# Hydrology of the Canby's Dropwort Preserve

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We are interested in the water level fluctuations in Canby's Dropwort Preserve because the health of our population of the endangered Canby's Dropwort is tied to them. I have been monitoring water levels since March, 2004, with a view toward eventually modeling the hydrology of the bay. At this point the utility of the data collected is limited by a lack of high rainfall periods. To make a detailed model, I need to observe the extreme conditions. However, The Nature Conservancy made annual measurements at a shallow well for four consecutive years in the 1990's, coinciding with surveys of the Canby's Dropwort population. These visits were in mid-August to mid-September. I have measured the water level in their well in early September on two occasions. Hence, we now have 6 measurements made at approximately the same time of year. Using monthly rainfall at Bamberg, and calculated Potential Evapotranspiration (PET), I constructed a simple model predicting the water level on September 1 of each year.

Each year evaluated was divided into a winter period (September-April) and a summer period (May-August). Net rainfall was calculated for each season by subtracting PET, calculated using the Thornthwaite[1] method, from rainfall. I then regressed water level in the bay with net summer rainfall. This regression was significant with an $r^2$=0.74. I then evaluated a model with both net summer rainfall and net winter rainfall included and found winter rainfall did not significantly improve the prediction. The following table shows measured and predicted water levels using the model with only net summer rainfall included. The elevations are relative to the top of a gate post which I arbitrarily set to an elevation of 100 ft.

| Year | Annual Rainfall to August 31 (in) | Actual Water Elev. (ft) | Predicted Water Elev. (ft) |
|---|---|---|---|
| 1993 | 56.02 | 89.02 | 88.80 |
| 1994 | 43.04 | 88.77 | 89.28 |
| 1995 | 65.01 | 91.18 | 91.40 |
| 1996 | 41.04 | 88.69 | 88.70 |
| 2004 | 36.22 | 88.62 | 89.15 |
| 2005 | 45.84 | 90.79 | 89.74 |

For the period extending from 1952 to 2005, modeled water level on September 1, ranged from 88.51 ft to 91.44 ft, with a mean of 89.56 ft. Ground level at the shallow well is 90.13 ft. There was standing water on the ground in the vicinity of the well in 1995 and 2005. Using the model to predict water on the ground, at the well, I estimate this was true in 12 out of 54 years, including 1991, 1995 and 2003.

I hope to be able to develop a more detailed hydrologic model of the bay at some point in the future. What I think I need is 8 inches of rain in one winter month. This happens at Bamberg relatively often, so I am optimistic we will have the observations we need in the near future.

[1]Thornthwaite CW 1948. An approach toward a rational classification of climate. *Geographical Review* 38:55-94.