DELTA Model® v2.2: Release Notes

February 2025

Summary

The latest version of the DELTA Model® introduces two main changes from DELTA Model® v2.1. These are:

- The Nutrient Target Transition Model;
- A Cellular Agriculture Model;

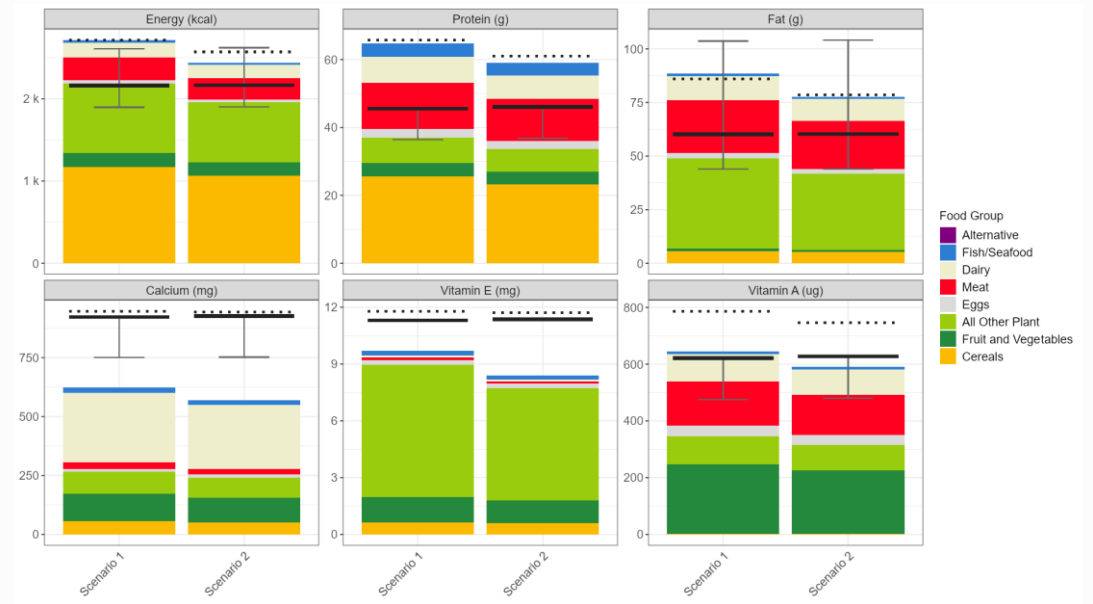
The following improvements have also been made:

- Changes to the Main results page;
- Addition of a Nutrient Density Scoring page.

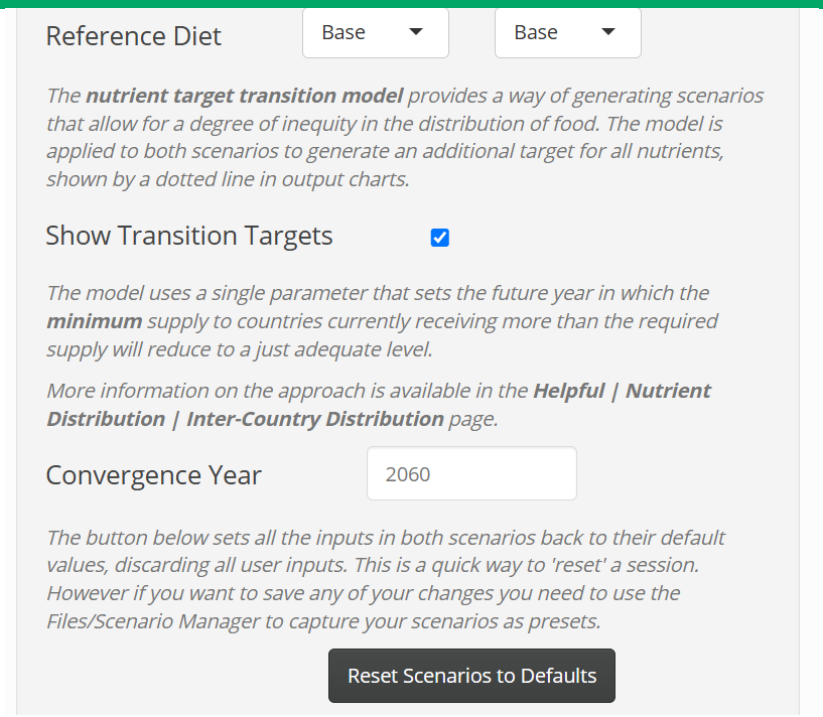
Nutrient Target Transition Model

Version 2.2 introduces the ability for users to set modified targets for nutrient supply that reflect the inequity of current global nutrient distribution. This functionality provides a more realistic level of global nutrient requirement that accounts for current undersupplies in some countries and a gradual reduction in consumption towards the minimum requirement for countries where the 2020 supply was above this basic level. This generates future scenarios that are more practical as they recognise that existing patterns of consumption will take time to change. The full background to the approach is provided in the related publication (Fletcher, Lozano & McNabb 2024).

The model generates an additional dotted line on each of the nutrient availability plots that shows the adjusted target.



The control settings are found at the bottom of the first section of the Scenario Editor. Activating the “Show Transition Targets” checkbox reveals an additional text input in which the user can set a convergence year. This is the year in which all countries will have nutrient supply equal to the standard target for DELTA, corresponding to perfectly equitable distribution. The dotted line shows where nutrient supply needs to be in 2020 if following this trajectory towards equity. The model guarantees the minimum requirement for all countries and, for countries where the 2020 nutrient availability was above requirement, generates a linear reduction from the 2020 country level availability to meet the basic sufficiency value in the specified year.

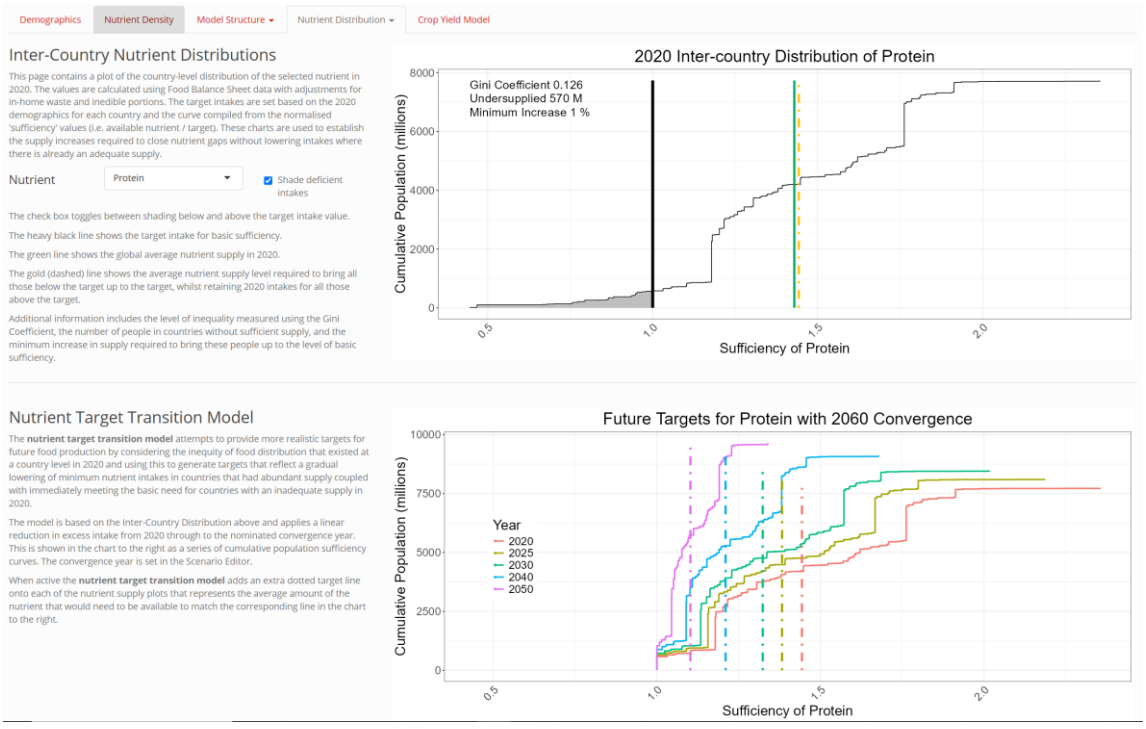


Supporting (Helpful) Information

Two additional Helpful pages have been added to support the nutrient target transition model. Both are found under the Nutrient Distribution tab.

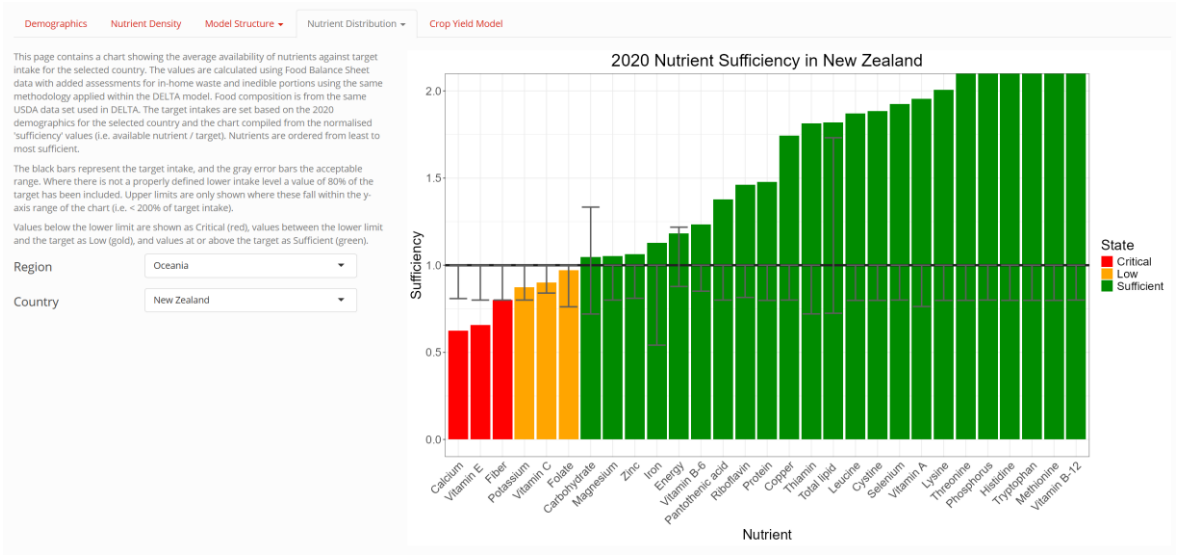
Global Nutrient Distribution

The Global Nutrient Distribution page shows the 2020 cumulative nutrient sufficiency distribution for a user selected nutrient. This illustrates the effective country level supply compared with demographically adjusted requirements. The second chart shows the impact of the Nutrient Target Transition Model on this distribution in future years assuming the requirements of the modified target are only just met.



Country Nutrient Supply

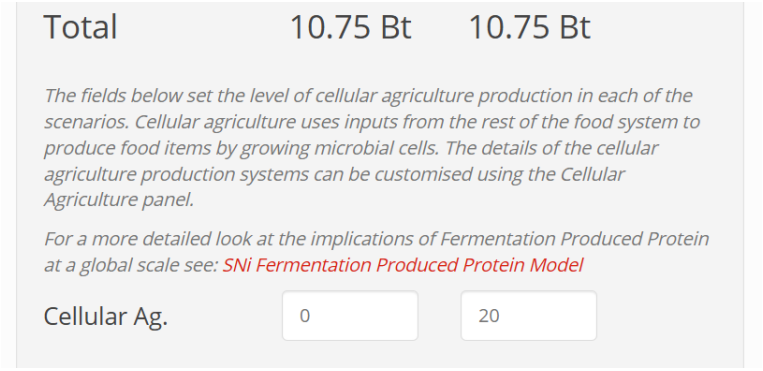
The Country Nutrient Supply page shows the 2020 Nutrient Sufficiency plot for all the nutrients in DELTA.



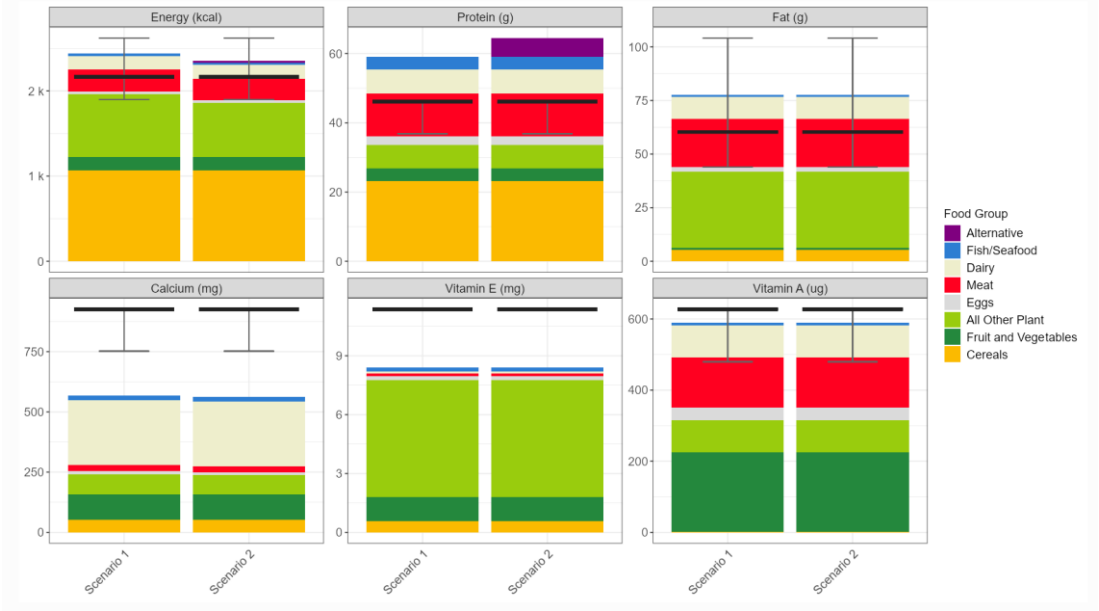
Cellular Agriculture Model

Several commentators have suggested that precision fermentation (PF), single cell protein (SCP), and cell cultured meat (CCM) provide a means to meet future demand for protein and other nutrients without reliance on animal production systems. To enable users to explore the impact of some of these technologies on the global food system, DELTA 2.2 includes a cellular agriculture (CA) model that diverts basic carbohydrate-rich commodities to produce PF proteins or lipids, or SCP. The current version does not support CCM systems, although these are part of the group of CA technologies, as the nutrient requirements for these are more complex.

The setting for the Cellular Ag. production for both scenarios is found at the bottom of the Primary Production table, below the totals. Cellular Ag. is a secondary production process that uses plant food materials as feedstock. This is handled in DELTA in the same way as animal feed (see the original DELTA Model® publication for technical details). The following images are based on the settings shown below for the two scenarios.

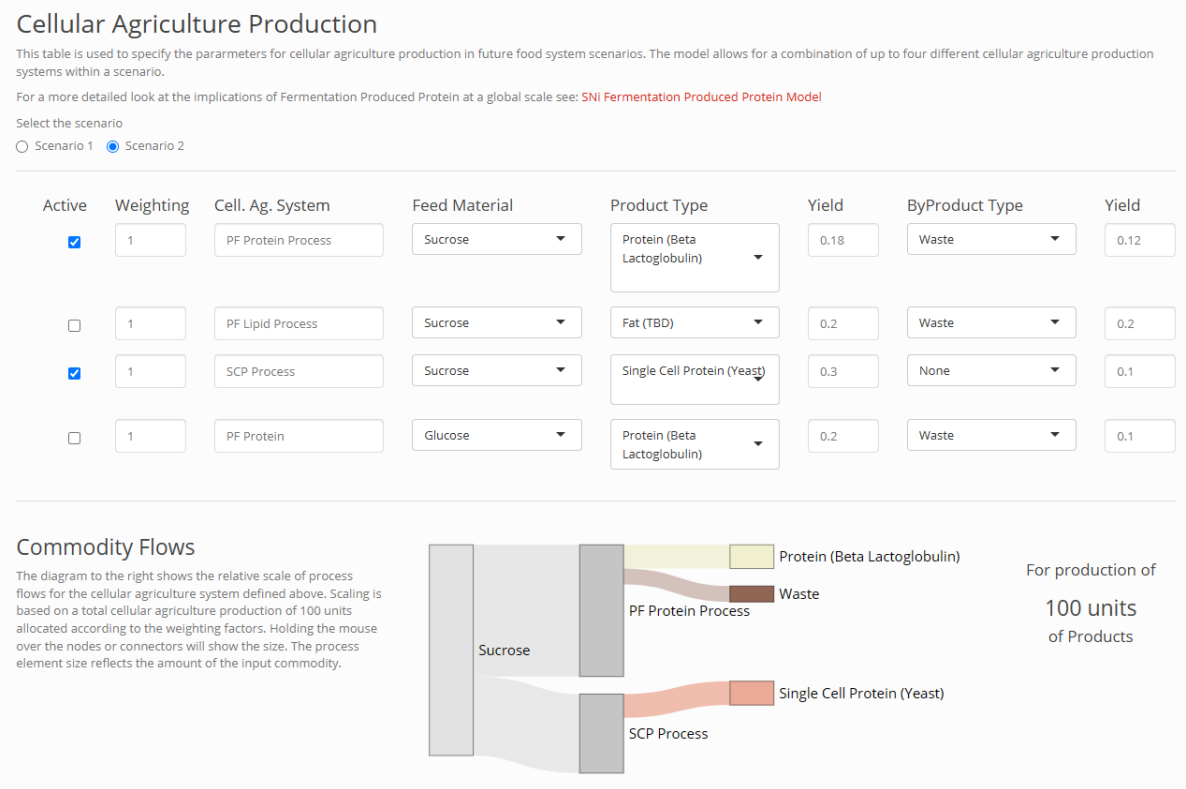


The results are shown on the nutrient availability plots as a purple bar, labelled as Alternative on the legend.

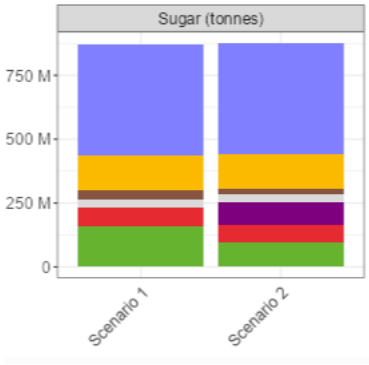


The specifics of the Cellular Ag. model for each scenario is set on the Cellular Agriculture tab for the model. Up to four PF or SCP systems can be set for each scenario with the amount each contributes to the total CA output set by the Weighting factor. The user can specify several parameters for each

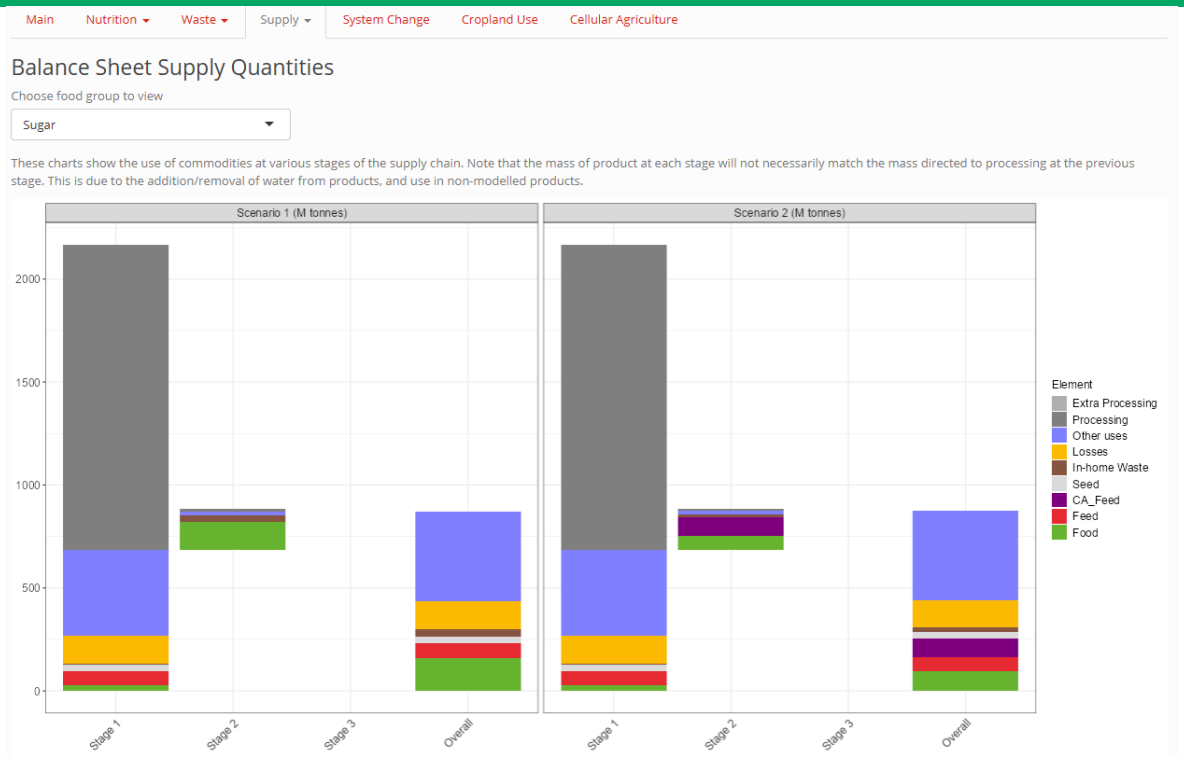
system. The example below illustrates a system producing equal amounts of PF protein and SCP yeast.



As well as the nutrient supply impact shown on the Main and Nutrition tabs, there is also information on the supply chain tabs. The chart below is from the stage 3 view of the Balance Sheet and shows the impact of 20 million tonnes of CA production using the settings above on the end use of sugar.



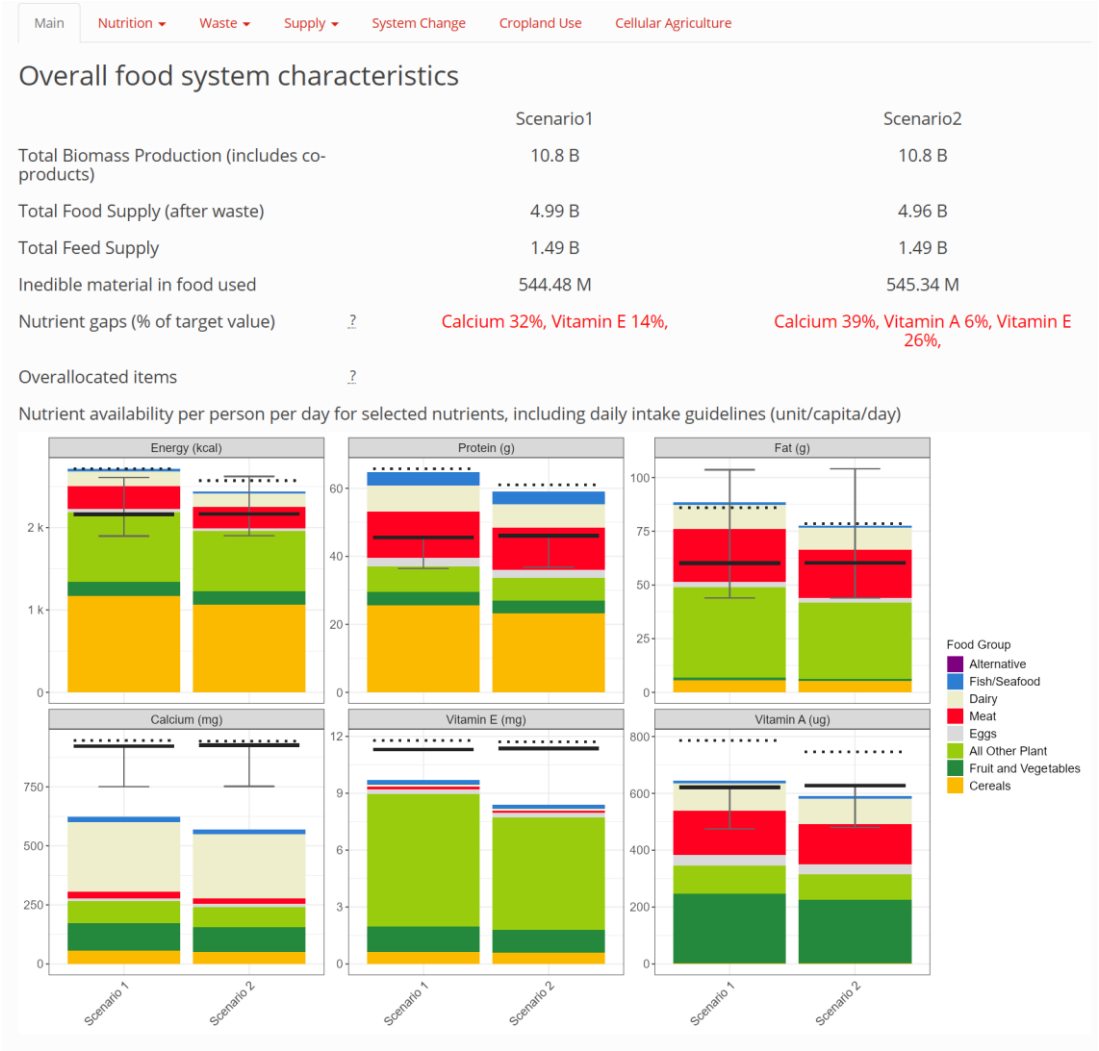
A more complete view is available on the Supply Chain Page, with the impact of the CA use shown in purple (CA_Feed).



Users wanting a more detailed understanding of the implications of large scale PF protein production can also access the Fermentation Produced Protein Model and read the associated paper (Fletcher, Smith, Hill and McNabb, 2024).

Visual Changes

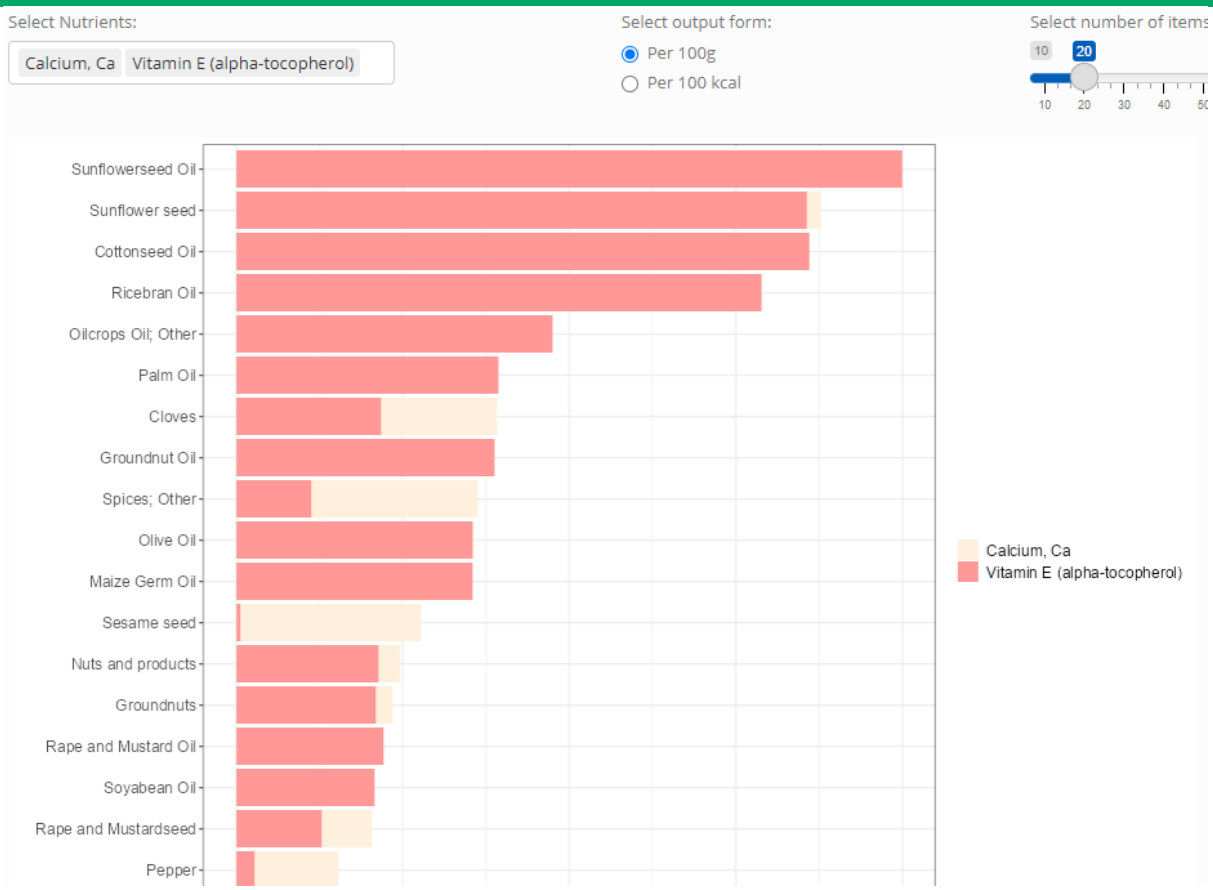
The Main results page has been modified to highlight the nutrients in short supply. The nutrient gaps are now shown in larger red text and the second row of nutrient availability charts now show the three nutrients with the lowest supply when compared with target requirements.



Addition of a Nutrient Density Scoring page

Under Helpful > Nutrient Density, there are now two options. Nutrient Density of Foods shows the nutrient density tool that has always been available in DELTA for looking at a ranked list of food items based on their density in a certain nutrient compared to their mass, or energy, or other constraint.

A new option, Nutrient Density Scoring, allows users to view a ranked list of food items based on their density in multiple nutrients. The user selects their nutrients of interest and whether they want to understand density per 100g or per 100 kcal of the food items. The model then compares how the nutrient content of each food compares to human requirement. This is then normalised to show a ranked list of foods, colour coded by how important each selected nutrient is to the food's overall score. This is shown in the left hand chart on this page (reproduced below), while the right hand chart shows the total food use of each food item, just as is seen on the Nutrient Density of Foods page.



Future version planning

Planned future versions of the model will include the following:

- Aquaculture model: the ability to identify and modify the seafood production sourced from aquaculture versus wild catch;
- Animal feed and grazing land model: calculation of grazing land footprints of scenarios, as well as an understanding of feed rations in different production systems;
- Extension of the Cellular Agriculture Model to include Cell Cultured Meat systems;
- Production greenhouse gas emissions.