

Chapter 4

Methodology

4.2 Statistical Methods

From provincial fire management records in the Ontario Ministry of Natural Resources (OMNR) fire database the following annual statistics will be calculated:

E_t the annual number of escapes (i.e., fires ≥ 3 ha)

L_t the annual number of large fires (i.e., fires ≥ 200 ha)

As Cumming (2005:775) suggests, the observed annual distribution of fires (L_t / E_t) will be used as an estimate of the annual probability (ρ_t) that a randomly chosen escaped fire (E) will fail to be suppressed and become a large fire (L).

Conditional on E_t (i.e., the annual number of escapes), L_t (i.e., the annual number of large fires) will, therefore, be a *binomial random variable* with an expected value of $L_t \rho_t$ and variance $L_t \rho_t (1 - \rho_t)$. As such, the hypotheses H_0 and H_S can be operationalised as logistic regression models of the annual variation in ρ_t , and tested by regressing the observations against the suppression strategy (S_i or S_m) being employed.

With the OMNR dataset .csv file downloaded to the working directory, the file was loaded into R.

To calculate N_t the annual load, the total number of fires per year were aggregated. The OMNR dataset was then split into the two Fire Management Zones, Intensive and Measured, required for the analysis.

The OMNR dataset was further separated into the number of suppressed and escaped fires in each Fire Management Zone.

N_s and N_e could then be aggregated.

```
> omnr.glm <- data.frame(zone=rep(c("mea", "int"), c(16, 16)), year=rep(1989:2004, 2), suppressed=
```

Call:

```
glm(formula = glm.eq, family = binomial(logit), data = omnr.glm)
```

Deviance Residuals:

Min	1Q	Median	3Q	Max
-8.3516	-0.3858	0.6594	1.8976	5.0376

Coefficients:

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	35.03499	40.31208	0.869	0.3848
omnr.glm\$zonemea	146.85587	70.22388	2.091	0.0365
omnr.glm\$year	-0.01650	0.02019	-0.817	0.4138
omnr.glm\$zonemea:omnr.glm\$year	-0.07409	0.03519	-2.105	0.0353

(Dispersion parameter for binomial family taken to be 1)

Null deviance: 238.46 on 31 degrees of freedom
Residual deviance: 183.76 on 28 degrees of freedom
AIC: 288.11

Number of Fisher Scoring iterations: 5

	Estimate	Std. Error	z value	Pr(> z)
(Intercept)	35.0350	40.3121	0.87	0.3848
omnr.glm\$zonemea	146.8559	70.2239	2.09	0.0365
omnr.glm\$year	-0.0165	0.0202	-0.82	0.4138
omnr.glm\$zonemea:omnr.glm\$year	-0.0741	0.0352	-2.11	0.0353

Table 1: Summary statistics for the regression model