Analysis resilience patterns two events

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Resilience

Mean values (Cluster population)

Table 1: Mean values (rs)

clu_pop	mean	sd	se	variable	event	seasonF
N	0.9391200	0.05105309	0.001703664	rs	2005	annual
S	0.9357996	0.05235562	0.001729879	rs	2005	annual
N	1.0025355	0.04849661	0.001618353	rs	2012	annual
S	0.9996486	0.04983377	0.001646554	rs	2012	annual
N	0.9410772	0.05756861	0.001921089	rs	2005	spring
S	0.9477028	0.06257670	0.002067593	rs	2005	spring
N	1.0151042	0.05766974	0.001924464	rs	2012	spring
S	1.0253790	0.06215434	0.002053637	rs	2012	spring
N	0.9271526	0.05488102	0.001831403	rs	2005	summer
S	0.9094511	0.05774945	0.001908096	rs	2005	summer
N	1.0196845	0.06014536	0.002007077	rs	2012	summer
S	0.9826980	0.04923157	0.001626657	rs	2012	summer

Summer

Summary ANOVA model

Table 2: ANOVA table: rs summer

term	df	sumsq	meansq	statistic	p.value
event	1	6.217	6.217	2009	**0**
clu_pop	1	0.6781	0.6781	219.1	**0**
event:clu_pop	1	0.08432	0.08432	27.25	**0**
Residuals	3624	11.22	0.00309		

	Statistic
R^2	0.38
adjR^2	0.38
σ_e	0.06
F	751.75
p	0.00
df_m	4.00
logLik	5335.40
AIC	-10660.80

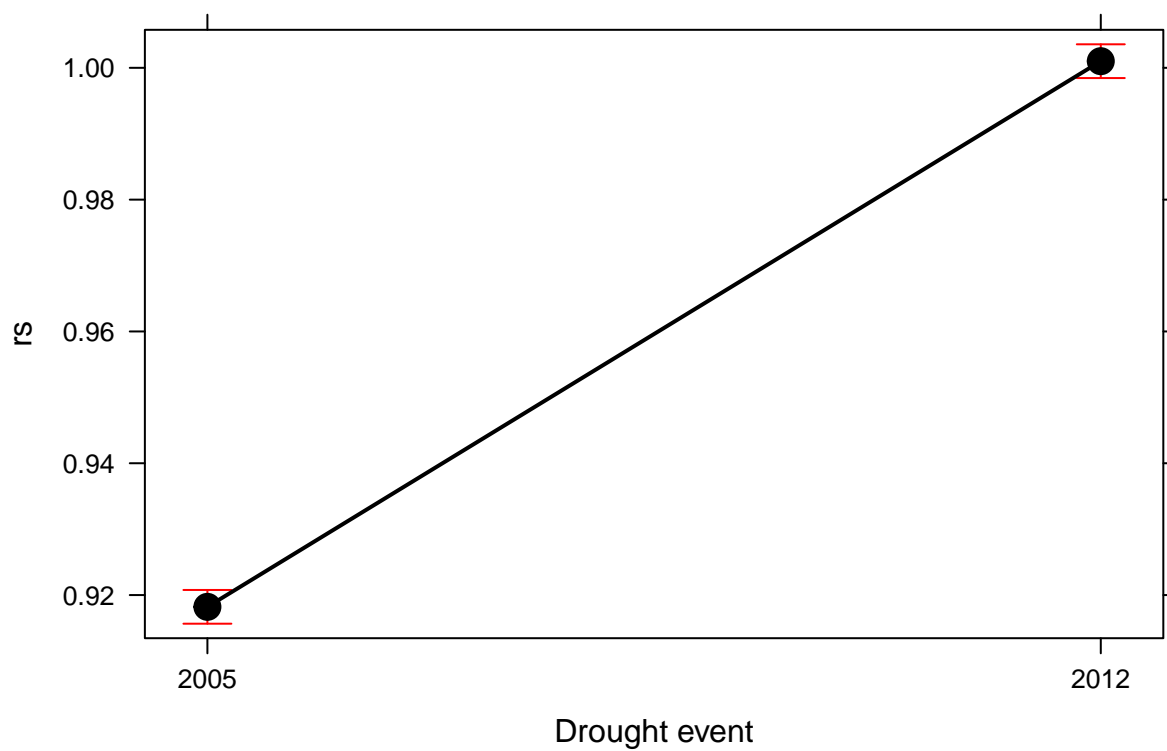|	Statistic
BIC	-10629.82
dev	11.22
df_e	3624.00

Effects plot

. ~ Cluster population
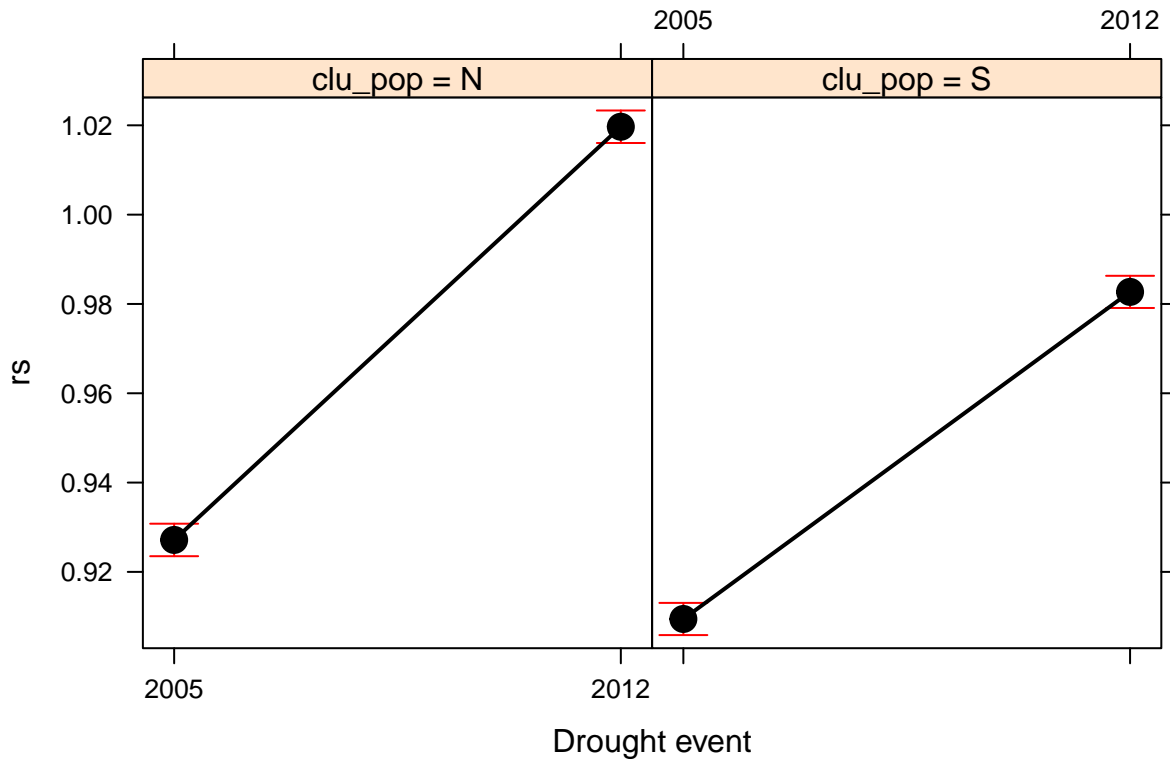
summer – rs vs. Cluster population
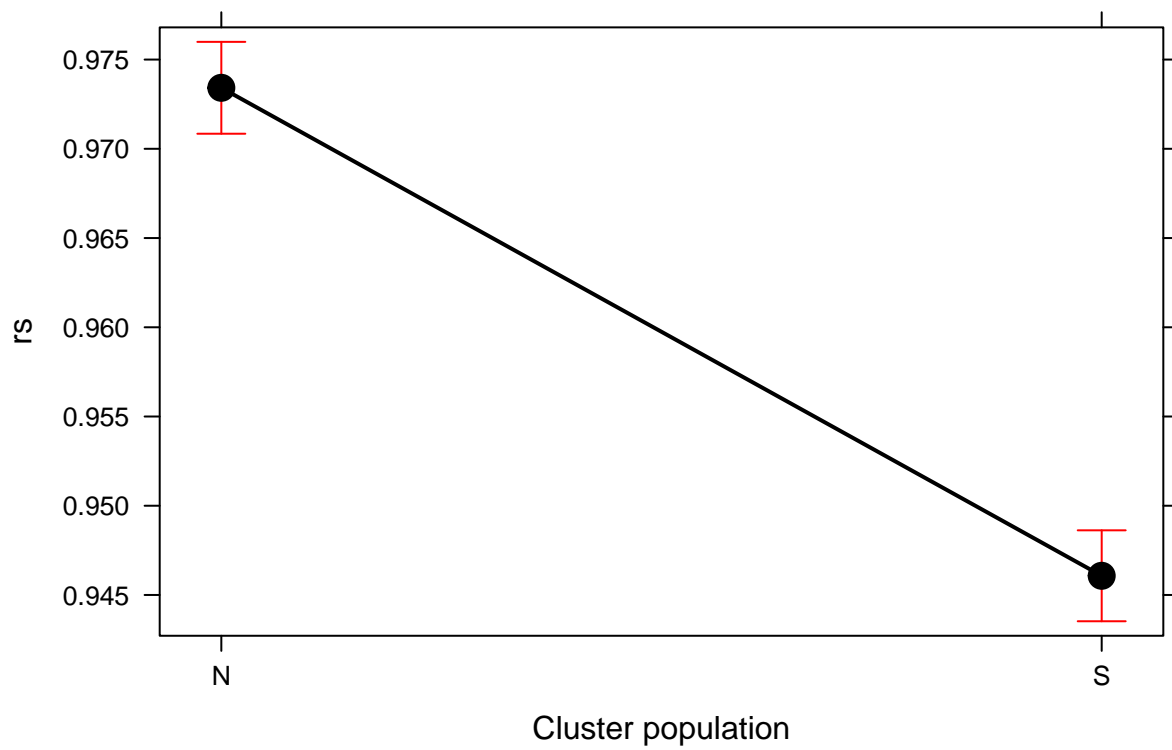
. ~ Disturbance Event

summer – rs vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rs) – summer

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean         SE   df  lower.CL  upper.CL
##  2005  0.9183018 0.001306243 3624 0.9157408 0.9208629
##  2012  1.0011913 0.001306243 3624 0.9986302 1.0037523
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast       estimate         SE   df t.ratio p.value
##  2005 - 2012 -0.08288943 0.001847307 3624  -44.87  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean         SE   df  lower.CL  upper.CL .group
##  2005  0.9183018 0.001306243 3624 0.9153792 0.9212244  a
##  2012  1.0011913 0.001306243 3624 0.9982687 1.0041139   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
## 
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  N       0.9734185 0.001312708 3624 0.9708448 0.9759923
##  S       0.9460745 0.001299746 3624 0.9435262 0.9486228
## 
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## 
## $contrasts
##  contrast    estimate          SE   df t.ratio p.value
##  N - S     0.02734401 0.001847307 3624  14.802  <.0001
## 
## Results are averaged over the levels of: event
## 
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL .group
##  S       0.9460745 0.001299746 3624 0.9431665 0.9489826  a
##  N       0.9734185 0.001312708 3624 0.9704815 0.9763556   b
## 
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
## 
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  2005  N       0.9271526 0.001856450 3624 0.9235128 0.9307923
##  2012  N       1.0196845 0.001856450 3624 1.0160447 1.0233243
##  2005  S       0.9094511 0.001838119 3624 0.9058472 0.9130549
##  2012  S       0.9826980 0.001838119 3624 0.9790941 0.9863018
## 
## Confidence level used: 0.95
## 
## $contrasts
##  contrast          estimate          SE   df t.ratio p.value
##  2005,N - 2012,N -0.09253197 0.002625416 3624 -35.245  <.0001
##  2005,N - 2005,S  0.01770146 0.002612487 3624   6.776  <.0001
##  2005,N - 2012,S -0.05554543 0.002612487 3624 -21.262  <.0001
##  2012,N - 2005,S  0.11023344 0.002612487 3624  42.195  <.0001
##  2012,N - 2012,S  0.03698655 0.002612487 3624  14.158  <.0001
##  2005,S - 2012,S -0.07324689 0.002599493 3624 -28.177  <.0001
## 
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Spring

Summary ANOVA model

Table 4: ANOVA table: rs spring

term	df	sumsq	meansq	statistic	p.value
event	1	5.221	5.221	1447	**0**
clu_pop	1	0.06476	0.06476	17.95	**2e-05**
event:clu_pop	1	0.00302	0.00302	0.8369	0.3603
Residuals	3624	13.07	0.00361		

	Statistic
R^2	0.29
adjR^2	0.29
σ_e	0.06
F	488.66
p	0.00
df_m	4.00
logLik	5057.34
AIC	-10104.68
BIC	-10073.69
dev	13.07
df_e	3624.00

Effects plot

. ~ Cluster population

spring – rs vs. Cluster population
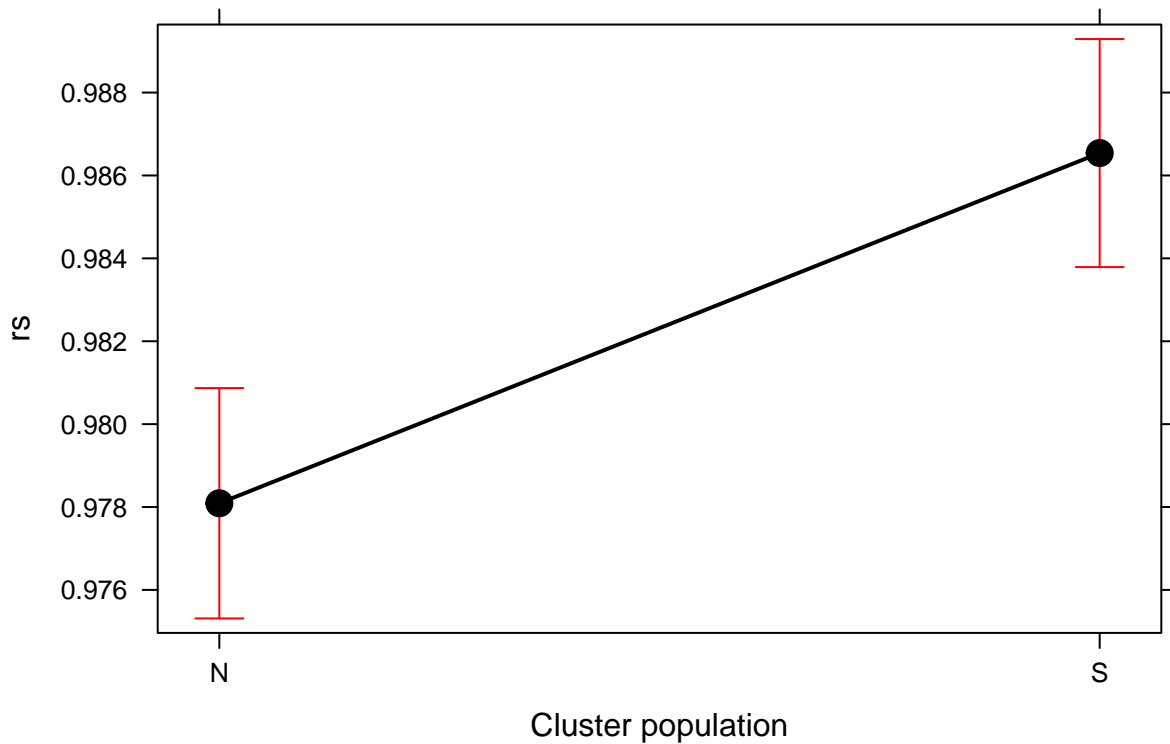
spring – rs vs. Drought event
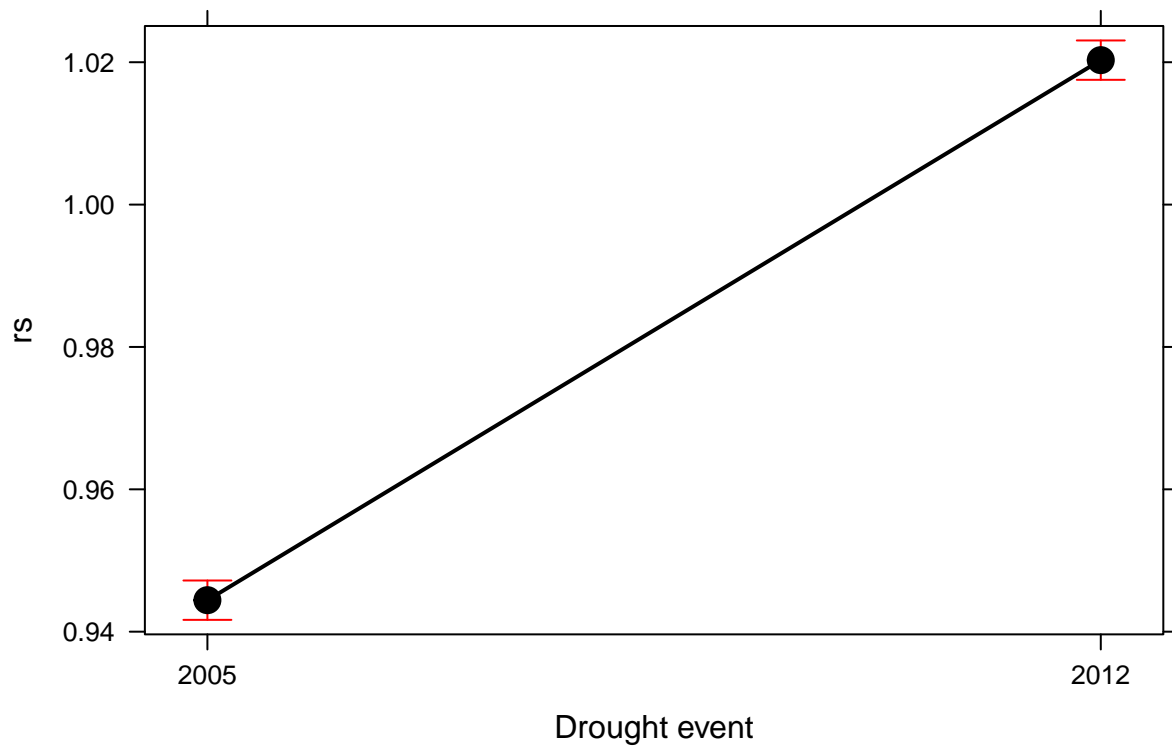
Interaction plot (rs) – spring
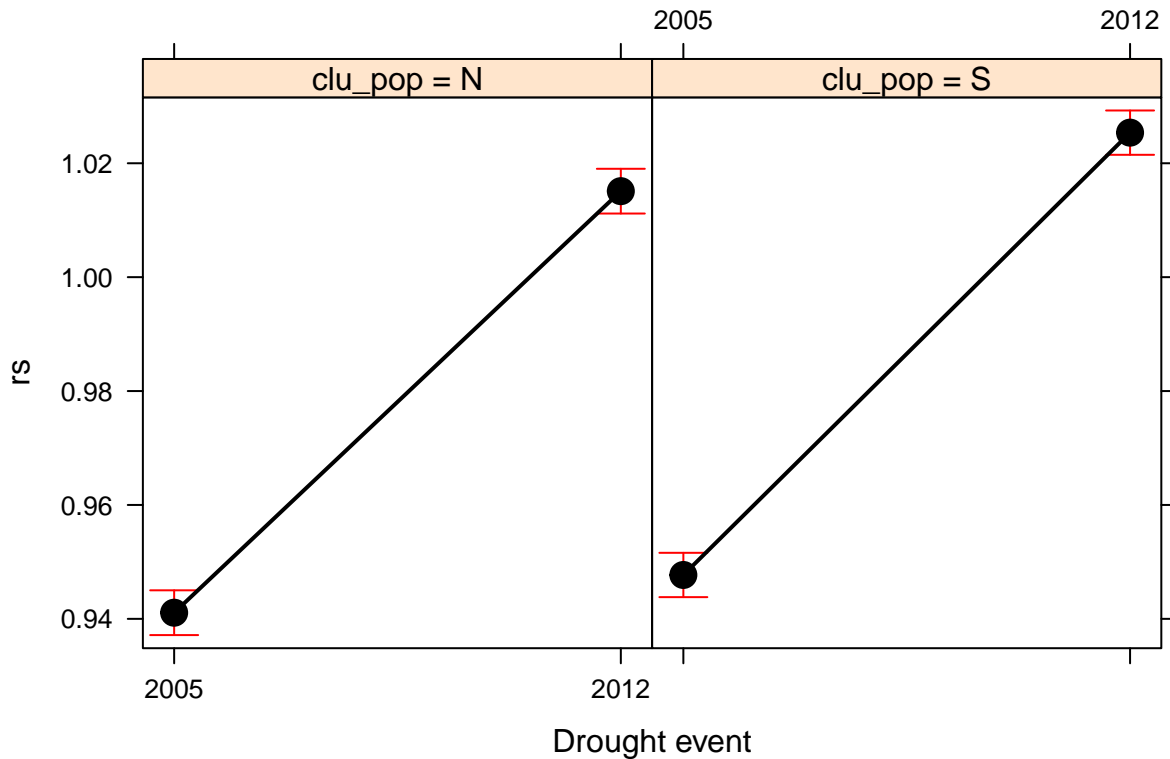
Post-hoc comparison

```
## 
## ### Event ###
## $lsmeans
##  event   lsmean         SE   df  lower.CL upper.CL
##  2005   0.944390 0.001410295 3624 0.9416249 0.947155
##  2012   1.020242 0.001410295 3624 1.0174765 1.023007
## 
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## 
## $contrasts
##  contrast        estimate          SE   df t.ratio p.value
##  2005 - 2012 -0.07585161 0.001994458 3624 -38.031  <.0001
## 
## Results are averaged over the levels of: clu_pop
## 
##  event   lsmean         SE   df  lower.CL upper.CL .group
##  2005   0.944390 0.001410295 3624 0.9412346 0.9475454  a
##  2012   1.020242 0.001410295 3624 1.0170862 1.0233970   b
## 
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  N       0.9780907 0.001417275 3624 0.9753119 0.9808694
##  S       0.9865409 0.001403280 3624 0.9837896 0.9892922
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast     estimate          SE   df t.ratio p.value
##  N - S    -0.008450257 0.001994458 3624  -4.237  <.0001
##
## Results are averaged over the levels of: event
##
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL .group
##  N       0.9780907 0.001417275 3624 0.9749196 0.9812617  a
##  S       0.9865409 0.001403280 3624 0.9834012 0.9896806   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  2005  N       0.9410772 0.002004329 3624 0.9371474 0.9450069
##  2012  N       1.0151042 0.002004329 3624 1.0111744 1.0190339
##  2005  S       0.9477028 0.001984538 3624 0.9438119 0.9515937
##  2012  S       1.0253790 0.001984538 3624 1.0214881 1.0292700
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast           estimate          SE   df t.ratio p.value
##  2005,N - 2012,N -0.074026985 0.002834549 3624 -26.116  <.0001
##  2005,N - 2005,S -0.006625633 0.002820590 3624  -2.349  0.0874
##  2005,N - 2012,S -0.084301867 0.002820590 3624 -29.888  <.0001
##  2012,N - 2005,S  0.067401352 0.002820590 3624  23.896  <.0001
##  2012,N - 2012,S -0.010274882 0.002820590 3624  -3.643  0.0016
##  2005,S - 2012,S -0.077676234 0.002806561 3624 -27.677  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```

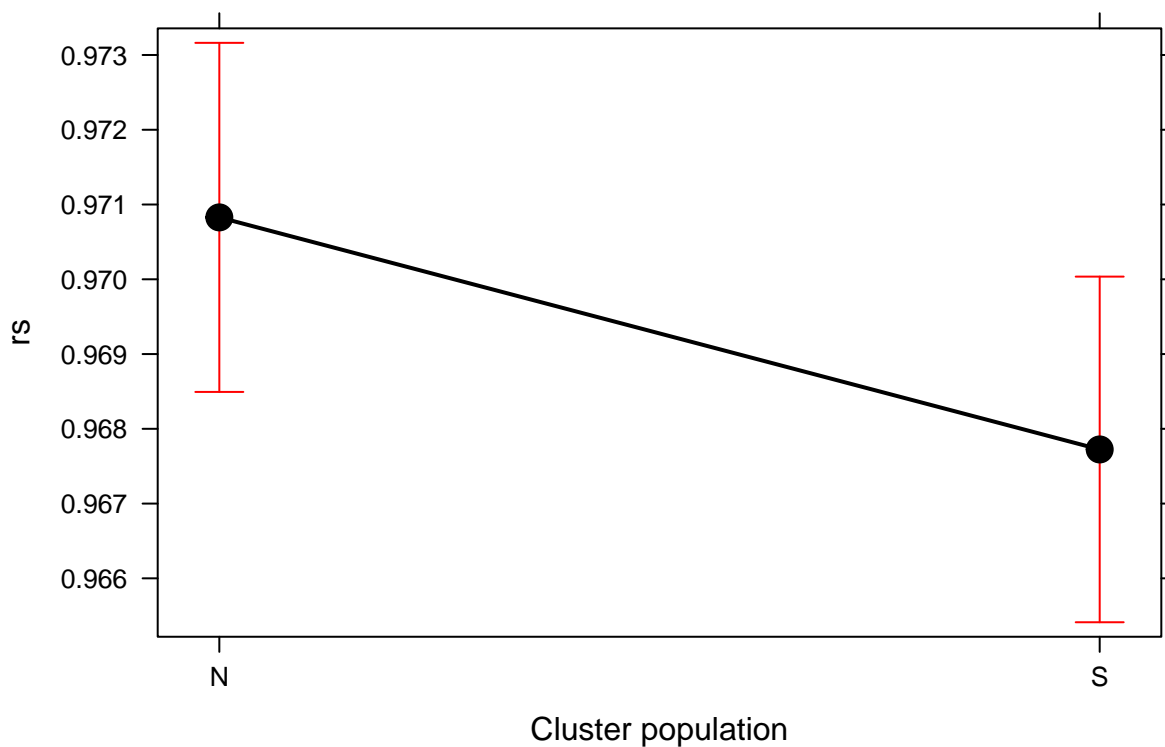## Annual

Summary ANOVA model

Table 6: ANOVA table: rs annual

term	df	sumsq	meansq	statistic	p.value
event	1	3.673	3.673	1442	**0**
clu_pop	1	0.00874	0.00874	3.431	**0.06407**
event:clu_pop	1	4e-05	4e-05	0.01673	0.8971
Residuals	3624	9.228	0.00255		

	Statistic
R^2	0.29
adjR^2	0.28
σ_e	0.05
F	481.93
p	0.00
df_m	4.00
logLik	5689.27
AIC	-11368.53
BIC	-11337.55
dev	9.23
df_e	3624.00

Effects plot

. ~ Cluster population

annual – rs vs. Cluster population

annual – rs vs. Drought event
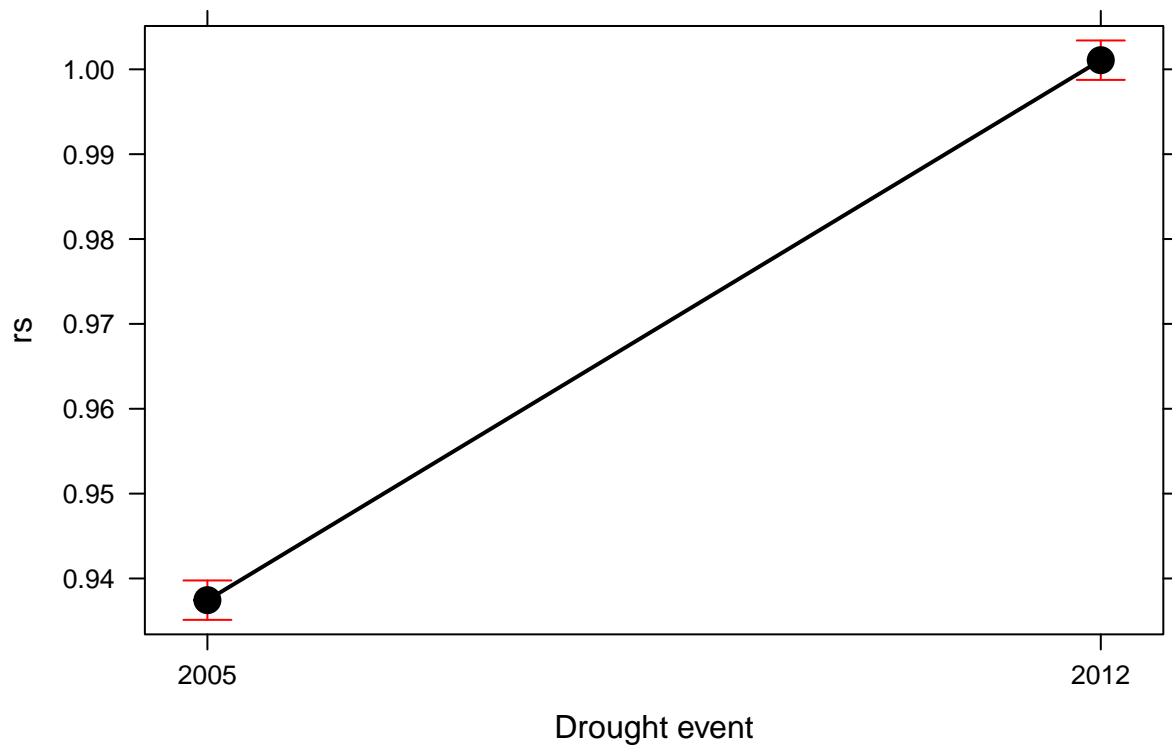
Interaction plot (rs) – annual
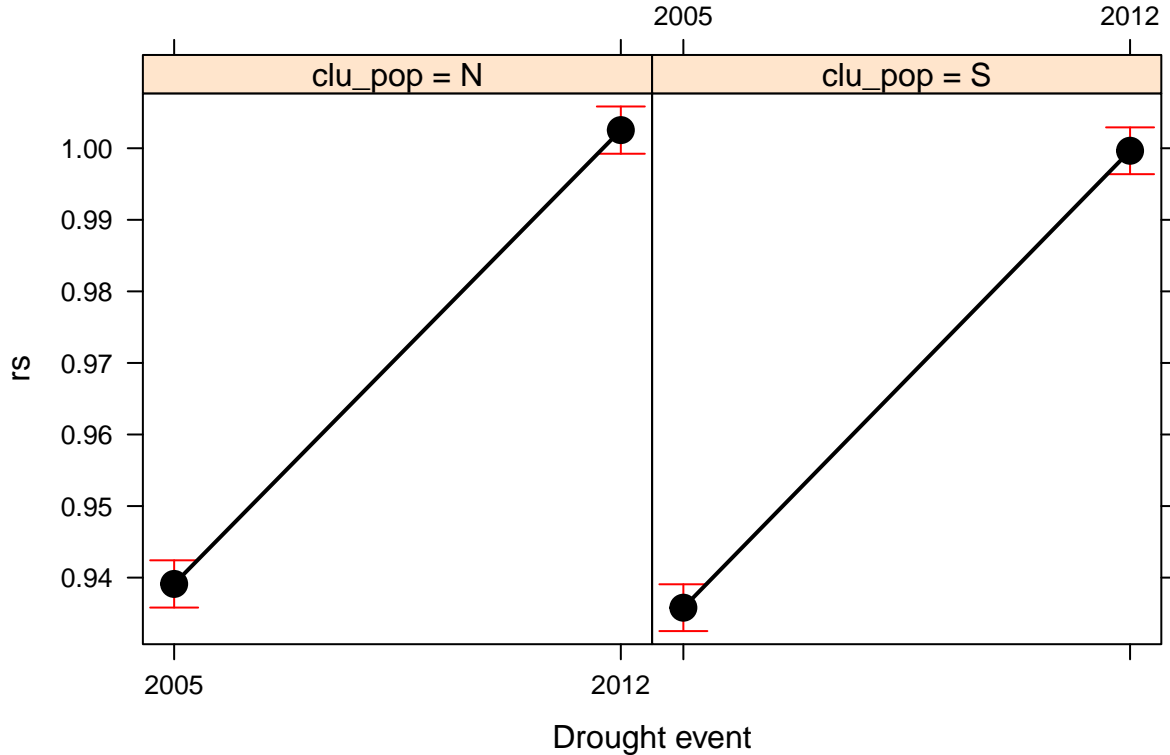
Post-hoc comparison

```
## 
## ### Event ###
## $lsmeans
##  event    lsmean          SE   df  lower.CL  upper.CL
##  2005   0.9374598 0.001184851 3624 0.9351367 0.9397828
##  2012   1.0010920 0.001184851 3624 0.9987690 1.0034151
## 
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## 
## $contrasts
##  contrast       estimate          SE   df t.ratio p.value
##  2005 - 2012 -0.06363224 0.001675633 3624 -37.975  <.0001
## 
## Results are averaged over the levels of: clu_pop
## 
##  event    lsmean          SE   df  lower.CL  upper.CL .group
##  2005   0.9374598 0.001184851 3624 0.9348088 0.9401108  a
##  2012   1.0010920 0.001184851 3624 0.9984410 1.0037430   b
## 
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  N        0.9708277 0.001190715 3624 0.9684932 0.9731623
##  S        0.9677241 0.001178958 3624 0.9654126 0.9700355
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast    estimate          SE   df t.ratio p.value
##  N - S     0.003103691 0.001675633 3624   1.852  0.0641
##
## Results are averaged over the levels of: event
##
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL .group
##  S        0.9677241 0.001178958 3624 0.9650862 0.9703619  a
##  N        0.9708277 0.001190715 3624 0.9681636 0.9734919  a
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  2005  N        0.9391200 0.001683926 3624 0.9358185 0.9424215
##  2012  N        1.0025355 0.001683926 3624 0.9992339 1.0058370
##  2005  S        0.9357996 0.001667299 3624 0.9325306 0.9390685
##  2012  S        0.9996486 0.001667299 3624 0.9963796 1.0029175
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast             estimate          SE   df t.ratio p.value
##  2005,N - 2012,N -0.063415479 0.002381431 3624 -26.629  <.0001
##  2005,N - 2005,S  0.003320455 0.002369703 3624   1.401  0.4986
##  2005,N - 2012,S -0.060528552 0.002369703 3624 -25.543  <.0001
##  2012,N - 2005,S  0.066735934 0.002369703 3624  28.162  <.0001
##  2012,N - 2012,S  0.002886927 0.002369703 3624   1.218  0.6152
##  2005,S - 2012,S -0.063849007 0.002357917 3624 -27.079  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Resistance

Mean values (Cluster population)

Table 8: Mean values (rt)

clu_pop	mean	sd	se	variable	event	seasonF
N	0.8451467	0.06040945	0.002015890	rt	2005	annual
S	0.8922909	0.07181880	0.002372960	rt	2005	annual
N	0.9743921	0.05969130	0.001991924	rt	2012	annual
S	0.9557776	0.06070864	0.002005870	rt	2012	annual
N	0.8338153	0.09068215	0.003026102	rt	2005	spring
S	0.8867083	0.09701567	0.003205488	rt	2005	spring
N	0.9538520	0.08139125	0.002716061	rt	2012	spring
S	0.9333331	0.07899139	0.002609949	rt	2012	spring
N	0.7977105	0.05960856	0.001989163	rt	2005	summer
S	0.8595639	0.06107296	0.002017907	rt	2005	summer
N	0.9496213	0.06035540	0.002014086	rt	2012	summer
S	0.9005109	0.05784069	0.001911110	rt	2012	summer

Summer

Summary ANOVA model

Table 9: ANOVA table: rt summer

term	df	sumsq	meansq	statistic	p.value
event	1	8.338	8.338	2337	**0**
clu_pop	1	0.03682	0.03682	10.32	**0.00133**
event:clu_pop	1	2.792	2.792	782.5	**0**
Residuals	3624	12.93	0.00357		

	Statistic
R^2	0.46
adjR^2	0.46
σ_e	0.06
F	1043.32
p	0.00
df_m	4.00
logLik	5077.57
AIC	-10145.14
BIC	-10114.16
dev	12.93
df_e	3624.00

Effects plot

. ~ Cluster population

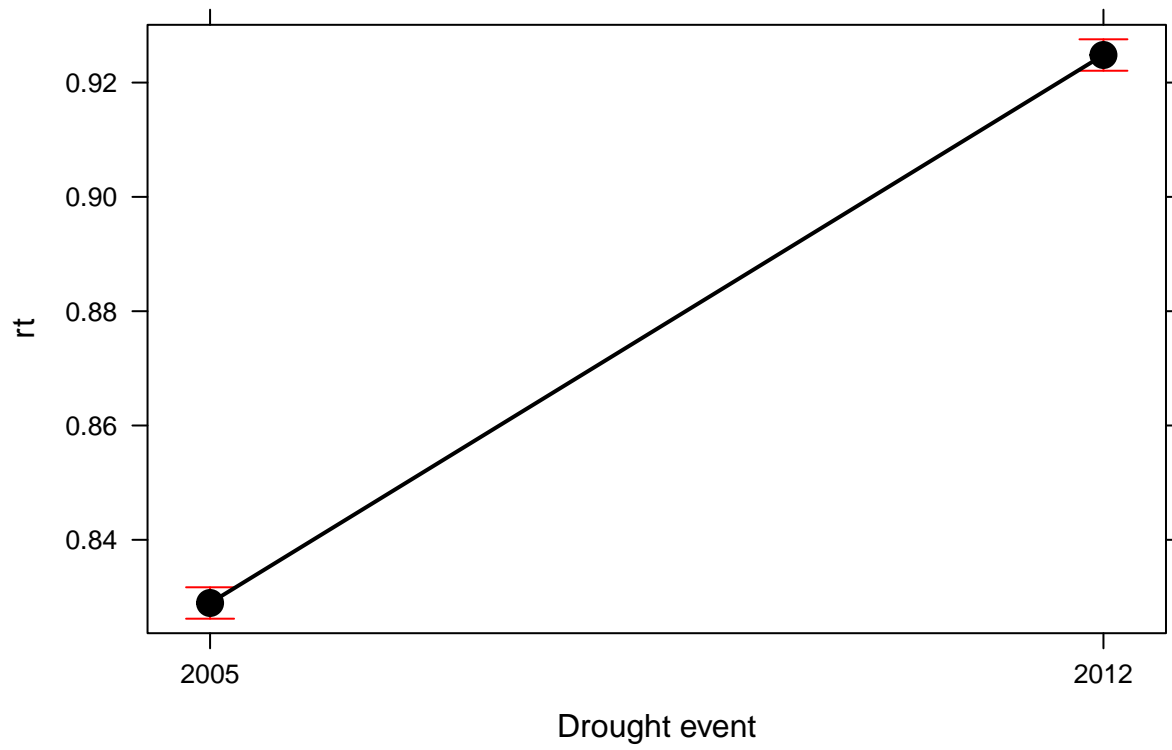# summer – rt vs. Cluster population

rt

0.882

0.880

0.878
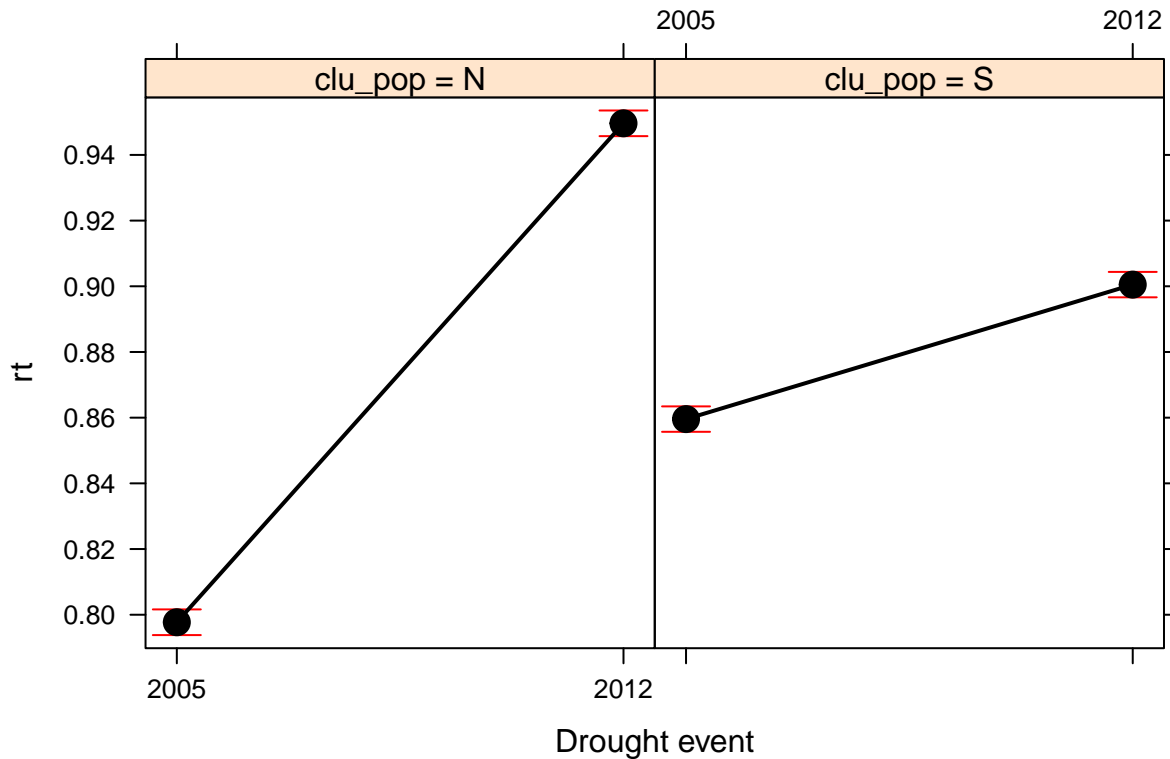
0.876

0.874

0.872

N

S

Cluster population
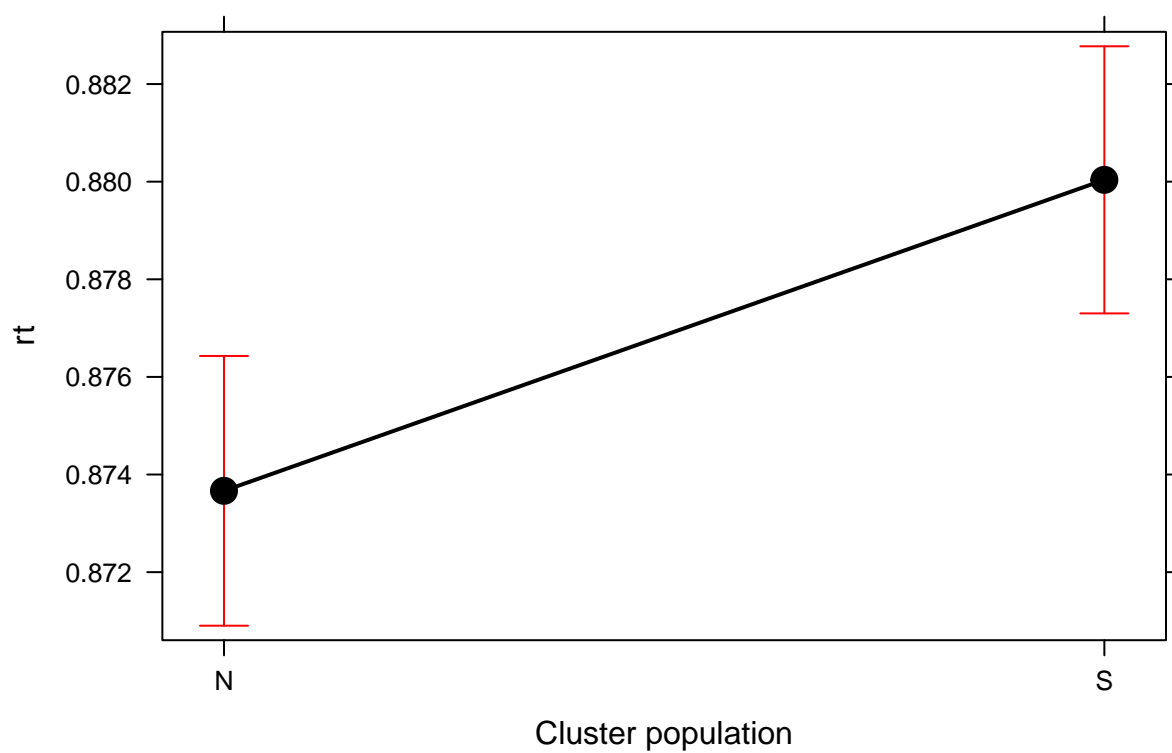
. ~ Disturbance Event

summer – rt vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rt) – summer

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean         SE   df  lower.CL  upper.CL
##  2005   0.8286372 0.001402452 3624 0.8258875 0.8313869
##  2012   0.9250661 0.001402452 3624 0.9223164 0.9278158
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast         estimate          SE   df t.ratio p.value
##  2005 - 2012 -0.09642889 0.001983366 3624 -48.619  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean         SE   df  lower.CL  upper.CL .group
##  2005   0.8286372 0.001402452 3624 0.8254994 0.8317751  a
##  2012   0.9250661 0.001402452 3624 0.9219283 0.9282040   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  N       0.8736659 0.001409393 3624 0.8709026 0.8764292
##  S       0.8800374 0.001395476 3624 0.8773014 0.8827734
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast      estimate          SE   df t.ratio p.value
##  N - S     -0.006371492 0.001983366 3624  -3.212  0.0013
##
## Results are averaged over the levels of: event
##
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL .group
##  N       0.8736659 0.001409393 3624 0.8705125 0.8768193  a
##  S       0.8800374 0.001395476 3624 0.8769152 0.8831597   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  2005  N       0.7977105 0.001993182 3624 0.7938026 0.8016184
##  2012  N       0.9496213 0.001993182 3624 0.9457135 0.9535292
##  2005  S       0.8595639 0.001973501 3624 0.8556947 0.8634332
##  2012  S       0.9005109 0.001973501 3624 0.8966416 0.9043802
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast           estimate          SE   df t.ratio p.value
##  2005,N - 2012,N -0.15191085 0.002818785 3624 -53.892  <.0001
##  2005,N - 2005,S -0.06185345 0.002804903 3624 -22.052  <.0001
##  2005,N - 2012,S -0.10280039 0.002804903 3624 -36.650  <.0001
##  2012,N - 2005,S  0.09005740 0.002804903 3624  32.107  <.0001
##  2012,N - 2012,S  0.04911047 0.002804903 3624  17.509  <.0001
##  2005,S - 2012,S -0.04094693 0.002790952 3624 -14.671  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```
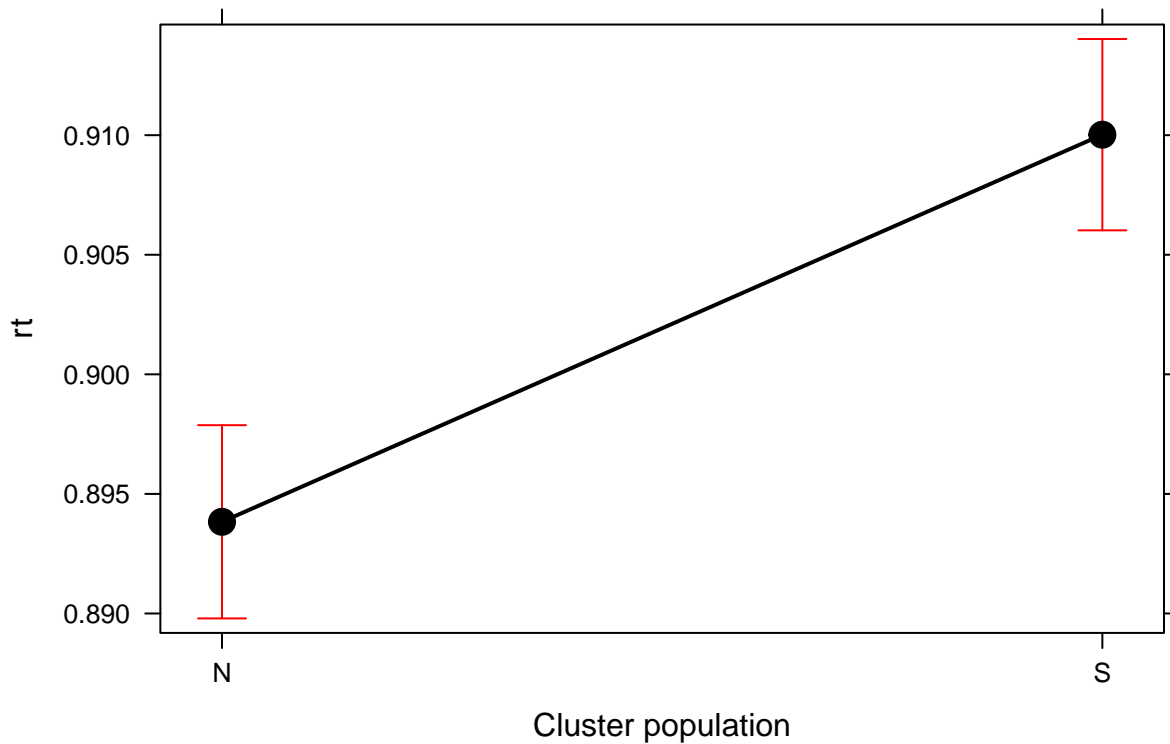
Spring

Summary ANOVA model

Table 11: ANOVA table: rt spring

term	df	sumsq	meansq	statistic	p.value
event	1	6.243	6.243	818.6	**0**
clu_pop	1	0.2376	0.2376	31.16	**0**
event:clu_pop	1	1.222	1.222	160.2	**0**
Residuals	3624	27.64	0.00763		

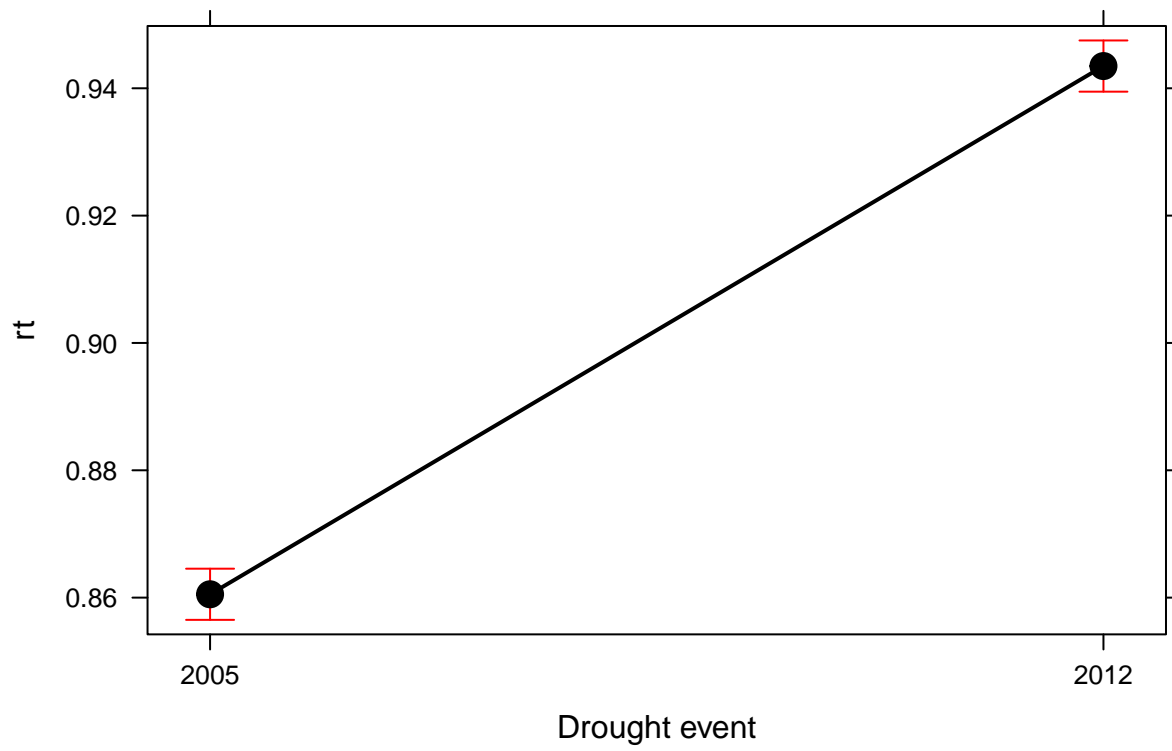|	Statistic
R^2	0.22
adjR^2	0.22
σ_e	0.09
F	336.65
p	0.00
df_m	4.00
logLik	3699.30
AIC	-7388.60
BIC	-7357.62
dev	27.64
df_e	3624.00

Effects plot

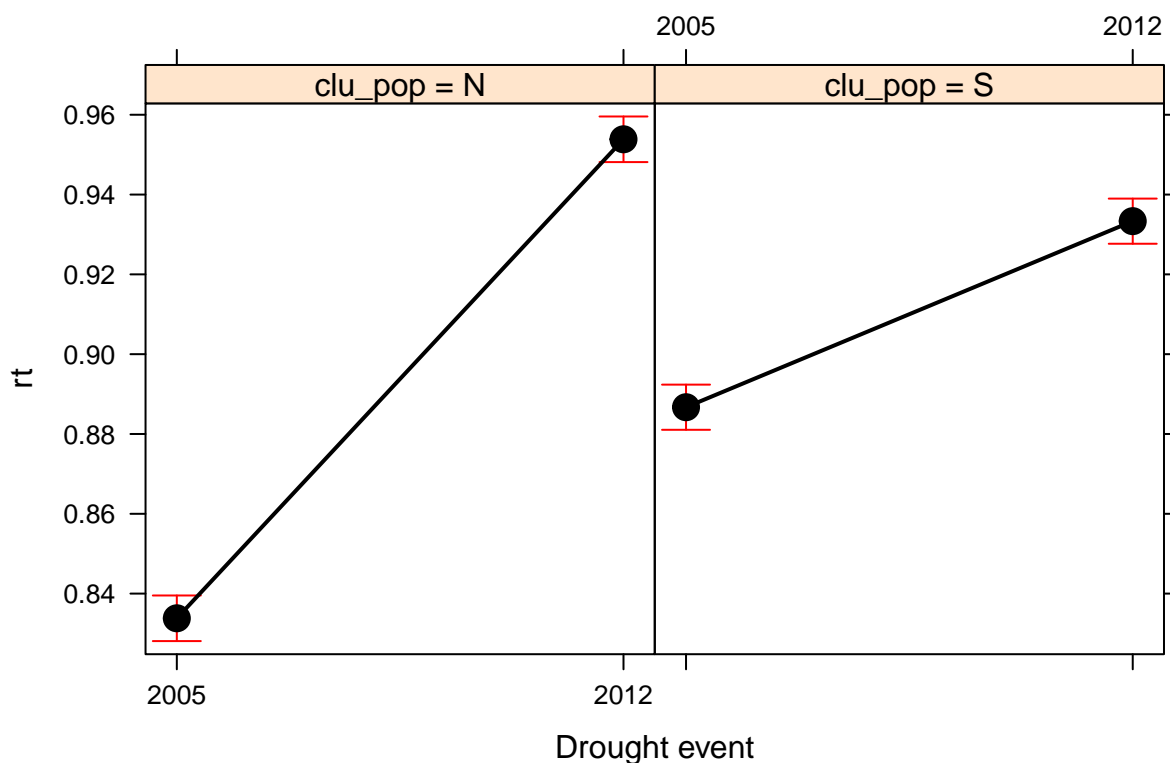**. ~ Cluster population**

spring – rt vs. Cluster population

spring – rt vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rt) – spring

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean          SE   df  lower.CL  upper.CL
##  2005   0.8602618 0.002050575 3624 0.8562414 0.8642822
##  2012   0.9435925 0.002050575 3624 0.9395721 0.9476129
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast       estimate          SE   df t.ratio p.value
##  2005 - 2012 -0.08333074 0.002899951 3624 -28.735  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean          SE   df  lower.CL  upper.CL .group
##  2005   0.8602618 0.002050575 3624 0.8556738 0.8648498  a
##  2012   0.9435925 0.002050575 3624 0.9390046 0.9481805   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
## 
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean           SE   df  lower.CL  upper.CL
##  N        0.8938337 0.002060724 3624 0.8897934 0.8978739
##  S        0.9100207 0.002040376 3624 0.9060203 0.9140211
## 
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## 
## $contrasts
##  contrast     estimate           SE   df t.ratio p.value
##  N - S     -0.01618703 0.002899951 3624  -5.582  <.0001
## 
## Results are averaged over the levels of: event
## 
##  clu_pop    lsmean           SE   df  lower.CL  upper.CL .group
##  N        0.8938337 0.002060724 3624 0.8892230 0.8984443  a
##  S        0.9100207 0.002040376 3624 0.9054555 0.9145858   b
## 
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
## 
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean           SE   df  lower.CL  upper.CL
##  2005  N        0.8338153 0.002914304 3624 0.8281015 0.8395291
##  2012  N        0.9538520 0.002914304 3624 0.9481382 0.9595658
##  2005  S        0.8867083 0.002885528 3624 0.8810509 0.8923657
##  2012  S        0.9333331 0.002885528 3624 0.9276757 0.9389905
## 
## Confidence level used: 0.95
## 
## $contrasts
##  contrast           estimate           SE   df t.ratio p.value
##  2005,N - 2012,N -0.12003670 0.004121448 3624 -29.125  <.0001
##  2005,N - 2005,S -0.05289298 0.004101151 3624 -12.897  <.0001
##  2005,N - 2012,S -0.09951777 0.004101151 3624 -24.266  <.0001
##  2012,N - 2005,S  0.06714371 0.004101151 3624  16.372  <.0001
##  2012,N - 2012,S  0.02051893 0.004101151 3624   5.003  <.0001
##  2005,S - 2012,S -0.04662478 0.004080752 3624 -11.426  <.0001
## 
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Annual

**Summary ANOVA model**

Table 13: ANOVA table: rt annual

term	df	sumsq	meansq	statistic	p.value
event	1	8.366	8.366	2082	**0**
clu_pop	1	0.1845	0.1845	45.93	**0**
event:clu_pop	1	0.9804	0.9804	244	**0**
Residuals	3624	14.56	0.00402		

	Statistic
R^2	0.40
adjR^2	0.40
σ_e	0.06
F	790.67
p	0.00
df_m	4.00
logLik	4861.87
AIC	-9713.75
BIC	-9682.76
dev	14.56
df_e	3624.00

Effects plot

. ~ Cluster population

annual – rt vs. Cluster population
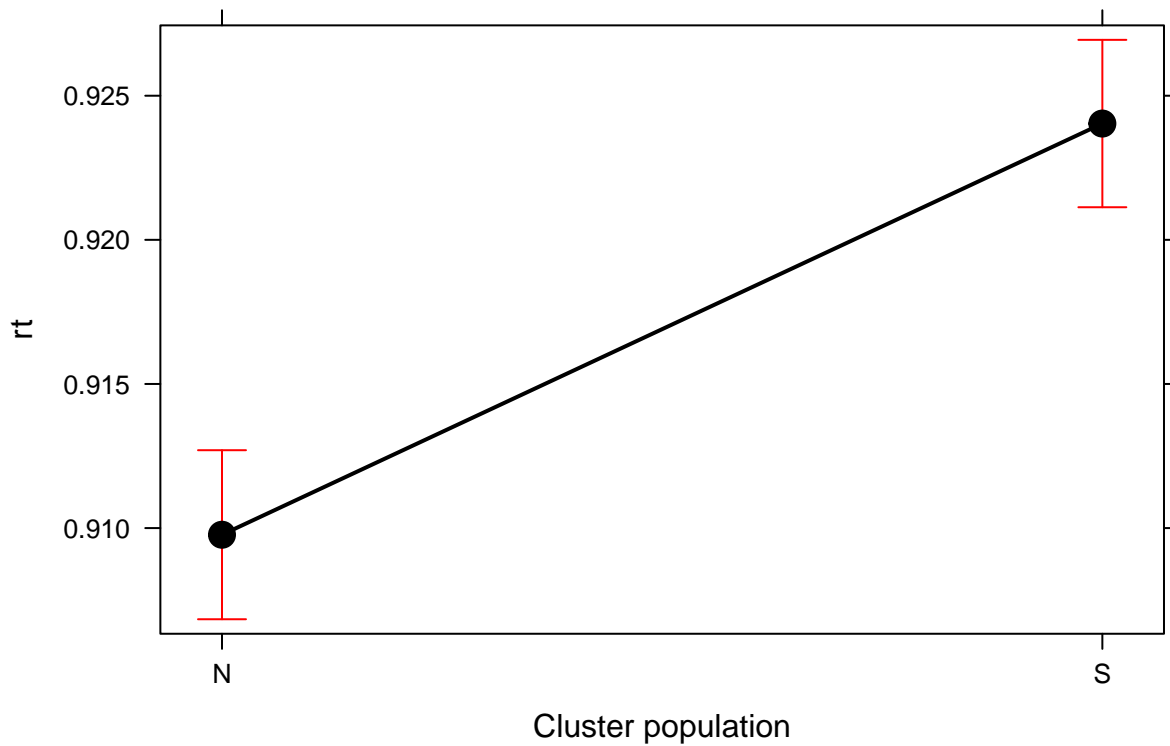
annual – rt vs. Drought event
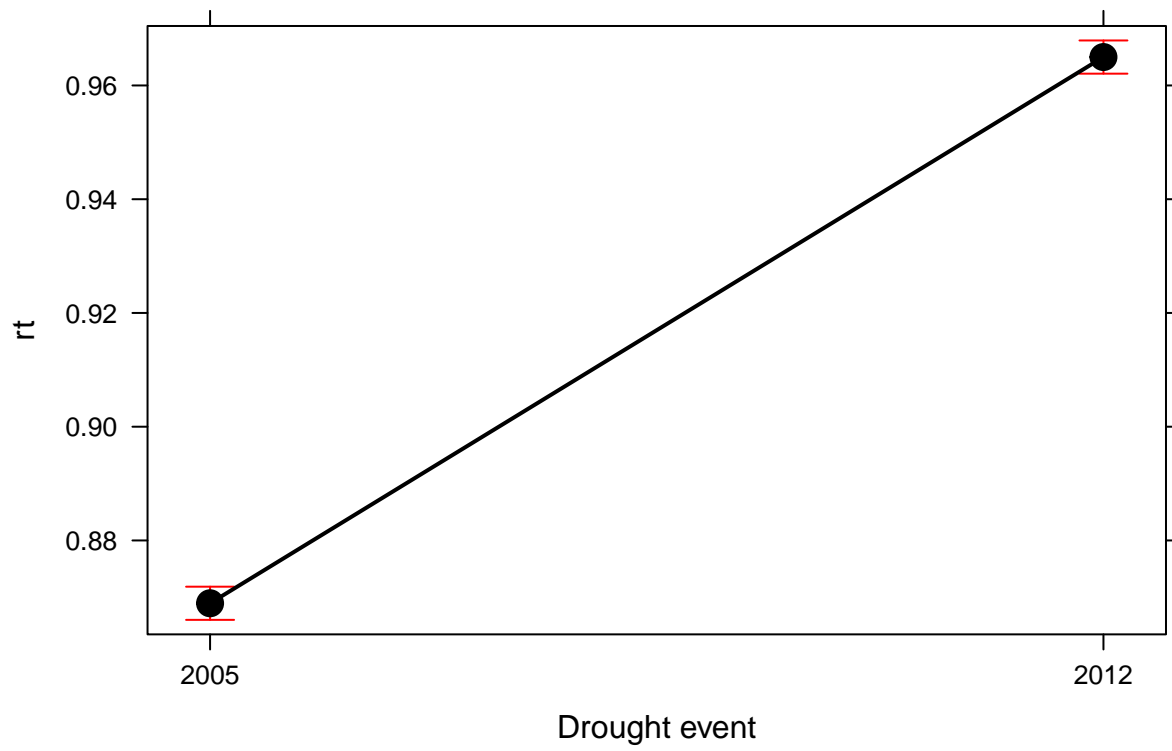
Interaction plot (rt) – annual
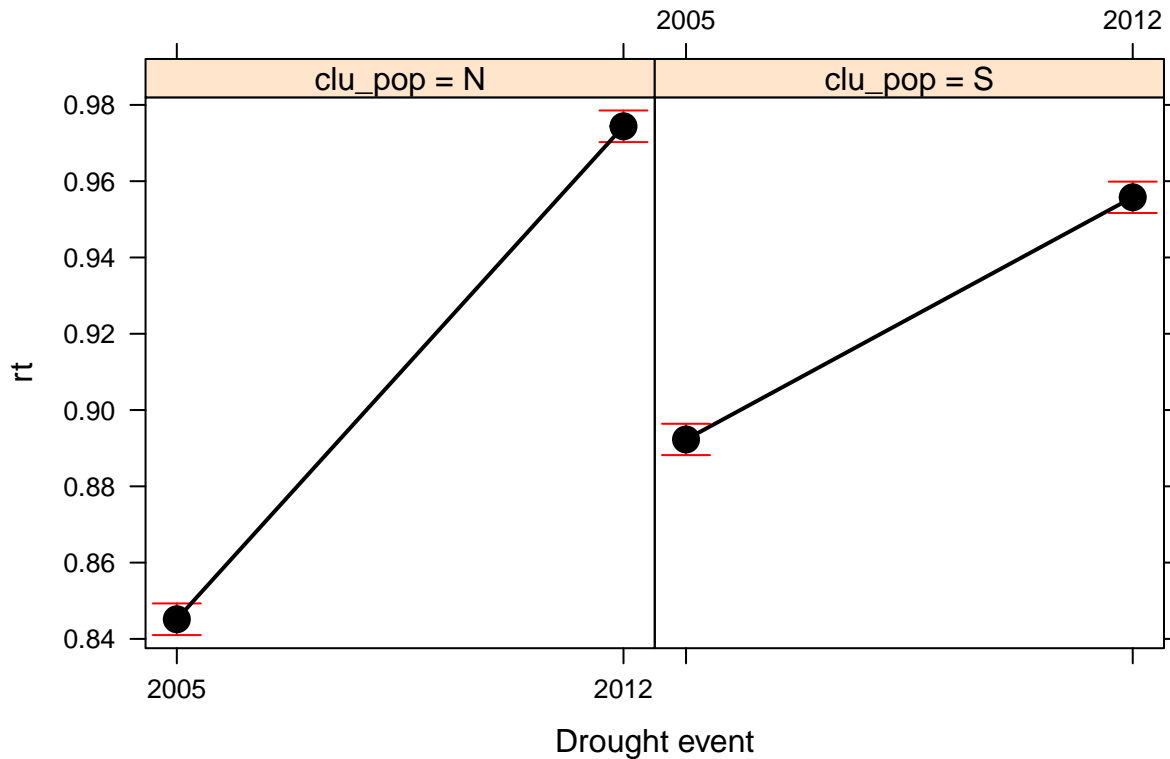
Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean          SE   df  lower.CL  upper.CL
##  2005   0.8687188 0.001488361 3624 0.8658007 0.8716369
##  2012   0.9650849 0.001488361 3624 0.9621667 0.9680030
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast        estimate          SE   df t.ratio p.value
##  2005 - 2012 -0.09636608 0.00210486 3624 -45.783  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean          SE   df  lower.CL  upper.CL .group
##  2005   0.8687188 0.001488361 3624 0.8653887 0.8720488  a
##  2012   0.9650849 0.001488361 3624 0.9617548 0.9684149   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  N       0.9097694 0.001495727 3624 0.9068368 0.9127019
##  S       0.9240342 0.001480958 3624 0.9211307 0.9269378
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast    estimate          SE   df t.ratio p.value
##  N - S    -0.01426488 0.00210486 3624  -6.777  <.0001
##
## Results are averaged over the levels of: event
##
##  clu_pop    lsmean          SE   df  lower.CL  upper.CL .group
##  N       0.9097694 0.001495727 3624 0.9064228 0.9131159  a
##  S       0.9240342 0.001480958 3624 0.9207207 0.9273477   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df  lower.CL  upper.CL
##  2005  N       0.8451467 0.002115277 3624 0.8409994 0.8492939
##  2012  N       0.9743921 0.002115277 3624 0.9702448 0.9785393
##  2005  S       0.8922909 0.002094391 3624 0.8881846 0.8963972
##  2012  S       0.9557776 0.002094391 3624 0.9516713 0.9598839
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast            estimate          SE   df t.ratio p.value
##  2005,N - 2012,N -0.12924541 0.002991454 3624 -43.205  <.0001
##  2005,N - 2005,S -0.04714420 0.002976721 3624 -15.838  <.0001
##  2005,N - 2012,S -0.11063096 0.002976721 3624 -37.165  <.0001
##  2012,N - 2005,S  0.08210120 0.002976721 3624  27.581  <.0001
##  2012,N - 2012,S  0.01861445 0.002976721 3624   6.253  <.0001
##  2005,S - 2012,S -0.06348676 0.002961916 3624 -21.434  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Recovery

Mean values (Cluster population)

Table 15: Mean values (rc)

clu_pop	mean	sd	se	variable	event	seasonF
N	1.114878	0.07432942	0.002480405	rc	2005	annual
S	1.053508	0.08003297	0.002644364	rc	2005	annual
N	1.030993	0.05383248	0.001796413	rc	2012	annual
S	1.047747	0.04684767	0.001547891	rc	2012	annual
N	1.138862	0.11071724	0.003694682	rc	2005	spring
S	1.078225	0.10758852	0.003554825	rc	2005	spring
N	1.069859	0.08801844	0.002937213	rc	2012	spring
S	1.103323	0.07914731	0.002615101	rc	2012	spring
N	1.166896	0.08962052	0.002990675	rc	2005	summer
S	1.061280	0.07633458	0.002522165	rc	2005	summer
N	1.075634	0.05798147	0.001934867	rc	2012	summer
S	1.094052	0.06470434	0.002137892	rc	2012	summer

Summer

Summary ANOVA model

Table 16: ANOVA table: rc summer

term	df	sumsq	meansq	statistic	p.value
event	1	0.7435	0.7435	139	**0**
clu_pop	1	1.724	1.724	322.3	**0**
event:clu_pop	1	3.488	3.488	652.2	**0**
Residuals	3624	19.38	0.00535		

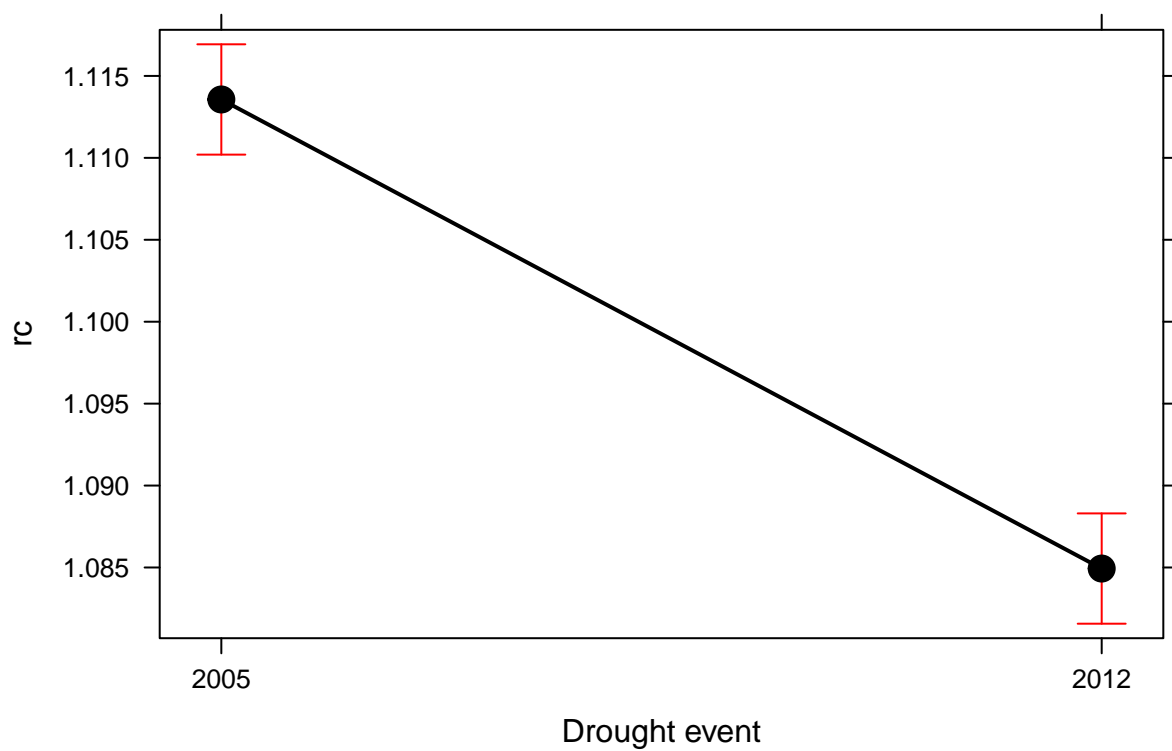|	Statistic
R^2	0.24
adjR^2	0.23
σ_e	0.07
F	371.17
p	0.00
df_m	4.00
logLik	4343.05
AIC	-8676.10
BIC	-8645.12
dev	19.38
df_e	3624.00

Effects plot

. ~ Cluster population

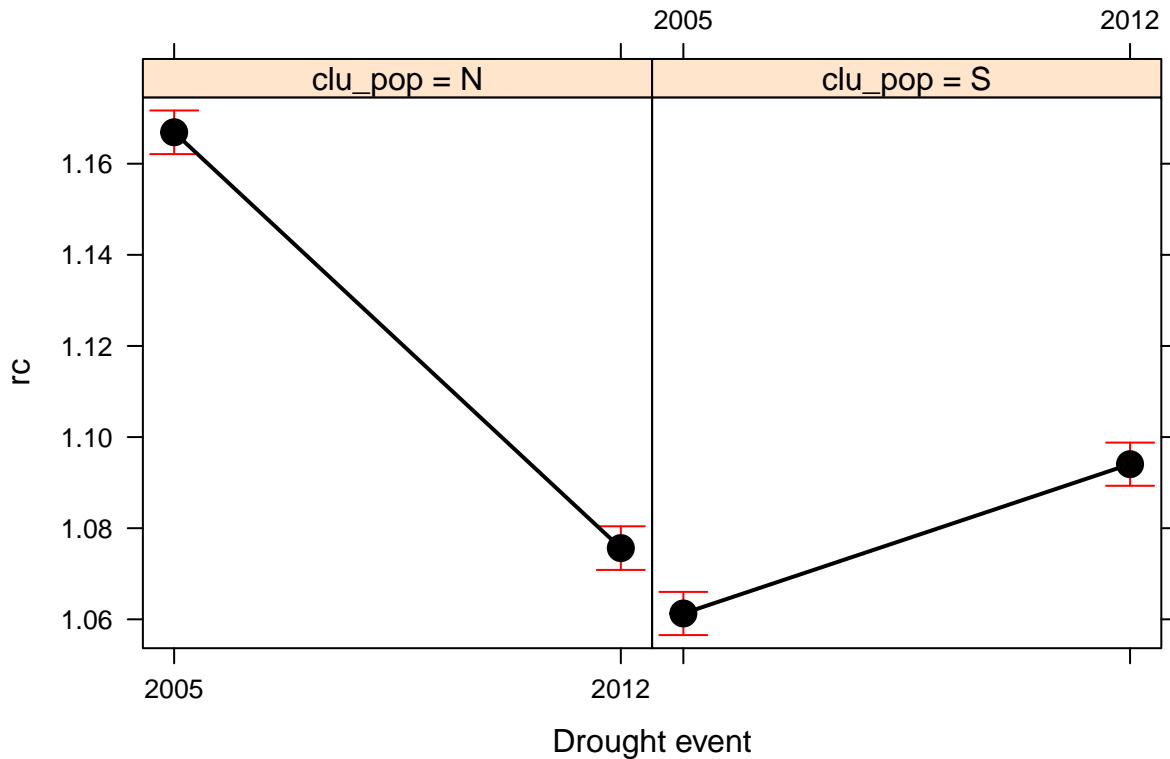# summer – rc vs. Cluster population
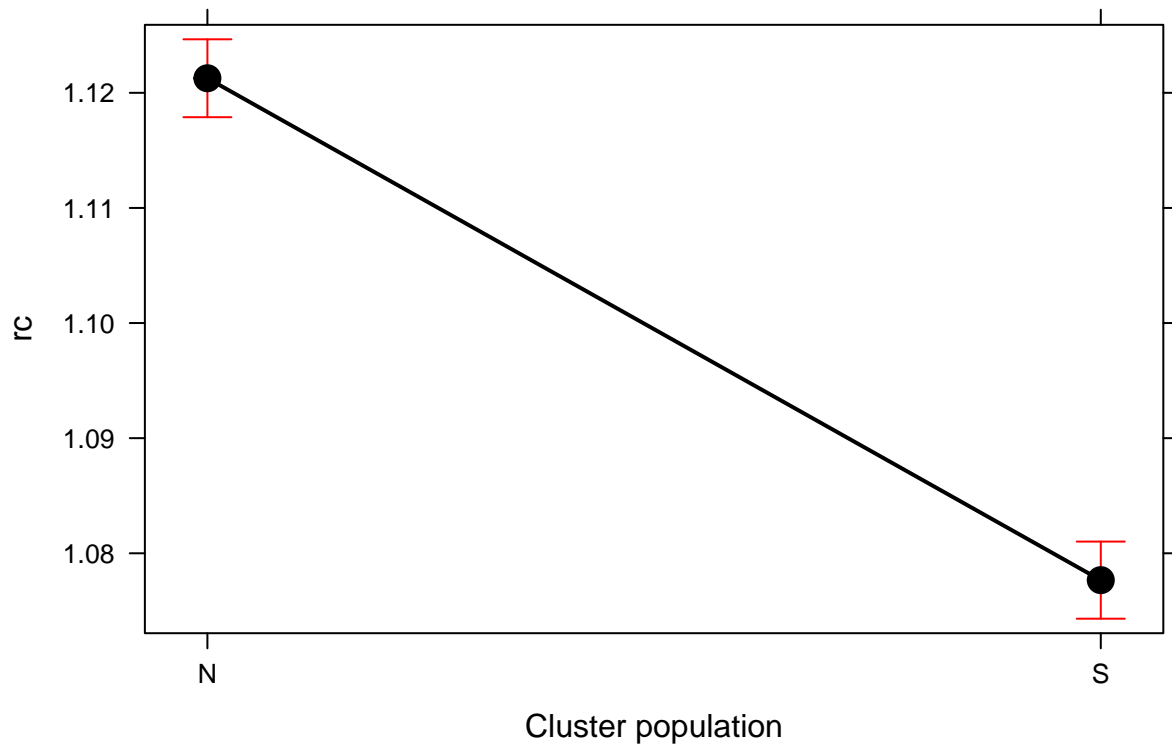
. ~ Disturbance Event

summer – rc vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rc) – summer

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean         SE   df lower.CL upper.CL
##  2005   1.114088 0.001717175 3624 1.110721 1.117455
##  2012   1.084843 0.001717175 3624 1.081476 1.088210
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast       estimate         SE   df t.ratio p.value
##  2005 - 2012 0.02924541 0.002428453 3624  12.043  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean         SE   df lower.CL upper.CL .group
##  2012   1.084843 0.001717175 3624 1.081001 1.088685  a
##  2005   1.114088 0.001717175 3624 1.110246 1.117930   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop    lsmean          SE   df lower.CL upper.CL
##  N        1.121265 0.001725674 3624 1.117882 1.124648
##  S        1.077666 0.001708635 3624 1.074316 1.081016
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate          SE   df t.ratio p.value
##  N - S    0.0435989 0.002428453 3624  17.953  <.0001
##
## Results are averaged over the levels of: event
##
##  clu_pop    lsmean          SE   df lower.CL upper.CL .group
##  S        1.077666 0.001708635 3624 1.073843 1.081489  a
##  N        1.121265 0.001725674 3624 1.117404 1.125126   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop    lsmean          SE   df lower.CL upper.CL
##  2005  N        1.166896 0.002440472 3624 1.162111 1.171681
##  2012  N        1.075634 0.002440472 3624 1.070849 1.080418
##  2005  S        1.061280 0.002416374 3624 1.056543 1.066018
##  2012  S        1.094052 0.002416374 3624 1.089314 1.098790
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast            estimate          SE   df t.ratio p.value
##  2005,N - 2012,N  0.09126265 0.003451348 3624  26.443  <.0001
##  2005,N - 2005,S  0.10561614 0.003434351 3624  30.753  <.0001
##  2005,N - 2012,S  0.07284431 0.003434351 3624  21.211  <.0001
##  2012,N - 2005,S  0.01435349 0.003434351 3624   4.179  0.0002
##  2012,N - 2012,S -0.01841834 0.003434351 3624  -5.363  <.0001
##  2005,S - 2012,S -0.03277183 0.003417269 3624  -9.590  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```
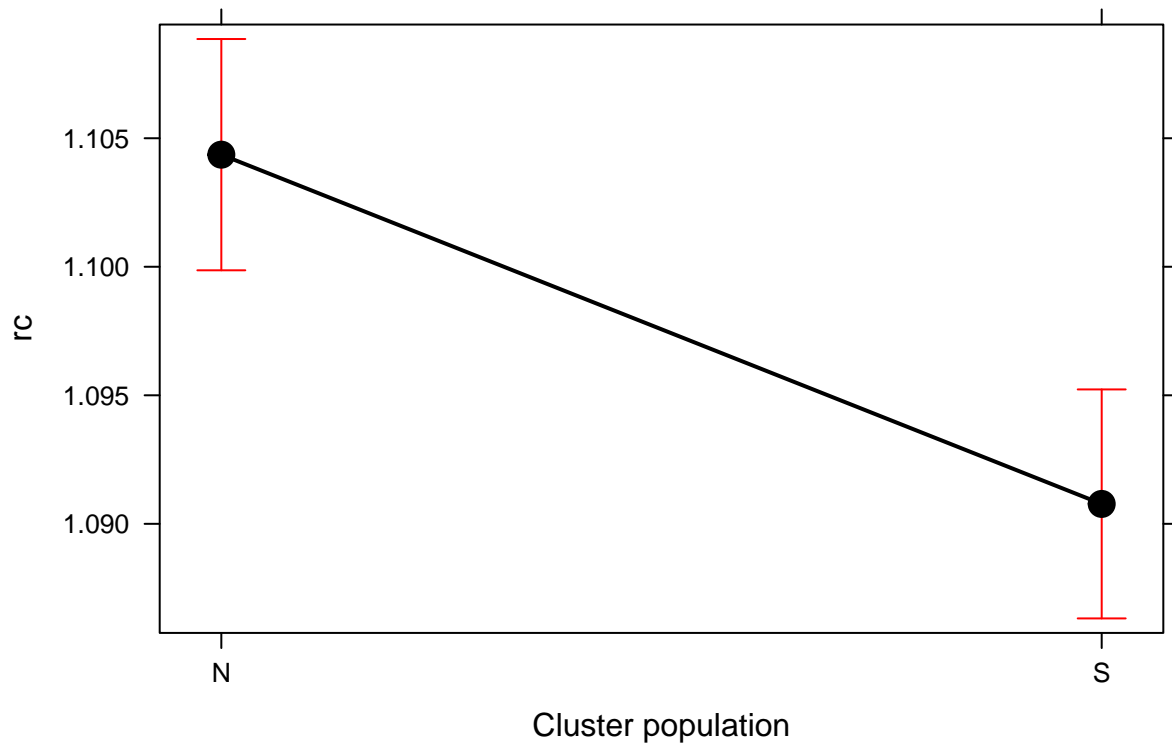
Spring

Summary ANOVA model

Table 18: ANOVA table: rc spring

term	df	sumsq	meansq	statistic	p.value
event	1	0.4187	0.4187	44.28	**0**
clu_pop	1	0.1674	0.1674	17.7	**3e-05**
event:clu_pop	1	2.008	2.008	212.3	**0**
Residuals	3624	34.27	0.00946		

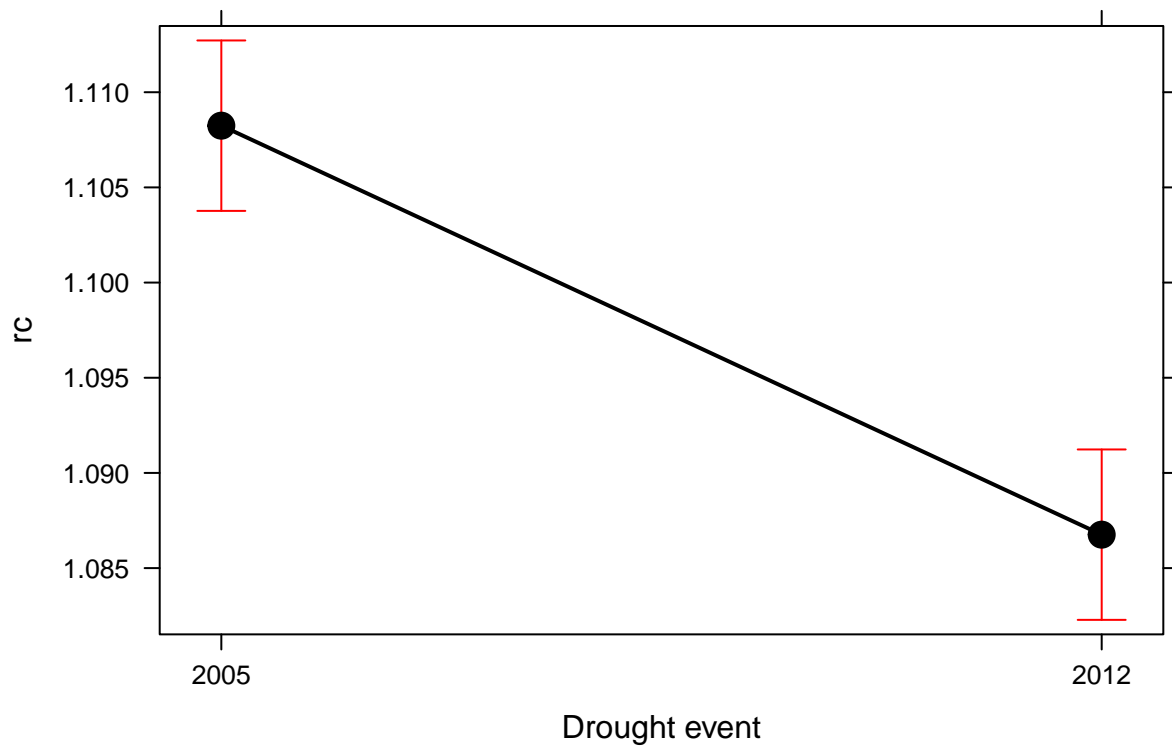|	Statistic
R^2	0.07
adjR^2	0.07
σ_e	0.10
F	91.43
p	0.00
df_m	4.00
logLik	3309.36
AIC	-6608.71
BIC	-6577.73
dev	34.27
df_e	3624.00

Effects plot

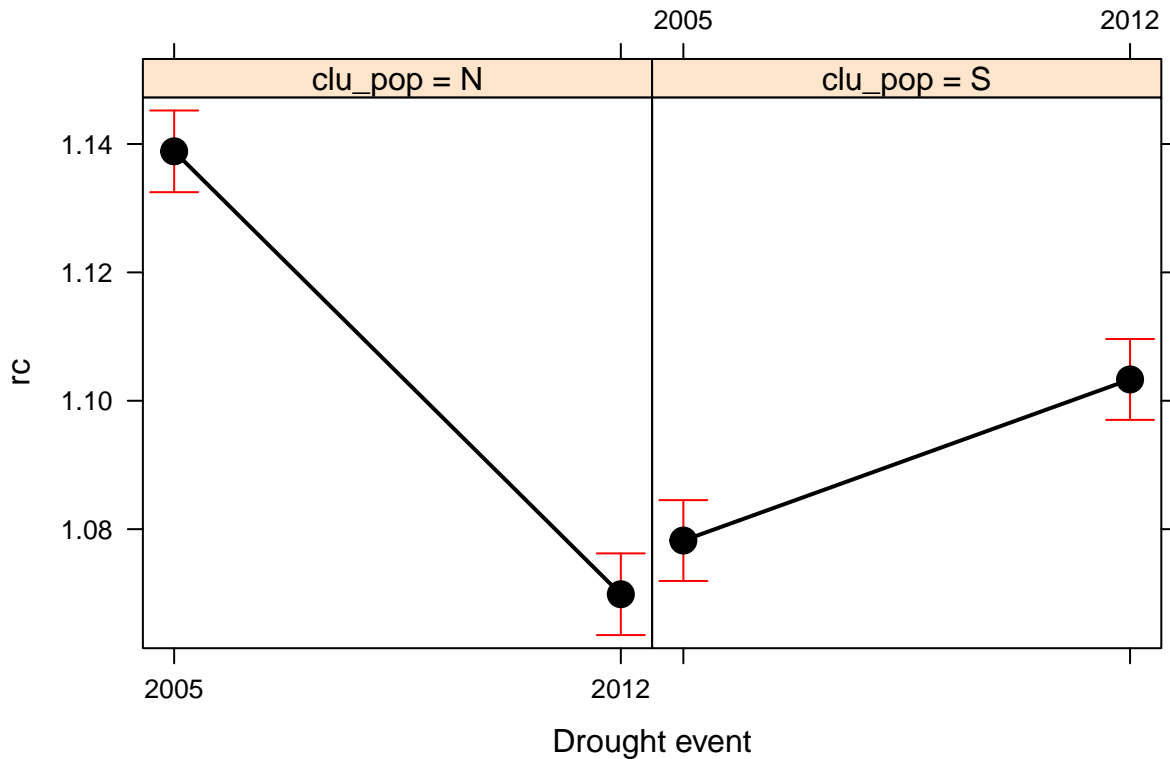**. ~ Cluster population**

spring – rc vs. Cluster population

spring – rc vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rc) – spring

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event    lsmean         SE   df lower.CL upper.CL
##   2005  1.108543 0.002283254 3624 1.104067 1.113020
##   2012  1.086591 0.002283254 3624 1.082115 1.091068
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast       estimate          SE   df t.ratio p.value
##   2005 - 2012 0.02195214 0.003229009 3624   6.798  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event    lsmean         SE   df lower.CL upper.CL .group
##   2012  1.086591 0.002283254 3624 1.081483 1.091700  a
##   2005  1.108543 0.002283254 3624 1.103435 1.113652   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop   lsmean          SE   df lower.CL upper.CL
##  N       1.104361 0.002294555 3624 1.099862 1.108859
##  S       1.090774 0.002271898 3624 1.086320 1.095228
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast   estimate          SE   df t.ratio p.value
##  N - S    0.01358678 0.003229009 3624    4.208  <.0001
##
## Results are averaged over the levels of: event
##
##  clu_pop   lsmean          SE   df lower.CL upper.CL .group
##  S       1.090774 0.002271898 3624 1.085691 1.095857  a
##  N       1.104361 0.002294555 3624 1.099227 1.109495   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop   lsmean          SE   df lower.CL upper.CL
##  2005  N       1.138862 0.003244990 3624 1.132500 1.145224
##  2012  N       1.069859 0.003244990 3624 1.063497 1.076222
##  2005  S       1.078225 0.003212949 3624 1.071925 1.084524
##  2012  S       1.103323 0.003212949 3624 1.097024 1.109623
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast            estimate          SE   df t.ratio p.value
##  2005,N - 2012,N  0.069002731 0.004589109 3624   15.036  <.0001
##  2005,N - 2005,S  0.060637370 0.004566509 3624   13.279  <.0001
##  2005,N - 2012,S  0.035538925 0.004566509 3624    7.783  <.0001
##  2012,N - 2005,S -0.008365361 0.004566509 3624   -1.832  0.2584
##  2012,N - 2012,S -0.033463806 0.004566509 3624   -7.328  <.0001
##  2005,S - 2012,S -0.025098444 0.004543796 3624   -5.524  <.0001
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```

Annual

Summary ANOVA model
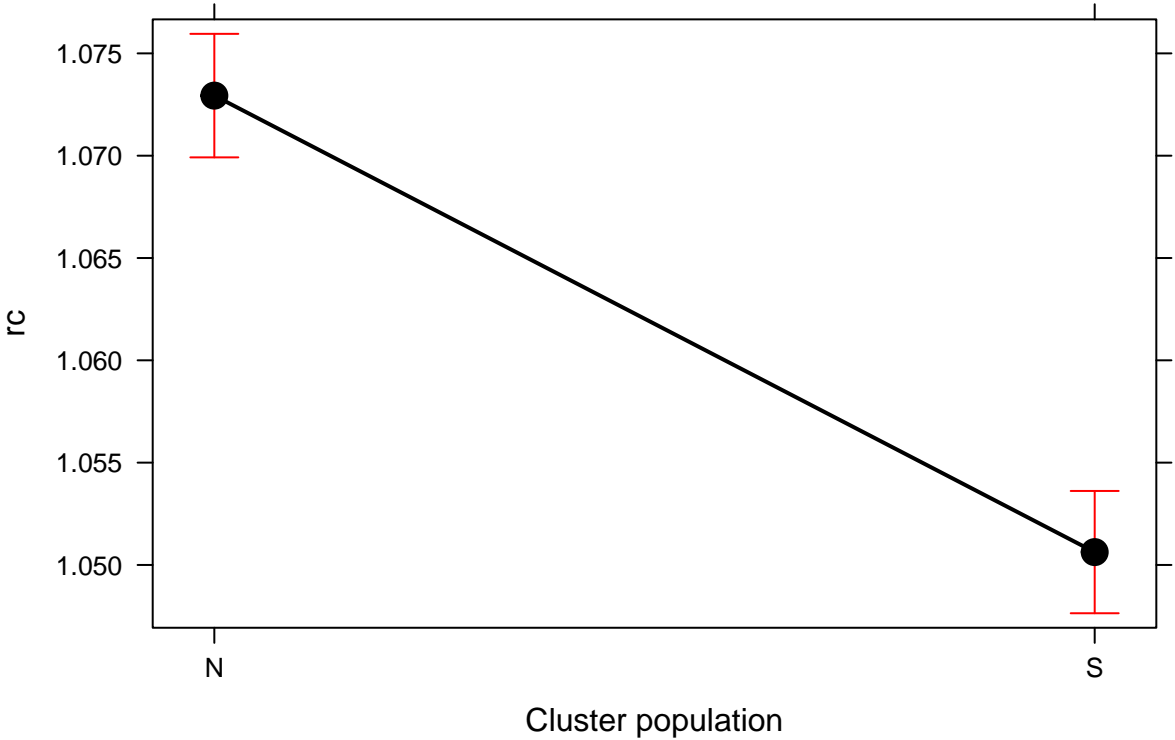
Table 20: ANOVA table: rc annual

term	df	sumsq	meansq	statistic	p.value
event	1	1.791	1.791	420.8	**0**
clu_pop	1	0.4513	0.4513	106	**0**
event:clu_pop	1	1.384	1.384	325.1	**0**
Residuals	3624	15.42	0.00426		

	Statistic
R^2	0.19
adjR^2	0.19
σ_e	0.07
F	283.99
p	0.00
df_m	4.00
logLik	4757.43
AIC	-9504.87
BIC	-9473.88
dev	15.42
df_e	3624.00

Effects plot

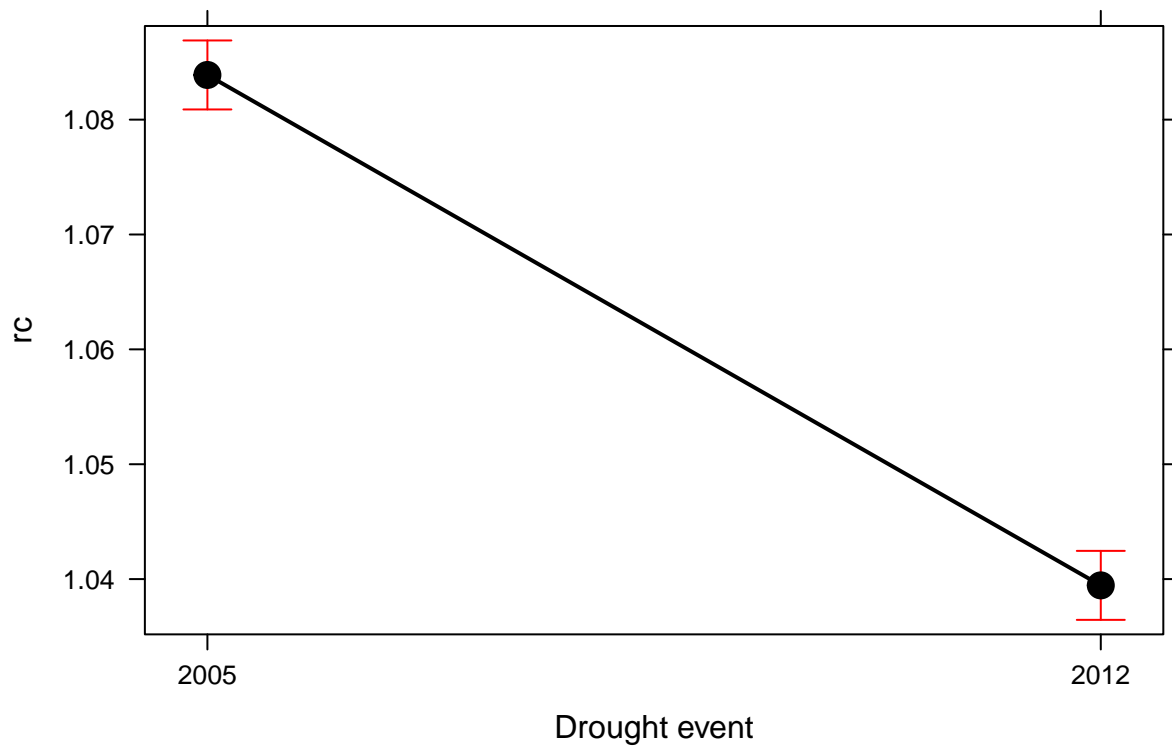**. ~ Cluster population**

annual – rc vs. Cluster population
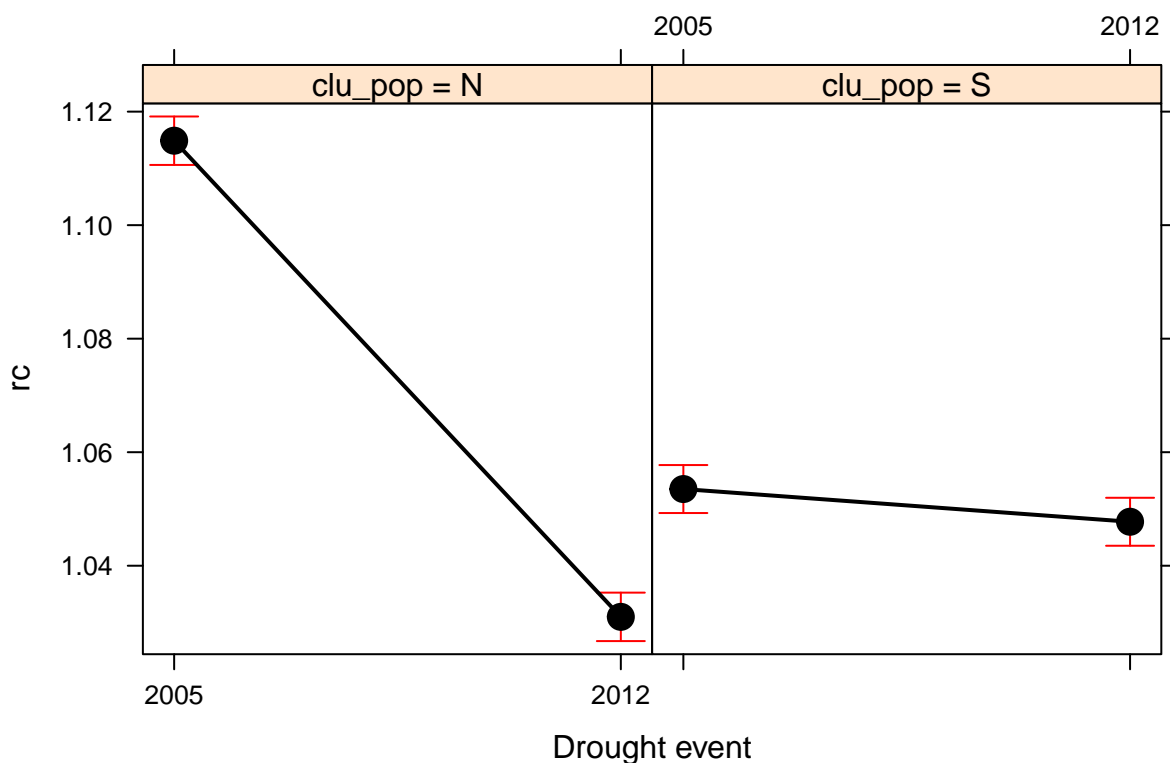
annual – rc vs. Drought event

. ~ Cluster population:Elevation

Interaction plot (rc) – annual

Post-hoc comparison

```
##
## ### Event ###
## $lsmeans
##  event   lsmean         SE   df lower.CL upper.CL
##  2005   1.084193 0.00153183 3624 1.081190 1.087197
##  2012   1.039370 0.00153183 3624 1.036366 1.042373
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
##
## $contrasts
##  contrast     estimate          SE   df t.ratio p.value
##  2005 - 2012 0.0448237 0.002166334 3624  20.691  <.0001
##
## Results are averaged over the levels of: clu_pop
##
##  event   lsmean         SE   df lower.CL upper.CL .group
##  2012   1.039370 0.00153183 3624 1.035942 1.042797  a
##  2005   1.084193 0.00153183 3624 1.080766 1.087621   b
##
## Results are averaged over the levels of: clu_pop
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
```

```
##
## ### Clu pop ###
## $lsmeans
##  clu_pop   lsmean          SE   df lower.CL upper.CL
##  N       1.072935 0.001539411 3624 1.069917 1.075954
##  S       1.050628 0.001524211 3624 1.047639 1.053616
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
##
## $contrasts
##  contrast    estimate          SE   df t.ratio p.value
##  N - S     0.02230785 0.002166334 3624  10.298  <.0001
##
## Results are averaged over the levels of: event
##
##  clu_pop   lsmean          SE   df lower.CL upper.CL .group
##  S       1.050628 0.001524211 3624 1.047217 1.054038  a
##  N       1.072935 0.001539411 3624 1.069491 1.076380   b
##
## Results are averaged over the levels of: event
## Confidence level used: 0.95
## Conf-level adjustment: sidak method for 2 estimates
## significance level used: alpha = 0.01
##
## ### Event:Clu pop ###
## $lsmeans
##  event clu_pop   lsmean          SE   df lower.CL upper.CL
##  2005  N       1.114878 0.002177056 3624 1.110610 1.119147
##  2012  N       1.030993 0.002177056 3624 1.026724 1.035261
##  2005  S       1.053508 0.002155559 3624 1.049282 1.057735
##  2012  S       1.047747 0.002155559 3624 1.043521 1.051973
##
## Confidence level used: 0.95
##
## $contrasts
##  contrast             estimate          SE   df t.ratio p.value
##  2005,N - 2012,N   0.083885858 0.003078822 3624  27.246  <.0001
##  2005,N - 2005,S   0.061370009 0.003063659 3624  20.032  <.0001
##  2005,N - 2012,S   0.067131543 0.003063659 3624  21.912  <.0001
##  2012,N - 2005,S  -0.022515849 0.003063659 3624  -7.349  <.0001
##  2012,N - 2012,S  -0.016754315 0.003063659 3624  -5.469  <.0001
##  2005,S - 2012,S   0.005761534 0.003048421 3624   1.890  0.2325
##
## P value adjustment: tukey method for comparing a family of 4 estimates
```