

Setting up a configuration for your simulation

1. **Choose a basic configuration to work with.** There is a default, if you just want to experiment with the program and get used to it. There are also basic configurations with either wheat or lupin in different standard types of soil. You can begin with one of those and modify it to match your experimental parameters. These are in the Configurations directory in a “library” directory.

2. **Your configuration directory should have the file rootmap.xml in it.** This is what you give the program when you want to load the simulation. It tells the model where to find all the other XML files in this configuration, and shouldn't need any changing or editing.

3. **Define the size of your scoreboard.** Do this in /Scoreboards.xml, located in the base directory of the config tree.

4. **Locate your plants in the Scoreboard (by coordinates).** Do this in process-data/Plants.xml, one plant for each plant. This is also where you state which type of plant it is. Types of plants are listed in process-data/PlantTypes.xml. At this stage of program development the plant types are basically identical – qualities that imply (for instance) “wheat” or “lupin” are defined in the plant characteristics (see step 7). The code is currently limited to a maximum of three plants - any more after this get ignored but may slow down processing.

5. **Define your volume object/s.** Do this in /VolumeObjects.xml (located in the base directory of your config tree). These are used for mimicking pots, gravel, compaction layers etc – anything that is not just uniform soil. There may be limits on the number of VOs modelled (unconfirmed). Sample Volume Object structures are provided for cylinders and “boxes”, include and modify to your requirements. (See also VO.DOC in Documentation for extra details.)

6. **Set soil properties** by modifying values in scoreboard_data directory. VO[none] is everything outside the VOs, then VO 1, 2 etc are the Volume Objects you have defined (such as pots).

7. **Get into the fine details of plant characteristics.**

- Is it a legume?
- Does its nutrient uptake (Imax) decline with time?
- Do you want to include calculating the effects of root hairs?
- Is it growing in nutrient solution rather than soil?
- Etcetera.

Most of this is in shared-attributes/PlantAttributes.xml

Currently the program gives the same characteristics to all plants in the configuration – you can't have mixed plants. It assumes that what you are comparing in the model is the same type of plants in different soil conditions rather than different plants in the same soil conditions.

8. **Set environmental factors.** When does it rain? Temperature of days? Do you want to include calculating evaporation? (default is NO.)

These environmental factors will apply to all plants in the model (they all get rained on). You'll need to edit the files

- shared-attributes/WaterAttributes.xml

- process_data/FullRad_RainfallEvents.xml
- and others; check the "List Of Characteristics" document for other factors of relevance to you.

9. **Check your assumptions.** The model makes a bunch of assumptions that can be controlled in the XML, mostly found in process_data\Processes.xml. For example:

- Temperature (soil) - minimum, maximum, default
- Wilting point
- Maintain Initial Water Content (don't remove the water from the soil when the plants drink it, so that you can see root-nutrient interactions without water dynamics, set to OFF by default)

This is not a full list. See the "List Of Characteristics" document.

10. **How long does the simulation run for, and do dates matter?** (for instance, are you matching the model run to field data)? Dates and the default run time are set in PostOffice.xml. Times are recorded in (years, weeks, days, hours, minutes, seconds) so the default of 0,0,35,0,0,0 means 35 days. Dates as set here will be recorded against the model output in the output files and visible on-screen during the simulation run.

11. **Do you want every run of this simulation to be exactly the same** without random variation? Set the Random Seed in PostOffice.xml to whatever eight digit number you like, so that all random variations in the model come out the same each time. If you want stochastic variation between your model runs, remove the Random Seed.

13. **Set the output characteristics you want to record** and their data formats, in the file OutputRules.xml in the base config directory. There is more detail in documentation under "Collecting Output".

14. **Set viewing characteristics** in the file Windows.xml. Generally this will not need changing. It controls how the simulation is displayed on screen during its run – colour choices, if you want plants in their own 3D windows etc. You may need it for making screenshots or demonstrations look pretty, for use in presentations, posters or group discussions.