Department of Statistics

COURSE STATS 330

Assignment 3, 2004

Instructions: Hand in your completed assignment to the Student Resource Centre by 4pm on Thursday 23rd September.

A biologist has approached you for statistical advice. The biologist is interested in the effect that various trace elements in the soil have on the growth of a species of marsh grass. He has data on 45 plots of ground, on which the following variables are measured:

Bio:	the above-ground biomass of the marsh grass growing on the plot (grams per square metre);
H2S:	Free sulphide (moles);
Sal:	Salinity (%);
Eh7:	Redox potential at pH 7;
pH:	acidity of water (pH);
BUF:	Buffer acidity at pH 6.6 (meg/100 cm3);
P:	Phosphorus concentration (ppm)
K:	Potassium concentration (ppm)
Ca:	Calcium concentration (ppm)
Mg:	Magnesium concentration (ppm)
Na:	Sodium concentration (ppm)
Mn:	Manganese concentration (ppm)
Zn:	Zinc concentration (ppm)
Cu:	Copper concentration (ppm)
NH4:	Ammonium concentration (ppm)

The biologist is interested in using the chemical measurements to predict the biomass. In particular, since the chemical measurements are quite expensive, he wants to know if a good prediction can be made with fewer variables.

Write a report which addresses these questions. Your report should not exceed 6 pages, and should have an executive summary, an introduction, a middle section and a conclusion. Technical details of model fitting should be placed in an appendix.

I have placed a Powerpoint presentation on report writing on the web page, which you may find helpful.

The data are in an Excel spreadsheet bio.csv in comma-delimited form. This may be downloaded from the course web page. The data are also reproduced overleaf.

Bio	H2S	Sal	Eh7	pH	BUF	P	K	Ca	Mg	Na	Mn	Zn	Cu	NH4
676	-610	33	-290	5	2.34	20.238	1441.67	2150	5169.05	35184.5	14.2857	16.4524	5.02381	59.524
516	-570	35	-268	4.75	2.66	15.591	1299.19	1844.76	4358.03	28170.4	7.7285	13.9852	4.19019	51.378
1052	-610	32	-282	4.2	4.18	18.716	1154.27	1750.36	4041.27	26455	17.8066	15.3276	4.79221	68.788
868	-560	30	-232	4.4	3.6	22.821	1045.15	1674.36	3966.08	25072.9	49.1538	17.3128	4.09487	82.256
1008	-610	33	-318	5.55	1.9	37.843	521.62	3360.02	4609.39	31664.2	30.5229	22.3312	4.60131	70.904
436	-620	33	-308	5.05	3.22	27.381	1273.02	1811.11	4389.84	25491.7	9.7619	12.2778	4.50794	54.206
544	-590	36	-264	4.25	4.5	21.284	1346.35	1906.63	4579.33	20877.3	25.7371	17.8225	4.91093	84.982
680	-610	30	-340	4.45	3.5	16.511	1253.88	1860.29	3983.09	25621.3	10.0267	14.3516	5.11364	53.275
640	-580	38	-252	4.75	2.62	18.199	1242.65	1799.02	4142.4	27587.3	9.0074	13.6826	4.64461	47.733
492	-610	30	-288	4.6	3.04	19.321	1281.95	1796.66	4263.93	26511.7	12.714	11.7566	4.58761	60.674
984	-540	30	-294	4.1	4.66	16.622	553.69	1019.56	1965.95	7886.5	31.4815	9.882	1.74582	65.875
1400	-560	37	-278	3.45	5.24	22.629	494.74	1373.89	2366.73	14596	64.4393	16.6752	3.21729	104.55
1276	-570	33	-248	3.45	6.32	13.015	525.97	1057.4	2093.1	9826.8	48.2886	12.373	2.97695	75.612
1736	-580	36	-314	4.1	4.88	13.678	571.14	1111.29	2108.47	11978.4	22.55	9.4058	2.71841	59.888
1004	-640	30	-328	3.5	4.7	14.663	408.64	843.5	1711.42	10368.6	33.433	14.9302	1.85407	77.572
396	-610	30	-328	3.25	6.26	60.862	646.65	1694.01	3018.6	17307.4	52.7993	31.2865	3.72767	102.196
352	-600	27	-374	3.35	6.36	77.311	514.03	1667.42	2444.52	12822	60.4025	30.1652	2.99087	96.418
328	-630	29	-356	3.2	5.34	73.513	350.73	1455.84	2372.91	8582.6	66.3797	28.5901	2.41503	88.484
392	-640	34	-354	3.35	4.44	56.762	496.29	2002.44	2241.3	12369.5	56.8681	19.8795	2.45754	91.758
236	-600	36	-348	3.3	5.9	39.531	580.92	1427.89	2778.22	14731.9	64.5076	18.5056	2.82948	101.712
392	-640	30	-390	3.25	7.06	39.723	535.82	1339.26	2807.64	15060.6	56.2912	22.1344	3.43709	179.809
268	-650	28	-358	3.25	7.9	55.566	490.34	1468.69	2643.62	11056.3	58.5863	28.6101	3.4709	168.098
252	-630	31	-332	3.2	7.72	35.279	552.39	1377.06	2674.65	8118.9	56.7497	23.1908	3.60202	210.316
236	-640	31	-314	3.2	8.14	97.695	661.32	1747.56	3060.1	13009.5	57.8526	24.6917	3.92552	211.05
340	-630	35	-332	3.35	7.44	99.169	672.15	1526.85	2696.8	15003.7	45.0128	22.6758	4.23913	185.454
2436	-620	29	-338	7.1	-0.42	3.718	528.65	6857.39	1778.77	10225	16.4856	0.3729	3.41143	16.497
2216	-620	35	-268	7.35	-1.04	2.703	563.13	7178	1837.54	8024.2	11.4075	0.2703	3.43998	13.655
2096	-570	35	-300	7.45	-1.12	2.633	497.96	6934.67	1586.49	10393	7.9561	0.3205	3.29673	17.627
1660	-620	30	-328	7.45	-0.86	3.148	458.38	6911.54	1483.41	8711.6	10.4945	0.2648	3.11813	15.291
2272	-570	30	-374	7.4	-0.9	2.626	498.25	6839.54	1631.32	10239.6	9.4637	0.2105	2.79145	14.75
824	-620	26	-336	4.85	3.72	16.715	936.26	1564.84	3828.75	20436	10.3375	18.9875	5.76402	95.721
1196	-630	29	-342	4.6	4.9	16.377	894.79	1644.37	3486.84	12519.9	21.6672	20.9687	5.36276	86.955
1960	-630	25	-328	5.2	2.78	21.593	941.36	1811	3517.16	18979	13.0967	23.9841	5.48042	83.935
2080	-630	26	-332	4.75	3.9	18.03	1038.79	1706.36	4096.67	22986.1	15.6061	19.9727	5.27273	104.439
1764	-610	26	-322	5.2	3.6	34.693	898.05	1642.51	3593.05	11704.5	6.9786	21.3864	5.71123	79.773
412	-640	25	-290	4.55	3.58	28.956	989.87	2171.35	3553.17	17721	57.5856	23.7063	3.68392	118.178
416	-610	26	-352	3.95	5.58	25.741	951.28	1767.63	3359.17	16485.2	72.516	30.5589	3.91827	123.538
504	-600	26	-280	3.7	6.58	25.366	939.83	1654.63	3545.32	17101.3	64.4146	26.8415	4.06829	135.268
492	-620	27	-290	3.75	6.8	17.917	925.42	1620.83	3467.92	17849	53.9583	27.7292	3.89583	115.417
636	-590	27	-328	4.15	5.3	20.259	954.11	1446.3	3170.65	16949.6	22.6657	21.5699	4.70368	108.406
1756	-560	24	-332	5.6	1.22	134.426	720.72	2576.08	2467.52	11344.6	51.9258	19.6531	4.11065	57.315
1232	-550	27	-276	5.35	1.82	35.909	782.09	2659.36	2772.99	14752.4	75.1471	20.3295	4.09826	77.193
1400	-550	26	-282	5.5	1.6	38.719	773.3	2093.57	2665.02	13649.8	71.0254	19.588	4.31487	68.294
1620	-540	28	-370	5.5	1.26	33.562	829.26	2834.25	2991.99	14533	70.1465	20.1328	6.09432	71.337
1560	-570	28	-290	5.4	1.56	36.346	856.96	3459.26	3059.73	16892.2	89.2593	19.242	4.87407	79.383