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Pakkasenkestävyyden estimointi SAS NLMIXED proseduurilla puulajikokeessa

Tulosteissa syysk = syyskuu ja parametrit c1 ja b1 ovat sille, lokak = lokakuu ja parametrit c2 ja b2 kuvaavat sen parametrejä estimointikäyrissä. Silmujen puhkeamisvaiheen analyysit tehtiin erikseen.

Parametrien estimaatit esitetään kullekin kasvinosalle puulajeittain.

SAS syntaksi kaikille testeille noudatti samaa kaavaa, josta esimerkkinä silmunpuhkeamisvaiheen neulasten kaava männylle.

```
proc nlmixed data=work.&NIMI;
parms c1=-12 b1=-0.5;

mu = (((1)/(1+exp(b1*(c1-temp)))));

l = mu**&MUUTTUJA * (1-mu)**(1-&MUUTTUJA);
ql = log(l);
model &MUUTTUJA~ general(ql);
predict mu out=out1;
ods output parameterestimates=pe;
run;

proc sql noprint;
select count(Parameter) into :nparm from pe;
quit;
title "Scale parameter";
title2 "Pearson Chi-square / DF";
proc sql;
select sum(phi_i) format=best12. as Scale into :phi from
(select (&MUUTTUJA-pred)**2/(pred*(1-pred)*(count(&MUUTTUJA)-&nparm))
as phi_i from out1);
quit;
title;

proc nlmixed data=work.&NIMI;
parms c1=-12 b1=-0.5;

mu = (((1)/(1+exp(b1*(c1-temp)))));

l = mu**&MUUTTUJA * (1-mu)**(1-&MUUTTUJA);
ql = (1/&phi)*log(l);
model &MUUTTUJA ~ general(ql);
predict mu out=needle1;
estimate 'T50' c1;
estimate 'T05' (c1-log(1/0.05-1)/b1);
run;
```

Laskennan tuloksetParametrien estimaatit

Männyn neulaset syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-8.3275	0.2397	576	-34.75	<.0001	-8.7982	-7.8567	0.000165
c2	-23.6477	0.4643	576	-50.93	<.0001	-24.5596	-22.7357	0.000090
b1	-0.7550	0.09824	576	-7.69	<.0001	-0.9479	-0.5620	0.000165
b2	-0.2737	0.02134	576	-12.83	<.0001	-0.3156	-0.2318	-0.00164

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-8.3275	0.2397	576	-34.75	<.0001	0.05	-8.7982	-7.8567
lokak	-23.6477	0.4643	576	-50.93	<.0001	0.05	-24.5596	-22.7357
syys05	-4.4274	0.6645	576	-6.66	<.0001	0.05	-5.7325	-3.1223
loka05	-12.8895	0.9534	576	-13.52	<.0001	0.05	-14.7619	-11.0170

Männyn ranka syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-11.1550	0.1473	576	-75.75	<.0001	-11.4442	-10.8657	-0.00002
c2	-26.5629	0.3993	576	-66.53	<.0001	-27.3470	-25.7787	0.000020
b1	-0.7206	0.05063	576	-14.23	<.0001	-0.8200	-0.6211	0.000142
b2	-0.2252	0.01316	576	-17.11	<.0001	-0.2511	-0.1994	-0.00090

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-11.1550	0.1473	576	-75.75	<.0001	0.05	-11.4442	-10.8657
lokak	-26.5629	0.3993	576	-66.53	<.0001	0.05	-27.3470	-25.7787
syys05	-7.0687	0.3183	576	-22.21	<.0001	0.05	-7.6939	-6.4435
loka05	-13.4909	0.8274	576	-16.30	<.0001	0.05	-15.1160	-11.8658

Männyn silmut syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-12.1884	0.3629	48	-33.59	<.0001	-12.9180	-11.4588	-1.68E-6
c2	-29.6141	1.2320	48	-24.04	<.0001	-32.0912	-27.1370	8.537E-9
b1	-0.8337	0.1465	48	-5.69	<.0001	-1.1283	-0.5391	0.000011
b2	-0.1794	0.02717	48	-6.60	<.0001	-0.2340	-0.1248	2.035E-6

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-12.1884	0.3629	48	-33.59	<.0001	0.05	-12.9180	-11.4588
lokak	-29.6141	1.2320	48	-24.04	<.0001	0.05	-32.0912	-27.1370
syys05	-8.6566	0.6714	48	-12.89	<.0001	0.05	-10.0066	-7.3067
loka05	-13.1992	2.5137	48	-5.25	<.0001	0.05	-18.2534	-8.1451

Männyn neulasetsilmun puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-15.2553	0.3263	392	-46.75	<.0001	-15.8968	-14.6138	2.498E-6
b1	-0.3508	0.02470	392	-14.20	<.0001	-0.3994	-0.3023	-0.00004

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-15.2553	0.3263	392	-46.75	<.0001	0.05	-15.8968	-14.6138
T05	-6.8620	0.5359	392	-12.80	<.0001	0.05	-7.9156	-5.8084

Männyn ranka silmun puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-14.9770	0.1826	392	-82.04	<.0001	-15.3359	-14.6181	2.461E-7
b1	-0.6423	0.04082	392	-15.73	<.0001	-0.7225	-0.5620	-8.11E-7

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-14.9770	0.1826	392	-82.04	<.0001	0.05	-15.3359	-14.6181
T05	-10.3927	0.2875	392	-36.15	<.0001	0.05	-10.9580	-9.8275

Männyn silmut silmun puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-14.2098	0.5804	24	-24.48	<.0001	-15.4077	-13.0120	-2.2E-6
b1	-0.6260	0.1274	24	-4.92	<.0001	-0.8889	-0.3632	-0.00007

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-14.2098	0.5804	24	-24.48	<.0001	0.05	-15.4077	-13.0120
T05	-9.5063	0.9474	24	-10.03	<.0001	0.05	-11.4617	-7.5509

Kuusen neulaset syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-10.6327	0.6303	576	-16.87	<.0001	-11.8707	-9.3947	-1.89E-7
c2	-38.2456	1.4338	576	-26.67	<.0001	-41.0617	-35.4294	9.264E-7
b1	-0.5654	0.1360	576	-4.16	<.0001	-0.8325	-0.2982	7.981E-7
b2	-0.2925	0.07436	576	-3.93	<.0001	-0.4385	-0.1464	-4.54E-6

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-10.6327	0.6303	576	-16.87	<.0001	0.05	-11.8707	-9.3947
lokak	-38.2456	1.4338	576	-26.67	<.0001	0.05	-41.0617	-35.4294
syys05	-5.4249	1.3904	576	-3.90	0.0001	0.05	-8.1557	-2.6941
loka05	-28.1779	2.5920	576	-10.87	<.0001	0.05	-33.2688	-23.0870

Kuusen ranka syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-12.1880	0.1986	576	-61.36	<.0001	-12.5781	-11.7979	-0.00015
c2	-33.6022	0.4369	576	-76.92	<.0001	-34.4602	-32.7442	-0.00007
b1	-0.5367	0.03656	576	-14.68	<.0001	-0.6085	-0.4649	0.002754
b2	-0.2377	0.01647	576	-14.43	<.0001	-0.2701	-0.2054	-0.00837

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-12.1880	0.1986	576	-61.36	<.0001	0.05	-12.5781	-11.7979
lokak	-33.6022	0.4369	576	-76.92	<.0001	0.05	-34.4602	-32.7442
syys05	-6.7020	0.3989	576	-16.80	<.0001	0.05	-7.4856	-5.9185
loka05	-21.2155	0.9235	576	-22.97	<.0001	0.05	-23.0293	-19.4017

Kuusen silmut syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-10.8228	0.2539	48	-42.63	<.0001	-11.3333	-10.3122	-0.08816
c2	-17.1245	.	48	-0.04262
b1	-0.6216	0.06724	48	-9.24	<.0001	-0.7568	-0.4864	0.060942
b2	-0.8568	0.04796	48	-17.87	<.0001	-0.9532	-0.7604	0.46937

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-10.8228	0.2539	48	-42.63	<.0001	0.05	-11.3333	-10.3122
lokak	-17.1245	.	48	.	.	0.05	.	.
syys05	-6.0858	0.5635	48	-10.80	<.0001	0.05	-7.2188	-4.9527
loka05	-13.6880	0.1832	48	-74.72	<.0001	0.05	-14.0563	-13.3197

Kuusen neulaset silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-15.2465	0.7273	425	-20.96	<.0001	-16.6761	-13.8169	6.865E-6
b1	-0.6680	0.1735	425	-3.85	0.0001	-1.0092	-0.3269	-0.00003

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-15.2465	0.7273	425	-20.96	<.0001	0.05	-16.6761	-13.8169
T05	-10.8389	1.1248	425	-9.64	<.0001	0.05	-13.0497	-8.6282

Kuusen ranka silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-15.8604	0.1383	425	-114.69	<.0001	-16.1322	-15.5886	3.687E-6
b1	-0.5774	0.02390	425	-24.15	<.0001	-0.6244	-0.5304	-0.00003

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-15.8604	0.1383	425	-114.69	<.0001	0.05	-16.1322	-15.5886
T05	-10.7608	0.2071	425	-51.96	<.0001	0.05	-11.1679	-10.3537

Kuusen silmut silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-12.9395	0.4433	24	-29.19	<.0001	-13.8544	-12.0245	-0.00007
b1	-0.8799	0.1876	24	-4.69	<.0001	-1.2671	-0.4927	0.000065

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-12.9395	0.4433	24	-29.19	<.0001	0.05	-13.8544	-12.0245
T05	-9.5933	0.7440	24	-12.89	<.0001	0.05	-11.1288	-8.0578

Douglaskuusen neulaset syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-6.7091	0.1232	575	-54.47	<.0001	-6.9510	-6.4672	-4.23E-8
c2	-17.7106	0.2780	575	-63.72	<.0001	-18.2565	-17.1647	-2.09E-7
b1	-1.2841	0.09458	575	-13.58	<.0001	-1.4699	-1.0984	-6.48E-7
b2	-0.3782	0.02273	575	-16.64	<.0001	-0.4228	-0.3336	-3.63E-7

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-6.7091	0.1232	575	-54.47	<.0001	0.05	-6.9510	-6.4672
lokak	-17.7106	0.2780	575	-63.72	<.0001	0.05	-18.2565	-17.1647
syys05	-4.4162	0.2260	575	-19.54	<.0001	0.05	-4.8600	-3.9723
loka05	-9.9253	0.5436	575	-18.26	<.0001	0.05	-10.9929	-8.8576

Douglaskuusen ranka syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-6.0493	0.1101	575	-54.93	<.0001	-6.2656	-5.8330	-1.9E-7
c2	-16.7094	0.2420	575	-69.06	<.0001	-17.1846	-16.2341	6.647E-7
b1	-1.4996	0.1169	575	-12.83	<.0001	-1.7292	-1.2700	0.000011
b2	-0.4406	0.02629	575	-16.76	<.0001	-0.4922	-0.3890	0.000014

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-6.0493	0.1101	575	-54.93	<.0001	0.05	-6.2656	-5.8330
lokak	-16.7094	0.2420	575	-69.06	<.0001	0.05	-17.1846	-16.2341
syys05	-4.0859	0.1736	575	-23.54	<.0001	0.05	-4.4268	-3.7450
loka05	-10.0267	0.4656	575	-21.53	<.0001	0.05	-10.9413	-9.1122

Douglaskuusen silmut syksyllä

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-5.8723	0.2411	48	-24.36	<.0001	-6.3571	-5.3876	2.616E-6
c2	-13.6019	0.3980	48	-34.18	<.0001	-14.4020	-12.8017	-3.73E-6
b1	-1.0727	0.1591	48	-6.74	<.0001	-1.3926	-0.7528	-3.41E-6
b2	-0.6325	0.08711	48	-7.26	<.0001	-0.8076	-0.4573	0.000027

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
syysk	-5.8723	0.2411	48	-24.36	<.0001	0.05	-6.3571	-5.3876
lokak	-13.6019	0.3980	48	-34.18	<.0001	0.05	-14.4020	-12.8017
syys05	-3.1274	0.4978	48	-6.28	<.0001	0.05	-4.1283	-2.1265
loka05	-8.9465	0.7787	48	-11.49	<.0001	0.05	-10.5121	-7.3809

Douglaskuusen neulaset silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-13.4749	0.9880	427	-13.64	<.0001	-15.4169	-11.5329	-4.57E-6
b1	-0.3395	0.07741	427	-4.39	<.0001	-0.4916	-0.1874	-0.00007

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-13.4749	0.9880	427	-13.64	<.0001	0.05	-15.4169	-11.5329
T05	-4.8020	1.8638	427	-2.58	0.0103	0.05	-8.4654	-1.1385

Douglaskuusen ranka silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-12.2587	0.7932	427	-15.45	<.0001	-13.8178	-10.6995	-2.45E-6
b1	-0.3397	0.06590	427	-5.16	<.0001	-0.4692	-0.2102	-0.00004

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-12.2587	0.7932	427	-15.45	<.0001	0.05	-13.8178	-10.6995
T10	-5.7906	1.2832	427	-4.51	<.0001	0.05	-8.3128	-3.2683
T05	-3.5909	1.6463	427	-2.18	0.0297	0.05	-6.8267	-0.3552

Douglaskuusen silmut silmujen puhkeamisvaiheessa

Parameter Estimates								
Parameter	Estimate	Standard Error	DF	t Value	Pr > t	95% Confidence Limits		Gradient
c1	-13.1905	3.4623	24	-3.81	0.0009	-20.3363	-6.0447	-3.03E-7
b1	-0.5934	0.7138	24	-0.83	0.4140	-2.0666	0.8798	-3.46E-6

Additional Estimates								
Label	Estimate	Standard Error	DF	t Value	Pr > t	Alpha	Lower	Upper
T50	-13.1905	3.4623	24	-3.81	0.0009	0.05	-20.3363	-6.0447
T05	-8.2284	5.9551	24	-1.38	0.1798	0.05	-20.5190	4.0622
