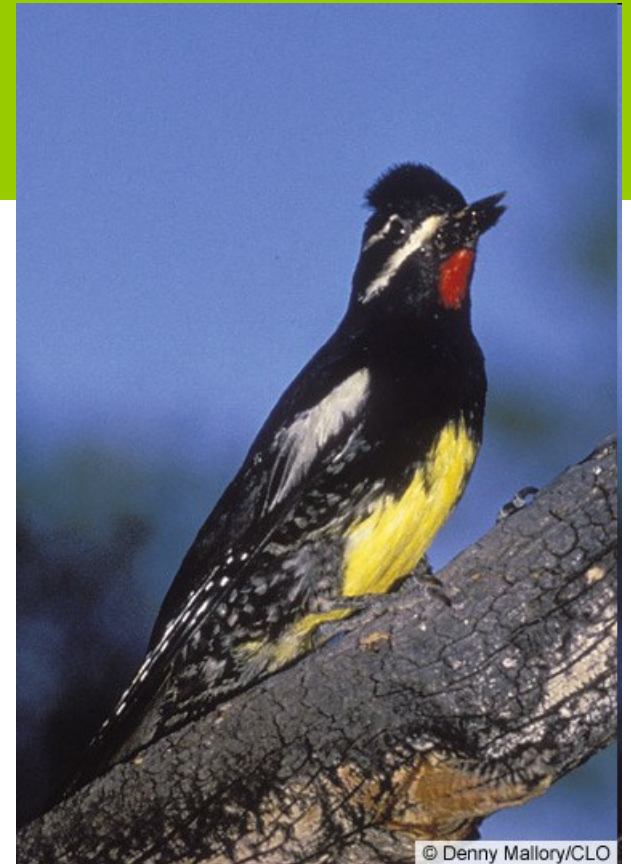


NEST SITE SELECTION ANALYSIS FOR WILLIAMSON'S SAPSUCKER: RESULTS TO DATE

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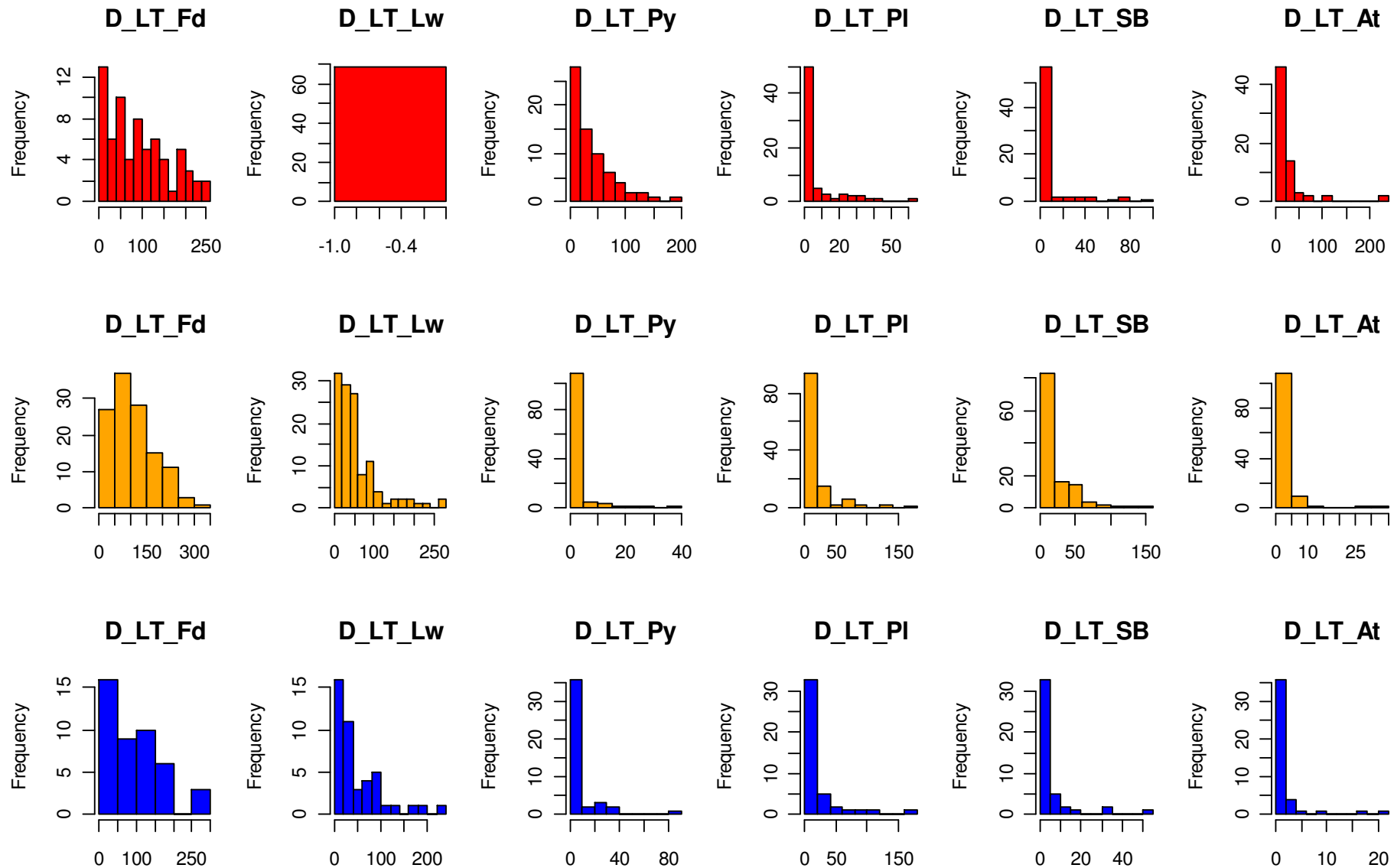
Nest Site Selection Analysis

Nest	West	Ok-Bdy	EK
0	28	52	17
1	41	70	27
Total	69	122	44

Logistic regression:

$P(\text{Nest} = 1)$ as a function of habitat variables

Stem Density across 3 Regions



The Approach

- Develop a suite of models that allows us to address relevant questions
- Compare (rank) the models, and make inference from ranks and from parameter estimates (variables) in models
- Each region examined separately

Two main questions

- **Thresholds:** can we identify thresholds in habitat variables that provide clear distinctions where we can expect WISA nests to occur/not occur?
- **Data sources:** how does remote sensing (GIS) data compare to field collected data?

Model Suite

#	Model	Variables
1	GIS Stand composition 800	Percent of polygon area by leading tree species at 800 m radius scale
2	GIS Ecological requirements 800	Percent composition of area with forest characteristics associated with nesting and sap trees – 800 m radius scale
3	GIS Stand composition 225	Percent of polygon area by leading tree species at 225 m radius scale
4	GIS Ecological requirements 225	Percent composition of area with forest characteristics associated with nesting and sap trees – 225 m radius scale

Model Suite - continued

#	Model	Variables
5	Stand history	Distances to stand of age 80+ yrs, and to stand with logging history of < 40 yrs
6	Stand Structure	Densities of stems in different dbh classes, includes density of all very large structures
7	Stand Structure (non-linear)	Density of stems in all dbh classes and quadratic term
8	Stand Composition	Density of stems by species (Lw, At, Fd, Py, Pl, SB)
9	Stand Composition – very large stems	Density of very large stems by species (Lw, At, Fd, Py, Pl, SB)

Model Suite - continued

#	Model	Variables
10	Percent Stand Composition	Percent composition of stems by species
11	Percent Stand Composition – very large stems	Percent composition of very large stems by species
12	Deadwood ('Ants')	Densities of logs, snags, and stumps
13	Cavity availability	Densities of all cavities, and of suitable cavities
14	Ecological requirements	Log Volume, snags, stumps, densities of Douglas firs and coniferous trees, very large Lw, Py, Fd, Aspen (>37.5cm dbh)

Comparing Models

- AICc: a measure of information loss
 - selects for parsimonious models in a predetermined set
 - Used to calculate $\Delta AICc$, Akaike weights (w)
- R^2 : proportion of variance in the response variable that is explained by model
- AUC (Area Under Curve):
 - varies between 0 and 1; 0.5 is random
 - provides a general measure of classifier performance

Results: Western Region

Model	K	AICc	Δ AICc	w	R ²	AUC
1	6	85.1	4.2	0.06	0.23	0.83
3	6	85.5	4.6	0.05	0.23	0.81
8	6	80.9	0.0	0.49	0.28	0.84
14	9	81.6	0.7	0.34	0.35	0.86

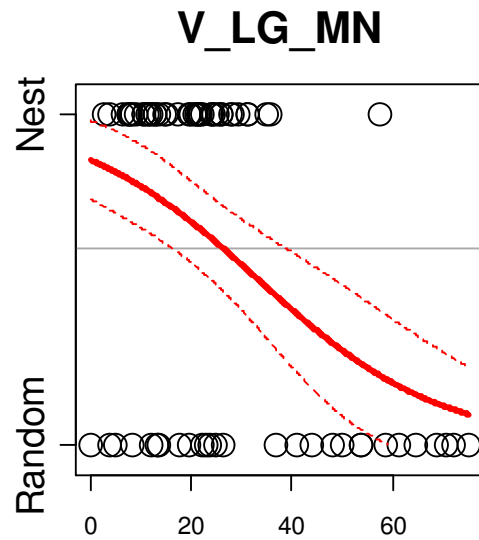
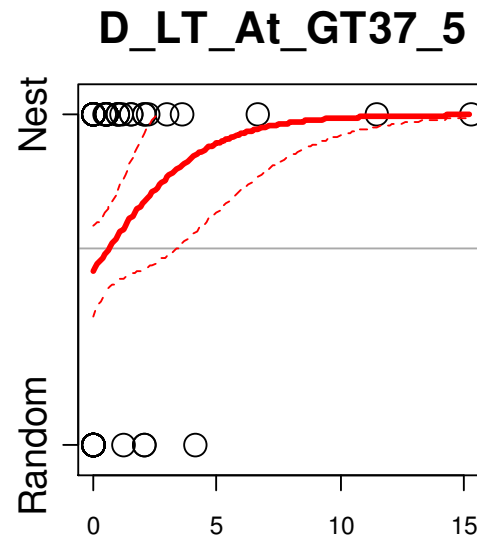
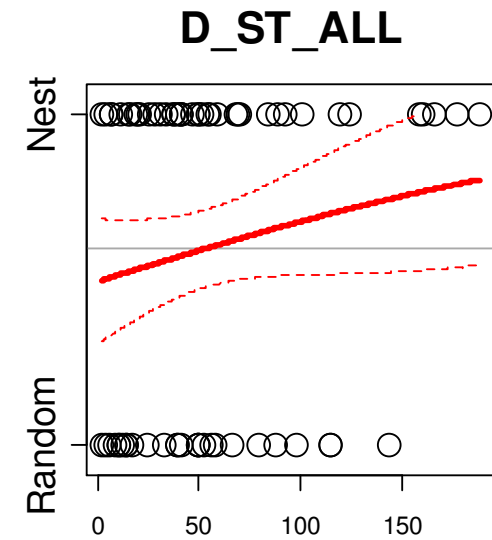
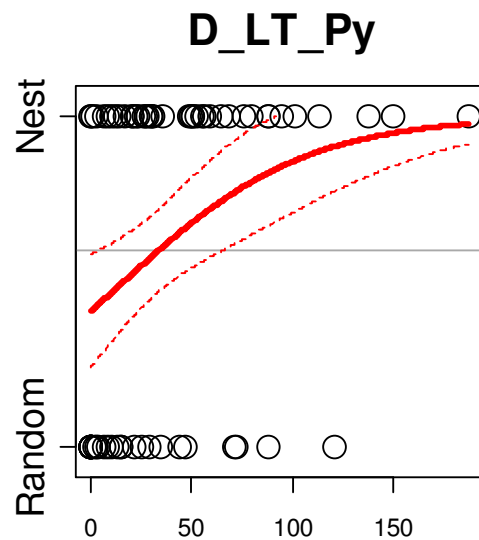
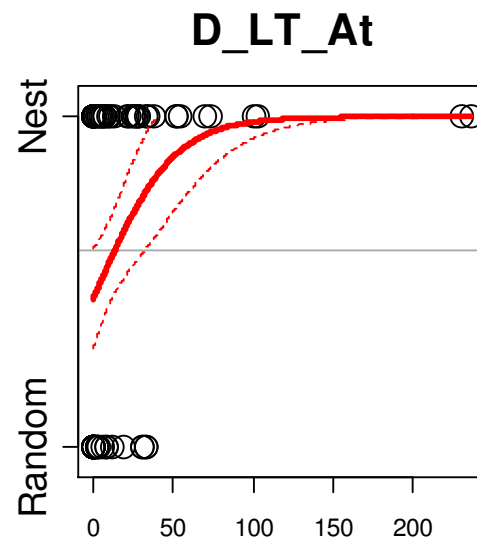
1: GIS stand composition 800m

3: GIS stand composition 225m

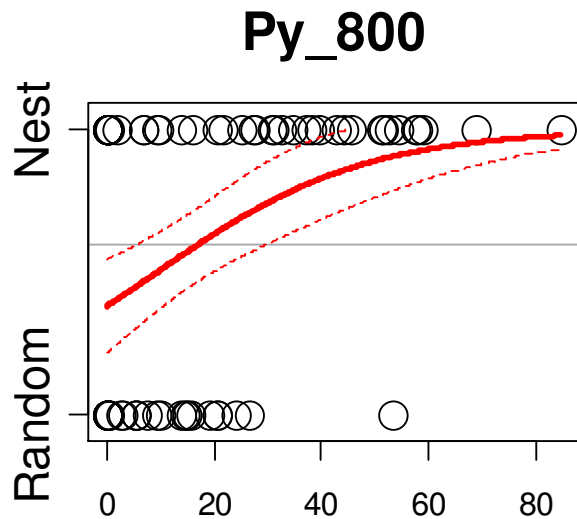
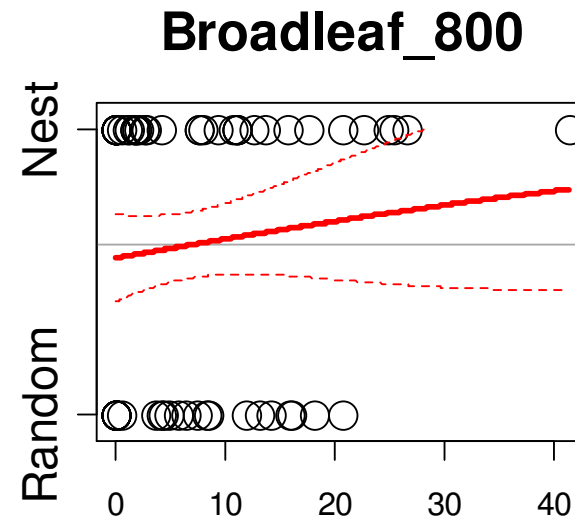
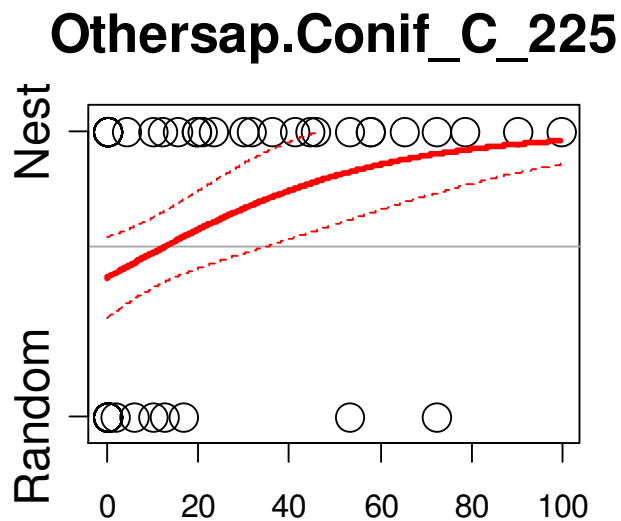
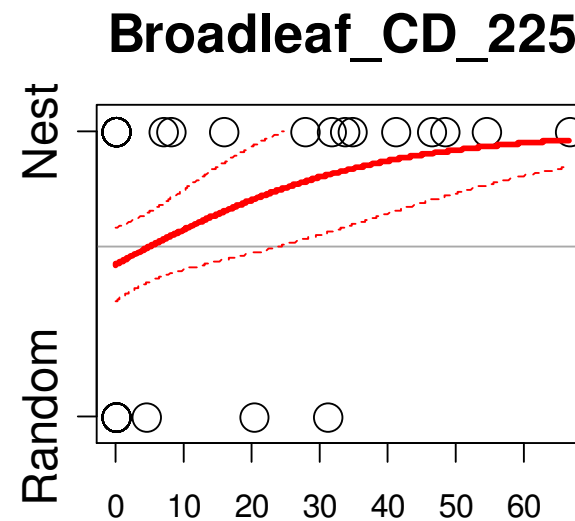
8: Stand composition – density

14: Ecological requirements

Field Variables: Western Region



GIS Variables: Western Region



Western Region Summary

- Field-based models gathered the bulk of support: 'ecological requirements' and 'stand composition – density'
- Strong relationship with Aspen: evidence of a threshold (>5 large diameter, or >50 live trees)
- Positive relationship with densities of Ponderosa pine and stumps
- Negative association with log volume

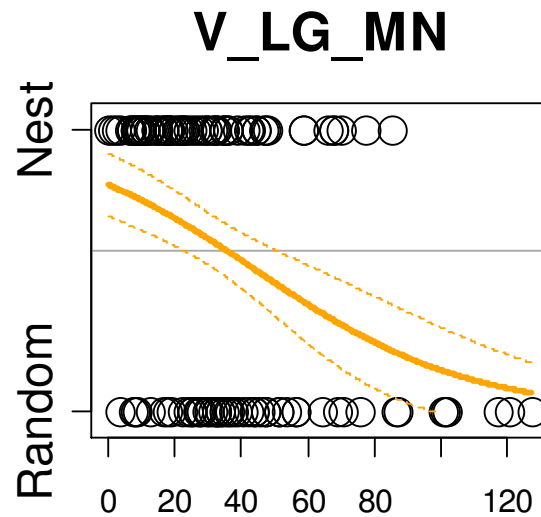
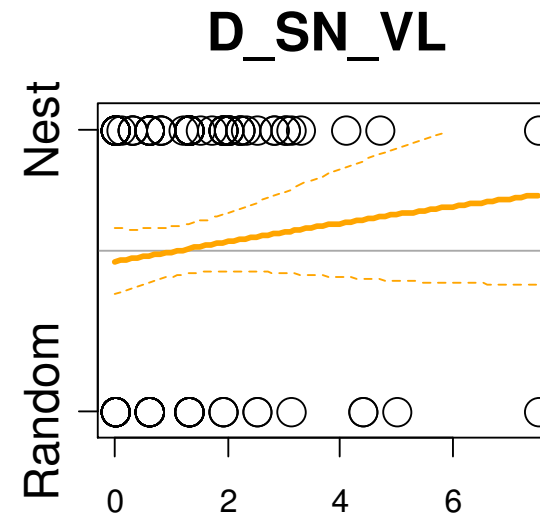
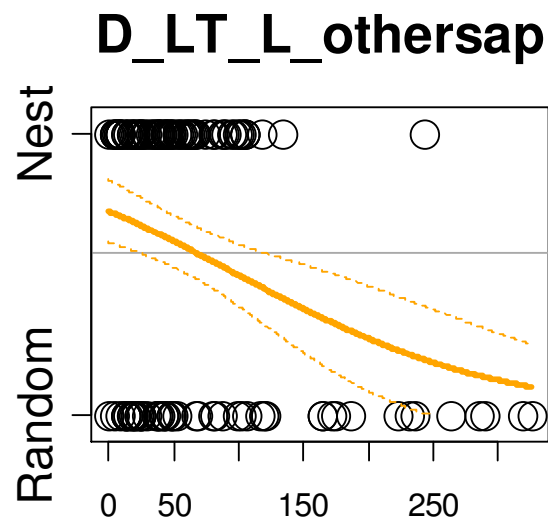
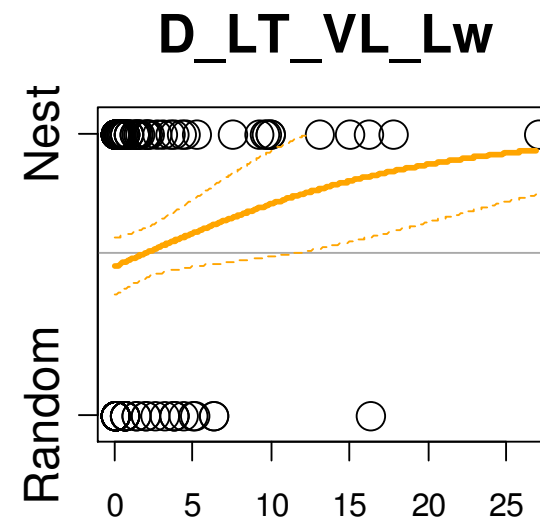
Results: Okanagan-Boundary

Model	K	AICc	Δ AICc	w	R ²	AUC
7	3	152.0	10.1	0.01	0.12	0.70
14	10	141.9	0.0	0.99	0.28	0.83

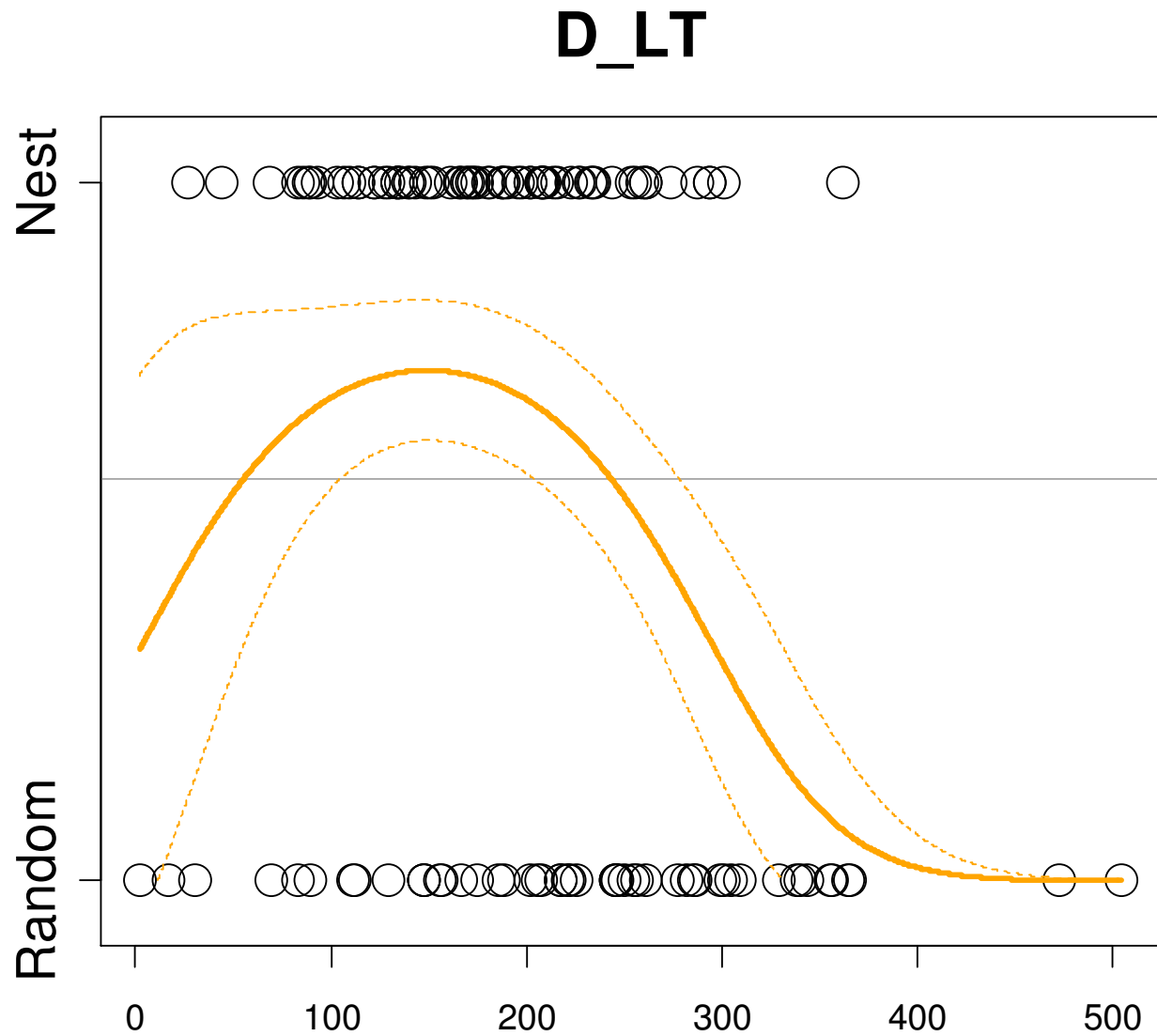
7: Non-linear stand structure

14: Ecological requirements

Field Variables: Okanagan-Boundary



Stem Density: Okanagan-Boundary



Okanagan-Boundary Summary

- Field-based 'Ecological requirements' model gathered the bulk of support
- Negative association with log volume and densities of non-Lw conifers
- Some evidence for thresholds of occurrence for very large Larch and snags
- WISA nests not found at stem densities greater than ~300/ha

Results: East Kootenay

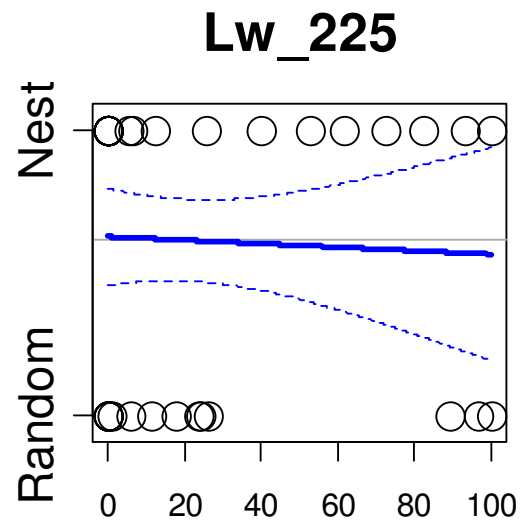
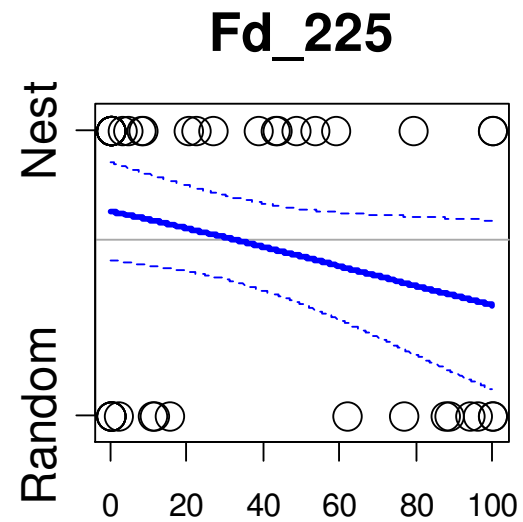
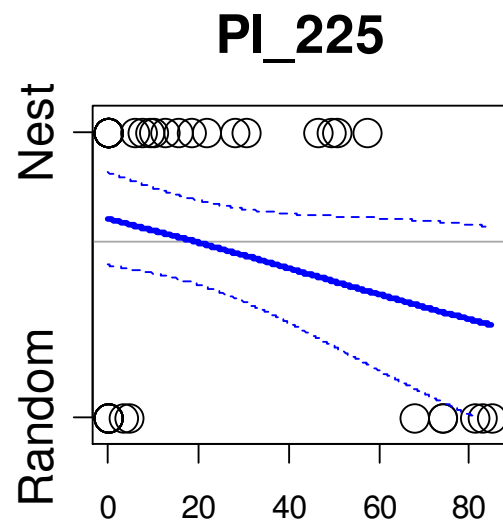
Model	K	AICc	Δ AICc	w	R ²	AUC
1	7	54.3	4.9	0.07	0.37	0.88
3	6	49.4	0.0	0.81	0.40	0.87
7	3	55.5	6.1	0.04	0.17	0.77

1: GIS stand composition 800m

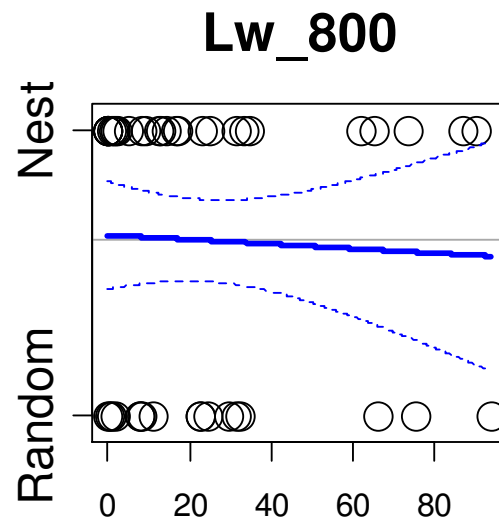
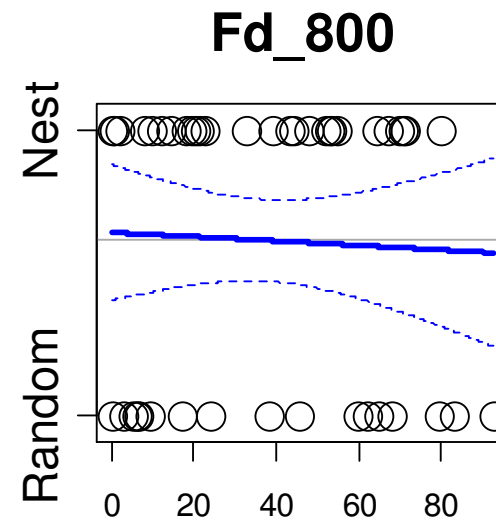
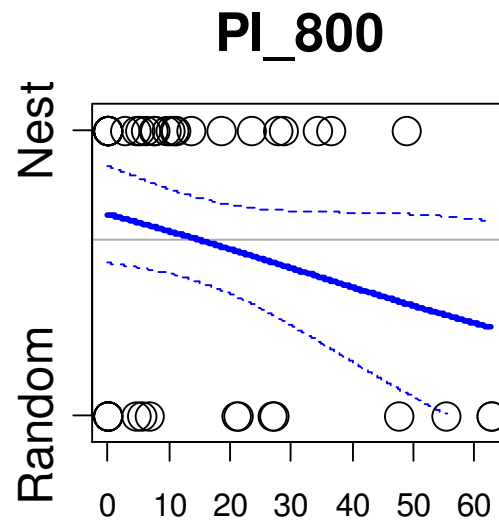
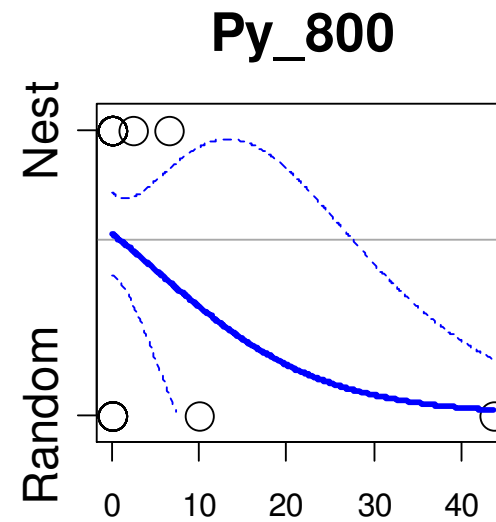
3: GIS stand composition 225m

7: Non-linear stand structure

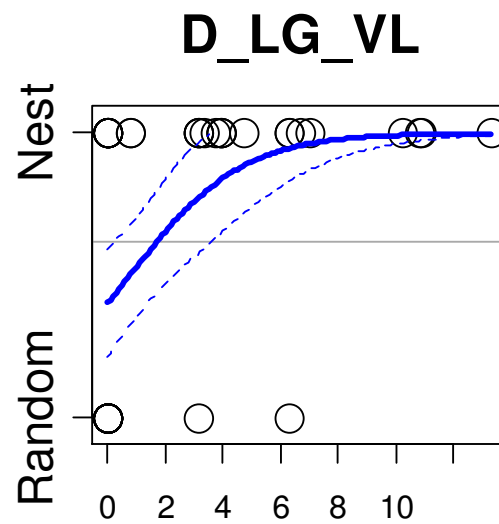
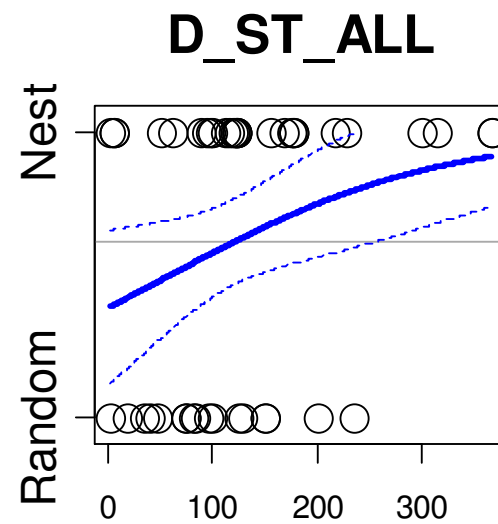
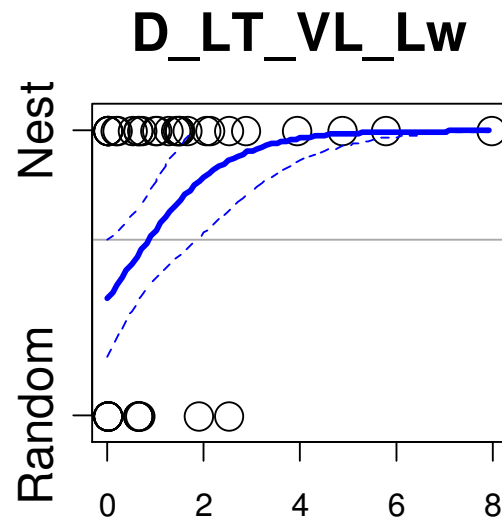
GIS 225: East Kootenay



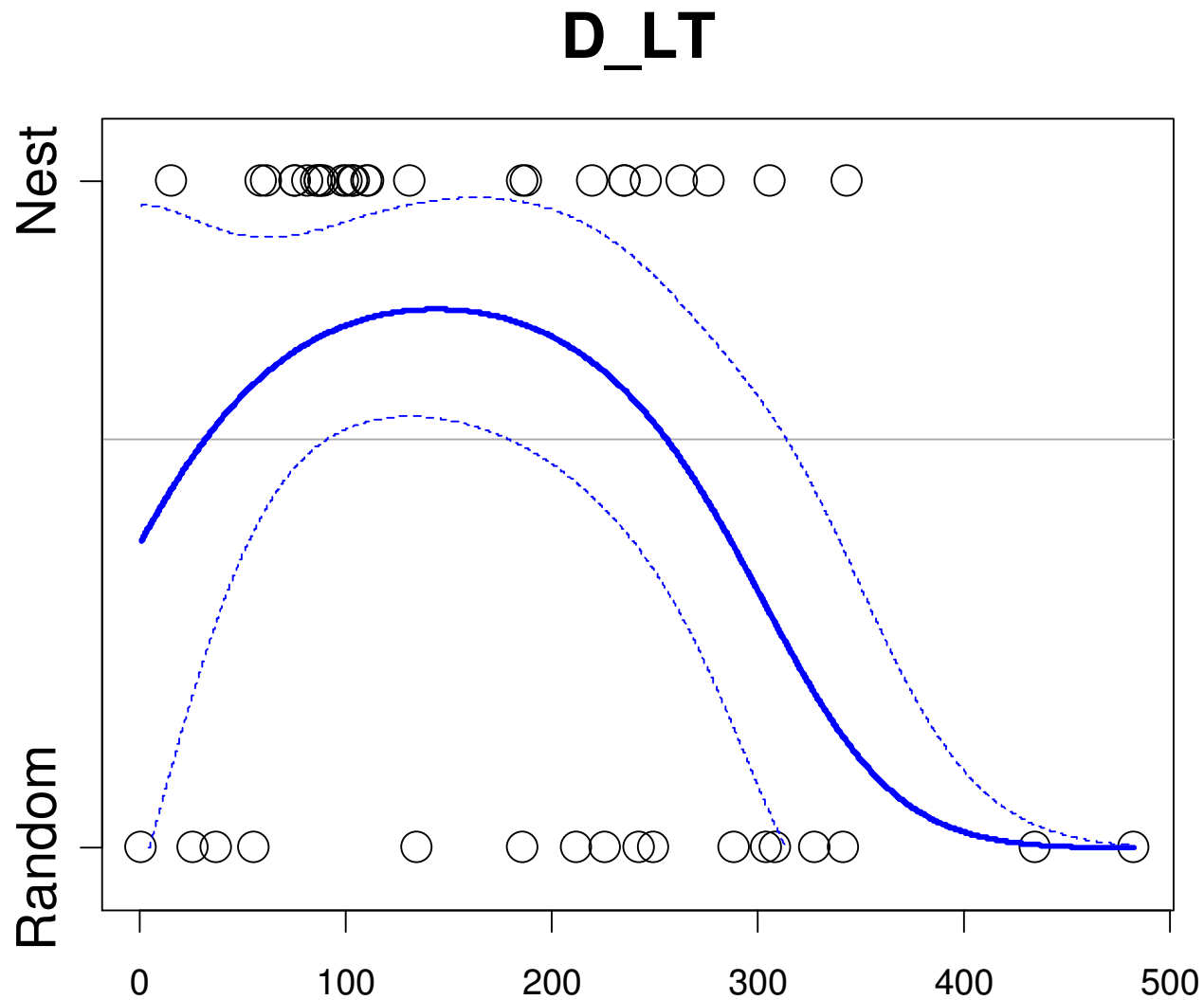
GIS 800: East Kootenay



Field variables: East Kootenay



Stem Density: East Kootenay



East Kootenay Summary

- Simple GIS-based models have strongest support, and suggest WISA select for mixed composition stands
- WISA nests not found at stem densities greater than ~300/ha
- Some evidence for thresholds of occurrence for very large logs, stumps, and very large live Larch

Overall Conclusions

- Focus on management of Aspen and Ponderosa pine in Western Region
- 'Ecological requirements' model performs well in the Okanagan-Boundary
- GIS forest cover data may be very useful in the East Kootenay

Future Directions

- Further tweaking after input from today
- Creation of 'supermodel' from best components of all models considered
- Some discussion about the use of AICc: should we be selecting for models that have lowest false negative rate?

