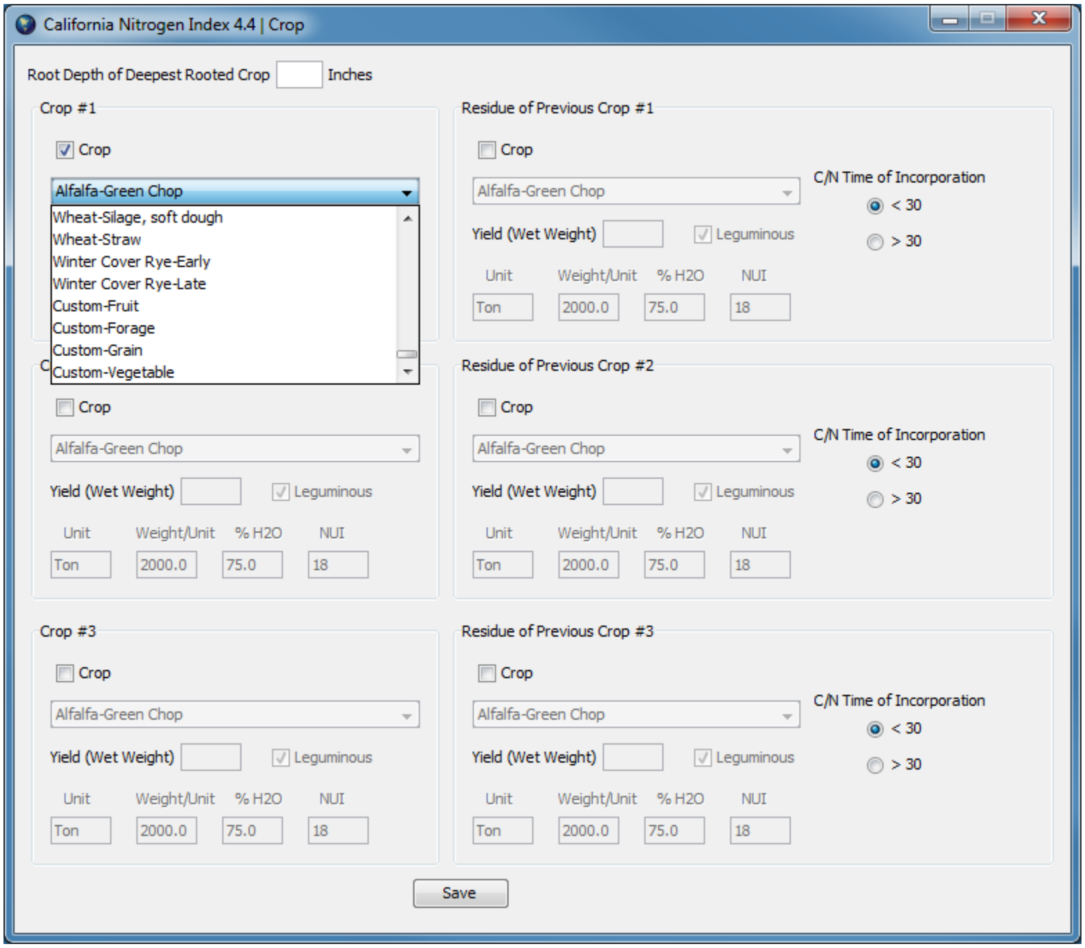


Figure 25a

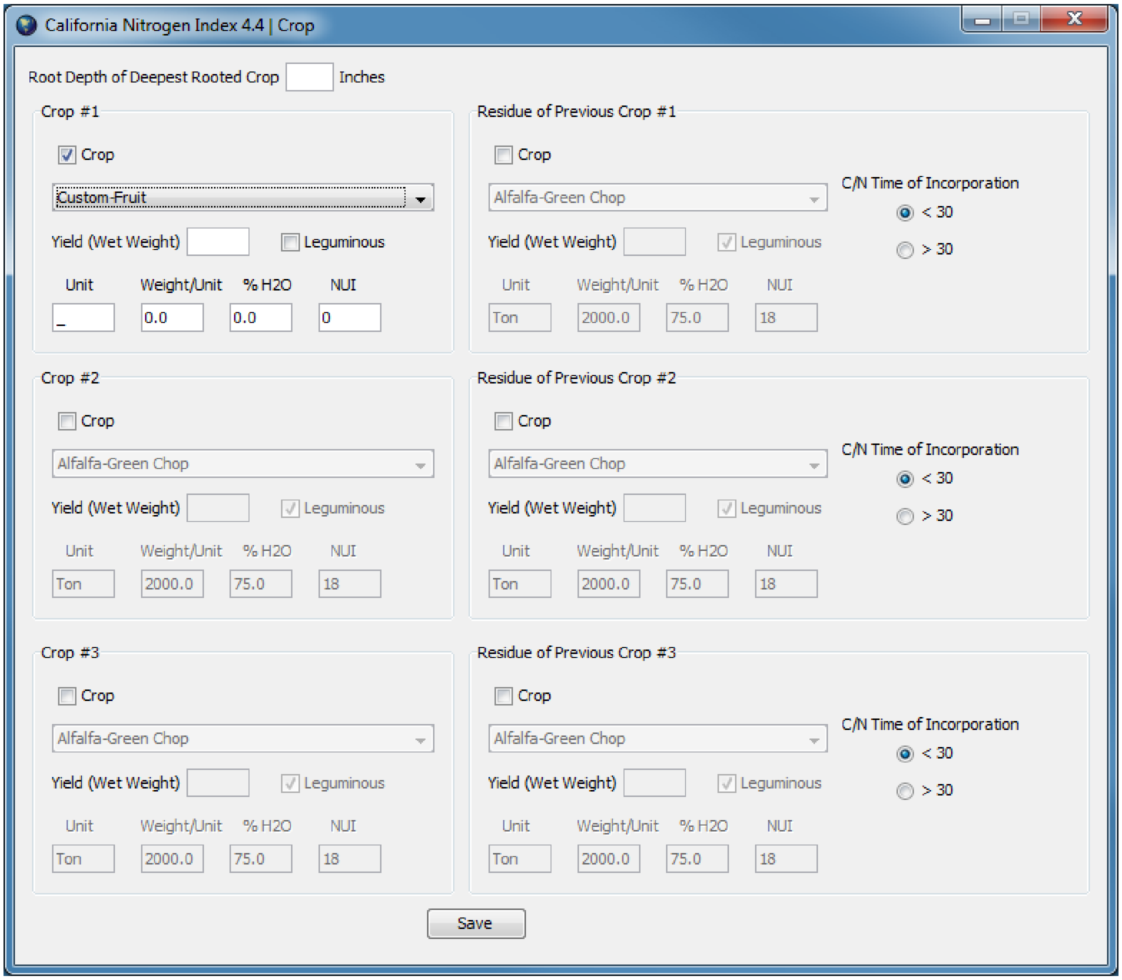

California Nitrogen Index 4.4 | Crop
Root Depth of Deepest Rooted Crop
Inches
Crop #1
Crop
Custom-Fruit
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
0.0
0.0
0
Residue of Previous Crop #1
Crop
Alfalfa-Green Chop
C/N Time of Incorporation
< 30
> 30
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
Ton
2000.0
75.0
18
Crop #2
Crop
Alfalfa-Green Chop
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
Ton
2000.0
75.0
18
Residue of Previous Crop #2
Crop
Alfalfa-Green Chop
C/N Time of Incorporation
< 30
> 30
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
Ton
2000.0
75.0
18
Crop #3
Crop
Alfalfa-Green Chop
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
Ton
2000.0
75.0
18
Residue of Previous Crop #3
Crop
Alfalfa-Green Chop
C/N Time of Incorporation
< 30
> 30
Yield (Wet Weight)
Leguminous
Unit
Weight/Unit
% H2O
NUI
Ton
2000.0
75.0
18
Save

Figure 25b

Appendices

Appendix 1: Soil Sustainability Index

The Soil Sustainability Index is adapted from Maryland Soil Quality Assessment Book. Following is a brief discussion on the capabilities of this index.

The majority of the windows you will encounter when choosing Bolivia or Ecuador as your region will be similar to the windows available for the other regions; however, the Bolivia and Ecuador Nitrogen Indices also include a Soil Sustainability window where you can enter information about top soil, erosion, crop residue management, and other variables (**Figs. 26a,b**).

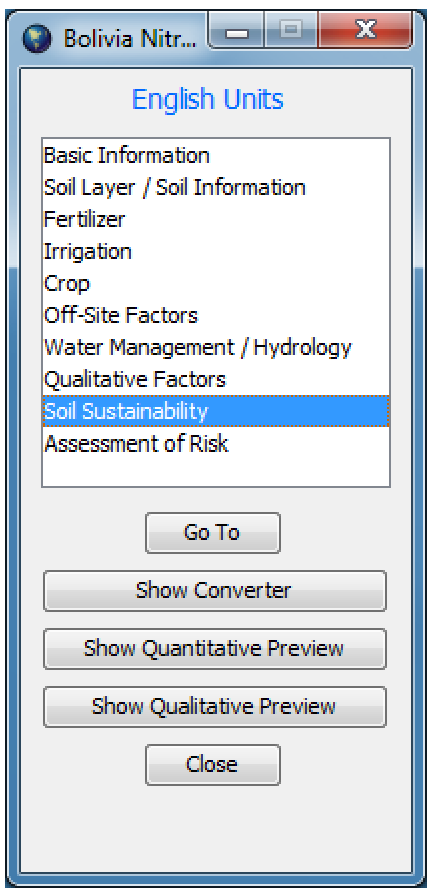


Fig. 26a

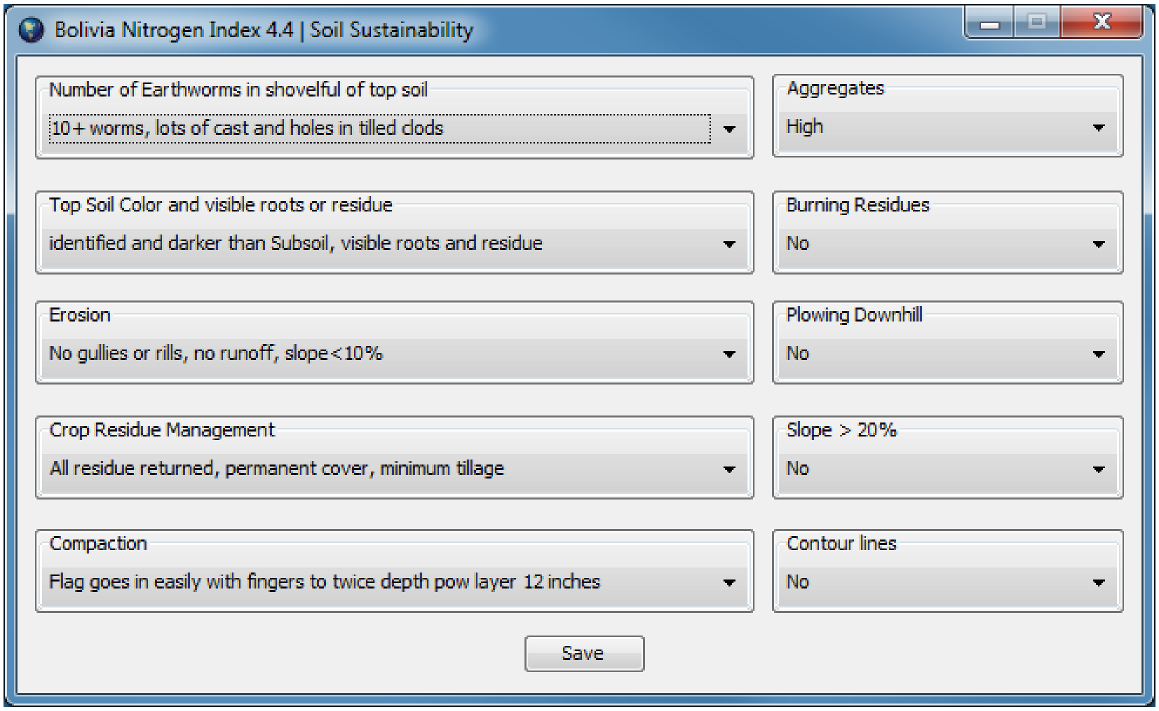


Fig. 26b

In the Assessment of Risk Screen (**Fig. 27a**) for the regions of Bolivia and Ecuador, you will also notice that there is a button named *Soil Sustainability.* Clicking this button allows you to see qualitatively how the data you entered affect the sustainability of the soil (**Fig. 27b**). Also, note that you can keep the qualitative Sustainability screen open when accessing other screens (**Fig. 27c**).

Important: When interpreting the qualitative results shown by the Soil Sustainability Index, it is very important to realize that higher values in these indices represent higher levels of risk. The example file used for **Figure 33**, for instance, has a high Soil Health value of 36; this indicates a ***high level of risk of having a negative impact*** on soil health. Similarly, the Sustainability Index has a value of 18; this large value indicates a ***high level of risk of having a negative impact*** on sustainability. In other words, the management practices in the example file would very likely have a negative impact on the soil health and sustainability for the situation in that example.

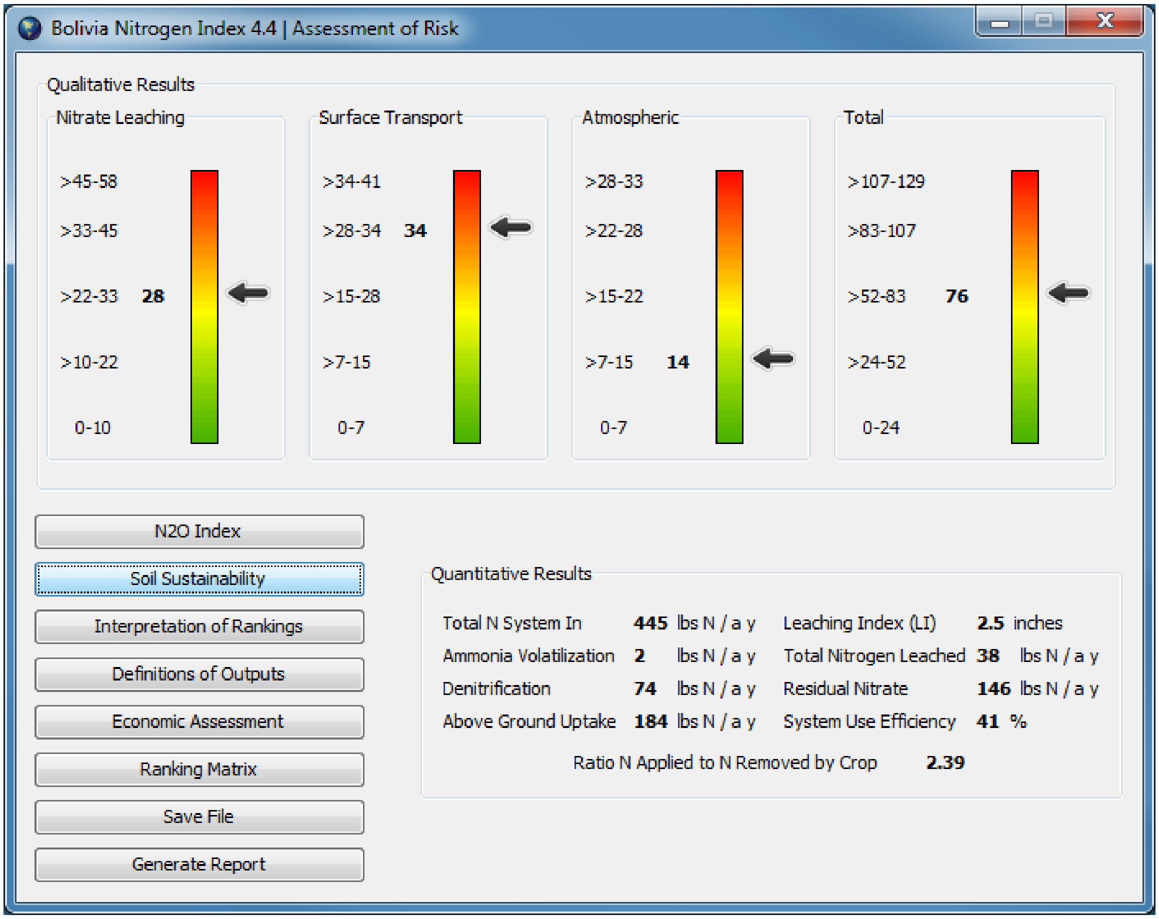


Fig. 27a

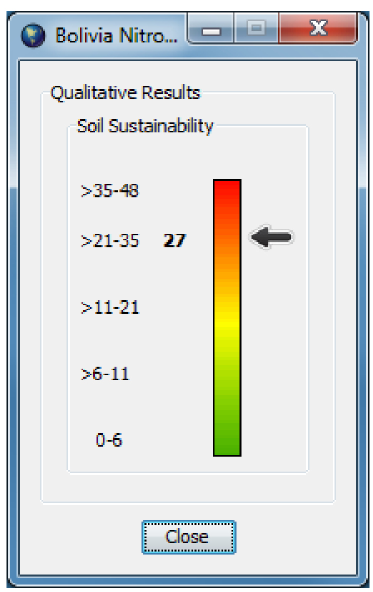


Fig. 27b

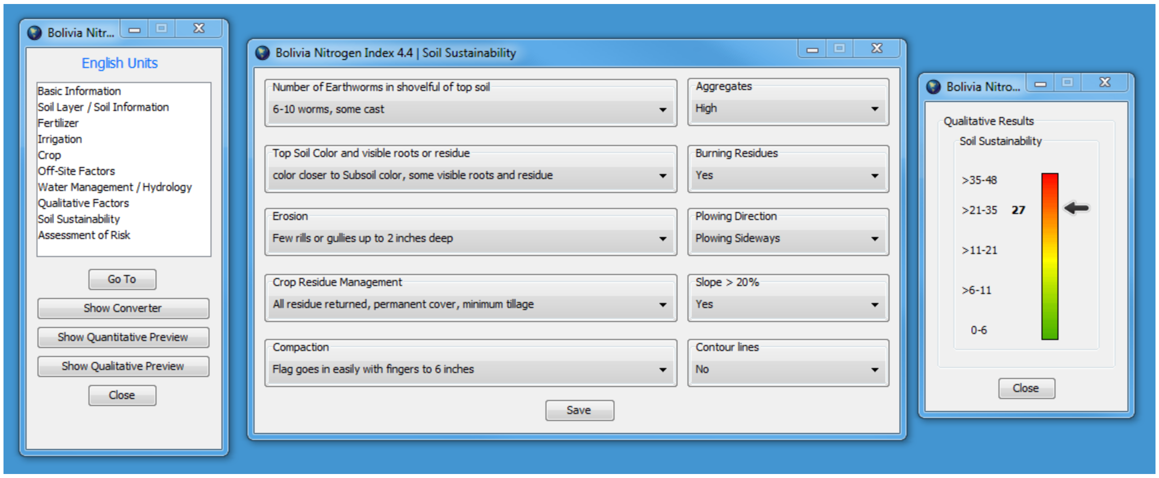


Fig. 27c

Appendix 2: Mexico and Caribbean Navigation Screens

When working with a Mexico or Caribbean Nitrogen Index run, it is important to recognize that these regions have altered navigation screens with added functions compared to the California navigation screen. As shown by **Figure 28a**, Mexico has an added button labeled *Show Converter*, while the Caribbean Navigation Screen has two added buttons: *Show Converter* and *Show PR Soil Information* (**Figure 28b**).

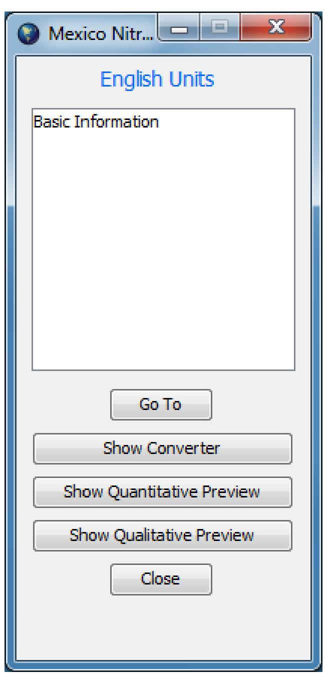


Fig. 28a

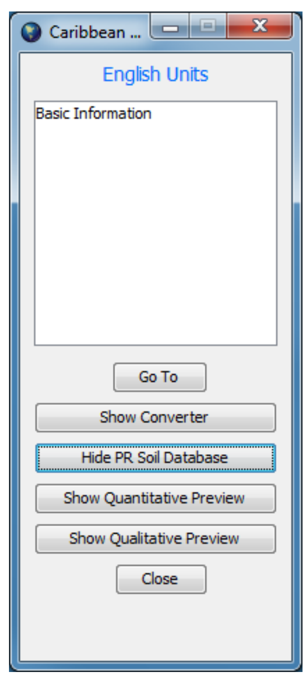


Fig. 28b

The *Show Converter* button, when clicked, will open the Converter Screen that allows the user to calculate conversions between units. **Figure 29a** is an example of the Converter Screen.

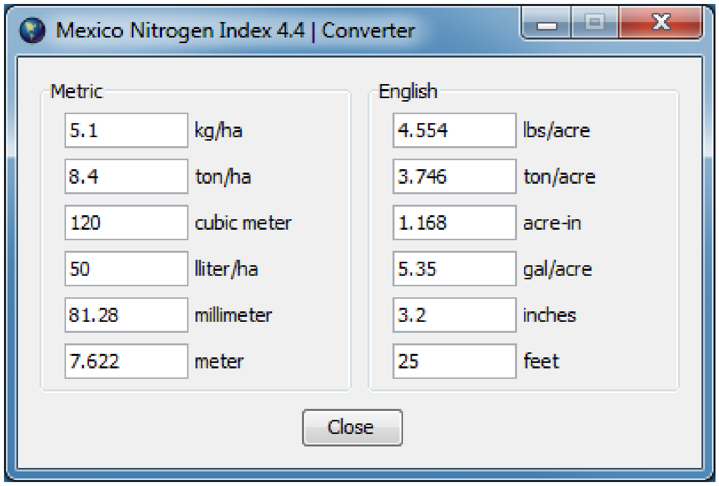


Fig. 29a

As shown by **Figure 29b**, the *Soil Database* window is made visible by clicking the *Show PR Soil Database* button in the Caribbean navigation screen. The *Soil Database* window will provide Bulk Density, Organic Matter, PH, Series Symbol, Hydrology, and Drainage values for each soil type.

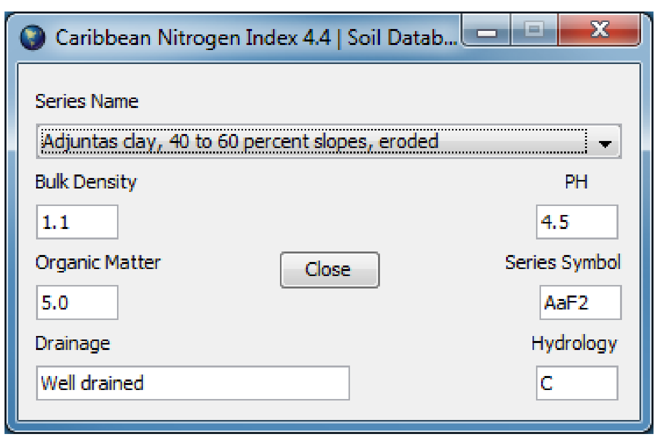


Fig. 29b

Appendix 3: Fully Bilingual and Metric Nitrogen Index

With the Nitrogen Index 4.4, users can create simulations in either *English* or *Spanish* languages and with *English* or *Metric* units. The index files are completely independent of language. If a file was originally created with *English* as the selected language, it does not limit a *Spanish* speaking user from opening the file. The index units do not act this way. Index files are completely dependent on which units it was created with. The Nitrogen Index 4.4 will not open a *Metric* file if the *English* units are selected. In future versions, index files will not be dependent on the original units selected and an index file will be able to be opened with either unit selected.

Appendix 4: N2O Index

The N2O Index is currently in development by Dr. Jorge Delgado and will be released in the next version of the Nitrogen Index.

Appendix 5: Screen Size

If your screens do not match the screens in the manual and fields on the screens are off the screen, the problem could be caused by your "Display" property. We recommend using the default text size when using the Index (**Fig. 30a**).

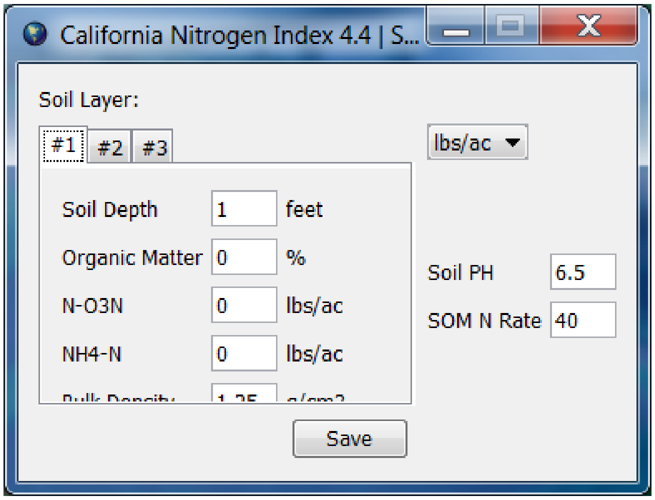


Fig. 30a

On Windows 7, the "Display" property is located by going to Control Panel, Appearance and Personalization, and selecting Display (**Fig. 30b**). To avoid any problems, make sure "Smaller – 100% (default)" is checked.

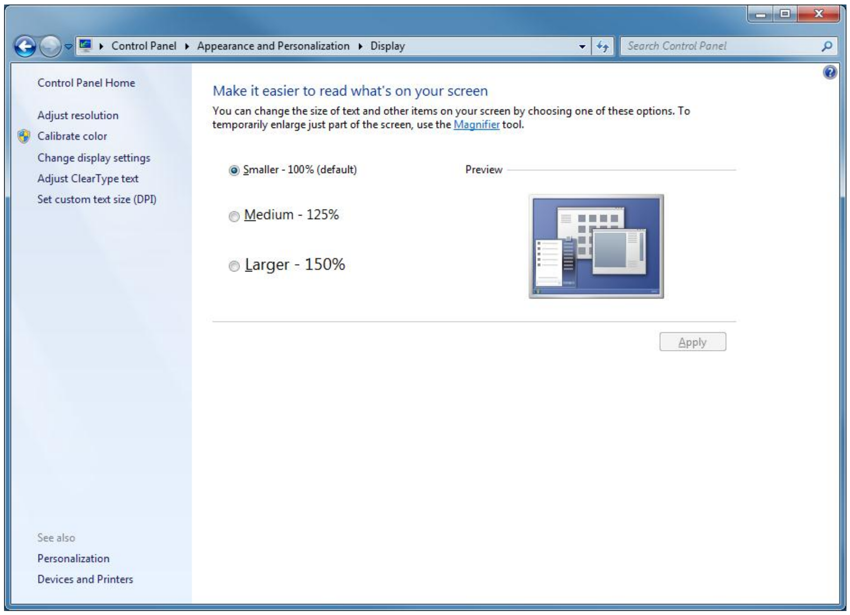


Fig. 30b

On Windows XP, the display properties can be viewed by going to Control Panel and selecting Display or by right-clicking going to "properties". Go to the Appearance tab and make sure Font Size is "Normal" (**Fig. 30c**).

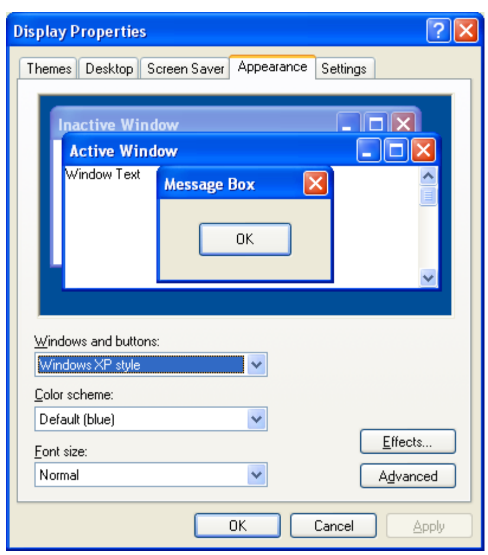


Fig. 30c

Calculations

1. Equations

The Calculations section is still being edited. It will be available in future versions of this user manual.

For basic equations please review:

Delgado, J.A., M. Shaffer, C. Hu, R. Lavado, J. Cueto Wong, P. Joosse, D. Sotomayor, W. Colon, R. Follett, S. Del Grosso X. Li, and H. Rimski-Korsakov. 2007. An index approach to assess nitrogen losses to the environment. Ecol. Eng. 32:108-120.

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For questions about specific calculations or algorithms that are not answered in this manual, please contact:

Dr. Jorge Delgado Email: jorge.delgado@ars.usda.gov

or

Mr. Kevin Kowalski Email: kevin.kowalski@ars.usda.gov

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