

Big ungulate crossing structure analysis

Script to run GLMM to look at the temporal variation in big 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

big 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

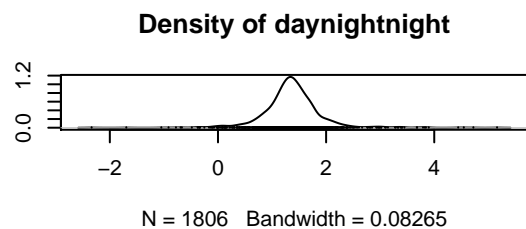
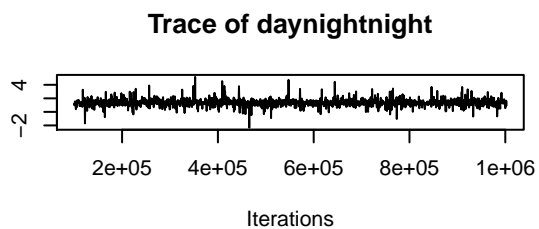
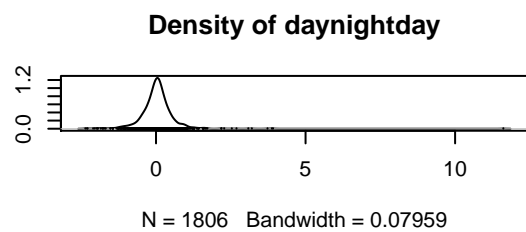
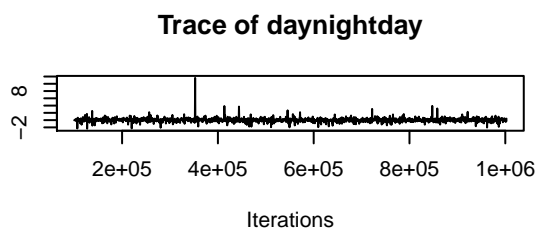
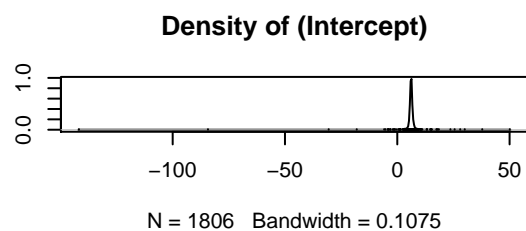
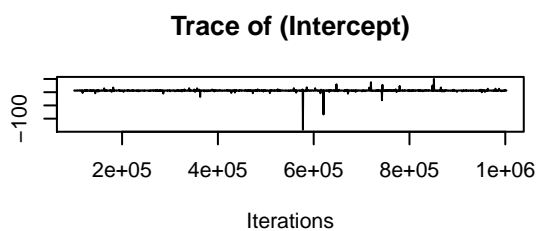
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 62.87299
##
## G-structure: ~average.effort
```

```

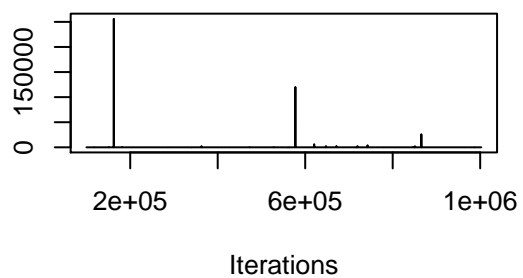
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort      241.3 0.0002826      16.3      1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units      0.3674 0.007622      1.089      1806
##
## Location effects: Total ~ daynight
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      6.07745 3.60142 8.55014      1806 0.0188 *
## daynightday      0.03724 -1.08409 0.98992      1806 0.9048
## daynightnight    1.36495 0.26420 2.38788      1806 0.0277 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 62.87996
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort      644.2 5.449e-09      446.1      1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units      0.3985 0.006232      1.037      1806
##
## Location effects: Total ~ daynight
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      6.38419 -5.56423 16.33316      1500 0.0930 .
## daynightday      0.02807 -1.01692 1.04761      1806 0.9181
## daynightnight    1.35536 0.25876 2.29578      1806 0.0221 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

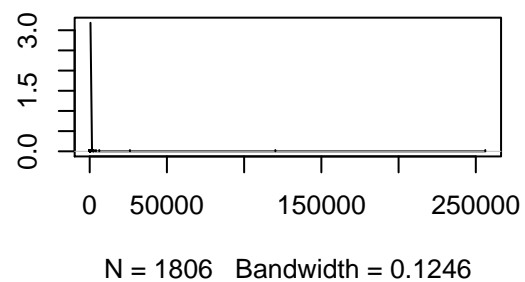
```



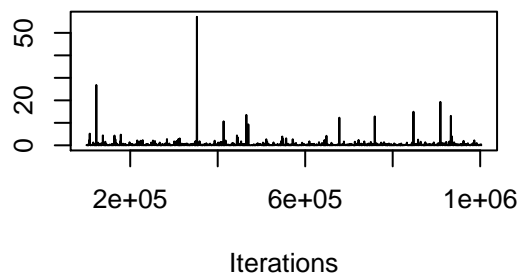
Trace of average.effort



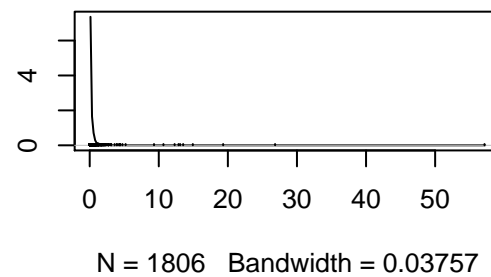
Density of average.effort

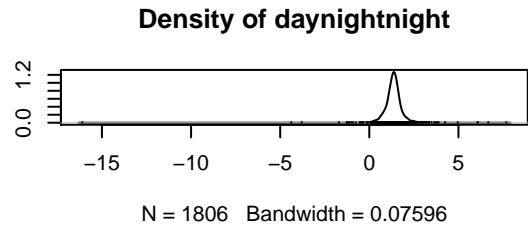
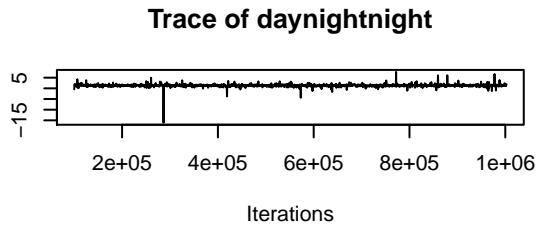
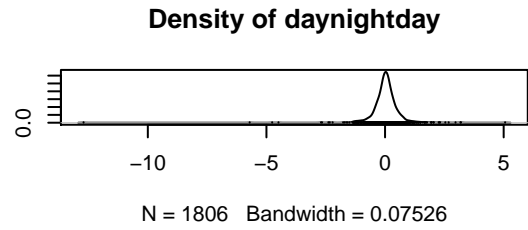
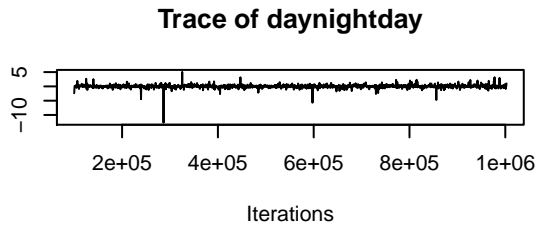
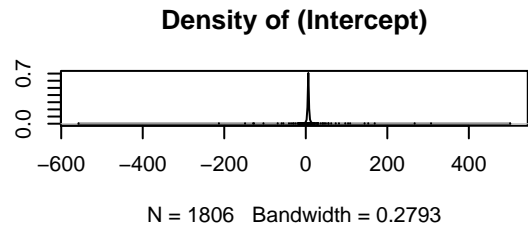
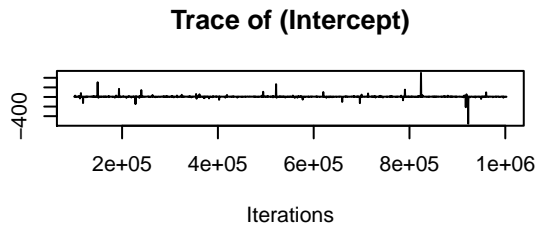


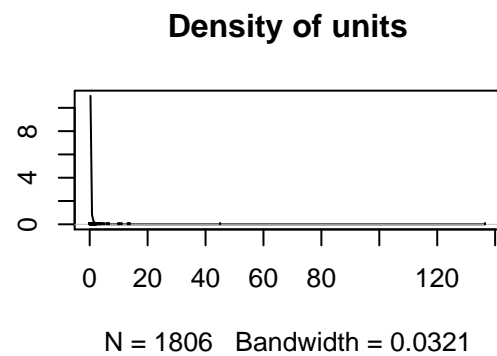
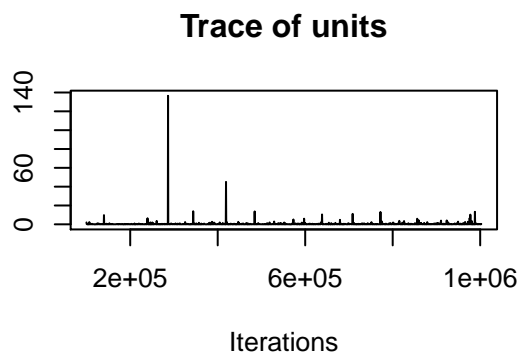
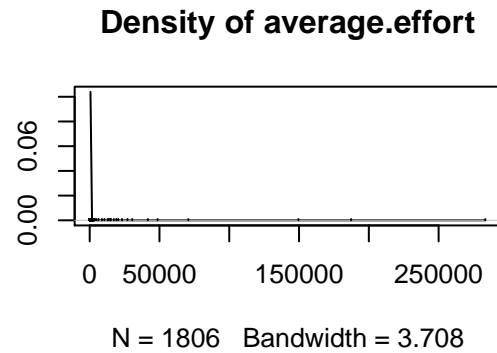
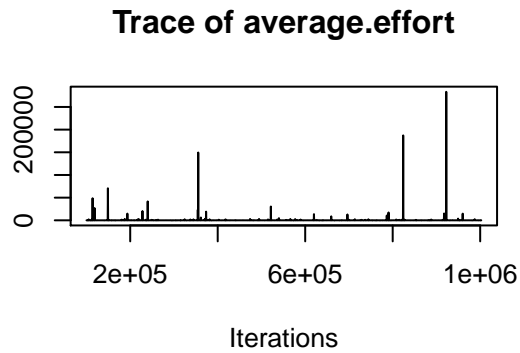
Trace of units



Density of units







Jumpout

model summary and plots of IG prior and expanded prior respectively

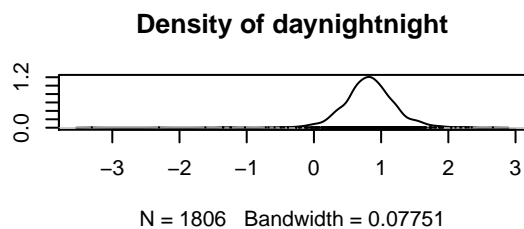
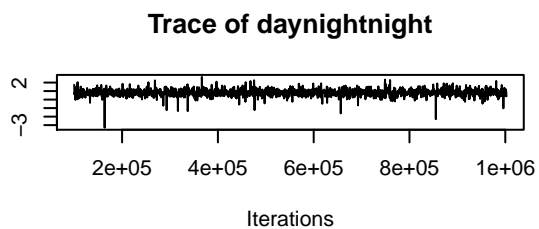
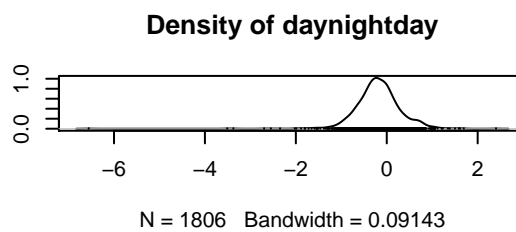
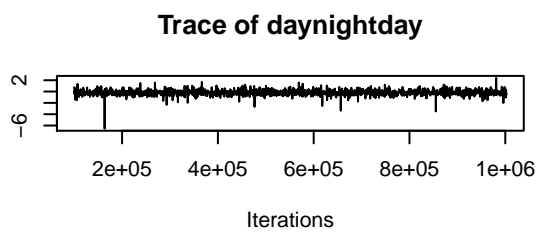
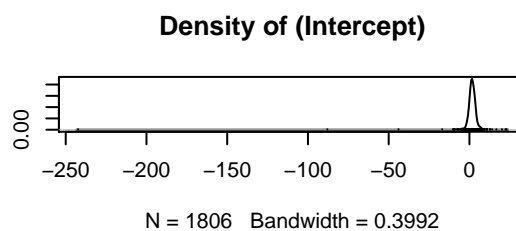
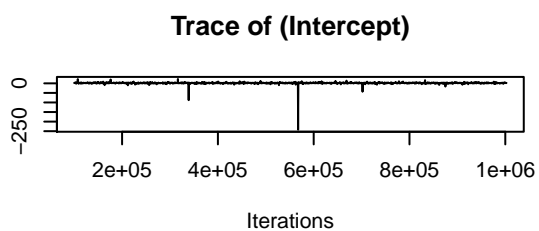
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 95.68332
##
## G-structure: ~average.effort
##
##           post.mean l-95% CI u-95% CI eff.samp
## average.effort    60.83 0.001023    44.06    1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units    0.07975 0.0002727    0.25    1806
##
## Location effects: Total ~ daynight + Location2 + daynight.human
##
##           post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    1.57034 -2.03906  6.68089    1806 0.3034
## daynightday    -0.18825 -0.99338  0.83622    1806 0.6146
```

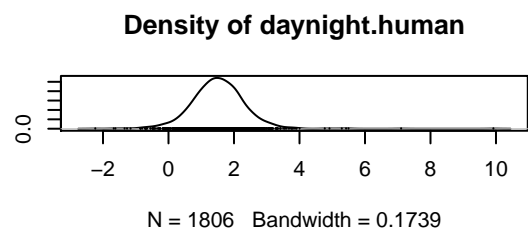
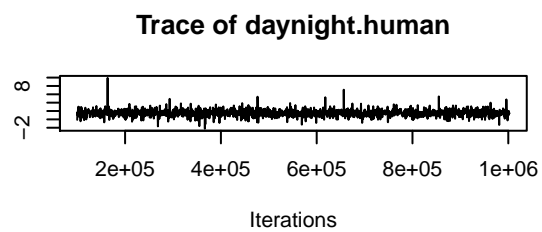
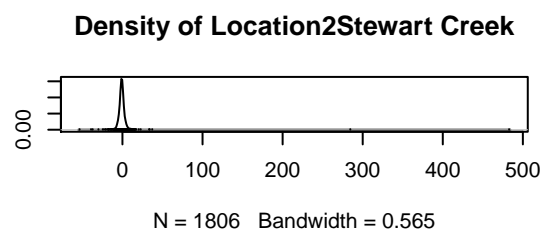
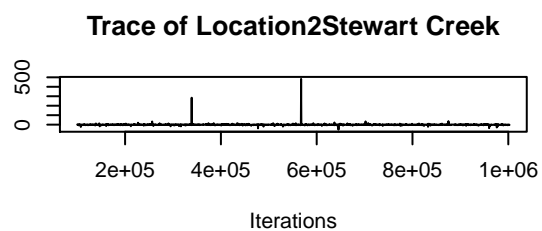
```

## daynightnight      0.81711  0.01713  1.59923      2120 0.0454 *
## Location2Stewart Creek -0.44375 -7.60777  7.44660      1806 0.7110
## daynight.human      1.51735 -0.02148  3.15618      1806 0.0664 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

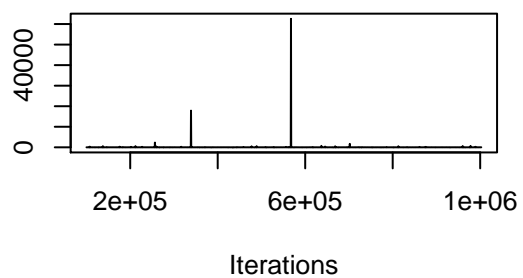
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 95.72217
##
## G-structure: ~average.effort
##
##               post.mean l-95% CI u-95% CI eff.samp
## average.effort    41.43   0.3398    110.9      1806
##
## R-structure: ~units
##
##               post.mean l-95% CI u-95% CI eff.samp
## units    0.07018 0.0002729   0.2382      1806
##
## Location effects: Total ~ daynight + Location2 + daynight.human
##
##               post.mean   l-95% CI   u-95% CI eff.samp pMCMC
## (Intercept)      1.957466 -3.822042   9.432105    1991 0.4075
## daynightday      -0.186417 -1.084717   0.737555    1806 0.6379
## daynightnight      0.822822  0.021554   1.618121    1806 0.0454 *
## Location2Stewart Creek -0.963769 -13.157832  10.915404    1806 0.8007
## daynight.human      1.521586 -0.002666   3.162383    1806 0.0520 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

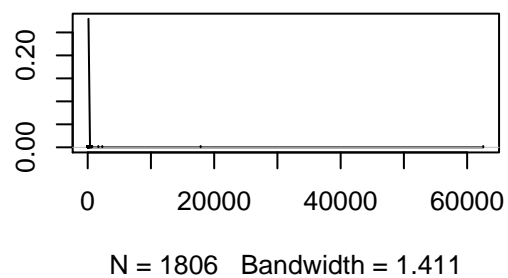




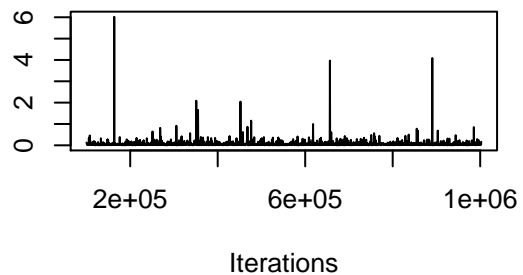
Trace of average.effort



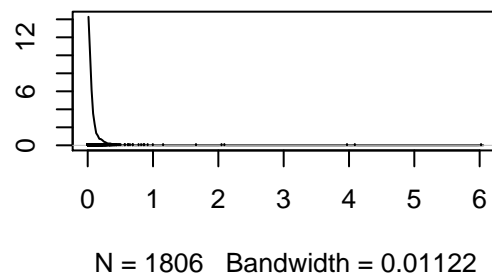
Density of average.effort



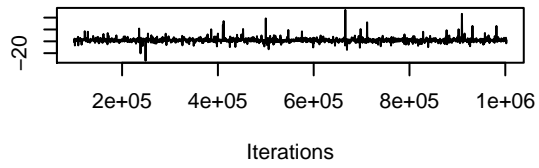
Trace of units



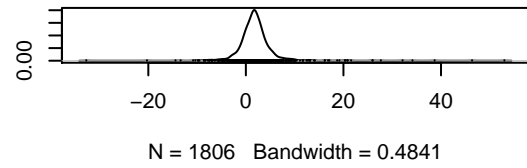
Density of units



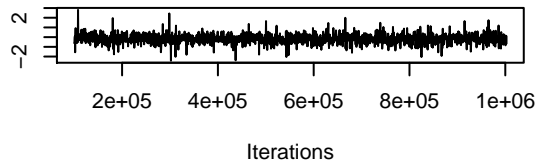
Trace of (Intercept)



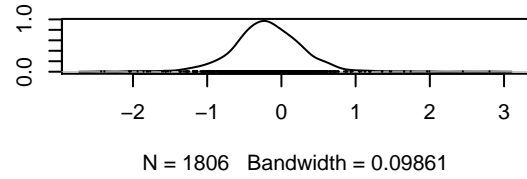
Density of (Intercept)



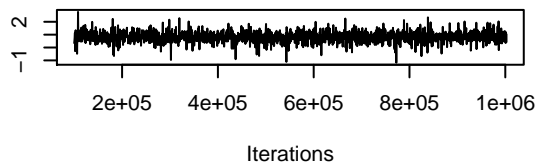
Trace of daynightday



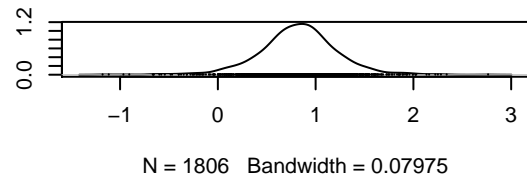
Density of daynightday



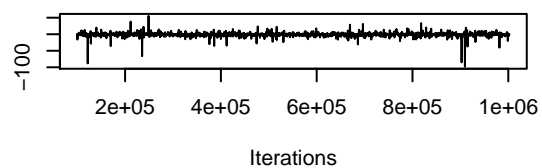
Trace of daynightnight



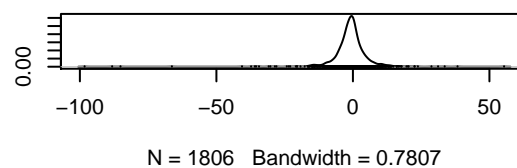
Density of daynightnight



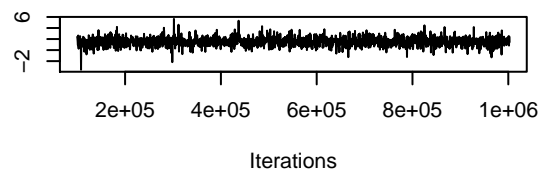
Trace of Location2Stewart Creek



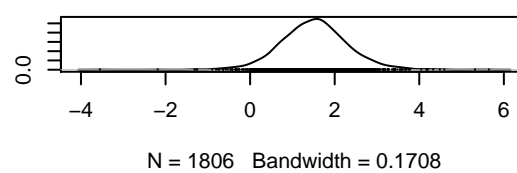
Density of Location2Stewart Creek

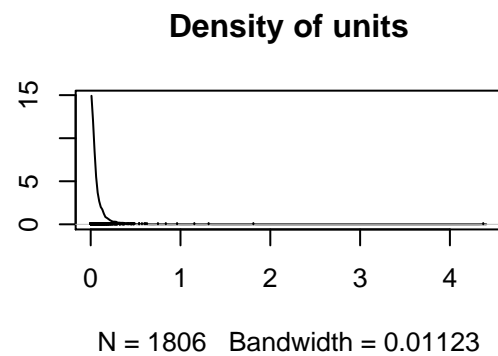
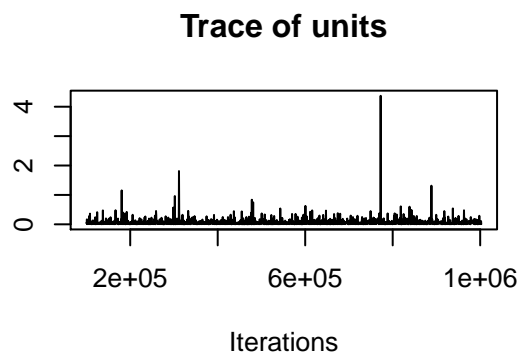
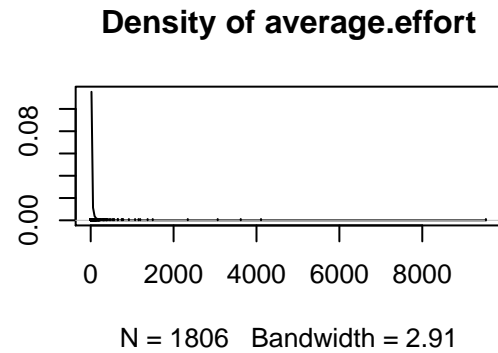
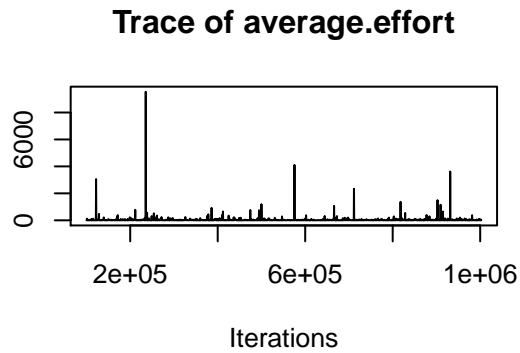


Trace of daynight.human



Density of daynight.human





big seasonal ungulates ## Underpass

model summary and plots of IG prior and expanded prior respectively

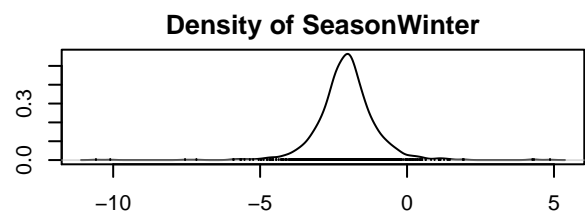
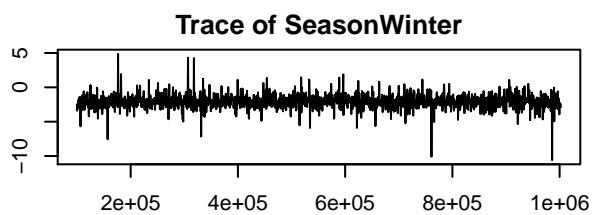
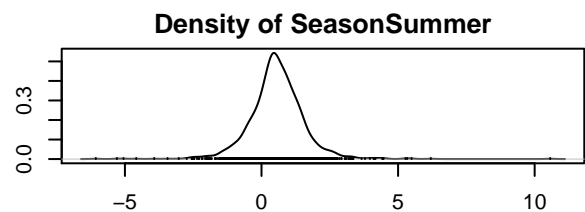
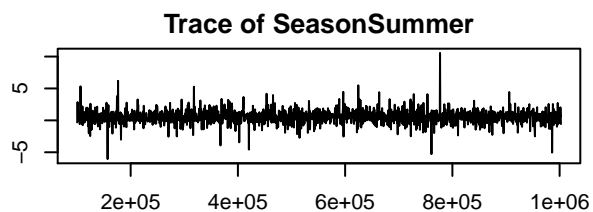
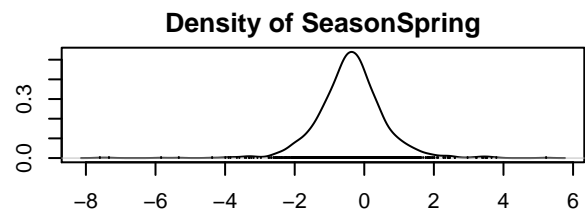
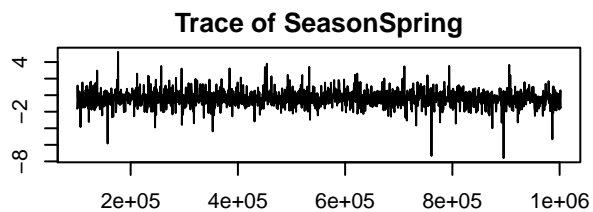
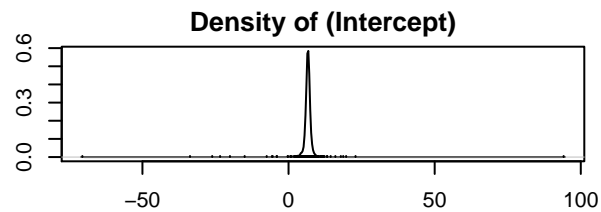
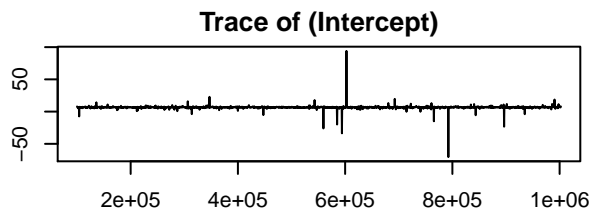
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 80.05684
##
## G-structure: ~average.effort
##
##           post.mean 1-95% CI u-95% CI eff.samp
## average.effort    112.2 0.0002575   7.667    1806
##
## R-structure: ~units
##
##           post.mean 1-95% CI u-95% CI eff.samp
## units           0.962  0.1028   2.965    1806
##
## Location effects: Total ~ Season
##
##           post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    6.5540  4.0796  8.5614   2157 0.0144 *
## SeasonSpring  -0.3870 -2.1656  1.5730   1806 0.5880
```

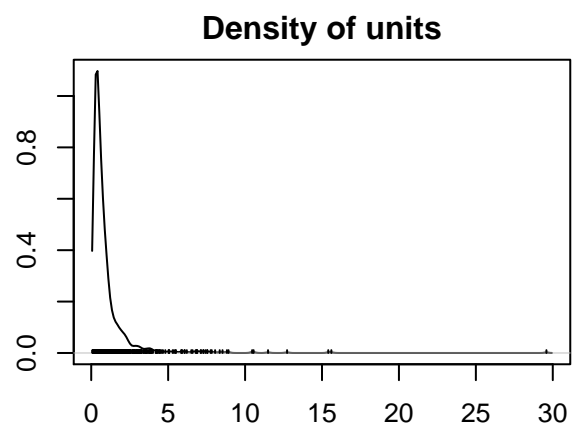
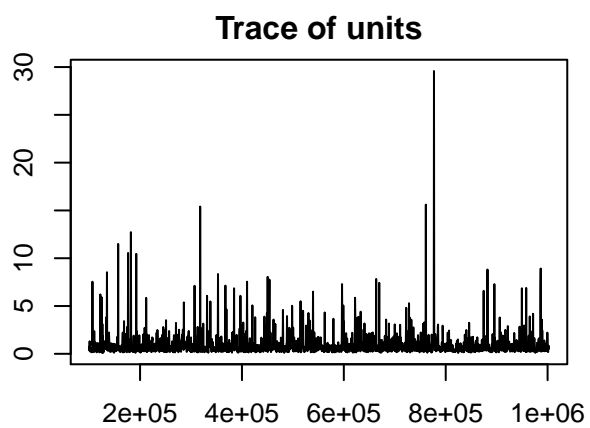
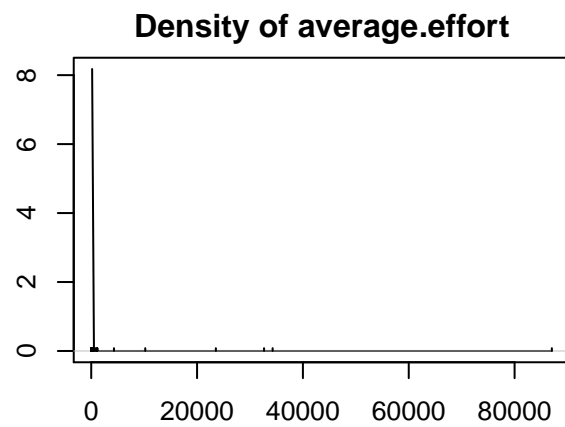
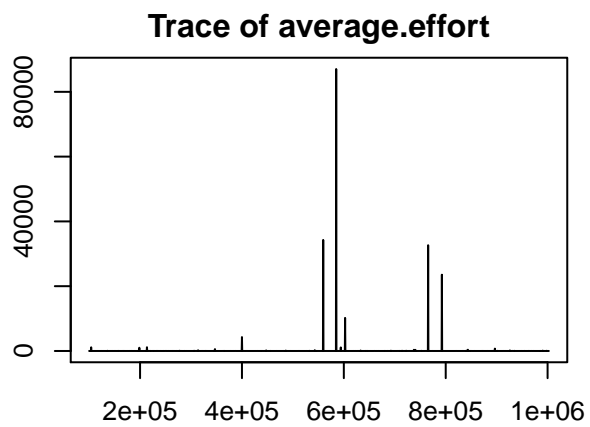
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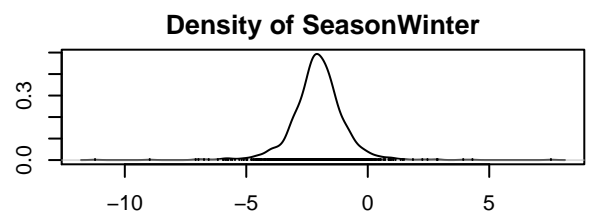
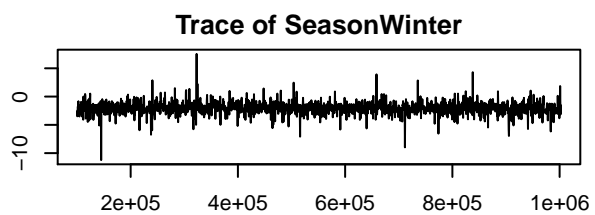
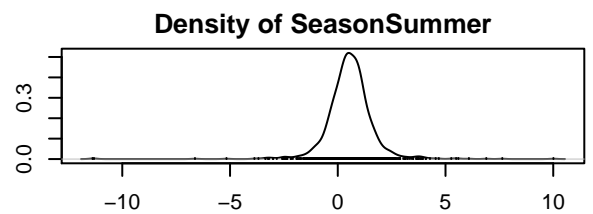
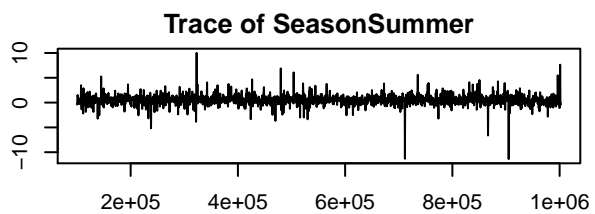
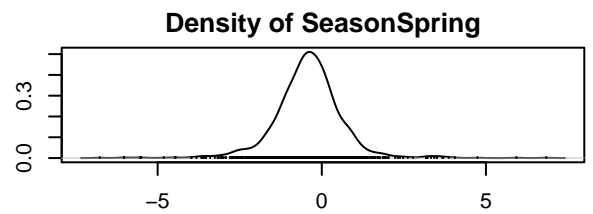
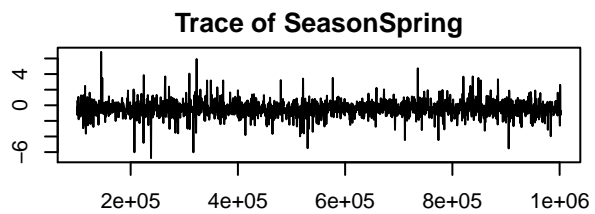
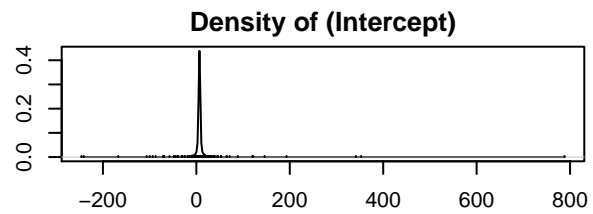
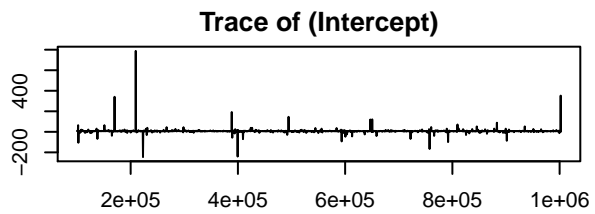
## SeasonSummer      0.5578  -1.5008   2.4799      2022 0.4563
## SeasonWinter     -2.0621  -3.9421  -0.1729      1806 0.0443 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

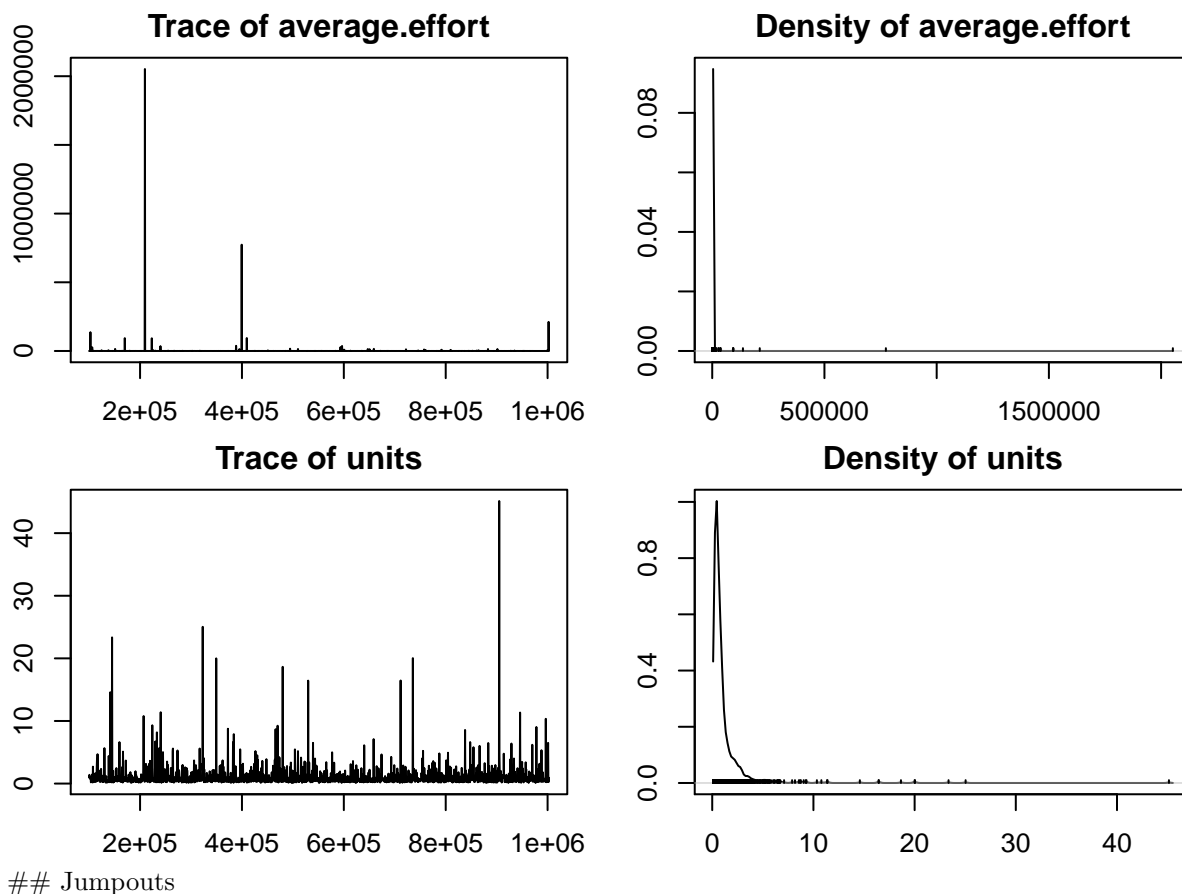
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 80.08541
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort      2209 3.291e-10   606.7      1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units           1.121 0.09624   3.364      1806
##
## Location effects: Total ~ Season
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      7.1054 -7.6023  19.3374      1806 0.1130
## SeasonSpring    -0.4096 -2.7218   1.3840      1806 0.5969
## SeasonSummer     0.5558 -1.4602   2.5552      1806 0.4662
## SeasonWinter    -2.0495 -4.1299   0.1309      1806 0.0554 .
## ---
## 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: 115.0455
##
## G-structure: ~average.effort
##
##           post.mean  l-95% CI u-95% CI eff.samp
## average.effort      36 0.0002577   68.41    1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units      1.165    0.1696    3.144    1806
##
## Location effects: Total ~ Season + Location2 + seasonal.human
##
##           post.mean l-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      3.0811 -14.0046  16.5581    1806 0.609
## SeasonSpring      1.2783  -0.3118   3.0289    2048 0.107
```

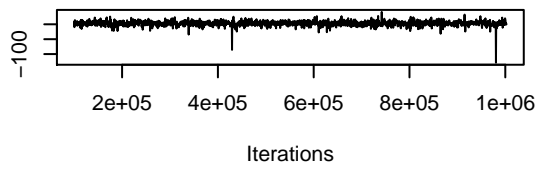
```

## SeasonSummer          1.6959   0.2458   3.4685   1806 0.041 *
## SeasonWinter          0.5592  -1.5332   2.3755   2125 0.502
## Location2Stewart Creek 0.1357  -8.3147   8.8082   1806 0.926
## seasonal.human       -0.2159 -10.6726   7.4795   1806 0.949
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

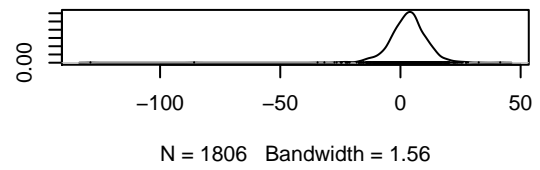
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 115.0044
##
## G-structure: ~average.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## average.effort    45.33 0.0007555    136.4    1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units           1.044   0.176    2.614    1732
##
## Location effects: Total ~ Season + Location2 + seasonal.human
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)         3.7740 -11.5464  18.9640    1806 0.5482
## SeasonSpring         1.2425 -0.2981   2.7721    1806 0.0997 .
## SeasonSummer         1.6757  0.1772   3.1916    1806 0.0321 *
## SeasonWinter         0.5220 -1.3154   2.2896    2044 0.5271
## Location2Stewart Creek -0.1195 -13.0788  12.4341    1806 0.9336
## seasonal.human       -0.4743 -8.2851   8.2150    1945 0.9003
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

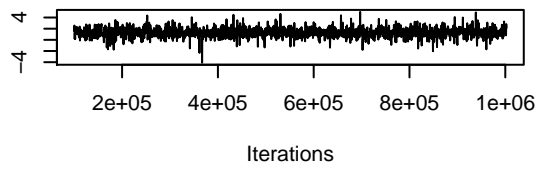
Trace of (Intercept)



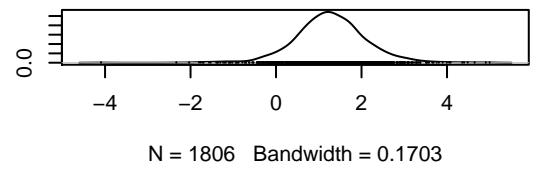
Density of (Intercept)



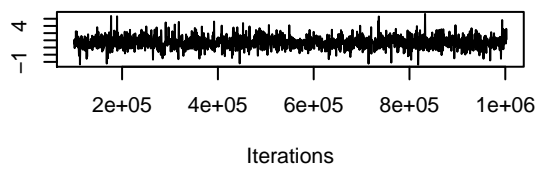
Trace of SeasonSpring



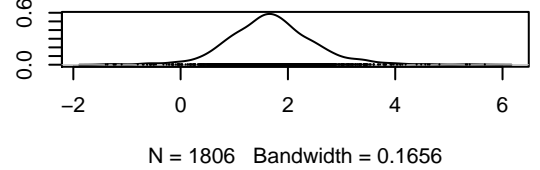
Density of SeasonSpring

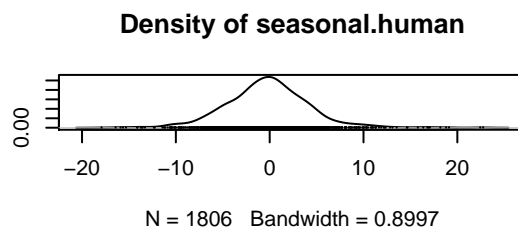
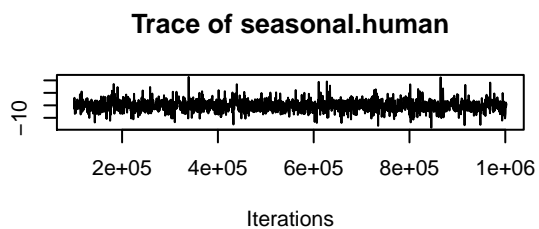
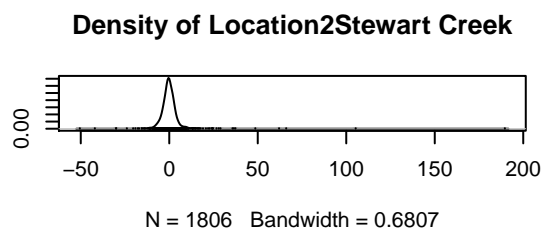
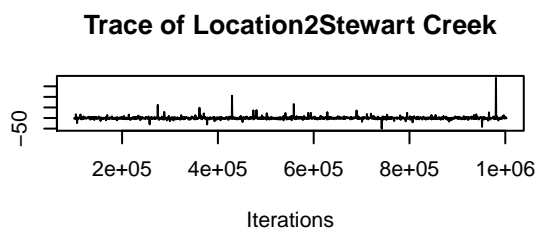
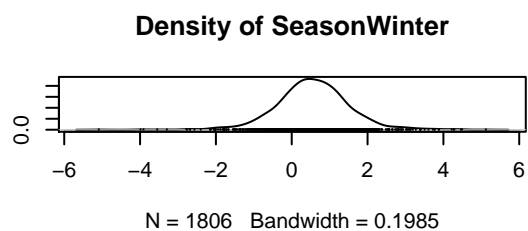
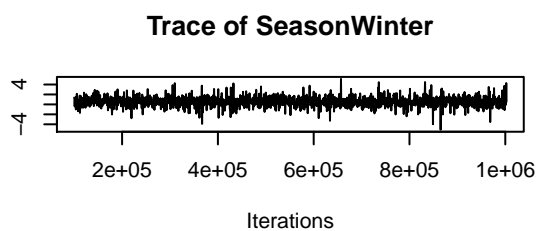


Trace of SeasonSummer

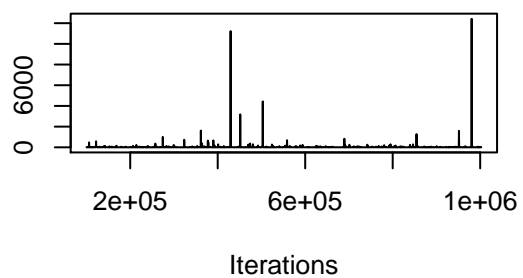


Density of SeasonSummer

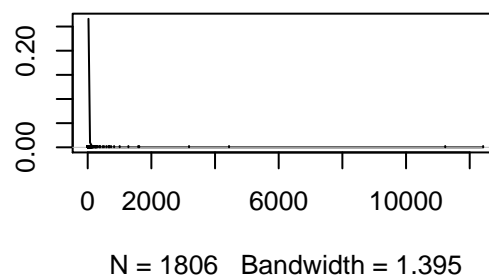




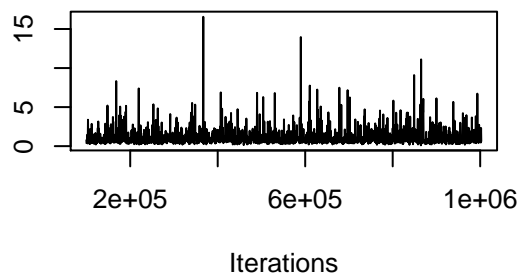
Trace of average.effort



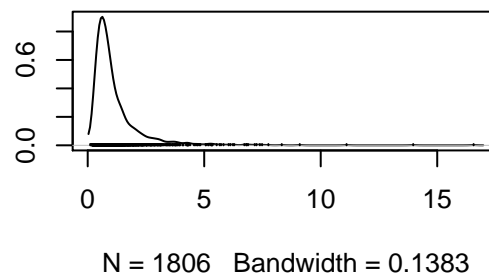
Density of average.effort



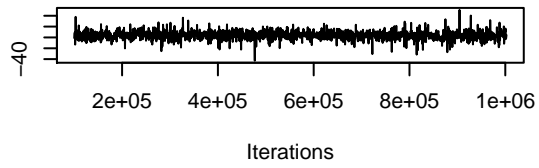
Trace of units



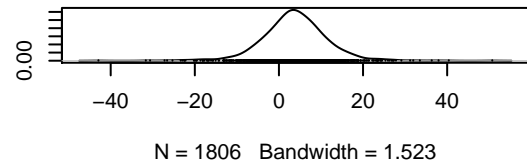
Density of units



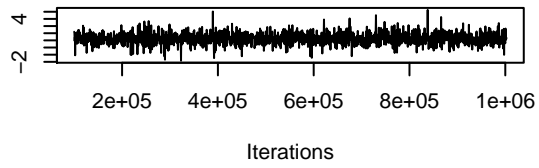
Trace of (Intercept)



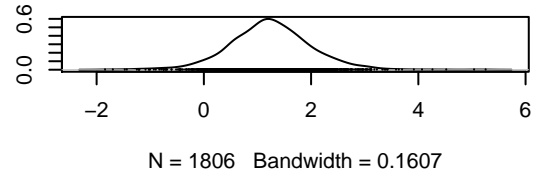
Density of (Intercept)



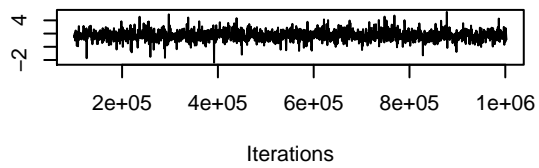
Trace of SeasonSpring



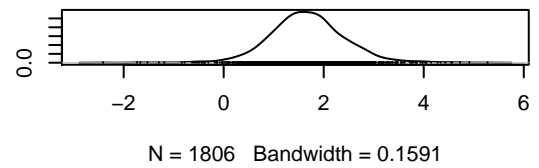
Density of SeasonSpring



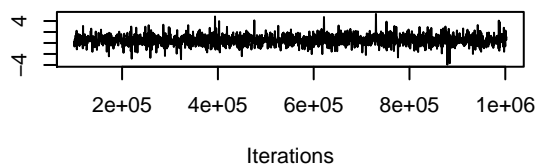
Trace of SeasonSummer



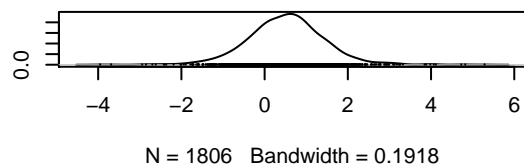
Density of SeasonSummer



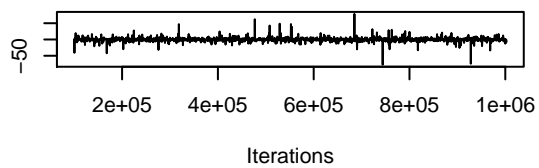
Trace of SeasonWinter



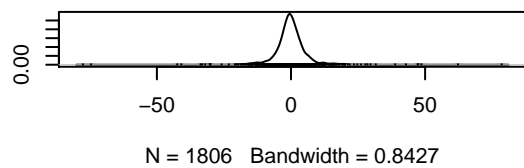
Density of SeasonWinter



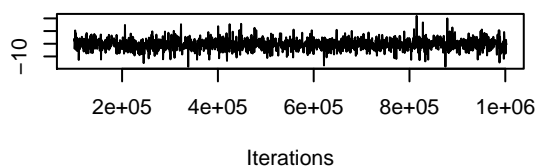
Trace of Location2Stewart Creek



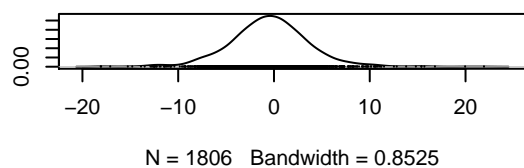
Density of Location2Stewart Creek

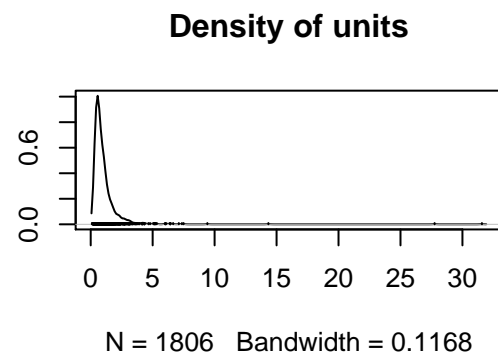
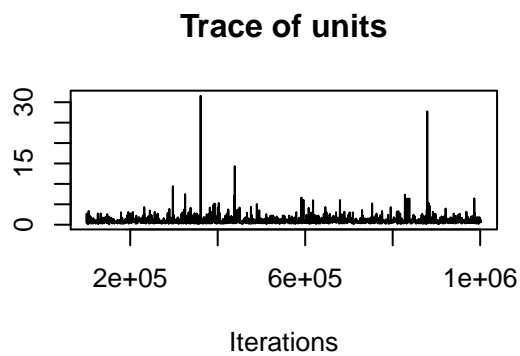
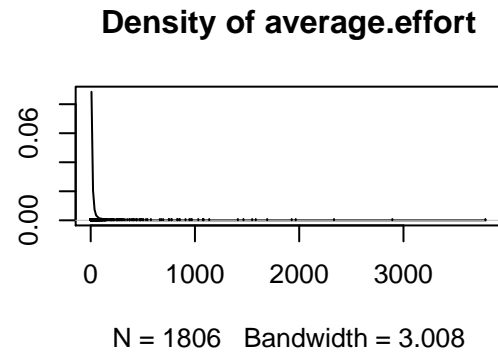
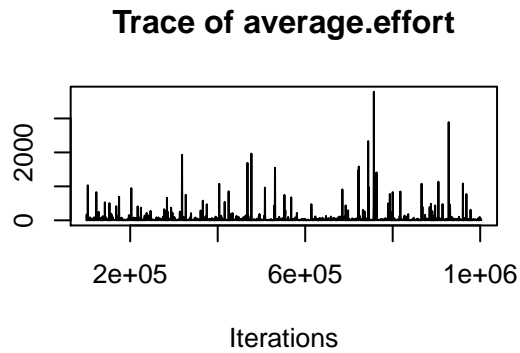


Trace of seasonal.human



Density of seasonal.human





big annual ungulates ## Underpass

model summary and plots of IG prior and expanded prior respectively

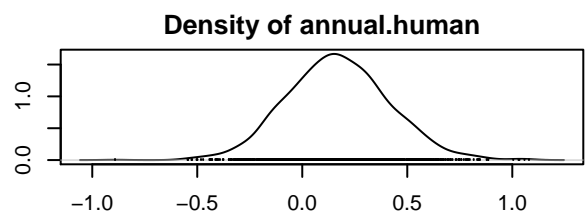
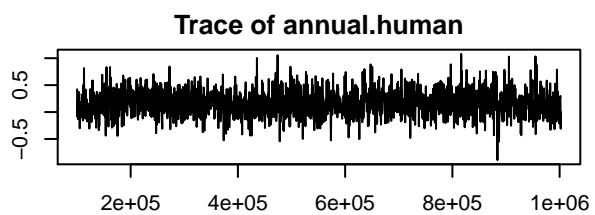
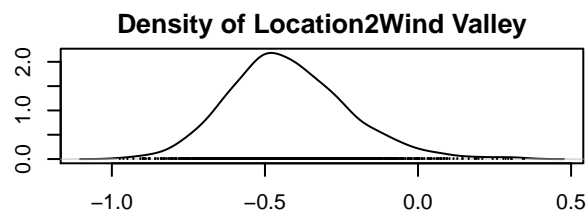
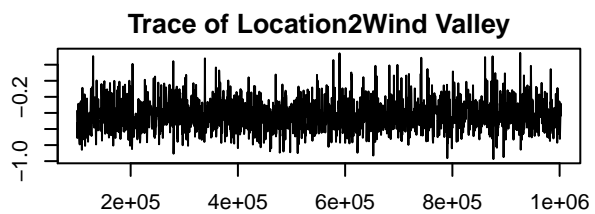
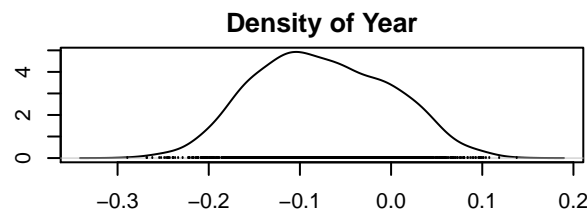
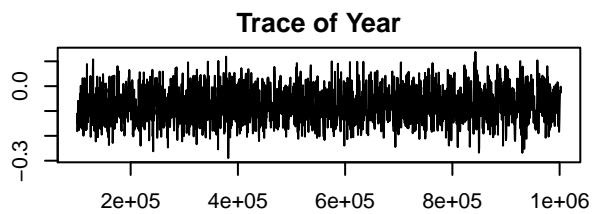
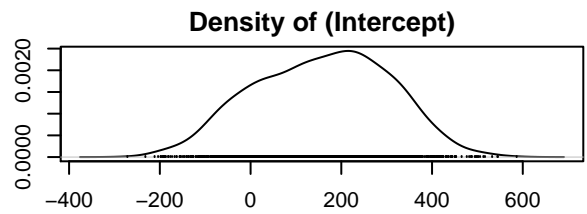
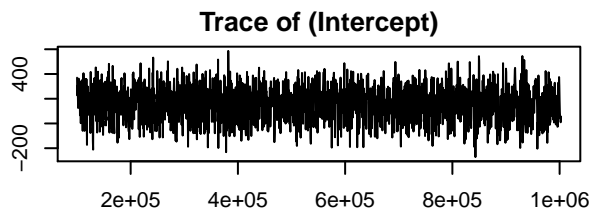
```
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 212.7361
##
## G-structure: ~annual.effort
##
##           post.mean l-95% CI u-95% CI eff.samp
## annual.effort  0.2724  0.00048  0.7818    1806
##
## R-structure: ~units
##
##           post.mean l-95% CI u-95% CI eff.samp
## units          0.1578  0.03261  0.3543    1958
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##           post.mean  l-95% CI  u-95% CI eff.samp pMCMC
## (Intercept)    157.40214 -109.36278  424.93260    2003 0.3344
## Year           -0.07561  -0.20834   0.05666    2003 0.3499
```

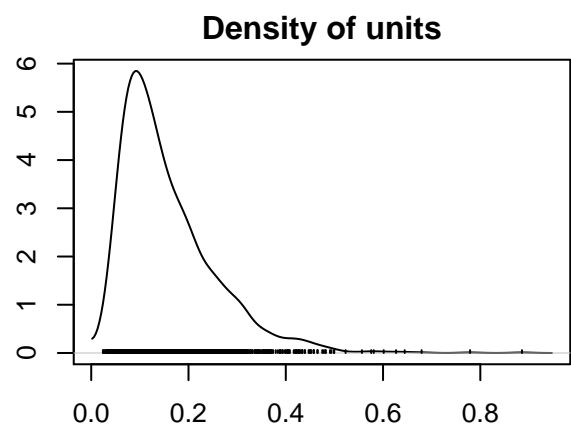
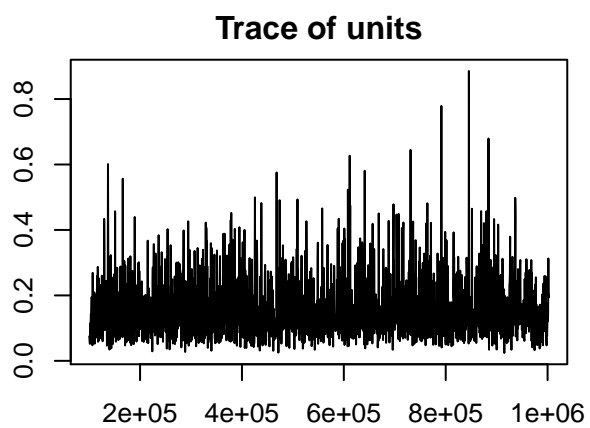
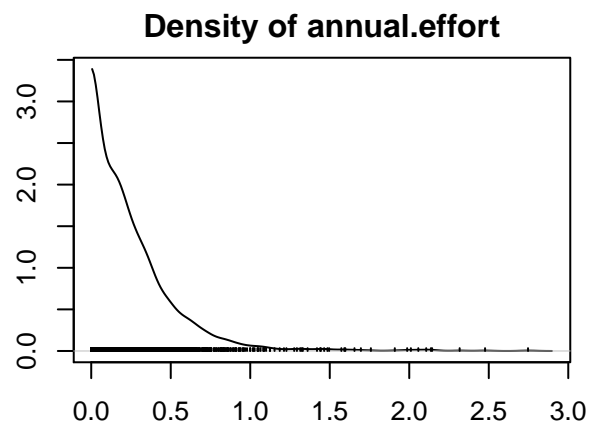
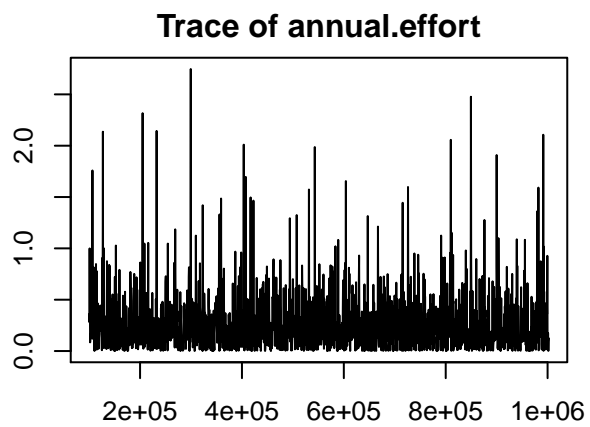
```

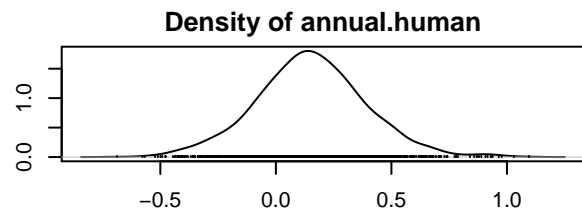
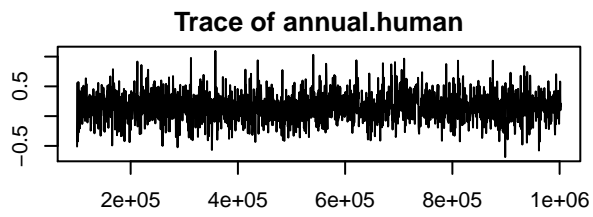
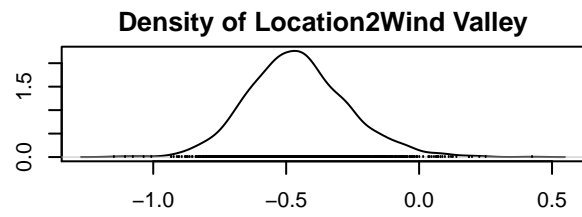
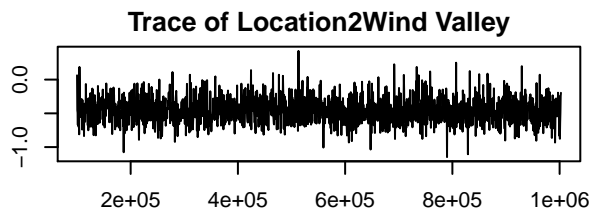
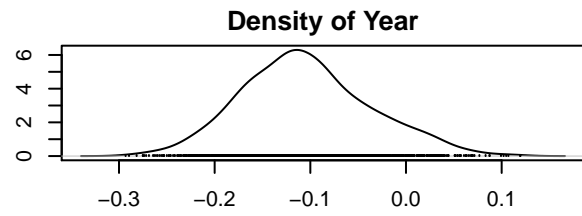
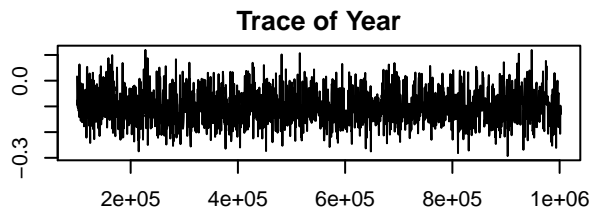
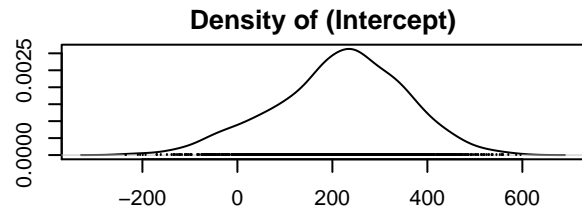
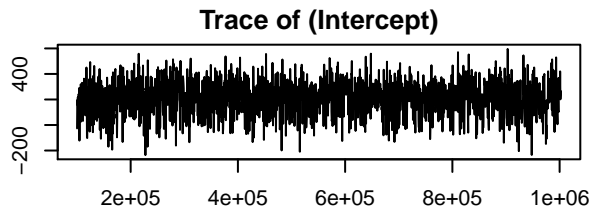
## Location2Wind Valley  -0.42448  -0.78112  -0.02273    1806 0.0543 .
## annual.human          0.16951  -0.30703   0.63758    1806 0.4784
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

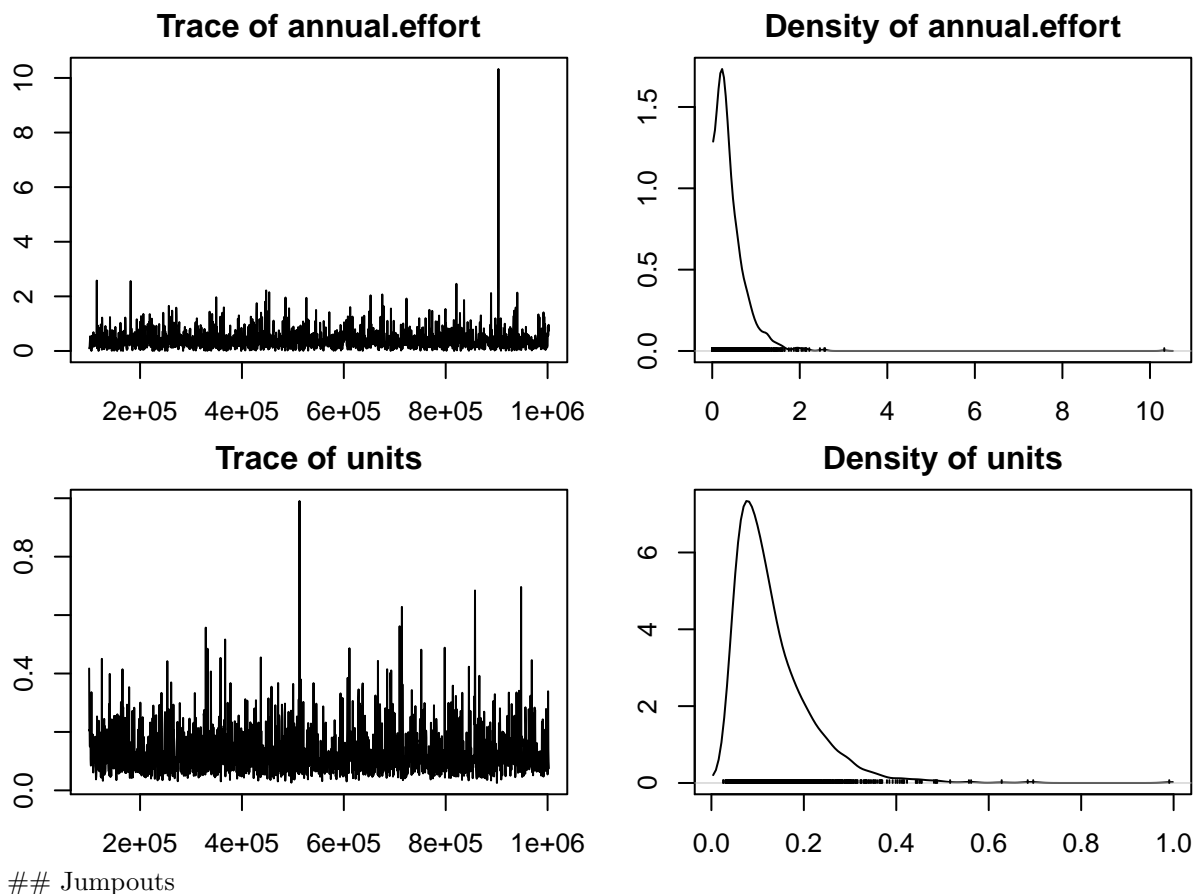
##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 212.628
##
## G-structure: ~annual.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## annual.effort    0.4153 6.001e-06      1.1      1630
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units           0.131 0.03282 0.2935      1806
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)    215.85301 -68.13868 457.56809    1671 0.1517
## Year           -0.10464 -0.22481 0.03636    1670 0.1584
## Location2Wind Valley -0.45616 -0.80048 -0.05909    1806 0.0277 *
## annual.human     0.15200 -0.32007 0.64683    1973 0.4950
## ---
## 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: 253.101
##
## G-structure: ~annual.effort
##
##          post.mean  l-95% CI u-95% CI eff.samp
## annual.effort    0.3852 0.0001942    1.212    1606
##
## R-structure: ~units
##
##          post.mean l-95% CI u-95% CI eff.samp
## units          1.413    0.582    2.35    1806
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##          post.mean  l-95% CI  u-95% CI eff.samp pMCMC
## (Intercept)    248.78803 -112.02475  659.07015    1806 0.2093
## Year           -0.12207  -0.32702    0.05792    1806 0.2148
```

```

## Location2Stewart Creek  -0.96652  -1.90372   0.01008   1806 0.0576 .
## annual.human           0.20526  -1.43669   1.87154   1501 0.7829
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

##
## Iterations = 100001:1002501
## Thinning interval = 500
## Sample size = 1806
##
## DIC: 253.0601
##
## G-structure: ~annual.effort
##
##               post.mean 1-95% CI u-95% CI eff.samp
## annual.effort   0.6487 2.276e-07   1.869   1806
##
## R-structure: ~units
##
##               post.mean 1-95% CI u-95% CI eff.samp
## units          1.335   0.6577   2.265   1806
##
## Location effects: Total ~ Year + Location2 + annual.human
##
##               post.mean 1-95% CI u-95% CI eff.samp pMCMC
## (Intercept)      254.8191 -173.8718  740.5050   1806 0.2835
## Year              -0.1251  -0.3664   0.0887   1806 0.2913
## Location2Stewart Creek -0.9151  -1.8815   0.0738   1806 0.0687 .
## annual.human       0.2178  -1.4195   1.8578   1806 0.7940
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

