

Open Source Supporting Information for the article: “Suicide and Drought in NSW, Australia, 1970-2007”.

Ivan C. Hanigan^{1,2} Colin D. Butler¹ Philip N. Kokic²
Michael F. Hutchinson³

[¹]National Centre for Epidemiology and Population Health, Australian National University

[²]Commonwealth Scientific and Industrial Research Organisation

[³]Fenner School of Environment and Society, Australian National University.

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1 Introduction

This document accompanies the R code at this website <https://github.com/ivanhanigan/SuicideAndDroughtInNSW> to reproduce the work published for the paper ‘Suicide and Drought in New South Wales (NSW), Australia, 1970-2007’ (doi:10.1073/pnas.1112965109). These results were not included in that paper or the supporting information published with PNAS, so are published here as open source additional material.

2 Drought Index

2.1 The Summation Method

When the index is calculated using the sum of each consecutive month’s rainfall deficiency score the resulting measure addresses the question of how intense the drought is, rather than just the

duration which is provided by the counting method. This version of the index is shown in Figure 1.

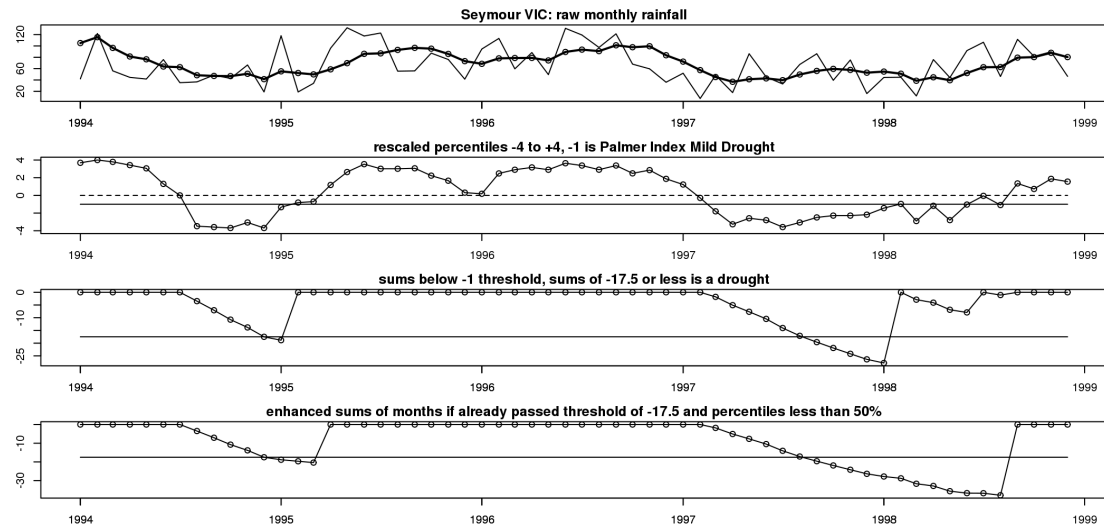


Figure 1: Drought in Seymour Victoria 1994-99 using the enhanced Hutchinson index

3 Suicide and Drought Modeling

Diagnostic plots of the core model are shown in Figure 2.

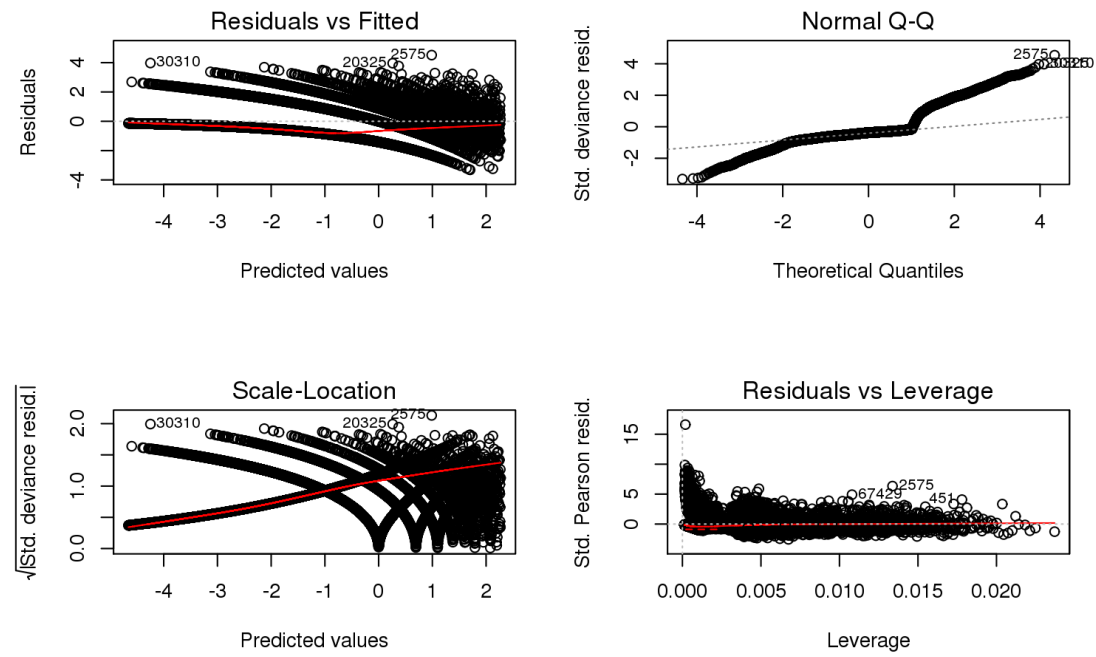


Figure 2: Core model diagnostic plots

3.1 Check Climate

The effect estimates for initial models of climate are shown in Figure 3. The drought effect was found to be complicated by the countervailing effects in men and women during subsequent modelling.

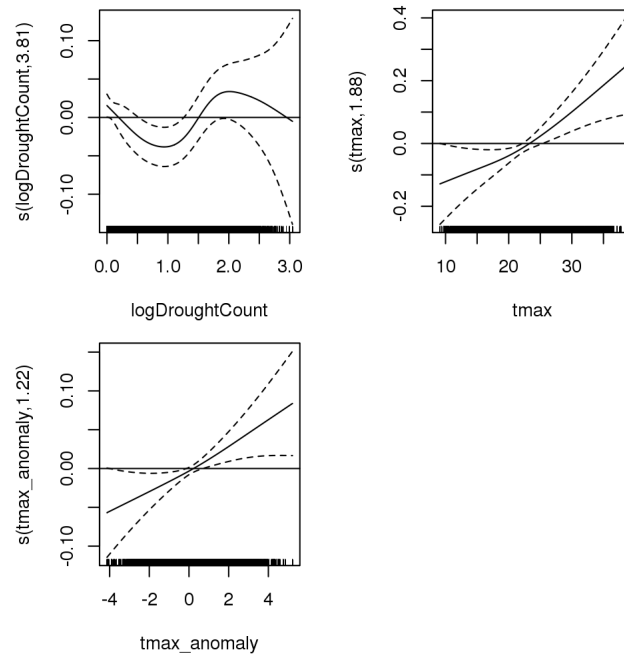


Figure 3: Drought and maximum temperature anomalies GAM results

3.2 Enhanced Drought Index

We conducted sensitivity analyses for the drought exposure variable. The drought index was enhanced with the threshold needed to end a drought made more stringent. For example in Figure 1 the drought in 1980 would not have ended in the middle of that year given the new threshold but would have continued into 1981 (the fourth panel).

The drought effects estimated were similar to those from our previous modeling.

The key effect estimates are shown for the enhanced drought index in Figure 4.

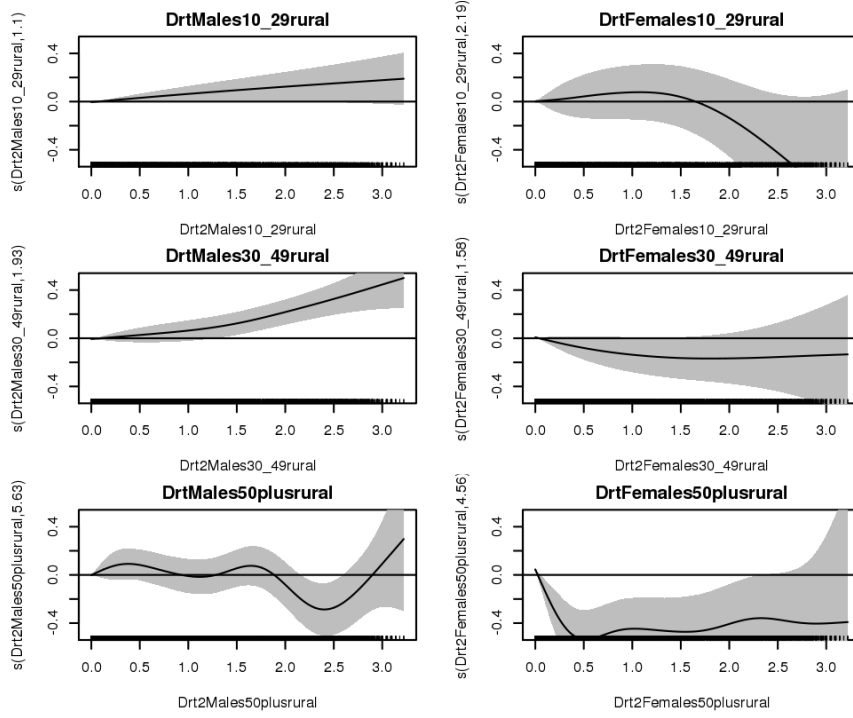


Figure 4: Interaction between drought and age, sex and rural using the enhanced Hutchinson index

3.3 Self-harm Coded as Undetermined

A sensitivity analysis was conducted that combined the suicide deaths with deaths coded as ‘Self inflicted injury, undetermined if intentional’. This analysis agreed with our previous modelling.

The key effect estimates for the drought index effect on Suicides Plus Undetermined are shown in Figure 5.

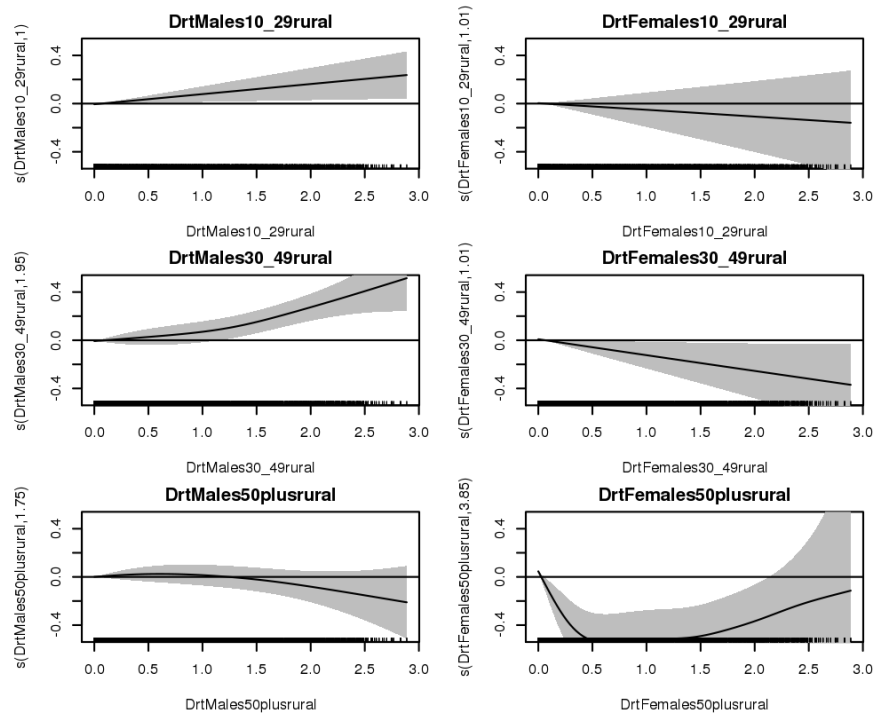


Figure 5: Interaction of drought, age, sex and rural for all suicides along with deaths with undetermined intent

3.4 Drop High Leverage Points

A sensitivity analysis was finally conducted that dropped any observations identified as having high leverage. Dropping these observations from the final model produced effect estimates that also agreed with our prior modeling results

A diagnostic plot of the leverage and residuals is shown in Figure 6. Dropping observations with high leverage produced effect estimates that also agreed with our prior modeling results (Figure 7).

3.5 Plot Check

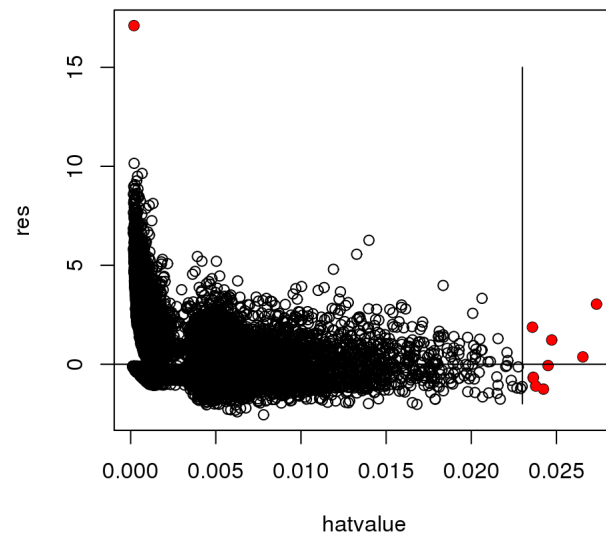


Figure 6: Interaction of drought, age, sex and rural: checks for high leverage

3.6 Plot Do

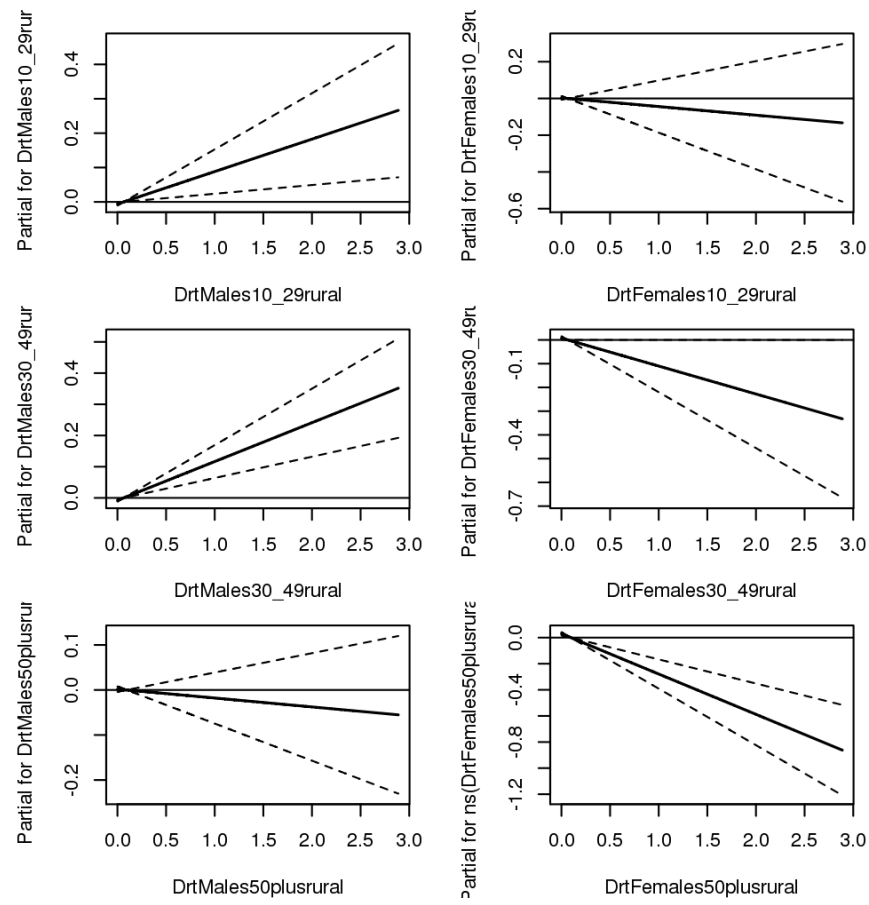


Figure 7: Interaction of drought, age, sex and rural: no leverage points

References

- [1] Smith, D. I, Hutchinson, M. F, & McArthur, R. J. (1992) *Climatic and Agricultural Drought: Payments and Policy*. (Centre for Resource and Environmental Studies, Australian National University, Canberra, Australia).
- [2] Palmer, W. (1965) *Meteorological drought. Research paper No. 45*. (U.S. Department of Commerce Weather Bureau, Washington, D.C.).
- [3] Wood, S. (2008) Fast stable direct fitting and smoothness selection for generalized additive models. *Journal of the Royal Statistical Society: Series B (Statistical Methodology)* **70**, 495–518.

4 Code for Figures 1 and 2

The R codes to fit the model and display the exposure-response relationships for the drought index on rural suicides (Figures 1 and 2 of the paper) are shown below using Sweave.

```
> #####
> #do, show model fig1 and 2
> #####
>
>
> # first fit the model
> interactionDrtAgeSexRuralModel2 <- gam(deaths ~ s(mm, k=3, fx=T, bs = 'cp')
+ + s(DrtMales10_29rural)
+ + s(DrtMales30_49rural)
+ + s(DrtMales50plusrural)
+ + s(DrtFemales10_29rural)
+ + s(DrtFemales30_49rural)
+ + s(DrtFemales50plusrural)
+ + s(DrtMales10_29urban)
+ + s(DrtMales30_49urban)
+ + s(DrtMales50plusurban)
+ + s(DrtFemales10_29urban)
+ + s(DrtFemales30_49urban)
+ + s(DrtFemales50plusurban)
+ + s(tmax_anomaly)
+ + agegp2
+ + rural
+ + sd_group
+ + sex
+ + agegp
+ + agegp*sex*ns(time,df = 3)
+ + offset(log(pop)), data=data,family=poisson)
>
```

The code to create this graph is shown next:

```
> #####
> #do, show plot fig 1 and 2
> #####
>
>
>
> # now make a plot of each group effects
>
> png('RuralMales20.png',res=200,width = 600, height = 1000)
> layout(matrix(c(1:4),ncol=1),heights=c(1,1,1,0.2))
> par(mfrow=c(4,1), mar=c(0.1,4,1.5,0.5), cex=.7)
> plot(interactionDrtAgeSexRuralModel2,select=2,se=T, ylim = c(-0.8,0.8), shade=TRUE,shad
> abline(0,0)
> title('Rural Males aged 10-29', cex=.5, font.main = 1)
> plot(interactionDrtAgeSexRuralModel2,select=3,se=T, ylim = c(-0.8,0.8), shade=TRUE,shad
> abline(0,0)
> title('Rural Males aged 30-49', cex=.5, font.main = 1)
> plot(interactionDrtAgeSexRuralModel2,select=4,rug=F,se=T, ylim = c(-0.8,0.8), shade=TRU
> abline(0,0)
> title('Rural Males aged 50 plus', cex=.5, font.main = 1)
> par(mar=c(1,4,6,0.5))
> plot(1,1,type = 'n', xaxt = 'n', yaxt='n',ylab='',xlab='', axes = F)
> title(main = 'Drought Index: log(1 + count months)', font.main = 1,cex.main=.9)
> dev.off()
> png('RuralFemales20.png',res=200,width = 600, height = 1000)
> layout(matrix(c(1:4),ncol=1),heights=c(1,1,1,0.2))
> par(mfrow=c(4,1), mar=c(0.1,4,1.5,0.5), cex=.7)
> plot(interactionDrtAgeSexRuralModel2,select=5,se=T, ylim = c(-0.8,0.8), shade=TRUE,shad
> abline(0,0)
> title('Rural Females aged 10-29', cex=.5, font.main = 1)
> plot(interactionDrtAgeSexRuralModel2,select=6,se=T, ylim = c(-0.8,0.8), shade=TRUE,shad
> abline(0,0)
> title('Rural Females aged 30-49', cex=.5, font.main = 1)
> plot(interactionDrtAgeSexRuralModel2,select=7,rug=F,se=T, ylim = c(-0.8,0.8), shade=TRU
> abline(0,0)
> title('Rural Females aged 50 plus', cex=.5, font.main = 1)
> par(mar=c(1,4,6,0.5))
> plot(1,1,type = 'n', xaxt = 'n', yaxt='n',ylab='',xlab='', axes = F)
> title(main = 'Drought Index: log(1 + count months)', font.main = 1,cex.main=.9)
> dev.off()
>
>
```