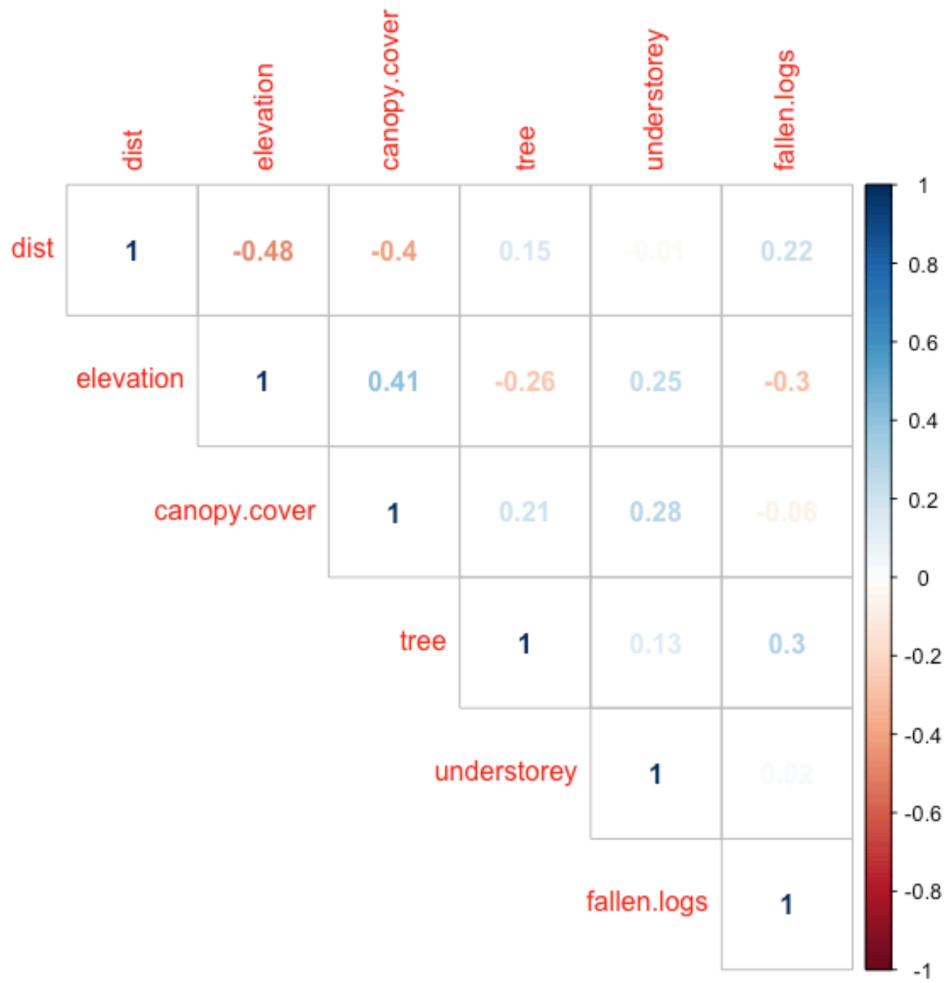
Supplementary Material

(Supplementary figures, tables and codes as per order mentioned in the manuscript)

Supplementary Code 1: Codes for pair-wise correlation between habitat covariates

```
#loading corrplot package

library(corrplot)

#setting up directory

setwd("/Users/multiseason occupancy manuscript/datasheet")

dir()

#reading covariate file

a=read.csv("covariate.csv")

#running the pair-wise correlation test

m=cor(a)

#checking correlation plot

corrplot(m, type = "upper", method = "number")
```

Supplementary Figure 1: Pair-wise Pearson's correlation plot of categorical habitat covariates collected for the study.



Note: No correlation detected as all pairwise values were lower than 0.7

Supplementary Code 2: Code for testing correlation for categorical and continuous variable using a standard regression model

```
#setting a working directory

setwd("/Users/multiseason occupancy manuscript/datasheet")

dir()

#reading the specific file

a=read.csv("stream correlation.csv")

a

#runnning a linear model

model=lm(a$distance.from.stream..m.~a$type)

#checking the summary

summary=summary(model)

print(summary)

#R squared

rsq=summary$r.squared

print(rsq)

#square root of R squared

print(sqrt(rsq))
```

Output: R^2 value = 0.90

Square root of R^2 = 0.94 (> 0.7)

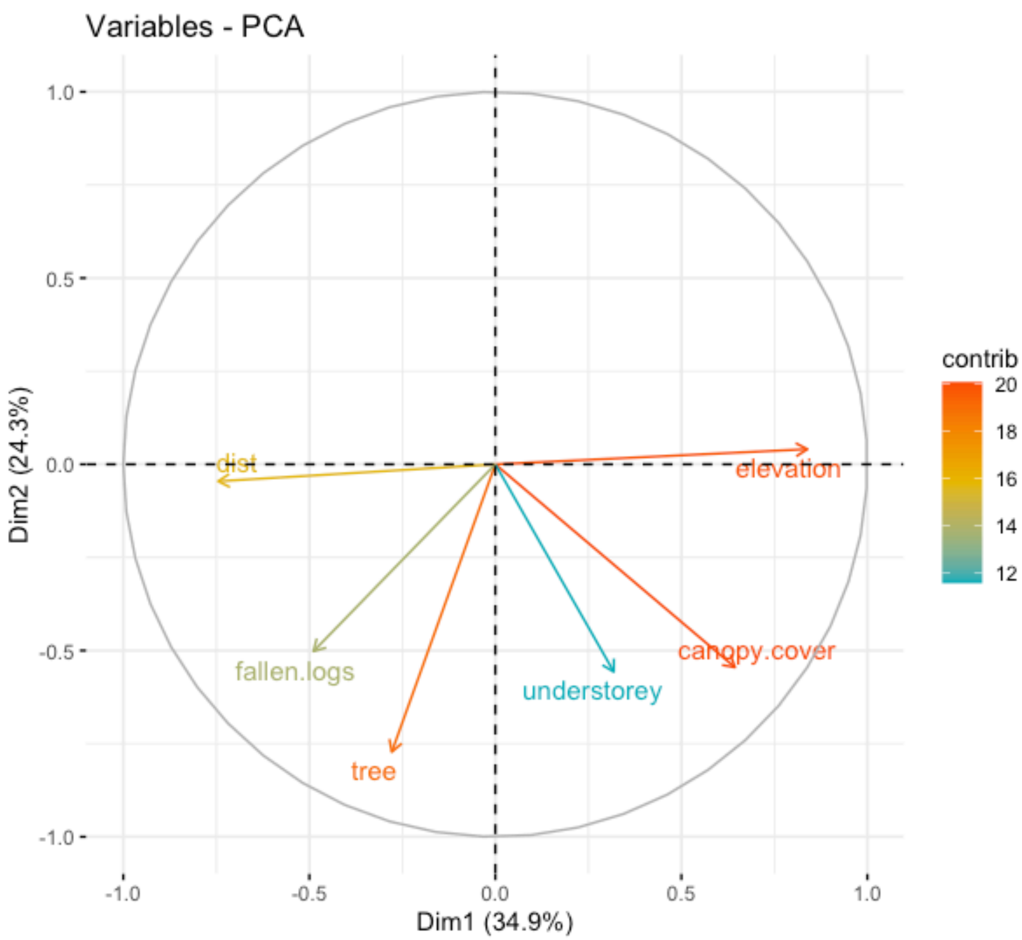
Note: Significant correlation between stream type and distance from stream edge detected, hence stream type was removed from further analysis/ occupancy models.

Supplementary Code 3: Code for testing multi-collinearity among habitat covariates

```
#loading factoextra package

library(factoextra)

setwd("/Users/multiseason occupancy manuscript/datasheet")

dir()

a=read.csv("covariates.csv")

#computing PCA

res.pca=prcomp(a, scale = TRUE)

#visualizing scree plot

fviz_eig(res.pca)

#visualizing individual sites on PCA plot

fviz_pca_ind(res.pca,

             col.ind = "cos2", # Color by the quality of representation

             gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"),

             repel = TRUE     # Avoid text overlapping

)

#visualizing contrbution of all covariates

fviz_pca_var(res.pca,

            col.var = "contrib", # Color by contributions to the PC

            gradient.cols = c("#00AFBB", "#E7B800", "#FC4E07"),

            repel = TRUE     # Avoid text overlapping
```

```
)

#estimating eigen vales

eig.val = get_eigenvalue(res.pca)

eig.val

#getting results for variables

res.var=get_pca_var(res.pca)

res.var

#checking for contribution of individual covariates

co=res.var$contrib

co

#exporting results in csv

write.csv(co, file = "co.csv")

#checking for coordinates of individual covariates

res.var$coord

#checking for quality of representation of individual covariates

res.var$cos2
```

Supplementary Figure 2: Test of multi-collinearity among all covariates using Principal Component Analysis (PCA). Figure shows individual contribution of all covariates in a 2-dimensional space.



Note: Elevation, canopy cover and number of trees were highly contributing covariates in our dataset. Hence only these three were selected to run as covariates in multi-season occupancy models for occupancy (ψ), colonization (γ) and epsilon (ε) probabilities. Low contributing variables, i.e., number of fallen logs, distance from stream and understory were not considered in the occupancy models. Distance from stream was still used as detection probability covariate as we expected it as an important variable for species detection in riparian forests.

Supplementary Table 1: Contribution of all covariates in all 6 dimensions

Covariates	Dim.1	Dim.2	Dim.3	Dim.4	Dim.5	Dim.6
Distance from stream	26.54	0.14	23.18	3.88	46.12	0.13
Elevation	33.64	0.11	1.65	4.66	14.26	45.67
Canopy cover	19.84	20.36	6.30	1.93	22.92	28.64
Number of trees	3.71	40.86	7.03	22.34	2.45	23.61
Understory	4.85	21.26	57.94	0.79	13.35	1.82
Number of fallen logs	11.43	17.26	3.90	66.39	0.90	0.12

Supplementary Table 2: Global occupancy models for all five species. [Codes used: AIC: Akaike Information Criteria; QAIC: quasi Akaike Information Criteria; ΔAIC: AIC difference between candidate models with AIC; ΔQAIC: difference between candidate models with QAIC; w: AIC weight of each candidate model; k: number of parameters in each candidate model; $\hat{c}$: overdispersion parameter; p: significance value]. [Covariate codes: ele: elevation; canopy: canopy cover (%), dist.: distance from stream edge; tree: number of trees]

Species	Model	QAIC/ AIC	ΔQAIC/ ΔAIC	w	k	$\hat{c}$	p
Gaur	ψ (ele+canopy+tree), γ (ele+canopy+tree), ε (ele+canopy+tree), p (season)	480.56	33.65	0	16	2.83	0.08
Sambar	ψ (ele+canopy+tree), γ (ele+canopy+tree), ε (ele+canopy+tree), p (season)	22611.98	21898.97	0.00	16	2.05	0.07
Barking deer	ψ (ele+canopy+tree), γ (ele+canopy+tree), ε (ele+canopy+tree), p (dist)	821.62	0.6	0.28	14	0.03	0.91
Porcupine	ψ (ele+canopy+tree), γ (ele+canopy+tree), ε (ele+canopy+tree), p (season+dist)	1392.82	5.4	0.02	17	0.85	0.41
Wild pig	ψ (ele+canopy+tree), γ (ele+canopy+tree), ε (ele+canopy+tree), p (dist + season)	1527.36	6.02	0.05	17	0.88	0.39

Supplementary Table 3: Candidate models for detection probability (p) of species. [Codes used: AIC: Akaike Information Criteria; QAIC: quasi Akaike Information Criteria; ΔAIC: AIC difference between candidate models with AIC; ΔQAIC: difference between candidate models with QAIC; w: AIC weight of each candidate model; k: number of parameters in each candidate model]. [Covariate codes: distance from stream edge; season: seasonal affect]

Species	Model	QAIC/ AIC	ΔQAIC/ ΔAIC	w	k
Gaur	p (season)	446.91	0	0.33	7
	p (.)	447.07	0.16	0.30	10
	p (dist)	448.16	1.26	0.17	5
	p (season+dist)	448.58	1.67	0.14	8
Sambar	p (season)	713.00	0.00	0.58	7
	p (dist+season)	714.74	1.73	0.24	8
	p (.)	716.17	3.16	0.12	4
	p (dist)	717.80	4.79	0.05	5
Barking deer	p (dist)	821.02	0	0.38	8
	p (dist+season)	825.72	4.7	0.04	8
	p (.)	828.89	7.87	0.01	4
	p (season)	829.54	8.52	0.01	7

Porcupine	p (season+dist)	1387.42	0	0.35	8
	p (season)	1388.9	1.48	0.17	7
	p(.)	1392.56	5.14	0.03	4
	p (dist)	1393.51	6.09	0.02	5
Wild pig	p (dist + season)	1521.34	0	0.93	11
	p (dist)	1534.48	13.14	0.00	5
	p (season)	1536.34	15	0.00	7
	p (.)	1538.92	17.58	0.00	4

Supplementary Table 4: Candidate models for occupancy (psi)

Species	Model	QAIC/ AIC	ΔQAIC/ ΔAIC	w	k
Gaur	ψ (.)	446.91	0	0.33	7
	ψ (tree)	448.69	2.78	0.05	5
	ψ (canopy)	449.89	2.99	0.03	5
	ψ (ele)	449.89	2.99	0.03	5
	ψ (ele+tree)	451.89	4.98	0.01	6
	ψ (canopy+tree)	451.89	4.98	0.01	6
	ψ (ele+canopy)	451.89	4.98	0.01	6
	ψ (ele+canopy+tree)	454.28	7.37	0.00	10
Sambar	ψ (.)	713.00	0.00	0.58	7
	ψ (tree)	717.75	4.75	0.04	5
	ψ (canopy)	717.82	4.82	0.04	5
	ψ (ele)	718.14	5.14	0.03	5
	ψ (canopy+tree)	719.09	6.09	0.05	6
	ψ (ele+canopy)	719.55	6.55	0.05	6

	ψ (ele+tree)	719.64	6.64	0.05	6
	ψ (ele+canopy+tree)	22602.99	21889.99	0.00	10
Barking deer	ψ (ele+canopy+tree)	821.02	0	0.38	8
	ψ (.)	824.6	3.58	0.06	5
	ψ (ele+canopy)	824.75	3.73	0.0483	6
	ψ (ele)	825.88	4.86	0.03	5
	ψ (ele+tree)	827.34	6.32	0.0132	6
	ψ (canopy)	830.58	9.56	0.00	5
	ψ (tree)	830.86	9.84	0.00	5
	ψ (canopy+tree)	832.48	11.46	0.001	6
Porcupine	ψ (.)	1387.42	0	0.35	8
	ψ (ele+canopy+tree)	1389.32	1.9	0.14	11
	ψ (tree)	1391.29	3.87	0.04	5
	ψ (ele+tree)	1392.98	5.56	0.0163	6
	ψ (canopy+tree)	1393.28	5.86	0.014	6
	ψ(ele)	1393.62	6.2	0.01	5
	ψ(canopy)	1394.14	6.72	0.01	5

	ψ (ele+canopy)	1394.48	7.06	0.0077	6
Wild pig	ψ (.)	1521.34	0	0.93	11
	ψ (ele+canopy+tree)	1527.36	6.02	0.05	17
	ψ (canopy)	1549.16	27.82	0	5
	ψ (tree)	1549.16	27.82	0	5
	ψ (canopy+tree)	1551.16	29.82	0	6
	ψ (ele)	1551.67	30.33	0	5
	ψ (ele+tree)	1553.67	32.33	0	6
	ψ (ele+canopy)	1553.67	32.33	0	6

Supplementary Table 5: Candidate models for colonization (gamma)

Species	Model	QAIC/ AIC	ΔQAIC/ ΔAIC	w	k
Gaur	γ (.)	446.91	0	0.33	7
	γ (ele)	447.59	2.68	0.10	5
	γ (tree)	448.89	2.98	0.05	5
	γ (canopy)	448.94	2.99	0.04	5
	γ (ele+canopy)	449.57	3.66	0.03	6
	γ (ele+tree)	449.59	3.68	0.03	6
	γ (canopy+tree)	450.70	3.79	0.02	6
	γ (ele+canopy+tree)	451.12	4.21	0.04	10
Sambar	γ (.)	713.00	0.00	0.58	7
	γ (tree)	718.16	5.16	0.03	5
	γ (ele)	727.63	14.63	0.00	5
	γ (canopy)	727.63	14.63	0.00	5
	γ (ele+canopy)	729.63	16.63	0.03	6
	γ (ele+tree)	729.63	16.63	0.03	6

	γ (canopy+tree)	729.63	16.63	0.03	6
	γ (ele+canopy+tree)	22603.42	21890.41	0.00	10
Barking deer	γ (.)	821.02	0	0.38	8
	γ (ele+canopy+tree)	821.62	0.6	0.28	14
	γ (canopy)	826.6	5.58	0.02	5
	γ (ele+canopy)	827.34	6.32	0.0132	6
	γ (tree)	829.78	8.76	0.00	5
	γ (ele)	830.77	9.75	0.00	5
	g γ (ele+tree)	831.77	10.75	0.00	6
	γ (canopy+tree)	832.48	11.46	0.00	6
Porcupine	γ (.)	1387.42	0	0.35	8
	γ (ele+canopy+tree)	1389.14	1.72	0.15	11
	γ (ele+canopy)	1391.69	4.27	0.031	6
	γ (tree)	1392.8	5.38	0.02	5
	γ (elevation)	1392.94	5.52	0.02	5
	γ (canopy)	1393.06	5.64	0.02	5

	γ (canopy+tree)	1393.79	6.37	0.0109	6
	γ (ele+tree)	1393.93	6.51	0.0101	6
Wild pig	γ (.)	1521.34	0	0.93	11
	γ (ele+canopy+tree)	1527.36	6.02	0.05	17
	γ (tree)	1540.21	18.87	0.0001	5
	γ (canopy)	1540.39	19.05	0.0001	5
	γ (ele)	1540.85	19.51	0.0001	5
	γ (canopy+tree)	1541.84	20.5	0	6
	γ (ele+canopy)	1542.03	20.69	0	6
	γ (ele+tree)	1542.21	20.87	0	6

Supplementary Table 6: Candidate models for extinction (epsilon)

Species	Model	QAIC/ AIC	ΔQAIC/ ΔAIC	w	k
Gaur	ε (.)	446.91	0	0.33	7
	ε (tree)	447.57	2.66	0.08	5
	ε (canopy)	448.18	3.27	0.06	5
	ε (ele)	448.60	3.69	0.05	5
	ε (canopy+tree)	448.42	3.51	0.05	6
	ε (ele+tree)	449.40	4.49	0.03	6
	ε (ele+canopy)	449.95	5.04	0.02	6
	ε (ele+canopy+tree)	461.40	14.48	0.001	10
Sambar	ε (.)	713.00	0.00	0.58	7
	ε (tree)	716.51	3.51	0.08	5
	ε (canopy)	725.24	12.24	0.00	5
	ε (ele)	725.76	12.76	0.00	5
	ε (canopy+tree)	727.24	14.24	0.03	6
	ε (ele+tree)	727.76	14.76	0.03	6

	ε (ele+canopy)	727.76	14.76	0.03	6
	ε (ele+canopy+tree)	22605.44	21892.43	0.00	10
Barking deer	ε (.)	821.02	0	0.38	8
	ε (ele+canopy+tree)	821.62	0.6	0.28	14
	ε (ele+tree)	826.06	5.04	0.0251	6
	ε (canopy+tree)	828.26	7.24	0.0084	6
	ε (tree)	828.61	7.59	0.01	5
	ε (canopy)	828.96	7.94	0.01	5
	ε (ele+canopy)	830.41	9.39	0.0029	6
	ε (ele)	938.29	117.27	0	5
Porcupine	ε (.)	1387.42	0	0.35	8
	ε (ele+canopy+tree)	1389.48	2.06	0.13	11
	ε (ele)	1393.14	5.72	0.02	5
	ε (ele+tree)	1393.34	5.92	0.0136	6
	ε (tree)	1393.78	6.36	0.01	5
	ε (canopy)	1394.55	7.13	0.01	5
	ε (ele+canopy)	1394.98	7.56	0.006	6

	ε (canopy+tree)	1395.77	8.35	0.004	6
Wild pig	ε (ele+canopy+tree)	1521.34	0	0.93	11
	ε (tree)	1529.08	7.74	0.0184	5
	ε (canopy+tree)	1529.2	7.86	0.0174	6
	ε (.)	1529.68	8.34	0.01	8
	ε (ele+tree)	1531.07	9.73	0.0068	6
	ε (ele+canopy)	1534.72	13.38	0.0011	6
	ε (canopy)	1536.22	14.88	0.0005	5
	ε (ele)	1539.69	18.35	0.0001	5

Supplementary Table 7: Body weight range of mammal species in our dataset

Species	Scientific name	Body weight range (kg)
Gaur	*Bos gaurus*	500–1500
Sambar	*Rusa unicolor*	100–350
Wild pig	*Sus scrofa*	75–100
Barking deer	*Muntiacus muntjac*	20–30
Porcupine	*Hystrix indica*	5–16