BWeb Notes for Chapter 6: Equilibrium Diagrams

The first two notes concern the stocks and flows in the rock cycle:

On page 67: 40 time units is sufficient for the oldest rocks on earth, and
Further down on page 67: estimates of melting are difficult to come by.

These and other aspects of the rock cycle model are taken from a website description of a Stella diagram by David Bice for a class at Carleton College. However, as of December 2009, I was not able to locate the Carleton website, and Dr. Bice is currently with the Department of Geosciences, Pennsylvania State University Park, PA 16802: [http://www.geosc.psu.edu/people/faculty/personalpages/dbice/index.html](http://www.geosc.psu.edu/people/faculty/personalpages/dbice/index.html)

Dr. Bice has written a paper on the use of Stella to simulate geologic systems:


The 40 time units correspond to 40 times 100 million years which is 4 billion years in the past. Dr. Bice provided estimates of the flows in Fig. 6.3, with the exception of lithification and melting. The book assumes that these estimates are difficult, and question marks are placed in Fig. 6.3 along side of lithification and melting. The reader is asked to estimate these flows if the rock cycle were in equilibrium. The answers would be:

- lithification = 900 million Pg/100 millions of years
- melting = 100 million Pg/100 millions of years

The values for other missing values in chapter 6 are as follows:

- Fig. 6.2: Both the river flow to oceans and the net transport toward land are 40 ckm/yr.
- Fig 6.4. The weathering of calcium phosphate minerals is 9 bkg/yr; ocean deposition is 2 bkg/yr.
- Fig 6.5. The black decay and black growth is 81 acres/yr. The white decay and white growth is 121 acres/year. Both the black growth rate and the white growth rate are 0.30/year.

**Fig 6.6. How much land in each category?** The text explains that the seedling area needs to be 8 times larger than the flow of 1,600 acres/year, which tells us that seedling area is 12,800 acres. Similar reasoning gives the following areas:

- Saplings = 8 years * 1,600 acres/yr = 12,800 acres
- Small Pulp = 5 years * 1,600 acres/yr = 8,000 acres
- Large Pulp = 5 years * 1,600 acres/yr = 8,000 acres
- Small Logs = 8 years * 1,600 acres/yr = 12,800 acres

Adding all the areas together gives the amount in the text: 97,067 acres.

**Page 70: How to insert a graphic image onto a Vensim comment?**

The image in the center of Fig. 6.6 is a doughnut graph created in an excel spreadsheet. Click on the graph and copy it to the clipboard. Then create the Vensim diagram, leaving plenty of space in the middle for a comment. Insert a comment into the middle of the diagram. (A frequent use of comments is to add some text and a symbol for a feedback, as in the three comments in Fig.
7.10 to name the feedback loops in the sales model.) We will use this comment to import the doughnut graphic from the clipboard. This is done by clicking on the comment, asking for the image under the graphics option, and clicking on the import button. Vensim will show the clipboard contents as a “special bmp” file with an arbitrary name (perhaps it will have the model name followed by 0000). Click OK, and the image will be part of the comment. Switch to the hand mode to resize the comment to fit neatly inside of the stocks and flows.

Graphic images may also be inserted into a Stella model as shown in Fig. 1. The stocks and flows are arranged in the same pattern as Fig. 6.6 with plenty of room for a Stella graphics frame. (The graphics frame is located to the right of the T, the text icon). Place the graphics frame in the middle of the diagram and ask Stella to import the doughnut image from the clipboard.

Fig. 1. Stella version of the forest land use model in Fig. 6.6 of the book.

BWeb Note on Surprising results -- page 70, just above the Stability Conditions heading.

This note mentions surprising results if you try the harvesting exercises. The exercises call for an increase in the harvest fraction part way through a simulation with the model in Fig. 1 (see the 7th and 8th exercises in the Extra Exercises for Chapter 6).