Models in R

Model Formula

Y – variable   **X – variable**

aka: **~**   **aka:**
Response variable   **Predictors**
Outcome variable   **Explanatory variable**
Dependent variable   **Independent variable**

This is basically how you define all models in R. t-tests, ANOVA, linear models, generalized additive models, hierarchical or mixed effects models, classification and regression trees….

Model Formula

`Fuel ~ Weight + Displacement`

Response   Predictor   Predictor

$$Fuel = \alpha + \beta_1 Weight + \beta_2 Displacement + \varepsilon$$

Intercept   Estimate   Estimate   Error

lm function

$$Fuel = \textcolor{orange}{\alpha} + \textcolor{red}{\beta_1}Weight + \textcolor{cyan}{\beta_2}Displacement + \varepsilon$$

```
mod1 <- lm(Fuel ~ Weight + Displacement, data=efficiency)

summary(mod1)      #have to do this to get output.
```

Call:
lm(formula = Fuel ~ Weight + Displacement, data = efficiency)

…

Coefficients:

	Estimate	**Std. Error**	**t value**	**Pr(>|t|)**
(Intercept)	**5.0126484**	**1.0389071**	**4.825**	**0.000158 *****
Weight	**0.0018732**	**0.0005754**	**3.255**	**0.004658 ****
Displacement	**0.1611806**	**0.0434117**	**3.713**	**0.001729 ****

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.5015 on 17 degrees of freedom
Multiple R-squared: 0.6028,   Adjusted R-squared: 0.5561
F-statistic: 12.9 on 2 and 17 DF, p-value: 0.0003906

Model Formula

| Predictors (i.e. right side of formula)	Meaning
A + B	main effects of A and B
A:B	interaction of A with B
A*B	main effects and interactions = A + B + A:B
A*B*C	main effects and interactions A+B+C+A:B+A:C+B:C+A:B:C
(A+B+C)^2	A, B, and C crossed to level 2: A+B+C+A:B+A:C+B:C
A*B*C-A:B:C	same as above: main effects plus 2-way interactions
log(A) + B	natural log of A
I(A+10) + B	A plus 10. The capital "i" tells R that this is a calculation
poly(A, 2) + B	fits a 2nd degree polynomial A (i.e. A + A^2 + B)
poly(A, 3) + poly(B, 2)	a 3rd degree polynomial for A and 2nd degree for B

Your turn

Data: From Michael Crawley's book.

Goal: Determine how Fruit size varies with Root size (diameter) and whether Grazing affects fruit size.

MODEL WARS:
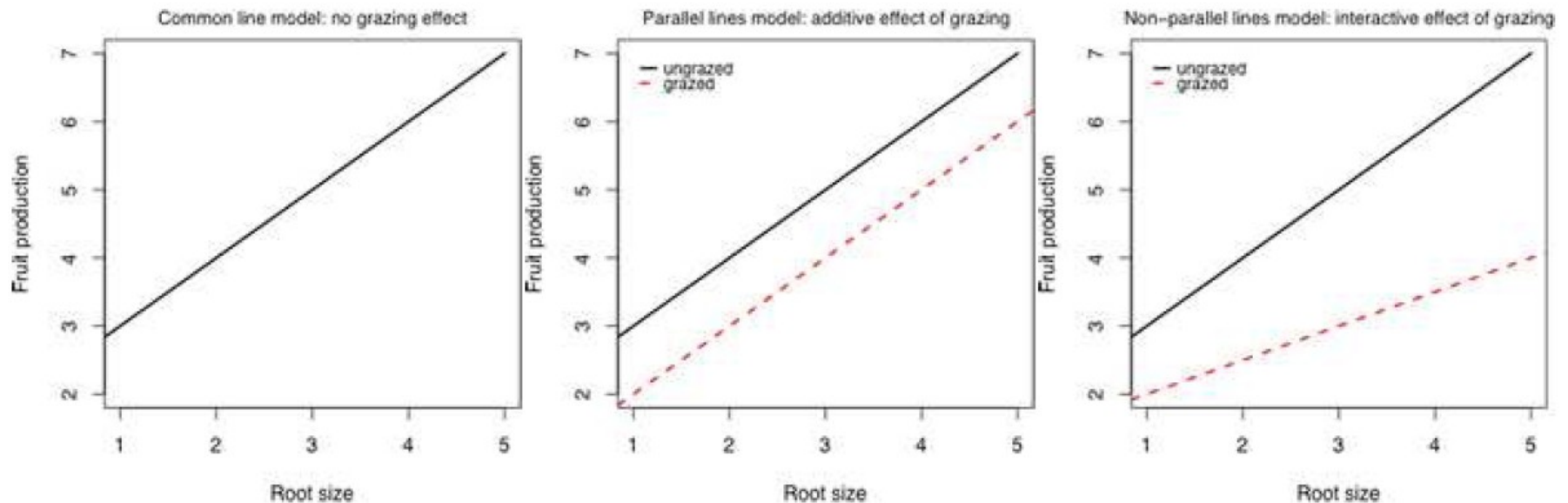
| **Root effect** | **Root and grazing effect** | **Root and grazing interaction** |