Instructions for Using the Bee Plant Finder Tool

The Bee Plant Finder tool is an interactive Lucid key developed by the Trees for Bees NZ team. It is a powerful tool to find good bee forage plants that bees love.

These pages contain information on how to use the tool. It is not the same as using an interactive Lucid key for identifying plants. Instead, the goal is to create a list of candidate plants that can be used in a bee forage plantation. For the best results, follow the sequence of selecting features as given below. You will find the tool simple and effortless.

We show the sequence for an example designed for a shelterbelt with one row low shrubs and a second row of tall trees. This involves two separate searches for candidate bee plants, one for each row.

Once the basics are understood, this tool can be used for creating planting lists for any type of bee forage plantation or for exploring the features of many candidate bee plants.

How to use the Bee Plant Finder Tool

General layout

Lucid keys have an intuitive interface divided into four quadrats on the page.

Step One: Open the page and click on RUN KEY.

You will see four quadrats on the page.

The two left-hand quadrats are for features (attributes or characters) of the plants where you can select and track the different feature categories (character states) that you are using to search.

The two right-hand quadrats are the list of bee plant species or varieties (entities) that are in the tool database. These can be selected according to the feature states you choose.

Once the key is fully loaded, the top left-hand quadrat displays a complete list of **Features Available** and the top right-hand quadrat, called **Entities Remaining,** shows the bee plants in the tool.

The first group of features on the left, **Site conditions and plant tolerances,** provides features to describe your site. This will be the foundation of your search because it will give you plants suitable for your site which you specify.

The second group, **Plant features,** allows you to choose the types of plants you want.

The third group, **Bee-related features,** allows you to enhance or optimise your search to further select features such as how attractive or important or productive the plant is for bee forage.

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Step 2: Expand the features list.

Features are organised in a file directory structure that you can open (expand) and close individually for all three groups at once.

To expand all at once, click on the title for features quadrat (it will turn blue) and then click on the green down arrow in the third icon from the left at the top of the page. Scroll down to see all the features and their categories.

You can reverse the expansion by clicking on the green up arrow that is to the left of the green down arrow at the top of the page.

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Step 3: Expand the groups in the Entities list

In the top right quadrat you will find the names of all the bee plants in the database. These are the entities in the tool. Some of the bee plants are organised into groups in a directory structure and others are listed individually and not in groups.

The entities are made up of individual plants and 34 groups of plants. Counting the group names and the individual plant names we have a total of 255 entities. Of these entities there are a total of 222 plants species, subspecies, varieties and cultivars. We use the term taxa as a short cut for referring to all these.

The reason for naming the 34 groups each based on a genus is to indicate that other taxa in the genus having similar flowers may also provide good bee forage. That means that plants in the same genus can be explored for other candidate plants not listed in the tool. We have listed only some examples that we have worked with in the field or on demonstration farms.

In most groups, the taxa tend to have the same types of flowers including pollen and/or nectar production, for example: brassicas, willows, oaks, maples, eucalypts and pip fruit trees. But be careful to watch out for plants in groups that the horticulture industry has bred into highly modified flowers such as in the *Camellia* or *Citrus* groups. Highly modified flowers usually do not provide good pollen or nectar for bees so check the flowers to see that they will deliver before you buy the plants.

When using the tool it is easiest to keep the groups closed and open them only as needed since the list is long. To expand the groups, use the same method as described above for features.

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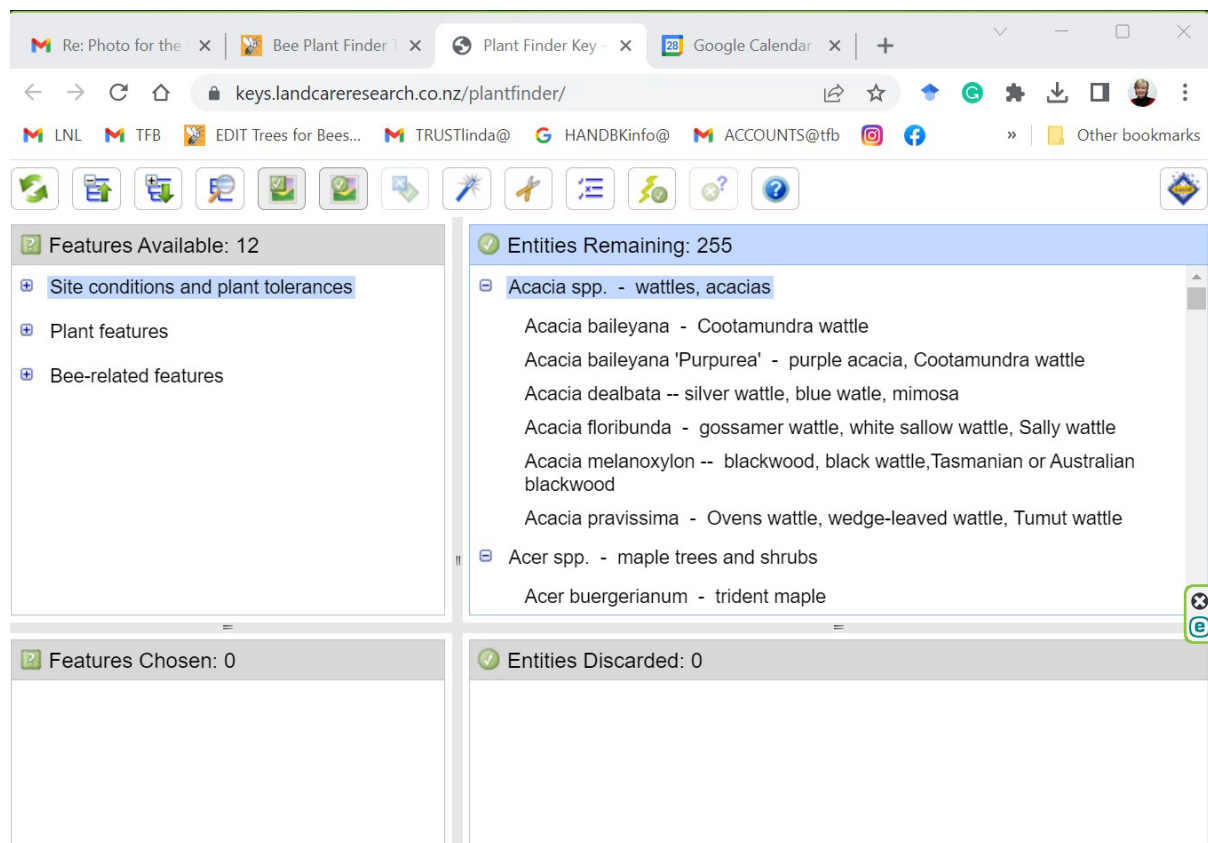
Step 4: Select the soil moisture conditions for your site.

In this example, we are searching for bee forage to plant a shelterbelt with two rows. We start the search for low shrubs needed for the front row of the shelterbelt.

The first step is to consider your site requirements. As you start using the key, the feature categories (character states) that you choose (by ticking score boxes in the top left-hand directory) appear in the 'Features Chosen' (bottom left) quadrat and the taxa that lack these features appear in the 'Entities Discarded' (bottom right) quadrat. The heading of the quadrat that you are in is highlighted in blue and all four panes are resizable.

It is advised to start your search by selecting the site conditions first since you cannot change the soil types or light at your site so this will constrain your search.

In this example, we select **moist soil** and this leave 217 entities remaining, and 38 entities discarded. You can select a second or third type of soil if there are seasonal changes that need to be managed but that will restrict your results dramatically.

In the upper right quadrat you will see the selected groups and other taxa. The groups are not expanded. You will see *Acacia, Acer, Alnus* and *Astelia* in light gray letters with a + box to the left of their names. Click on the green arrow as described above to expand these groups to see which species in the genus are selected and scroll down as desired.

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Step 5: Select light conditions for your site.

In the upper left quadrat, scroll down to the feature for light conditions. Select **partial shade** since this shrub row will be partially shaded by the second row of taller trees. In this case 145 bee plants are remaining. If you selected both sun and partial shade that could be a problem because it would give you plants that prefer or tolerate only full sun as well and these will not thrive in your conditions of partial shade only.

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Step 6: Select plant features: life form.

Selecting life form as shrub. This selection gives you 53 entities remaining.

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Step 7: Select plant features: height.

Selecting two height ranges for the shrubs (from 1 to 2 meters and from 2.1 to 5 meters) gives you 29 possible shrubs to plant. If you only chose one of these height ranges you would have less choice in that there are only 5 shrubs in the under one meter category versus 24 in the 2.1 to 5 meter category. Expanding and limiting the height range is always an option.

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Step 8: Select Plant Features: flowering season.

Select the season of flowering time based on what the bees need or when pollen or nectar dearth occur in your area, or any other time that is important to feed the bees. If you want to supply for honey bees then spring and autumn are the most important times of pollen dearth and are either side of the honey season (summer).

If you wanted to supply native bees then summer is the most important season and for bumble bees late winter and spring are the most important. Your beekeeper will know precisely when the dearth times are for honey bees in your region.

It is worth noting that these flowering times are generalised at the national level and so you will need local advice if you want specific times. For example, clover begins flowering very early Northern NZ and one or two months later in the far South. For further information, read the features description document: https://treesforbeesnz.org/s/Feature-Descriptions-for-Bee-Plant-Finder-Tool.pdf

In this example, we are selecting for the two most common dearth times for honey bees -- both **spring** and **autumn** flowering. This gives us 22 remaining entities.

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Step 9: Select Plant Features: deciduousness.

The last plant feature we need to consider is deciduousness. In this example, we want only evergreen shrubs because they provide good low shelter. Selecting for evergreen gives 20 candidate plant entities remaining.

For the next plant feature regarding native versus exotic we want both choices so we skip this feature. Clicking nothing will allow both exotic and native to be included in your plant list. Do not click on both native and exotic if you want both because it compromises the bee-related features in the next section. See feature descriptions on this point https://treesforbeesnz.org/s/Feature-Descriptions-for-Bee-Plant-Finder-Tool.pdf

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Step 10: Select Bee-related Features: Attractiveness, Importance, and Nectar

The last step is optional. You may want to consider optimising or enhancing your list of plants but this step can be skipped entirely if you do not have enough candidate plants on your list to choose from.

The bee-related features allow you to experiment to see if you can improve the plant list by selecting the best nectar and pollen producers. If we choose highly attractive, we get 15 entities remaining while adding high importance reduces the list to 13. So, it is better not to select for importance. At this point you might review all 20 plants previously selected to see if you can afford to select for any other bee related feature and still have enough different plants on your candidate list.

As an aside, it is worth noting that if you had previously selected native plants only and then selected for only those that provide surplus honey stores in the hives then you would end up with two shrubs: *Discaria toumaou* (matagouri, tumatakuru) and *Geniostoma rupestre* var. ligustrifolium (hangehange, pigwood). If you wanted native plants that gave pollen mainly or entirely you would get four different *Coprosma* species. See details in Feature Descriptions https://treesforbeesnz.org/s/Feature-Descriptions-for-Bee-Plant-Finder-Tool.pdf

There are many options at this point depending on your goals for the bee plantation you are designing so experimenting with your list at this point is recommended.
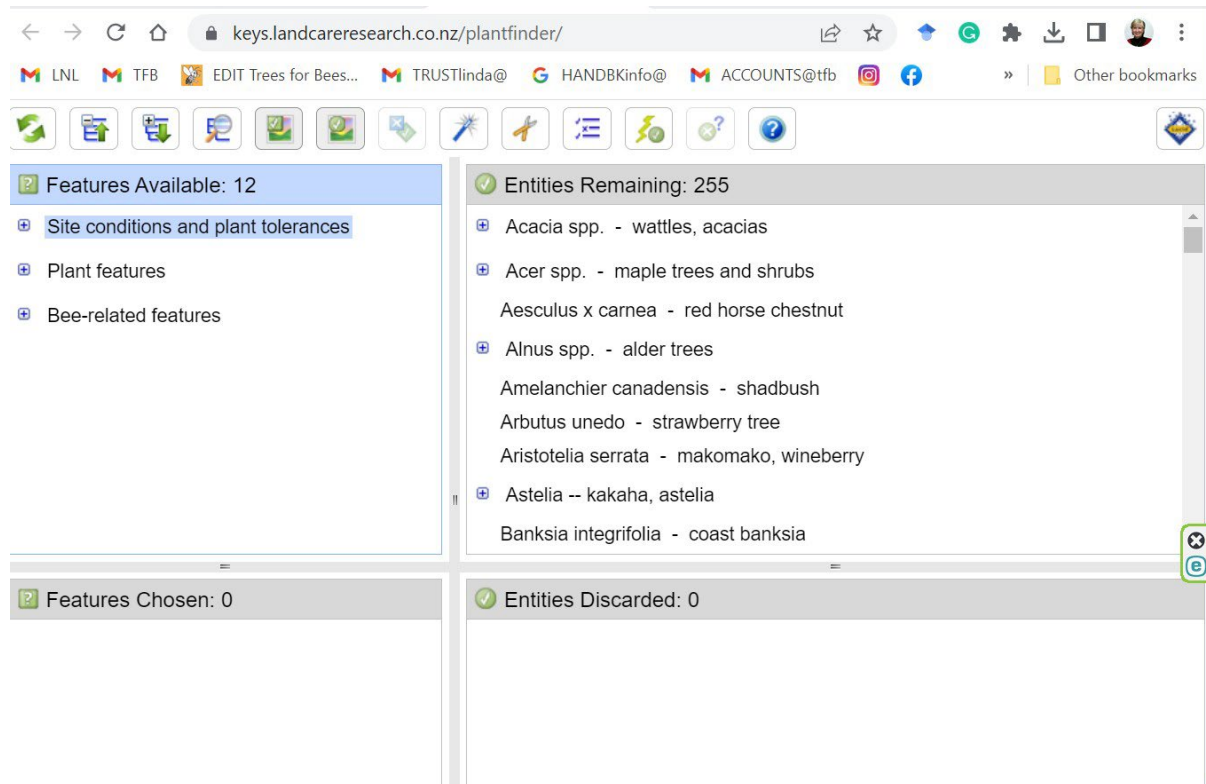
Finally, be sure to **record your resulting list of plants and the features** you selected before you start the next search for the shelterbelt row with tall trees. You can copy/paste the plant names after expanding the show all the taxa in the groups. When you restart for the next search, you will need to keep records of the list for the shrubs row of your shelterbelt.

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Step 11: Restart the tool to begin the second search for your shelterbelt.

To make the second search for the back row of tall trees, click on the restart button in the top left corner of the page. This removes all the previous search information by clearing all the tick boxes.

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Step 12: Search for the tall tree row by make selections in the same manner as above

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Select site conditions.

Soil moisture: **moist soil**

Light conditions: **full sun** - 207 entities remaining. *Note the trees are not shaded.*

Select plant features:

Life form: **tree** - 142 remaining

Height select **3 categories**: 96 remaining. *See the screenshot for the categories.*

Flowering season: **spring** and **autumn** - 90 remaining

Deciduousness: **deciduous** - 46 remaining. *If you do not want shading from the trees in winter.*

Native or exotic: **do not specify**

Select bee-related features:

Attractiveness: **highly attractive**

Importance: **high** - 34 entities remaining

Surplus honey/nectar producer in native or exotic plants: Select two categories as follows:

Known to be good nectar producer in NZ - 10 entities remaining

AND

May be a good nectar producer in NZ - 20 entities remaining.

NOTE: In this search you may want to restrict the height to taller trees as follows:

Go back to deselect (remove) **Height 6 to 10 meters** - 11 entities remaining.

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Finally, make a record of the candidate trees for your second plant list to create the shelterbelt planting plan.

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