

# LANDFIRE AutoKey User Guide

Version 2.2



1/31/2008

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## 1. Key Logic

This program applies a sequence table approach to plot data to key plots to Existing Vegetation Type (EVT) map units based on floristics and spatial criteria. The key contains fields for plot-level and species-level criteria. The plot-level criteria denote requirements for total cover on the plot, the amount of cover distributed by lifeform, planted stand origin<sup>1</sup>, and spatial criteria including elevation, ECOMAP Subsection, EPA Ecoregion, TNC Ecoregion, and LANDFIRE Map Zone. The program tests plots against these criteria row by row in the key, in the order denoted by the “Row\_No” field. A plot is tested against each row until it satisfies all the criteria required by that row of the key, and will return with either an EVT assignment or a lack thereof if it failed the criteria of all rows. Each column that is populated with a criterion in the key is tested using AND logic, such that all conditions specified by columns in that row must be met by a given plot.

Within a given row in the key, the plot is first tested against the plot-level criteria. If the plot passes those criteria, it is then tested against the species-level criteria. The species-level criteria are a series of pairs of an indicator species list and cover conditions. Each indicator species can be denoted by genus (e.g., “*Artemisia*” or “*Artemisia* spp.”), species (e.g., “*Artemisia tridentata*”), species-subspecies (e.g., “*Artemisia tridentata* ssp. *wyomingensis*”), species-variety (e.g., “*Clematis columbiana* var. *tenuiloba*”, or species-subspecies-variety (in that order only). The key classifier supports genus abbreviations in the species list where there is no ambiguity of the genus being referred to (e.g., “*Antennaria racemosa*, *A. rosea*, *Bupleurum americanum*”).

Each species in the species list is tested against the species present on a plot using regular expression searching. This means that if the case-sensitive text of the indicator species is found in the name of a species on the plot, that species is considered found and its cover is added to the tally that will be tested against the condition specified for the species list to which this indicator belongs. For example, if the species list includes “*Clematis columbiana*”, then a plot that records “*Clematis columbiana* var. *tenuiloba*” with 10% cover will be added to the total cover tested against the condition of that species list. The cover is summed across all species in the species list that were found on the plot.

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<sup>1</sup>An additional criterion was added in March 2007 for forest stands that have evidence that they originated from planting. A code of “1” in the “planted” field indicates that this row of the key requires that a stand have evidence of planted origins in addition to all the other criteria required of this row. This field must otherwise be blank. Plots that do not have evidence of planted origins (“planted” is false) or from datasets in which this information is unavailable (“planted” is missing) are treated equivalently in this case; thus it is impossible to specify a criterion that a plot *not* have evidence of originating from planting.

Note: using multiple levels of specificity for a species within a species list can produce redundant counting of cover on the plot for that species. For example, the indicator species list is: “Artemisia, Artemisia tridentata, Artemisia tridentata ssp. wyomingensis”, and this species is measured on a plot as “Artemisia tridentata ssp. wyomingensis” with 10% cover. The key will test on each species in the species list, and each will return with a measurement of 10% cover, for a total of 30% cover that will be compared against the cover condition of the indicator species list. The best way to avoid this situation is to specify a species only as specifically as required for that EVT, and never include more generic references to it within that species list.

A cover condition can specify a cover value that the species list must be greater than, less than, or equal to. It can specify a range of covers (e.g., “10-25%”). It can also specify “present” or “absent” if the actual cover values of the species are unimportant for keying a plot. To test against this criterion, the relative cover value of each species within the species list that is found on a given plot is added together. This total is then compared to the criterion. If this value is nonzero, the “present” criterion is satisfied. If this value is zero, the “absent” criterion is satisfied.

## 2. Required Software

### **Python:**

This software was written in Python, an interpreted language. As such, the Python interpreter must be installed for the program to run, unlike free-standing software. Python is freely-available, accessible, and easy-to-install. In our experience, Python can be installed completely by users who lack administrative privileges.

To download python, visit:

<http://www.python.org/>

Follow the links for the latest version (currently 2.5). Be sure to select the Windows version. The installation program will guide you through the installation process.

### **Pywin32:**

This Python module must be installed in order to access the MS ACCESS database required by this program. To download this module, visit SourceForge:

<https://sourceforge.net/projects/pywin32/>

Click on the download link for the latest software release (typically halfway down the page on the right). Select the release for your version of Python (contains version number in the name of the downloaded file). The installation program will automatically find the existing installation of Python and install to the correct directory. If you experience problems, make sure that you select the correct release of this module that matches the version of Python, or try reinstalling Python.

### **Source Database:**

This must be an MS ACCESS database containing tables that conform to the format rule laid out in “Key\_Implementation.doc”

### 3. Running The AutoKey Program

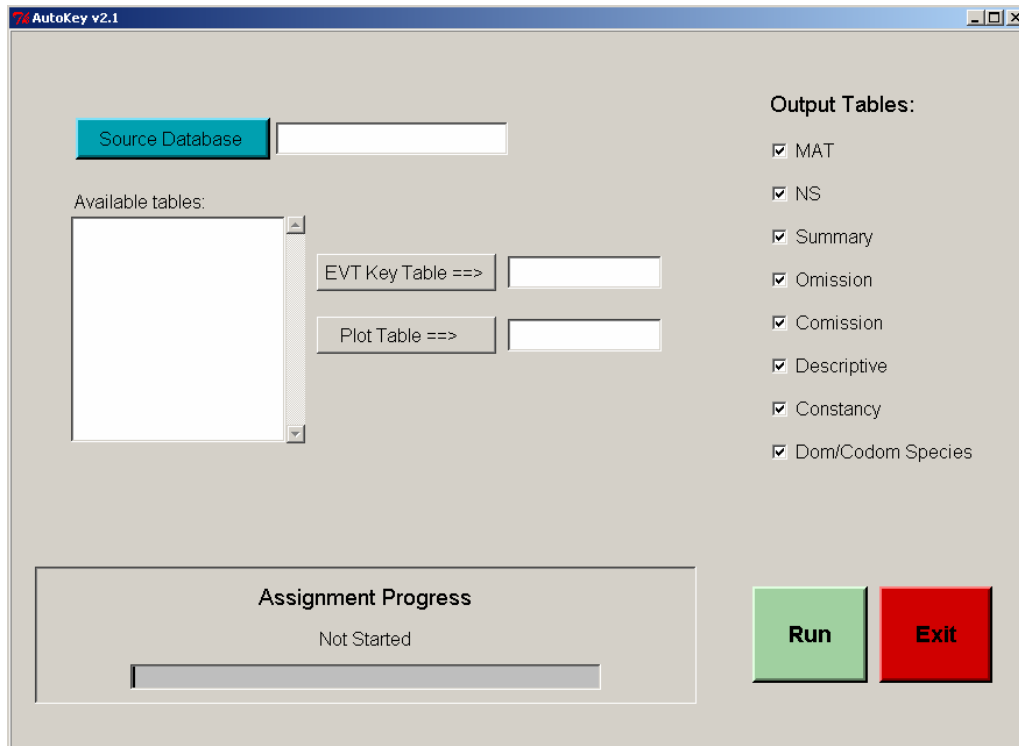
Open your favorite file browser (typically Windows Explorer or My Computer). Navigate to the directory where you stored the Python files for this program. This directory must contain the following three files:

AutoKey\_V2.pyw – This is the Graphical User Interface (GUI) for the program

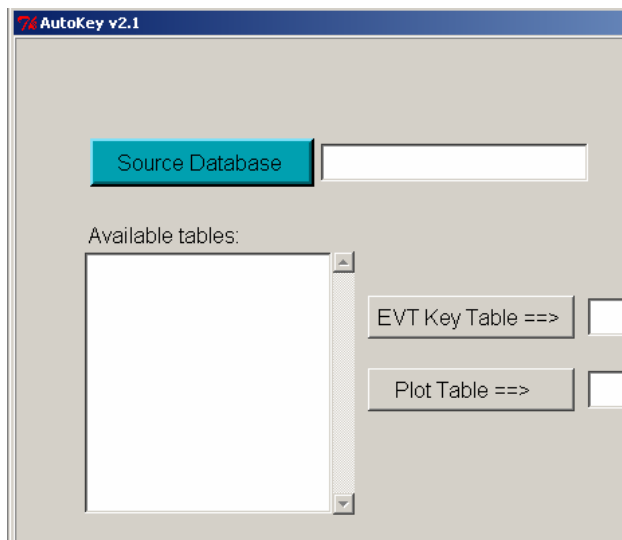
\_Functions.py – This is a required script containing function and class definitions

\_Proc\_Key.py – This is the core of the AutoKey program used by the GUI

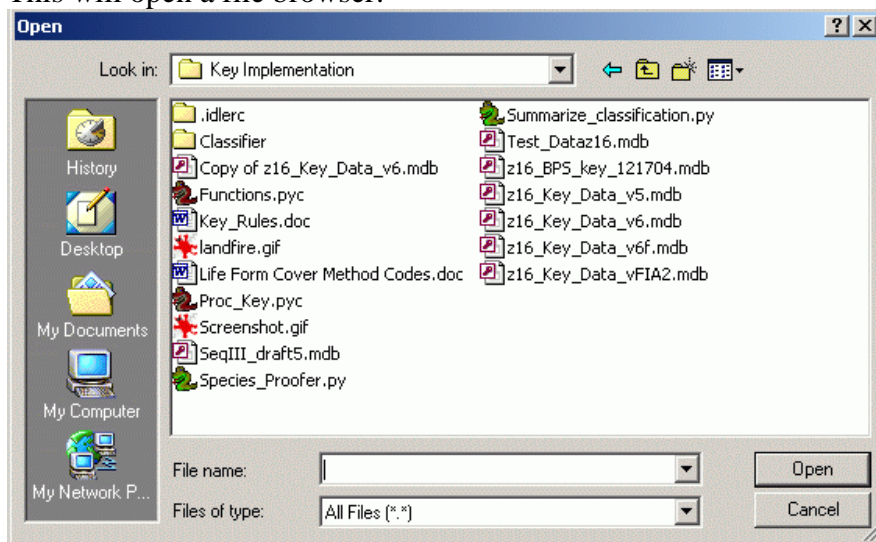
To run the Classifier, double-click AutoKey\_V2.pyw. This will execute the GUI using a call to the Python interpreter you installed earlier. You should now see the following window:



Once you have the Classifier open, you must now select the Source Database by clicking on the Source Database button:

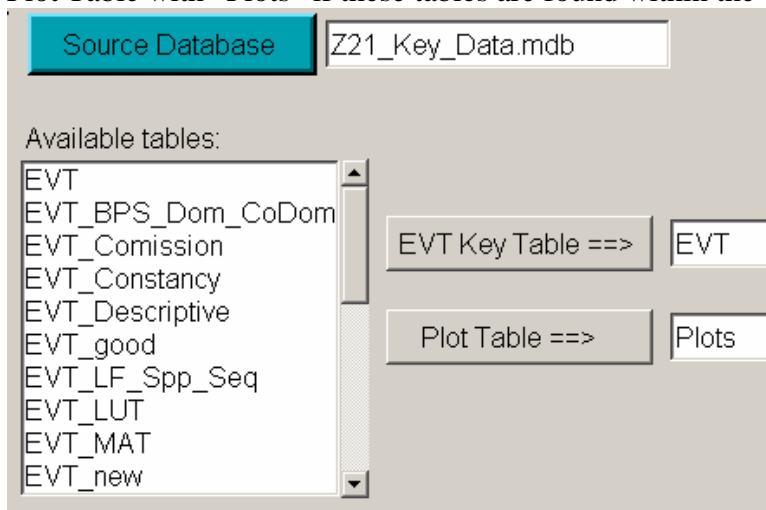


This will open a file browser:



Navigate to the correct folder and select the MS ACCESS database containing the keys and plot data. Note: typing the filename into the entry field will not work – you must use the file browser to locate the file. If the file is valid, you will be returned to the Classifier, and it will automatically populate the Available Tables field.

Now enter the required tables by first selecting the table from the Available Tables field, then clicking the appropriate button for that field. This will automatically populate the entry field for that table. The program will automatically populate the EVT Key Table with “EVT” and the Plot Table with “Plots” if these tables are found within the database.



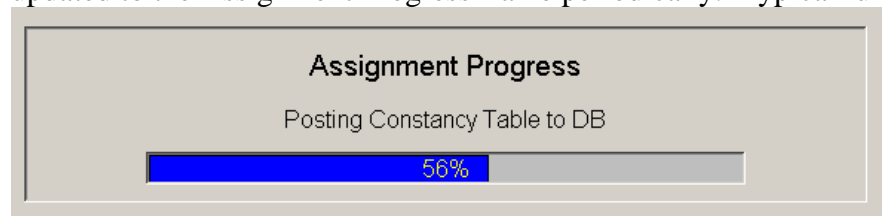
The Descriptive Table is required to produce the Descriptive output – the button and entry field will be activated when you select the Descriptive output checkbox. The Species List Table is required by the Constancy output – the button and entry field will be activated when you select the Constancy output checkbox.

Select the desired Output tables from the List of Checkboxes:

|   |  |
|---|--|
| <b>Output Tables:</b><br><br><input checked="" type="checkbox"/> MAT<br><br><input checked="" type="checkbox"/> NS<br><br><input checked="" type="checkbox"/> Summary<br><br><input checked="" type="checkbox"/> Omission<br><br><input checked="" type="checkbox"/> Comission<br><br><input checked="" type="checkbox"/> Descriptive<br><br><input checked="" type="checkbox"/> Constancy<br><br><input checked="" type="checkbox"/> Dom/Codom Species | MAT: Map Attribute Table, incorporated into LFRDB for plot EVT assignments<br><br>NS: Attribute table of plots joined to Ecological System IDs<br><br>Summary: Frequency of plots per EVT<br><br>Omission: Plots not keyed to an EVT, joined to plot data (useful for finding additional criteria to key out these plots)<br><br>Comission: Keyed plots joined to plot data<br><br>Descriptive: Plots Joined to descriptive data (e.g., EPA Ecoregion, elevation, slope, etc.)<br><br>Constancy: Constancy Coverage Tables for EVT (useful for determining which species occur at highest cover values and most frequently on plots keyed to each EVT) |
|---|--|

Dom/Codom Species: Dominant and codominant species table for EVT (useful for determining which species tend to dominate on plots keyed to particular EVTs). To create this table, the EVT assigned to each plot is associated with a list of lifeforms associated with the NS\_Lifeform of that EVT (from join of EVT\_LUT and Lifeform\_XWalk). All species within those lifeforms are selected from each plot and sorted by absolute cover. The dominant species will be the one with the highest absolute cover, and the codominant species will be the next highest cover. When more than one species has the highest cover on a plot, the species are then sorted alphabetically to determine dominant and codominant.

Click on the Run button to begin the assignment process. The current step and progress will be updated to the Assignment Progress frame periodically. Typical run times are 10-50 minutes.



## 4. Proofing the EVT Key Table

The AutoKey program automatically proofs the EVT key table at the beginning of a run. The program checks each valid species list in the key for misspelled species and duplicate species references. Rows in the key which are not assigned an EVT code will be ignored during proofing. All species names in the key are compared to the master species list extracted from the NRCS Plants Database used to build the species tables in the source database. Duplicate species references occur when two or more references ranging from more generic to more specific are contained in a given species list. This means that such species could be double-counted on plots that are identified to the more specific case (see Section 1 for more details). For example, the key will detect the following as duplicate references: “*Pseudotsuga menziesii*, *Pseudotsuga menziesii* var. *glauca*” if they occur within the same species list.

If misspelled species or duplicate species references are found, the program will create an EXCEL file duplicating the key from the database, where the filename is prefixed by name of the current key table (e.g., “EVT\_Key\_Errors.xls”). This file contains cells that are highlighted based on the error that was found within them, accompanied by comments specifying what particular species were erroneous or duplicated. If either type of error is found within any valid row of the key table, the program halts after writing the EXCEL file and does not apply the key against any plot data.

| 1  | A      | B        | C       | D          | E      | F      | G       | H         | I         | J         | K         | L         | M                                      | N         | O   | P         |
|----|--------|----------|---------|------------|--------|--------|---------|-----------|-----------|-----------|-----------|-----------|--|-----------|---|-----------|
| 2  | Row No | EVT Code | ESL Map | EVT Nam    | totcov | wdycov | treecov | conifeshb | conifeshb | conifeshb | conifeshb | conifeshb | conifeshb                              | conifeshb | conifeshb   | conifeshb |
| 3  | 370    | 2054     |         | Southern F | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Pinus ponderosa</i> , <i>Pinus</i>  | >50%      | <i>Abies concolor</i> , <i>Pseudotsuga menziesii</i>    | <25%      |
| 4  | 380    | 2054     |         | Southern F | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Pinus ponderosa</i> , <i>Pinus</i>  | >25%      | <i>Abies concolor</i> , <i>Pseudotsuga menziesii</i>    | <5%       |
| 5  | 390    | 2109     | 25      | Sonoran P  | >10%   | >10%   | >10%    |           |           | >5%       |           |           | <i>Carnegiea gigantea</i> , <i>Ol</i>  | >50%      |   |           |
| 6  | 400    | 2023     |         | Madrean E  | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Quercus pauciloba</i> , <i>Qu</i>   | >50%      | <i>Quercus toumeyii</i>                                 | <25%      |
| 7  | 410    | 2024     |         | Madrean F  | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Pinus arizonica</i> , <i>Pinus</i>  | >15%      |   |           |
| 8  | 420    | 2024     |         | Madrean F  | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Pinus arizonica</i> , <i>Pinus</i>  | >15%      | <i>Quercus arizonica</i> , <i>Quercus chrys</i>         | present   |
| 9  | 430    | 2121     |         | Apacheria  | >10%   | >10%   | 10-25%  |           |           | <50%      |           | >20%      | <i>Quercus arizonica</i> , <i>Que</i>  | >50%      | <i>Bouteloua rothrockii</i> , <i>Bouteloua ra</i>       | present   |
| 10 | 440    | 2011     |         | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Populus tremuloides</i>             | >70%      |   |           |
| 11 | 450    | 2011     |         | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Populus tremuloides</i> , <i>A</i>  | >70%      | <i>Populus tremuloides</i>                              | >25%      |
| 12 | 460    | 2011     |         | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Populus tremuloides</i>             | >25%      | <i>Abies concolor</i> , <i>Abies lasiocarpa</i>         | <5%       |
| 13 | 470    | 2011     |         | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Populus tremuloides</i>             | >25%      | <i>Abies concolor</i> , <i>Abies lasiocarpa</i>         | <25%      |
| 14 | 480    | 2061     |         | Inter-Moun | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Populus tremuloides</i>             | >25%      | <i>Abies concolor</i> , <i>Abies lasiocarpa</i>         | >25%      |
| 15 | 490    | 2056     | 25      | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Abies lasiocarpa</i> , <i>Picea</i> | >50%      | <i>Rhododendron albiflorum</i> , <i>Amelan</i>          | present   |
| 16 | 500    | 2055     | 25      | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Abies lasiocarpa</i> , <i>Picea</i> | >50%      |   |           |
| 17 | 510    | 2055     | 25      | Rocky M    | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Abies lasiocarpa</i> , <i>Picea</i> | >25%      | <i>Abies concolor</i> , <i>Pseudotsuga menziesii</i>    | <50%      |
| 18 | 520    | 2026     |         | Madrean U  | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Pseudotsuga menziesii</i>           | >50%      | <i>Quercus hypoleucoides</i> , <i>Quercus</i>           | present   |
| 19 | 530    | 2051     |         | Southern F | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Abies concolor</i> , <i>Pinus</i>   | >50%      | <i>Abies concolor</i> , <i>Picea pungens</i> , <i>P</i> | >5%       |
| 20 | 540    | 2052     |         | Southern F | >10%   | >10%   | >15%    |           |           |           |           |           | <i>Abies concolor</i> , <i>Pseud</i>   | >50%      | <i>Picea engelmannii</i> , <i>Populus trem</i>          | present   |

The color scheme for highlighting erroneous cells is as follows:

|                                  |
|----------------------------------|
| Misspelled Species               |
| Duplicate Species                |
| Misspelled and Duplicate Species |
| Missing Criteria                 |

Each highlighted cell is accompanied by a comment corresponding to the errors contained within them. Simply hover over the highlighted cells to reveal the comment, or use View->Comments on the File Menu to reveal all comments.



|                             |      |                 |
|-----------------------------|------|-----------------|
| Arenaria capillaris, Min pr |      |                 |
| Geum rossii var. turbin     |      |                 |
| Veratrum, Chamerion         | >5   | ber             |
| Dasiphora, Arctostaphy      | >5   | arr             |
| Bromus porteri, Dantho      | >5   |                 |
| Bouteloua gracilis, Koe     | >50% | Bromus porteri, |
| Andronnann gerardii S       | >50% | Andronnann ger  |

**Duplicate Species:**  
"Geum rossii"

For duplicate species, the most generic reference is indicated. However, in most cases, it is the more specific cases (e.g., subspecies or varieties) that are redundant for that species list and should be removed depending upon the requirements of that EVT.

## 5. Results

Results of the classification and post-classification queries will be posted to the Source Database. Post-classification queries will be named using the name of the current key as the prefix. Note: these results will overwrite existing data in the Source Database if the key was run previously using a key table with the same name.

## 6. Common Errors

This program comes with rudimentary error-handling abilities. These errors will be displayed on new pop-up windows informing the user about the possible cause of the error. These error messages were written to be as self-explanatory as possible, and will not be covered here.