

Small ungulate crossing structure analysis

Script to run GLMM to look at the temporal variation in small ungulate use of underpasses and jumpouts We first separate out the day/season/annual counts by structure type and explore the influence of time of day (crep/day/night) for the day counts, season for the season counts and year for the annual counts. We also explore the influence of vehicles and humans. For all daily/seasonal underpass models only the day/season parameter is explored as the sample size for these models is too small to sample more parameters. The traffic variable is dropped from all models as it was extremely collinear with the day/season/year parameter.

Model structure: count (per structure) ~ crep/day/night or season + traffic volume + human use +

Location + random = sampling effort

Small daily ungulates

```
prior<-list(R=list(V=1, nu=0.002),
            G = list(G1 = list(V = 1, nu = 0.002)))

prioexp<- list(R = list(V = 1, nu=0.002), #residuals prior
              G = list(G1 = list(V = 1, nu= 0.02, alpha.mu=0, alpha.V=1000)))
```

Underpass

model summary and plots of IG prior and expanded prior respectively

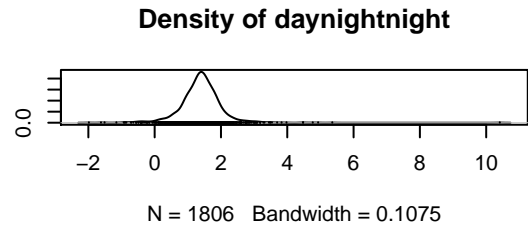
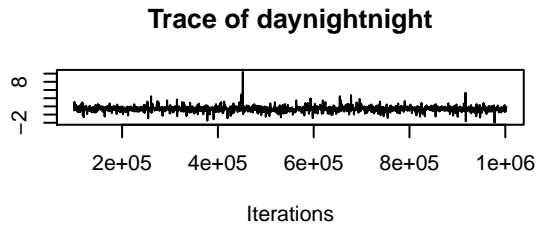
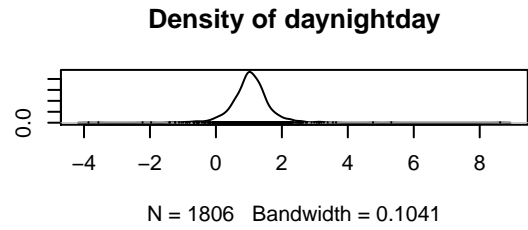
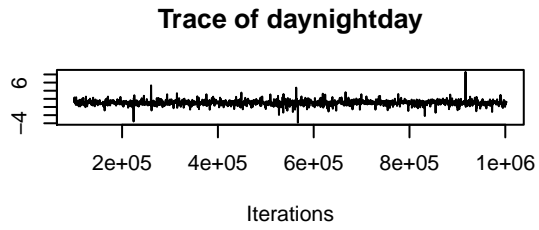
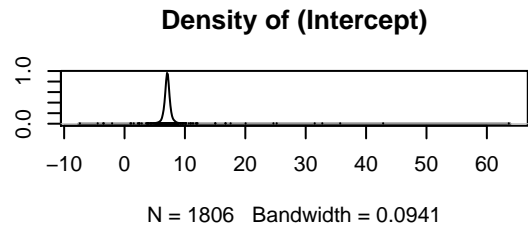
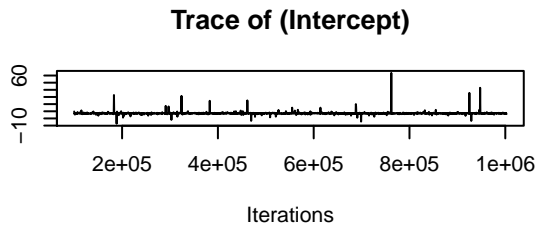
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 70.33261
##
## G-structure: ~average.effort
```

```

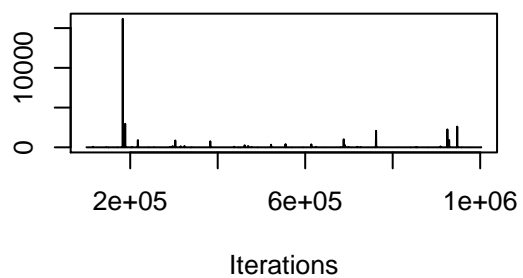
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort      19.32 0.0001927    6.238    1331
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units      0.4759 0.02657    1.592    1806
##
## Location effects: Total ~ daynight
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      7.1920  5.3842  8.6956    1806 0.00554 **
## daynightday       1.0458 -0.1023  2.3054    1806 0.07198 .
## daynightnight     1.3944  0.1280  2.6141    1958 0.03765 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 70.3445
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort    7068668 9.445e-08    851.9    1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units      0.6518 0.02041    2.037    1806
##
## Location effects: Total ~ daynight
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      4.5368 -8.8665 21.2836    1806 0.1096
## daynightday       1.0907 -0.3404  2.5145    1806 0.0853 .
## daynightnight     1.4416  0.1563  3.1357    1806 0.0454 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

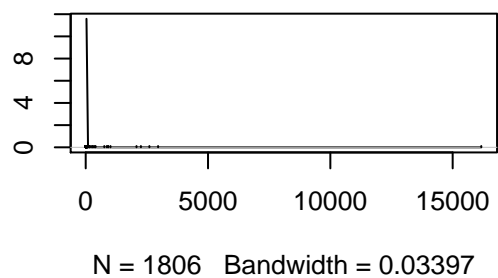
```



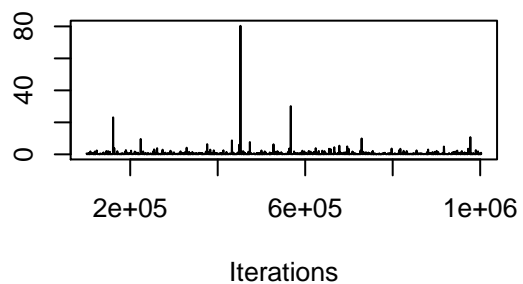
Trace of average.effort



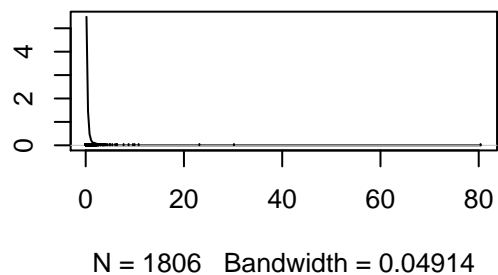
Density of average.effort



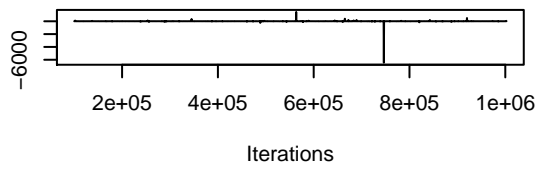
Trace of units



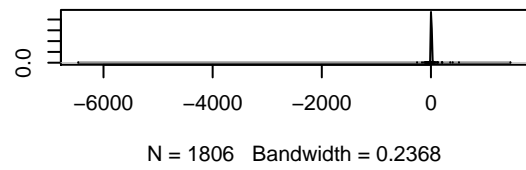
Density of units



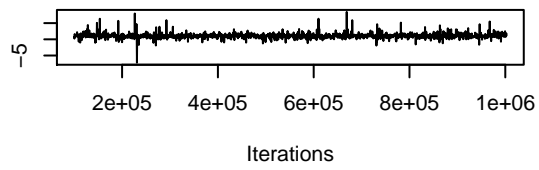
Trace of (Intercept)



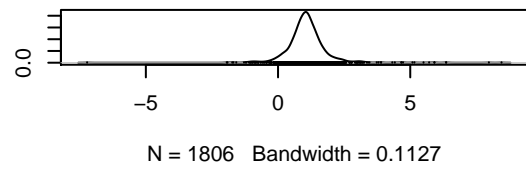
Density of (Intercept)



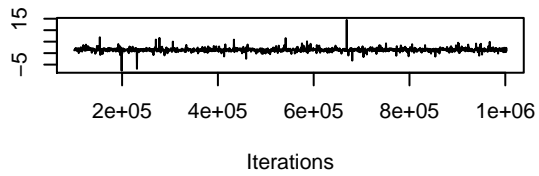
Trace of daynightday



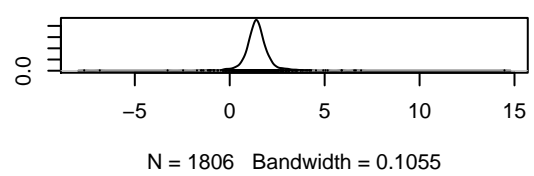
Density of daynightday

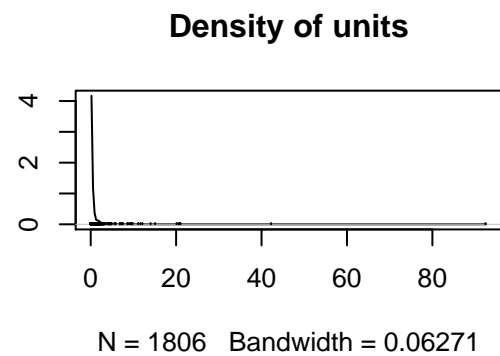
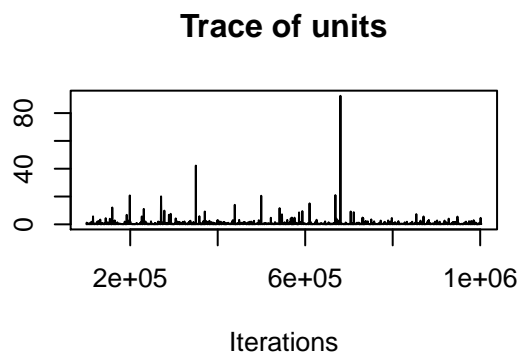
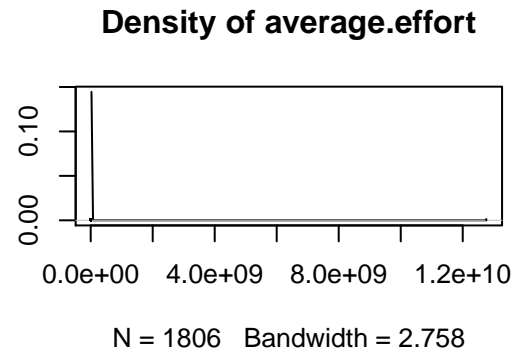
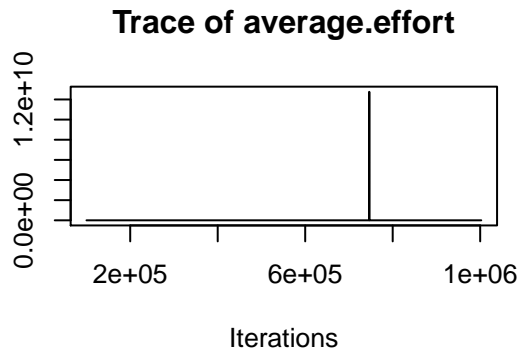


Trace of daynightnight



Density of daynightnight





Jumpout

model summary and plots of IG prior and expanded prior respectively

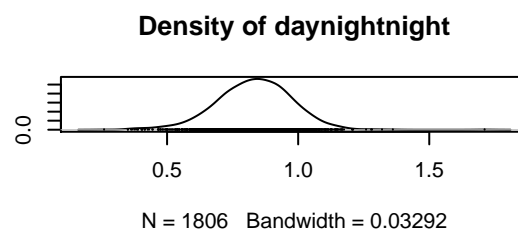
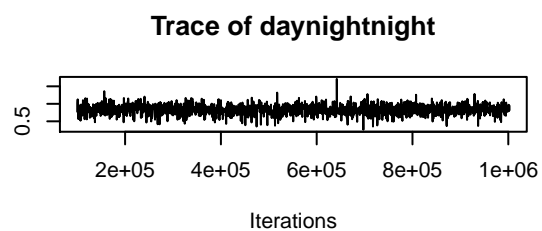
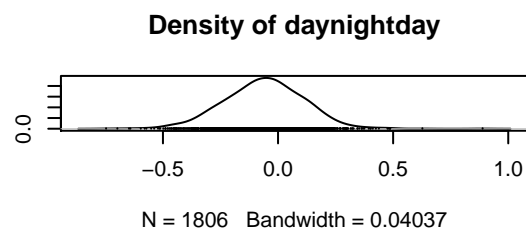
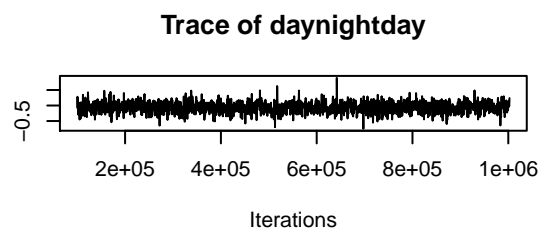
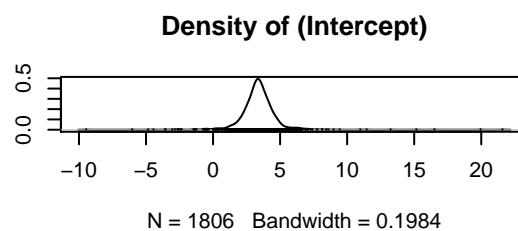
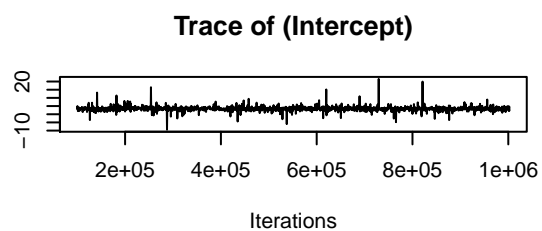
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 104.2032
##
## G-structure: ~average.effort
##
##           post.mean l-95% CI u-95% CI eff.samp
## average.effort    16.46   0.1129    20.6     1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units    0.005242 0.000172  0.01642     1806
##
## Location effects: Total ~ daynight + Location2 + daynight.human
##
##           post.mean l-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)      3.38320  1.01973  6.22400     1806 0.02990 *
## daynightday      -0.06109 -0.41356  0.25853     2051 0.71539
```

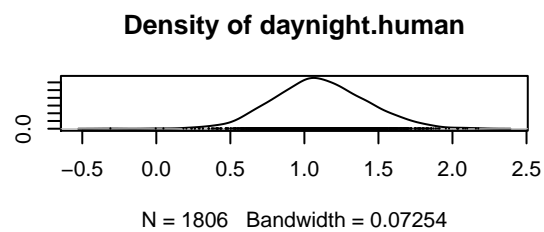
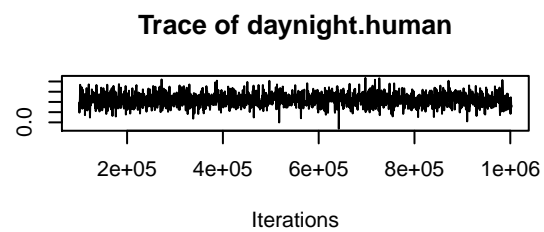
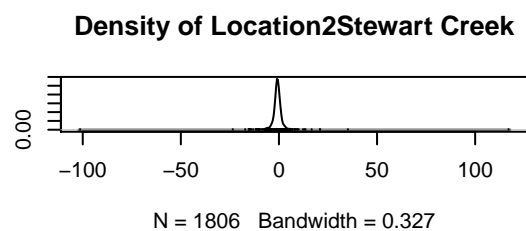
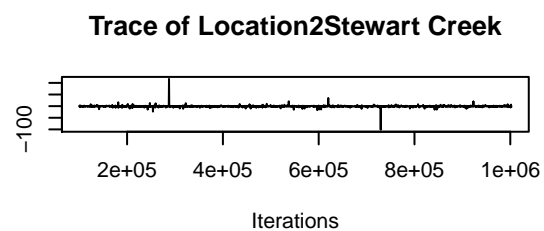
```

## daynightnight          0.83244  0.54086  1.10659      1806 < 6e-04 ***
## Location2Stewart Creek -0.77240 -5.86125  3.62186      1806 0.56035
## daynight.human         1.10608  0.50750  1.72516      1806 0.00221 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

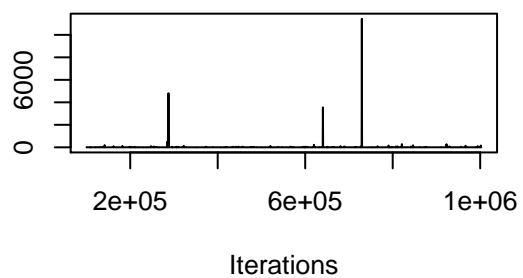
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 104.2141
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort    25.09   0.1747   53.76      1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units  0.005667 0.0001558 0.01923      1806
##
## Location effects: Total ~ daynight + Location2 + daynight.human
##
##               post.mean 1-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)      3.30809 -0.16922  7.58957      1806 0.06866 .
## daynightday      -0.06626 -0.39564  0.26234      1682 0.72979
## daynightnight     0.82395  0.54570  1.13283      1806 0.00111 **
## Location2Stewart Creek -0.76183 -8.43997  6.32648      1806 0.64673
## daynight.human     1.11725  0.49319  1.71693      1806 0.00111 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

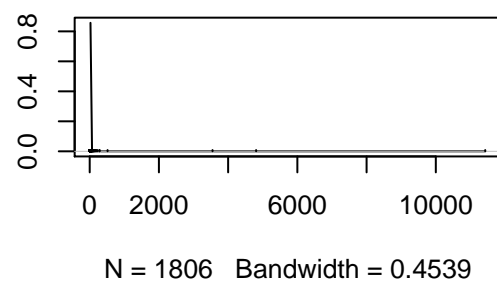




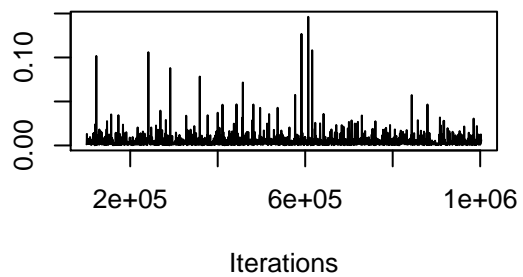
Trace of average.effort



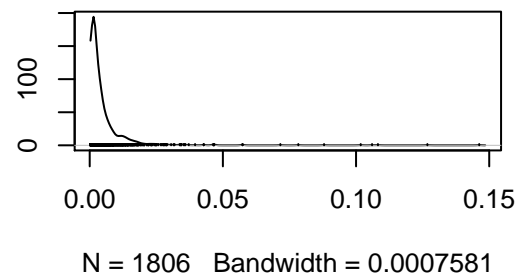
Density of average.effort

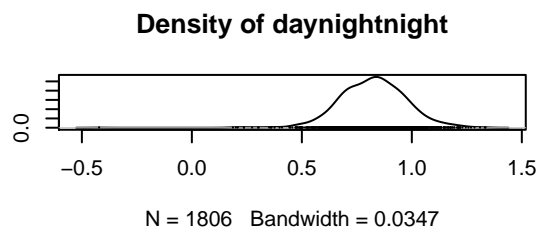
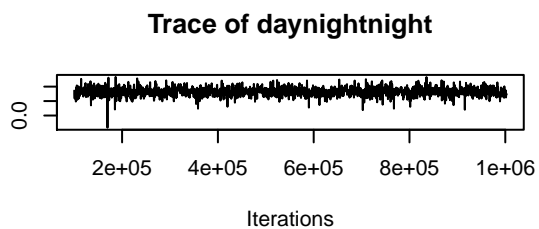
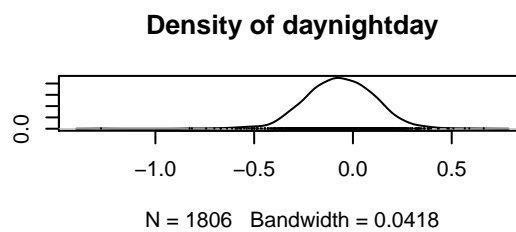
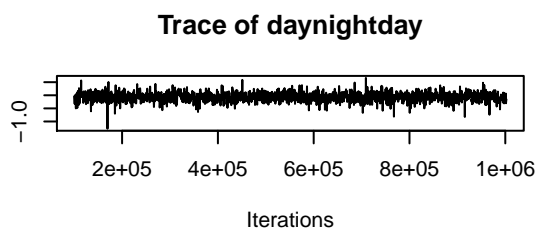
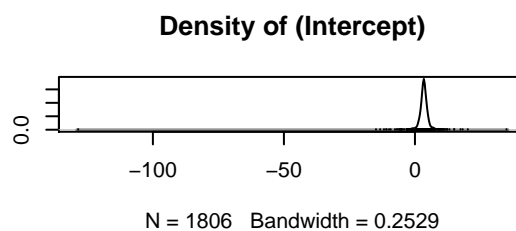
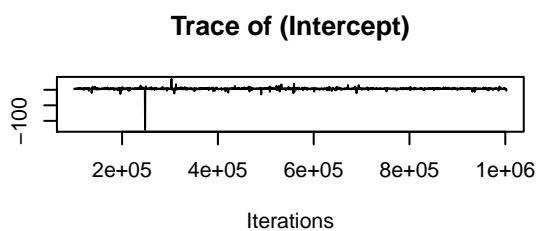


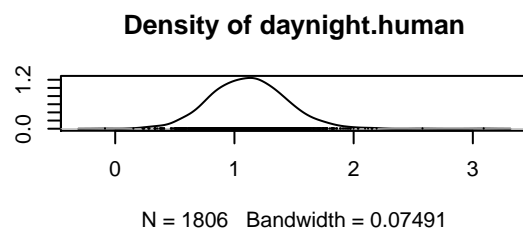
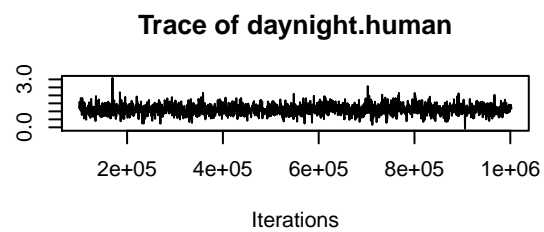
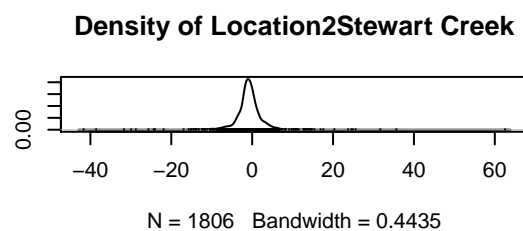
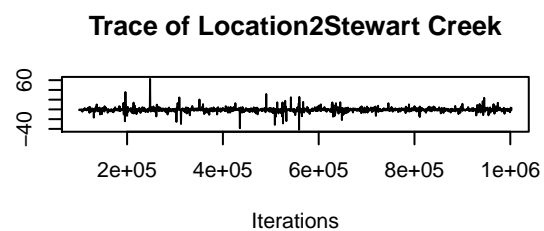
Trace of units

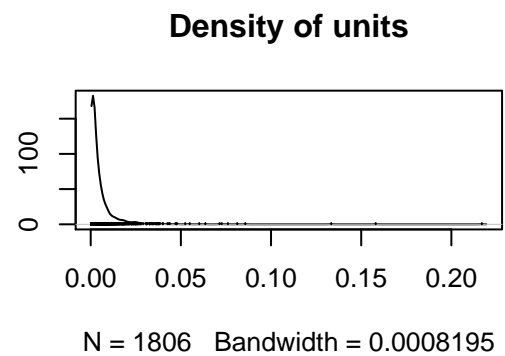
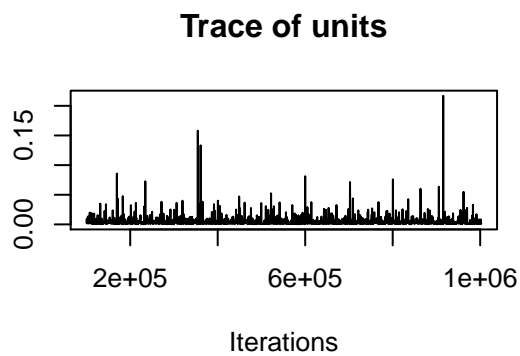
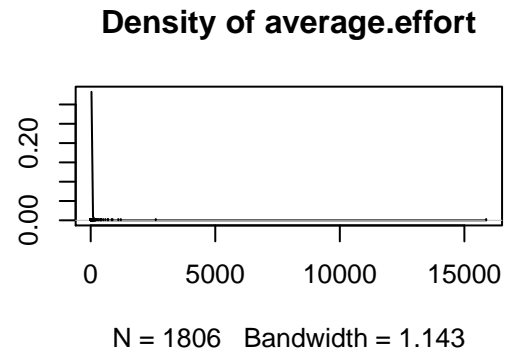
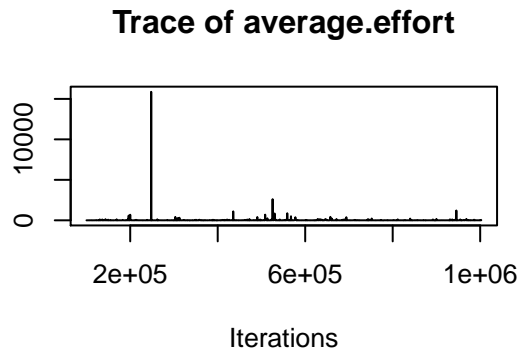


Density of units









Small seasonal ungulates ## Underpass

model summary and plots of IG prior and expanded prior respectively

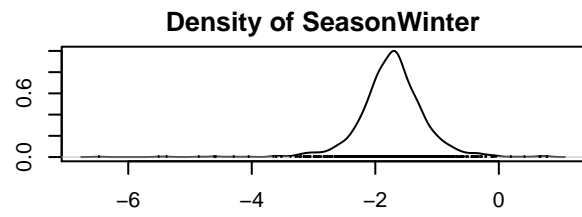
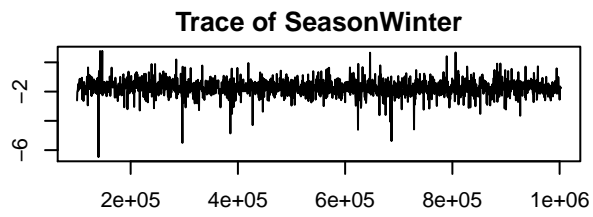
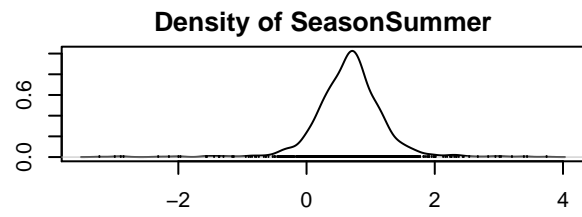
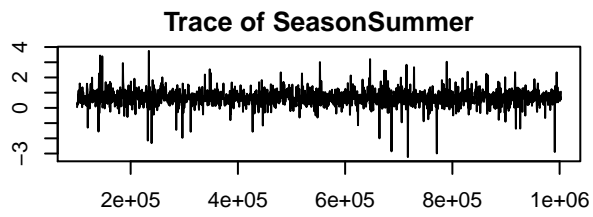
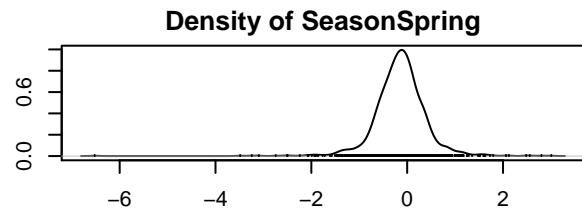
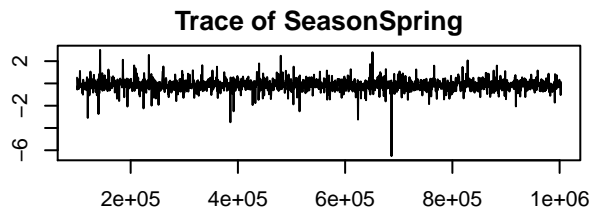
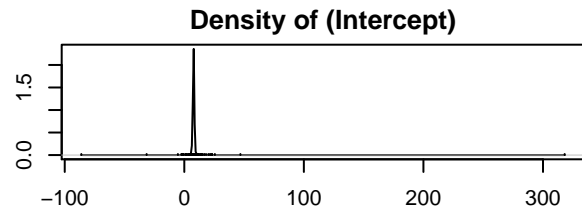
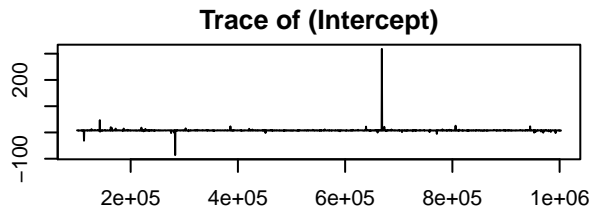
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 90.41189
##
## G-structure: ~average.effort
##
##           post.mean l-95% CI u-95% CI eff.samp
## average.effort    64.61 0.000211    4.948    1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units           0.282 0.02339    0.8097    1806
##
## Location effects: Total ~ Season
##
##           post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    7.8955    6.2795    9.0293    1806 0.01107 *
## SeasonSpring  -0.1449   -1.2643    0.8750    1806 0.72093
```

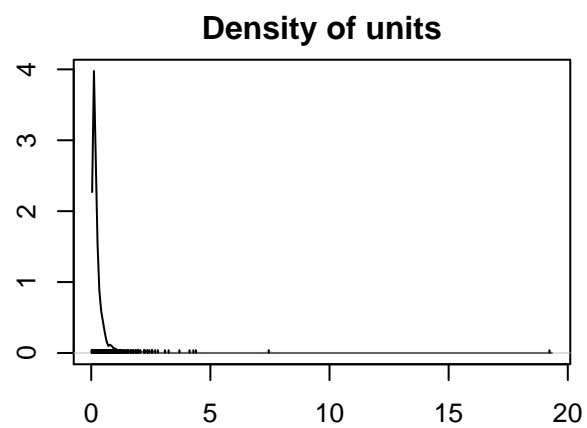
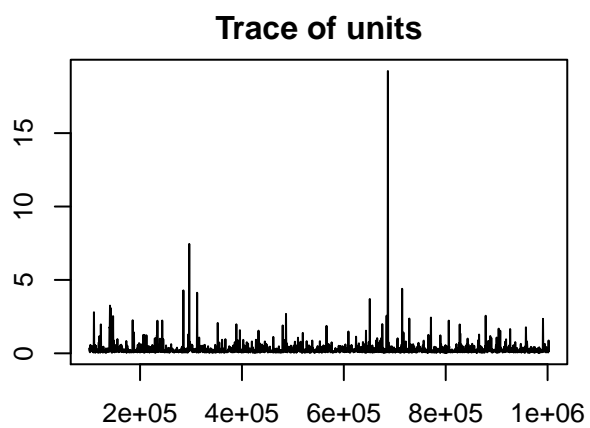
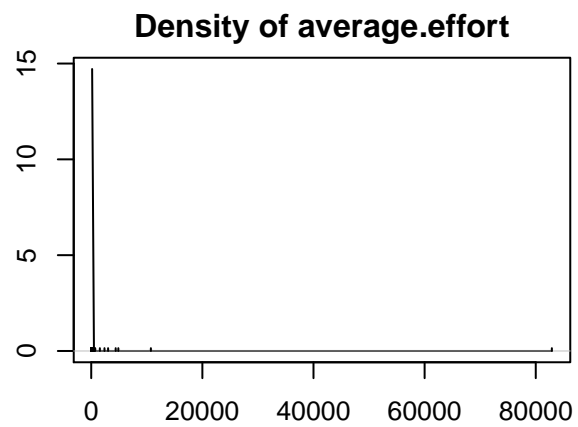
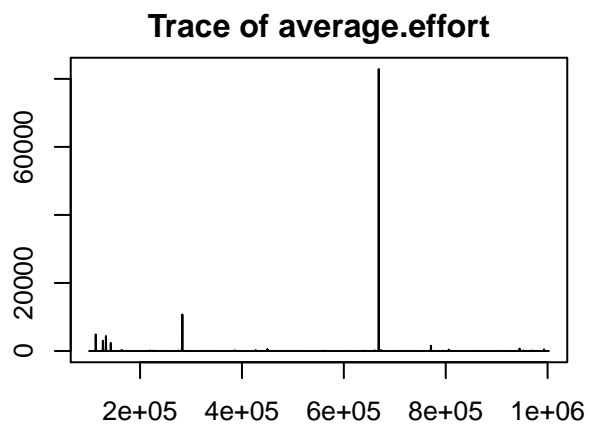
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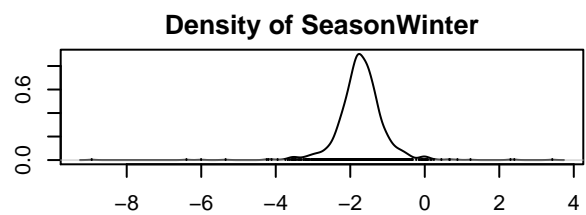
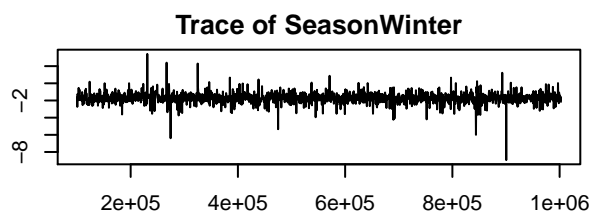
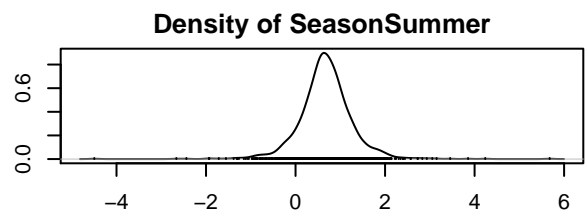
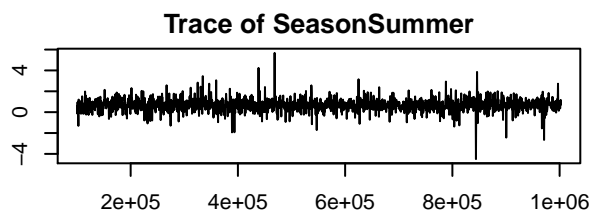
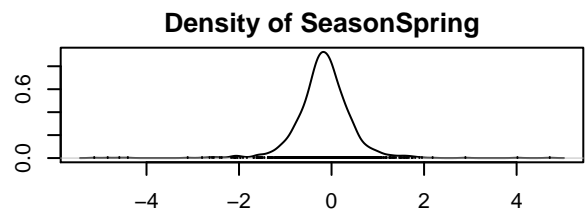
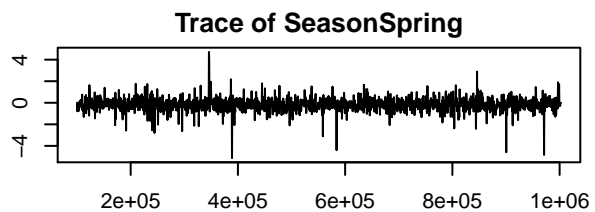
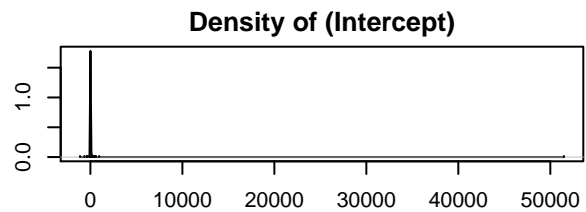
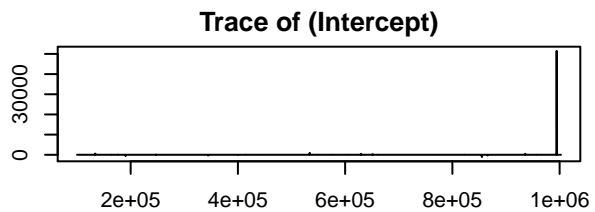
## SeasonSummer    0.6682 -0.3302  1.7091    1956 0.13068
## SeasonWinter   -1.7300 -2.8212 -0.6661    1952 0.00664 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

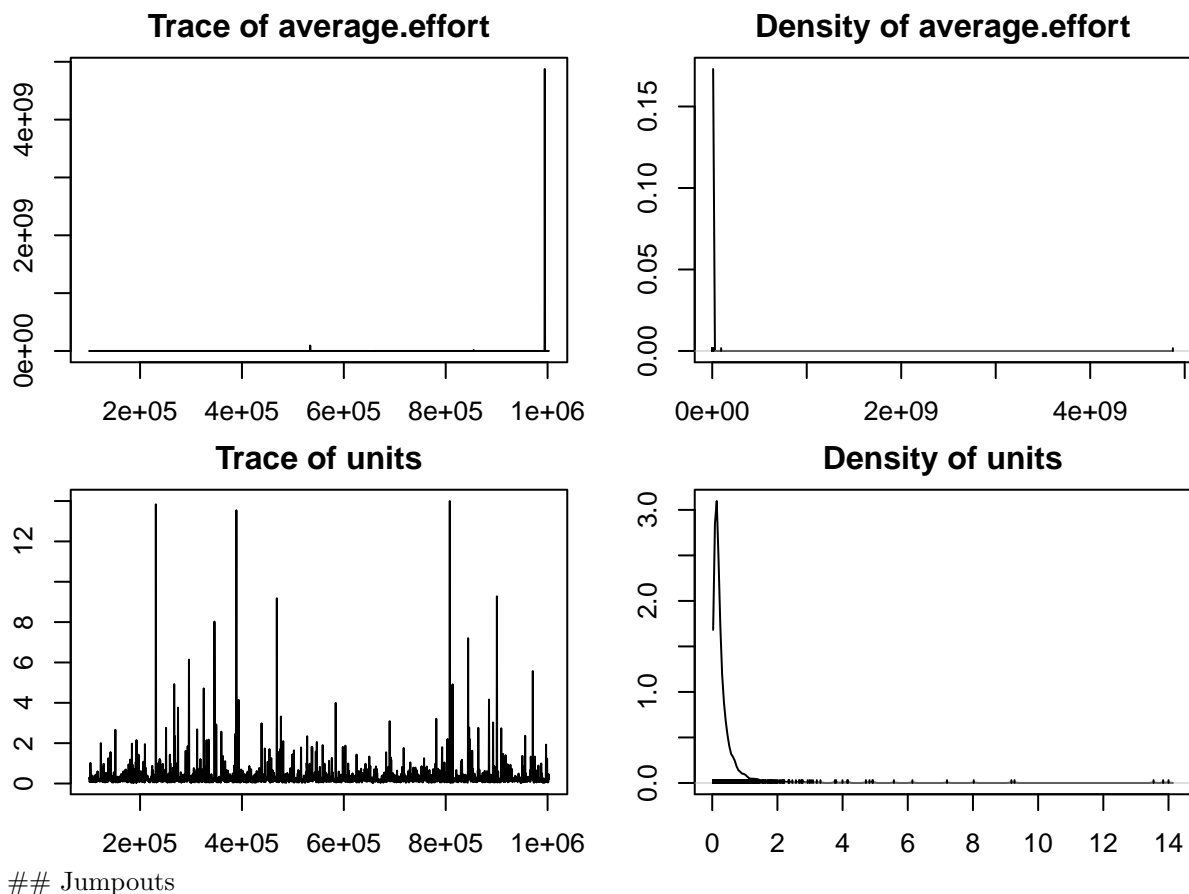
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 90.3863
##
## G-structure: ~average.effort
##
##               post.mean l-95% CI u-95% CI eff.samp
## average.effort  2764854 2.29e-07      470      1806
##
## R-structure: ~units
##
##               post.mean l-95% CI u-95% CI eff.samp
## units          0.384  0.02752    1.176    1806
##
## Location effects: Total ~ Season
##
##               post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    36.6286 -4.1360  21.1394    1806 0.0764 .
## SeasonSpring   -0.1667 -1.2174   1.0877    1806 0.7043
## SeasonSummer    0.6725 -0.4557   1.9118    1806 0.1894
## SeasonWinter   -1.7184 -3.0104  -0.5320    1806 0.0210 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```









model summary and plots of IG prior and expanded prior respectively

```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 134.6166
##
## G-structure: ~average.effort
##
##          post.mean  l-95% CI u-95% CI eff.samp
## average.effort    12.52 0.0004956   23.74    1806
##
## R-structure: ~units
##
##          post.mean l-95% CI u-95% CI eff.samp
## units          1.789   0.309   4.663    1806
##
## Location effects: Total ~ Season + Location2 + seasonal.human
##
##          post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    10.5503  -5.6769  29.2346    1806 0.181
## SeasonSpring     0.9067  -1.0978   2.8336    1806 0.305
```

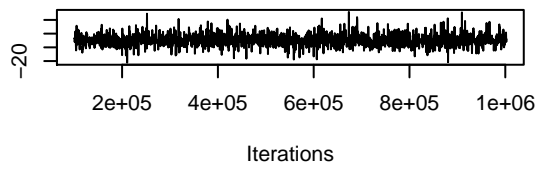
```

## SeasonSummer          1.1983 -0.7664  3.0702    1806 0.202
## SeasonWinter          -0.9669 -3.3381  1.3250    1806 0.353
## Location2Stewart Creek  1.0167 -5.2395  8.0705    1684 0.628
## seasonal.human        -3.7394 -14.9057  6.8052    1806 0.410

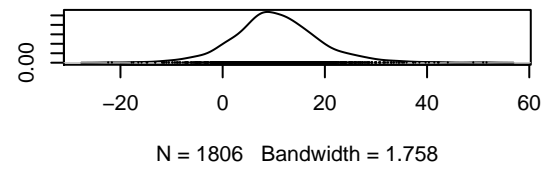
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 134.5056
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort    38.43 0.0001032    88.08    1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units           1.613  0.2339    4.135    1806
##
## Location effects: Total ~ Season + Location2 + seasonal.human
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      10.6076 -5.9547  28.2861    1806 0.187
## SeasonSpring       0.8761 -0.8516   2.7832    1806 0.290
## SeasonSummer       1.2210 -0.5675   3.0282    1806 0.151
## SeasonWinter      -0.9475 -3.0659   1.1497    1806 0.350
## Location2Stewart Creek  1.3222 -10.3203 10.5488    1806 0.703
## seasonal.human    -3.7964 -13.8623   5.8886    1806 0.423

```

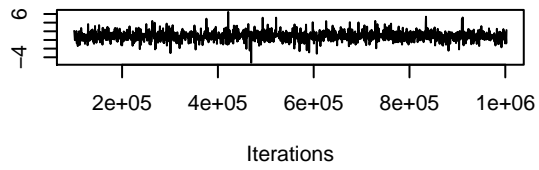
Trace of (Intercept)



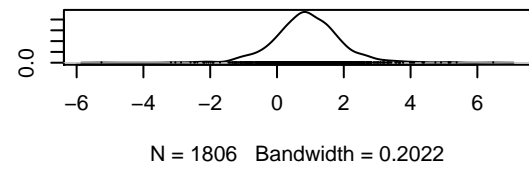
Density of (Intercept)



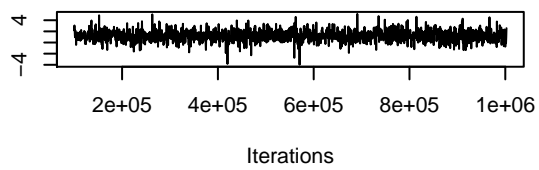
Trace of SeasonSpring



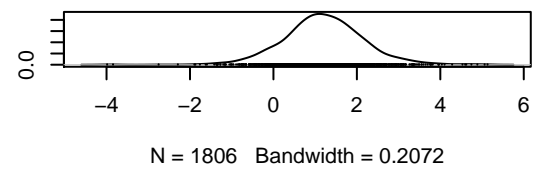
Density of SeasonSpring



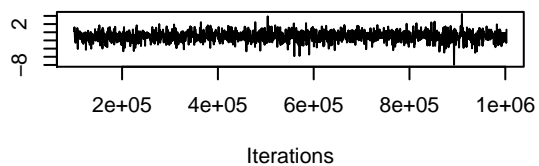
Trace of SeasonSummer



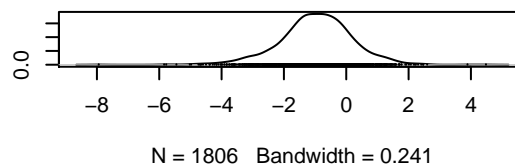
Density of SeasonSummer



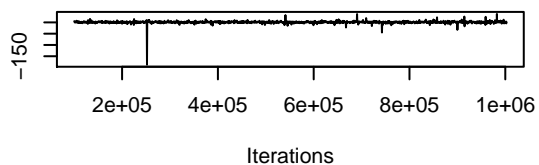
Trace of SeasonWinter



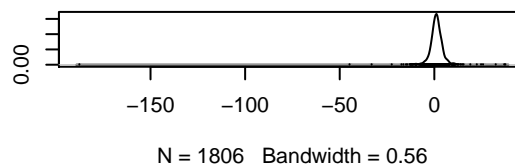
Density of SeasonWinter



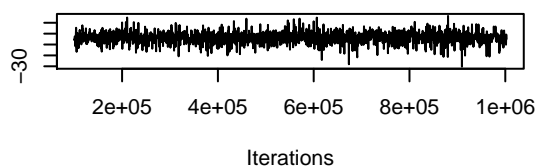
Trace of Location2Stewart Creek



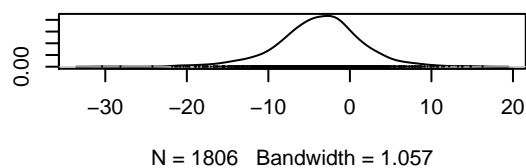
Density of Location2Stewart Creek



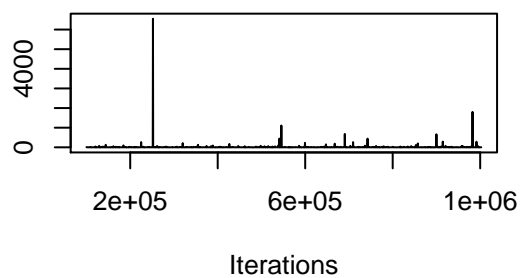
Trace of seasonal.human



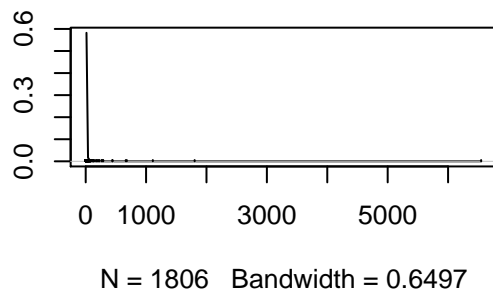
Density of seasonal.human



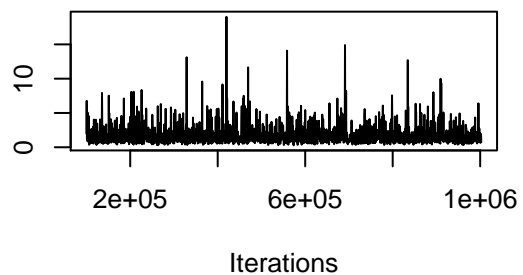
Trace of average.effort



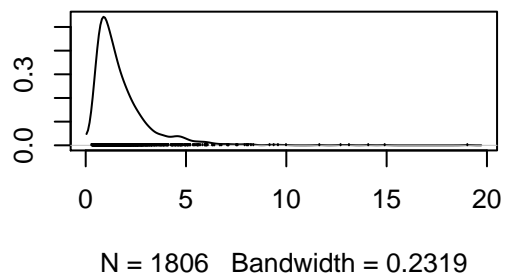
Density of average.effort



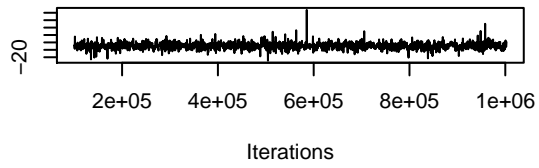
Trace of units



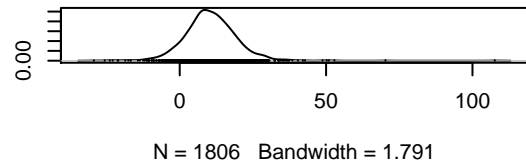
Density of units



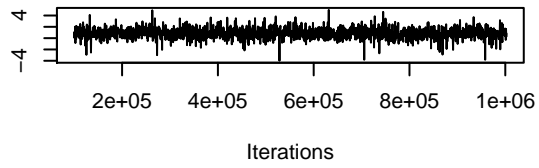
Trace of (Intercept)



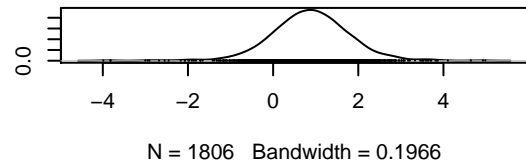
Density of (Intercept)



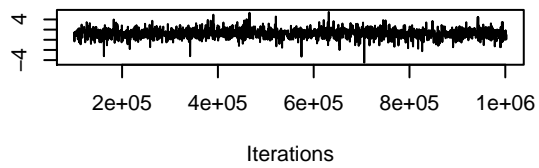
Trace of SeasonSpring



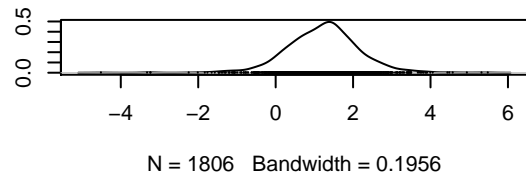
Density of SeasonSpring



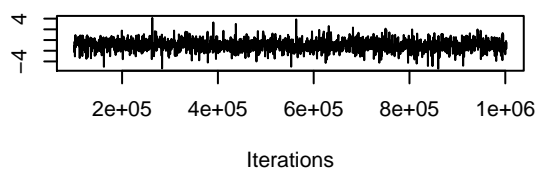
Trace of SeasonSummer



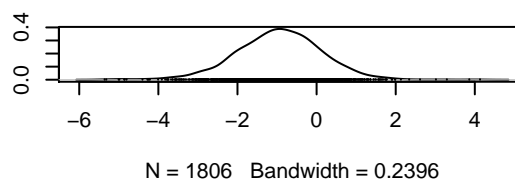
Density of SeasonSummer



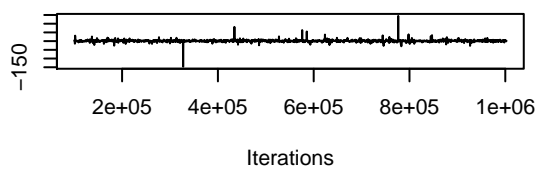
Trace of SeasonWinter



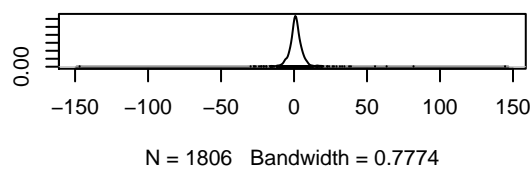
Density of SeasonWinter



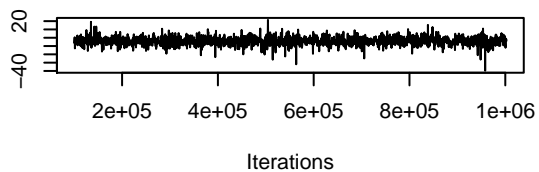
Trace of Location2Stewart Creek



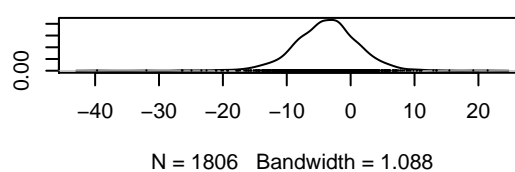
Density of Location2Stewart Creek

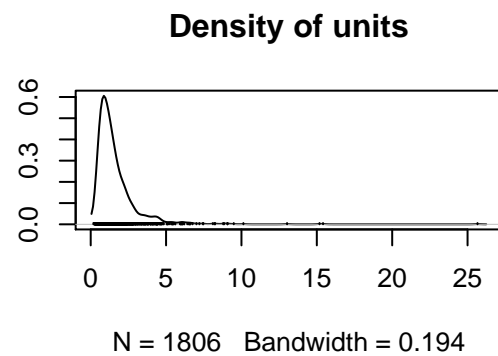
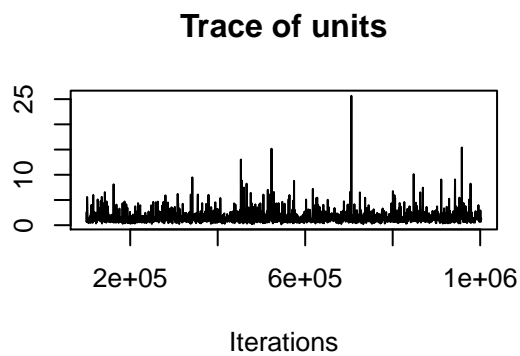
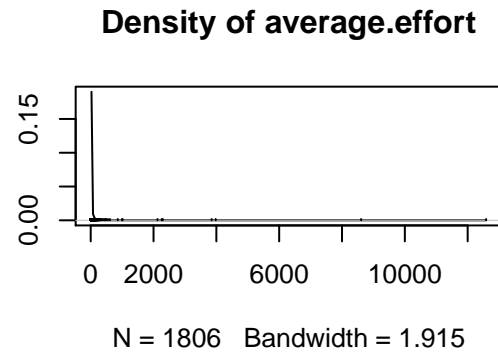
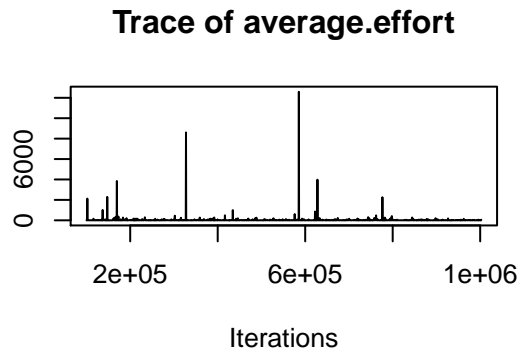


Trace of seasonal.human



Density of seasonal.human





Small annual ungulates ## Underpass

model summary and plots of IG prior and expanded prior respectively

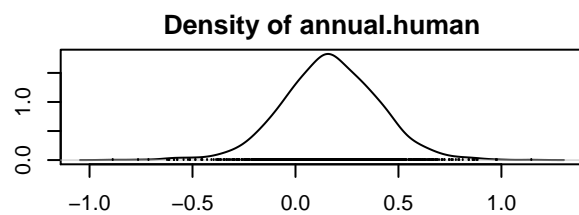
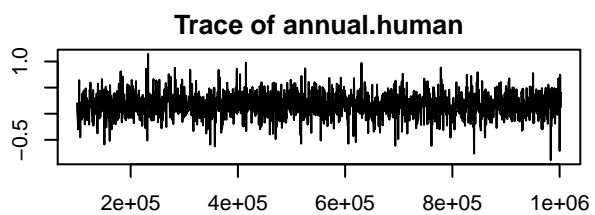
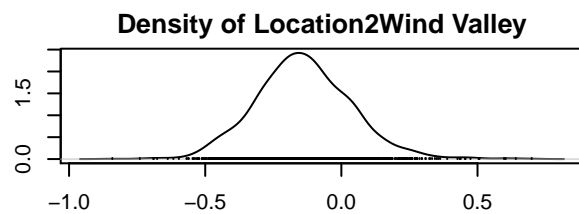
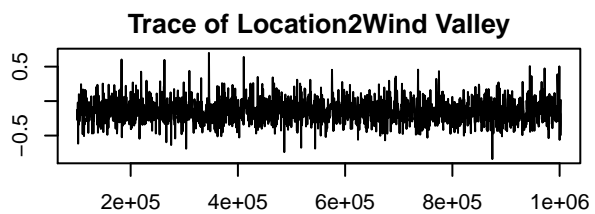
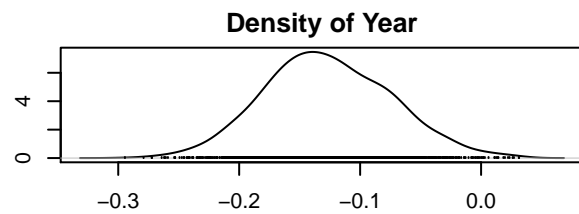
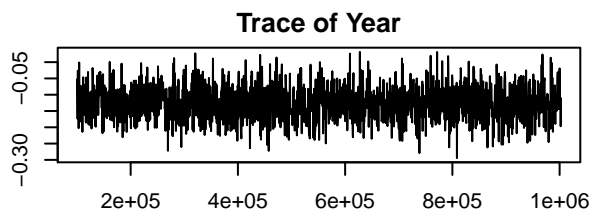
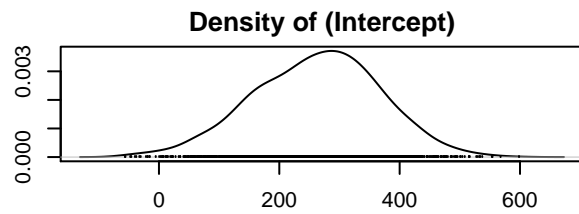
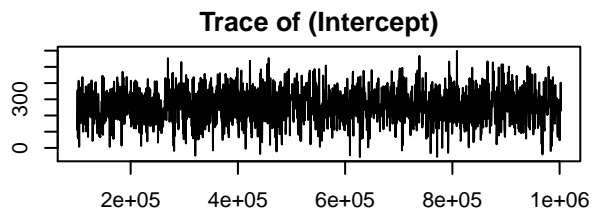
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 241.1853
##
## G-structure: ~annual.effort
##
##          post.mean  l-95% CI u-95% CI eff.samp
## annual.effort    0.244 0.0004898  0.6204    1806
##
## R-structure: ~units
##
##          post.mean l-95% CI u-95% CI eff.samp
## units      0.1377  0.04082  0.3037    1806
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##          post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    261.6754  54.8903 461.2348    1423 0.0155 *
## Year          -0.1268  -0.2268  -0.0250    1423 0.0210 *
```

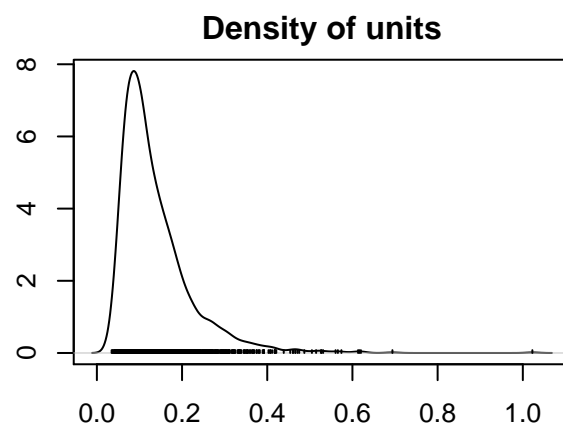
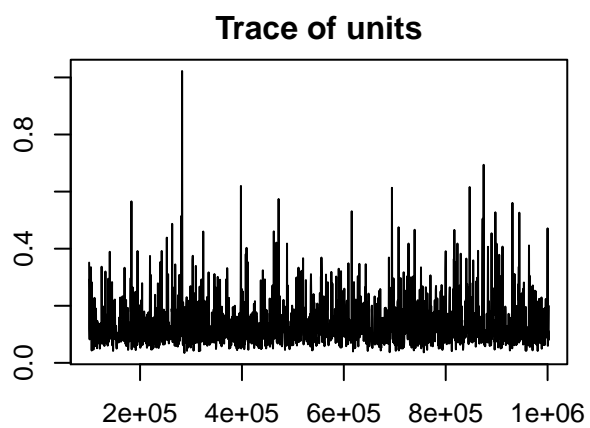
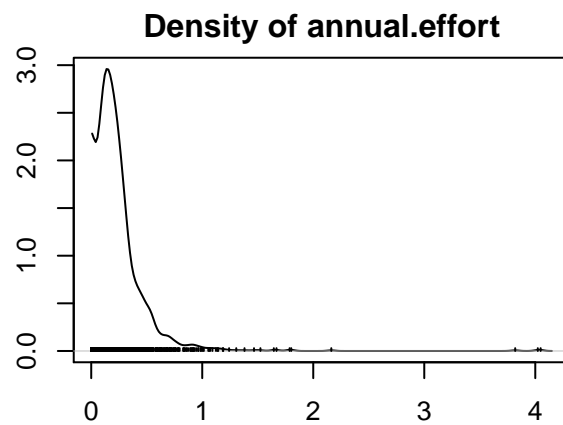
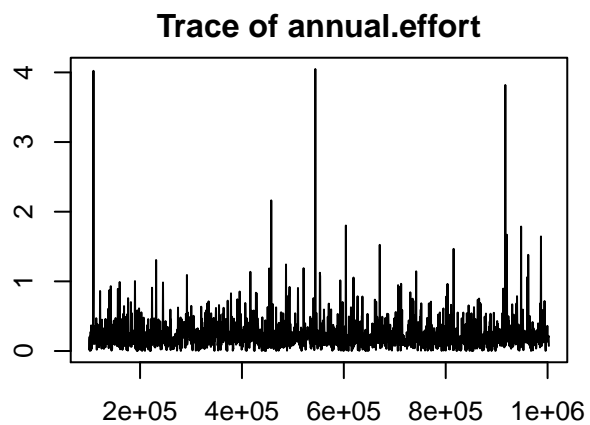
```

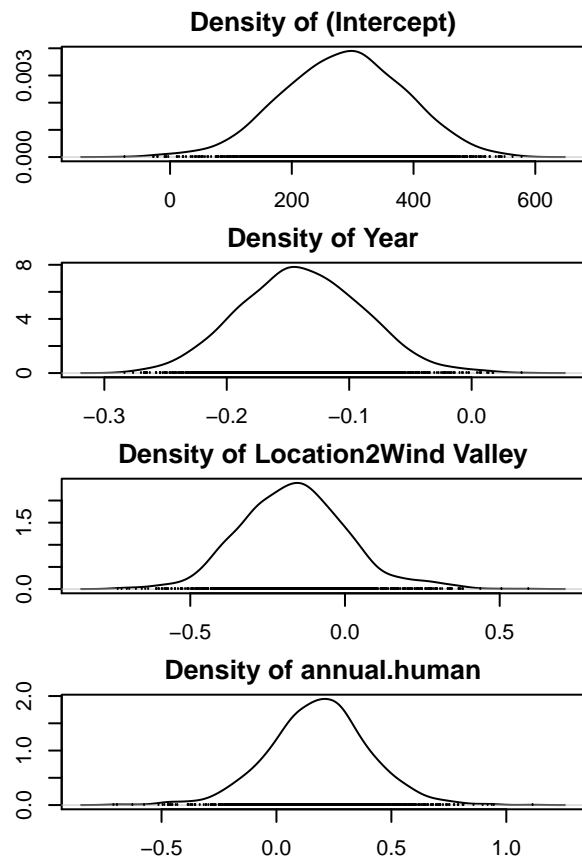
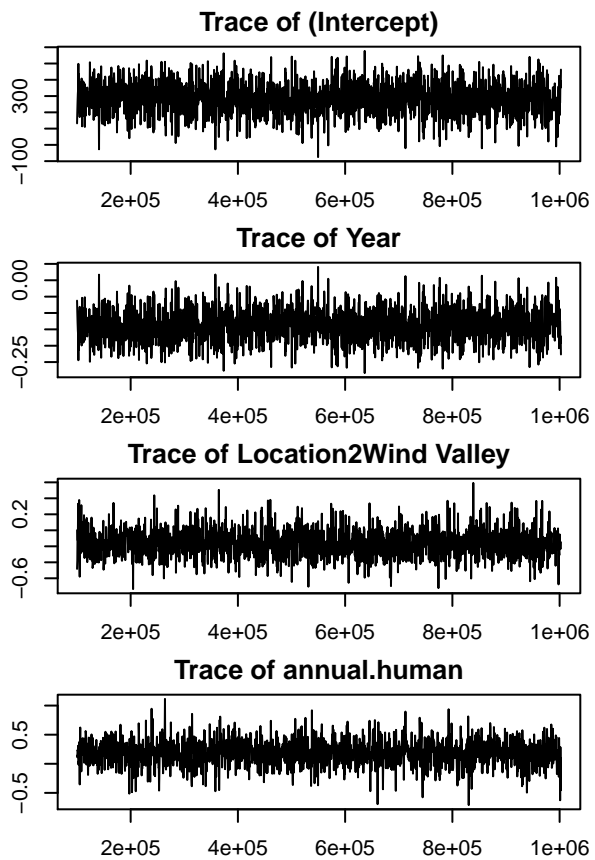
## Location2Wind Valley  -0.1387  -0.4970   0.1878      1958 0.4086
## annual.human          0.1692  -0.3029   0.6082      1806 0.4374
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

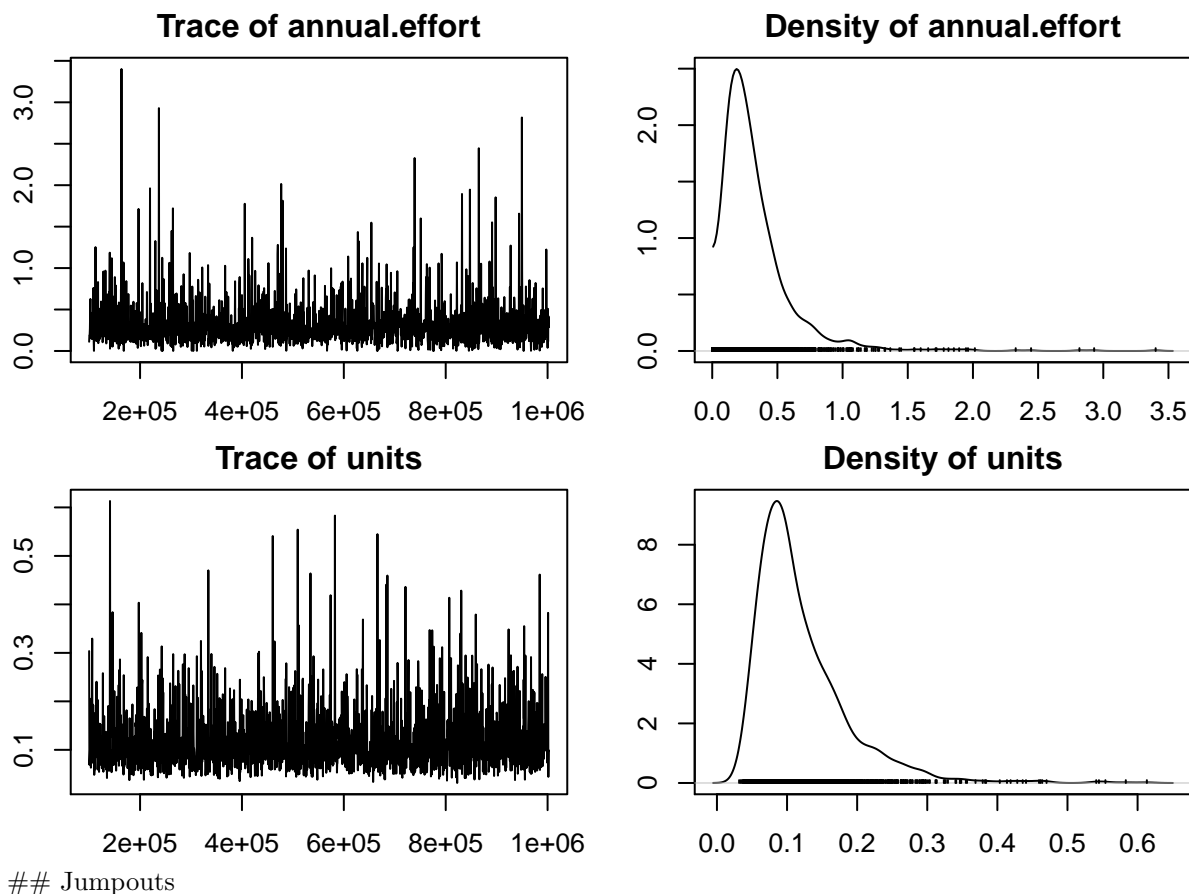
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 241.1592
##
## G-structure: ~annual.effort
##
##           post.mean l-95% CI u-95% CI eff.samp
## annual.effort  0.3278  5.2e-06   0.8183      1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units         0.1207  0.03656   0.2505      1951
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##           post.mean l-95% CI u-95% CI eff.samp  pMCMC
## (Intercept)    285.3148  93.5692 481.1845      1662 0.00997 **
## Year           -0.1386  -0.2356  -0.0427      1662 0.00997 **
## Location2Wind Valley -0.1642 -0.4974   0.1950      1951 0.31229
## annual.human     0.1846  -0.2495   0.6029      1568 0.35770
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```









model summary and plots of IG prior and expanded prior respectively

```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 323.094
##
## G-structure: ~annual.effort
##
##           post.mean  l-95% CI u-95% CI eff.samp
## annual.effort    0.2833 0.0003258    0.945    1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units      0.8877    0.4135    1.379    1806
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##           post.mean  l-95% CI  u-95% CI eff.samp pMCMC
## (Intercept)   -20.92776 -344.50301  291.66974    1806 0.919
## Year           0.01229   -0.14438    0.17248    1806 0.900
```

```

## Location2Stewart Creek  -0.46397  -1.30380  0.22273  1632 0.236
## annual.human           0.15096  -1.09044  1.35265  1806 0.800

##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 322.9756
##
## G-structure: ~annual.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## annual.effort   0.4873 6.156e-05   1.375   1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units          0.8281   0.436   1.354   2824
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    -24.36709 -391.37525 317.93368   1806 0.926
## Year            0.01405  -0.15484   0.19835   1806 0.911
## Location2Stewart Creek -0.35907 -1.14034   0.40050   1806 0.351
## annual.human     0.08692  -1.14303   1.24810   1806 0.884

```

