10 Supplementary Materials

10.1 Simulation Inputs

10.1.1 Palette

Figure S1. Universal colour key for behavioural states 0 - resting, 1 - foraging, 2 - exploring; and example species. Name assigned to the colour in bold, and the hex code in italics below.

10.1.2 Vulture Inputs

Values input to generate more vulture-like movement patterns.

```
VULTURE_shelterLocs <- data.frame(
  "x" = c(1024, 1005, 1115),
  "y" = c(1193, 1070, 882))

VULTURE_shelterSize <- 5


VULTURE_k_step <- c(2, 2.2*60, 1.5*60)
VULTURE_s_step <- c(40, 1.2, 1)
VULTURE_mu_angle <- c(0, 0, 0)
VULTURE_k_angle <- c(0.6, 0.99, 0.6)

VULTURE_destinationRange <- c(50, 120)
VULTURE_destinationDirection <- c(0, 0.01)
VULTURE_destinationTransformation <- 2
VULTURE_destinationModifier <- 2

VULTURE_rescale <- 20


VULTURE_rest_Cycle <- c(0.1, 0, 24, 24)

# additional cycle
c0 <- c(0.025, 0, 24* (365/2), 24* 365) # seasonal

VULTURE_additional_Cycles <- rbind(c0)

VULTURE_behaveMatrix <- Default_behaveMatrix
VULTURE_behaveMatrix[2,3] <- 0.0002
VULTURE_behaveMatrix[3,2] <- 0.000015
```

```
VULTURE_movementMatrix <- landscapeLayersList$movement
VULTURE_movementMatrix[] <- 1


VULTURE_forageMatrix <- landscapeLayersList$forage
VULTURE_forageMatrix[1:950,1:2000] <- VULTURE_forageMatrix[1:950,1:2000] - 0.6
VULTURE_forageMatrix[VULTURE_forageMatrix[] < 0] <- 0
```

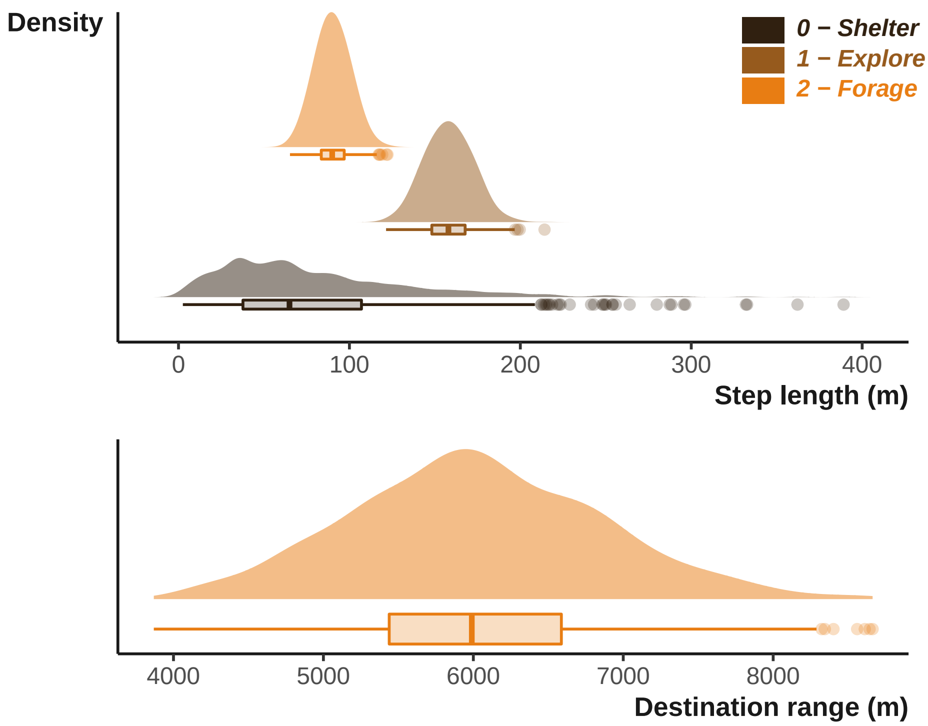

Figure S2. The distribution of step lengths, and corresponding box plot for the vulture example. The lower plot shows the distribution used to generate potential foraging desintations.

10.1.3 King Cobra Inputs

Values input to generate more king cobra-like movement patterns.

```
KINGCOBRA_k_step <- c(30, 40, 20)
KINGCOBRA_s_step <- c(0.75, 1.2, 1.75)
KINGCOBRA_mu_angle <- c(0, 0, 0)
KINGCOBRA_k_angle <- c(0.6, 0.99, 0.6)

KINGCOBRA_destinationRange <- c(50, 10)
KINGCOBRA_destinationDirection <- c(0, 0.01)
KINGCOBRA_destinationTransformation <- 2
KINGCOBRA_destinationModifier <- 1.5

KINGCOBRA_rescale <- 10


KINGCOBRA_rest_Cycle <- c(0.14, 0, 24, 24)

# multiple additional cycle
```

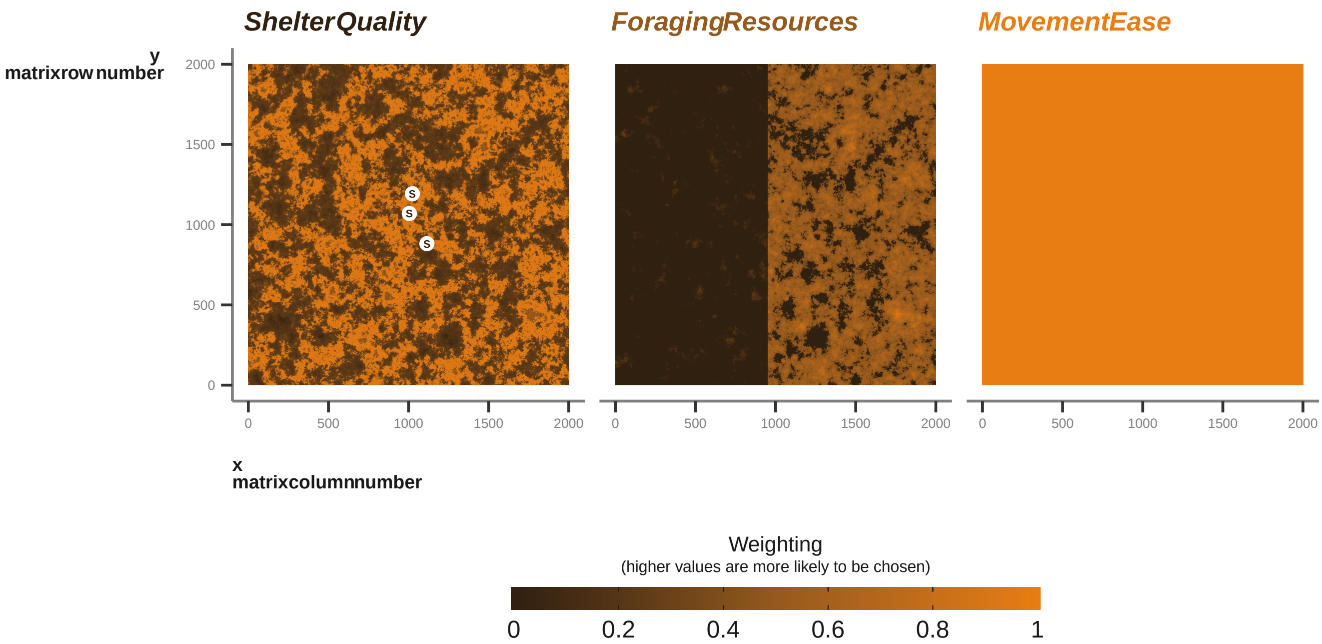

Figure S3. The three resulting landscape layers to be fed into the simulation for the vulture example: shelter quality, foraging resources, movement ease.

```
c0 <- c(0.12, 0, 24, 24*4) # digest
c1 <- c(0.05, 0, 24 * (365/2), 24* 365 ) # seasonal

KINGCOBRA_additional_Cycles <- rbind(c0, c1)

KINGCOBRA_behaveMatrix <- Default_behaveMatrix
KINGCOBRA_behaveMatrix[1,1] <- 0.95
KINGCOBRA_behaveMatrix[1,2] <- 0.005
KINGCOBRA_behaveMatrix[3,1] <- 0.00025
KINGCOBRA_behaveMatrix[3,2] <- 0.000001
KINGCOBRA_behaveMatrix[3,3] <- 0.999


KINGCOBRA_shelteringMatrix <- landscapeLayersList$shelter
KINGCOBRA_forageMatrix <- landscapeLayersList$forage
KINGCOBRA_movementMatrix <- landscapeLayersList$movement

# two strong intersections hampering movement
roadMin_x <- 1360
roadMax_x <- roadMin_x + 40
roadMin_y <- 660
roadMax_y <- roadMin_y + 40

KINGCOBRA_shelteringMatrix[roadMin_x:roadMax_x,1:2000] <-
  KINGCOBRA_shelteringMatrix[roadMin_x:roadMax_x,1:2000] - 90
KINGCOBRA_shelteringMatrix[1:2000,roadMin_y:roadMax_y] <-
  KINGCOBRA_shelteringMatrix[1:2000,roadMin_y:roadMax_y] - 90
KINGCOBRA_shelteringMatrix[!KINGCOBRA_shelteringMatrix >= -99.9] <- -99

KINGCOBRA_forageMatrix[roadMin_x:roadMax_x,1:2000] <-
  KINGCOBRA_forageMatrix[roadMin_x:roadMax_x,1:2000] - 90
```

```
KINGCOBRA_forageMatrix[1:2000,roadMin_y:roadMax_y] <-
  KINGCOBRA_forageMatrix[1:2000,roadMin_y:roadMax_y] - 90
KINGCOBRA_forageMatrix[!KINGCOBRA_forageMatrix >= -99.9] <- -99

KINGCOBRA_movementMatrix[roadMin_x:roadMax_x,1:2000] <-
  KINGCOBRA_movementMatrix[roadMin_x:roadMax_x,1:2000] - 90
KINGCOBRA_movementMatrix[1:2000,roadMin_y:roadMax_y] <-
  KINGCOBRA_movementMatrix[1:2000,roadMin_y:roadMax_y] - 90
KINGCOBRA_movementMatrix[!KINGCOBRA_movementMatrix >= -99.9] <- -99

KINGCOBRA_avoidLocs <- data.frame(
  "x" = c(552, 1232, 1587),
  "y" = c(789, 975, 1356))

KINGCOBRA_avoidTransformation <- 2
KINGCOBRA_avoidModifier <- 1

# roadMin_x/2000
# roadMax_y/2000

sampledShelters <- sampleRandom(raster(landscapeLayersList$shelter), 12,
                                ext = extent(0.35, 0.65, 0.42, 0.65),
                                rowcol = TRUE)

KINGCOBRA_shelterLocs <- data.frame(
  "x" = sampledShelters[,2],
  "y" = sampledShelters[,1])

KINGCOBRA_shelterSize <- 10
```

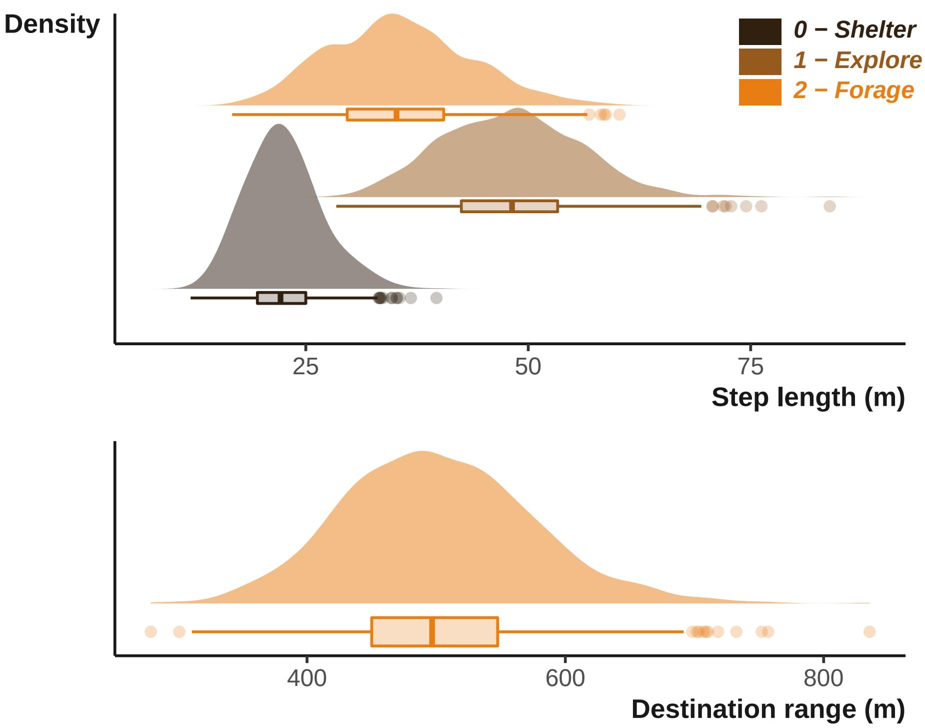

Figure S4. The distribution of step lengths, and corresponding box plot for the king cobra example. The lower plot shows the distribution used to generate potential foraging desintations.

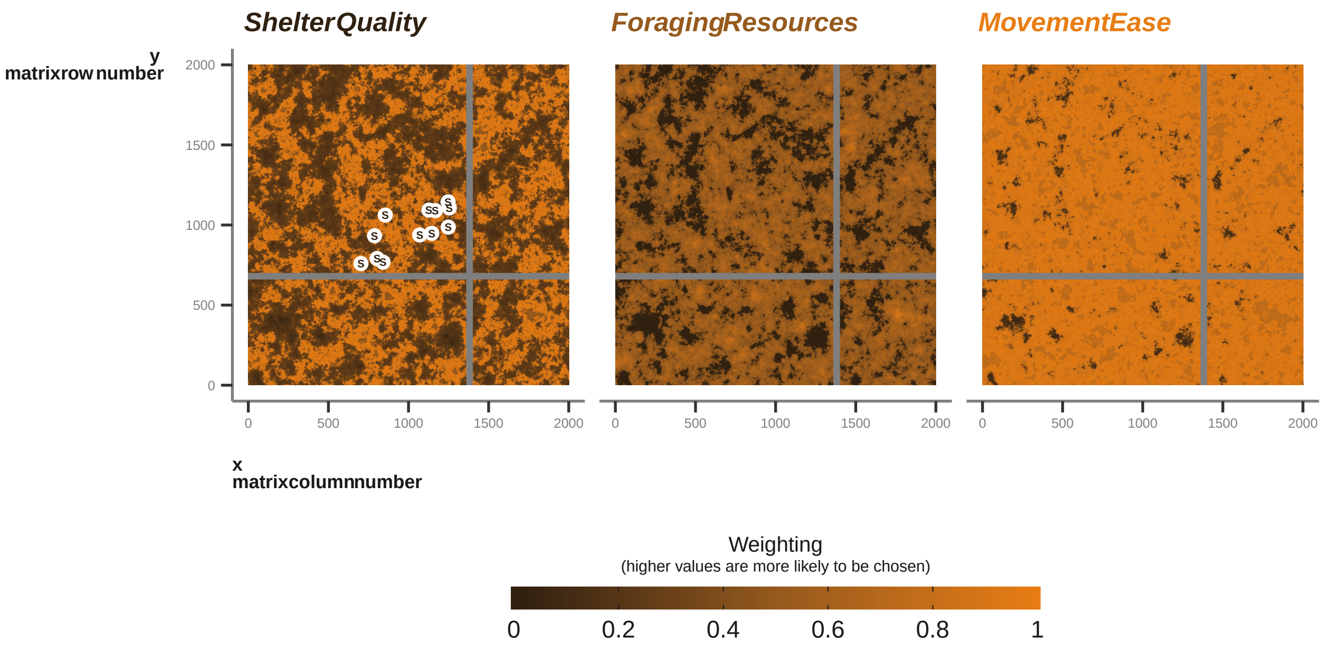

Figure S5. The three resulting landscape layers to be fed into the simulation for the king cobra example: shelter quality, foraging resources, movement ease. Movement ease is blocked by bars of -99 weighting.

10.2 Simulation Outputs

Figures S2 and S4 describe the inputs for the vulture and king cobra example respectively, and are comparable to figures S6 and S7. Figures 5, S6, and S7 also provide information on the rates of stationary behaviour, defined in the plot as step lengths less than the shelter site size. The king cobra example in particular highlights the prolonged near weekly resting periods.

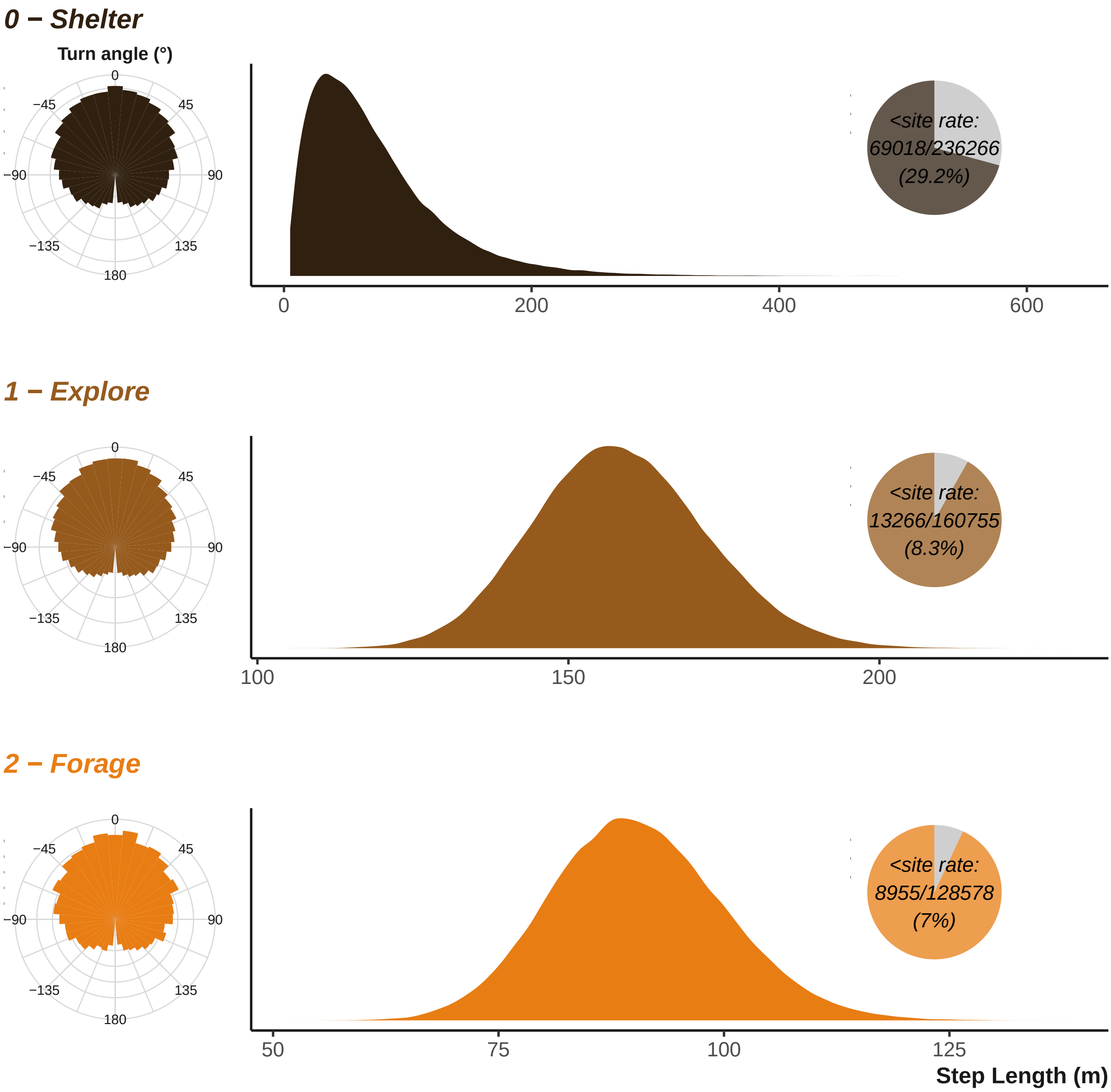

Figure S6. The vulture example's observed turn angles and step lengths resulting from the simulation. Step lengths are scaled back to the input units. Inset pie chart show the number of step lengths that were below the shelter site size; the sub-shelter site step lengths are excluded from the density plot. Note that x axis is not consistent between the three plots.

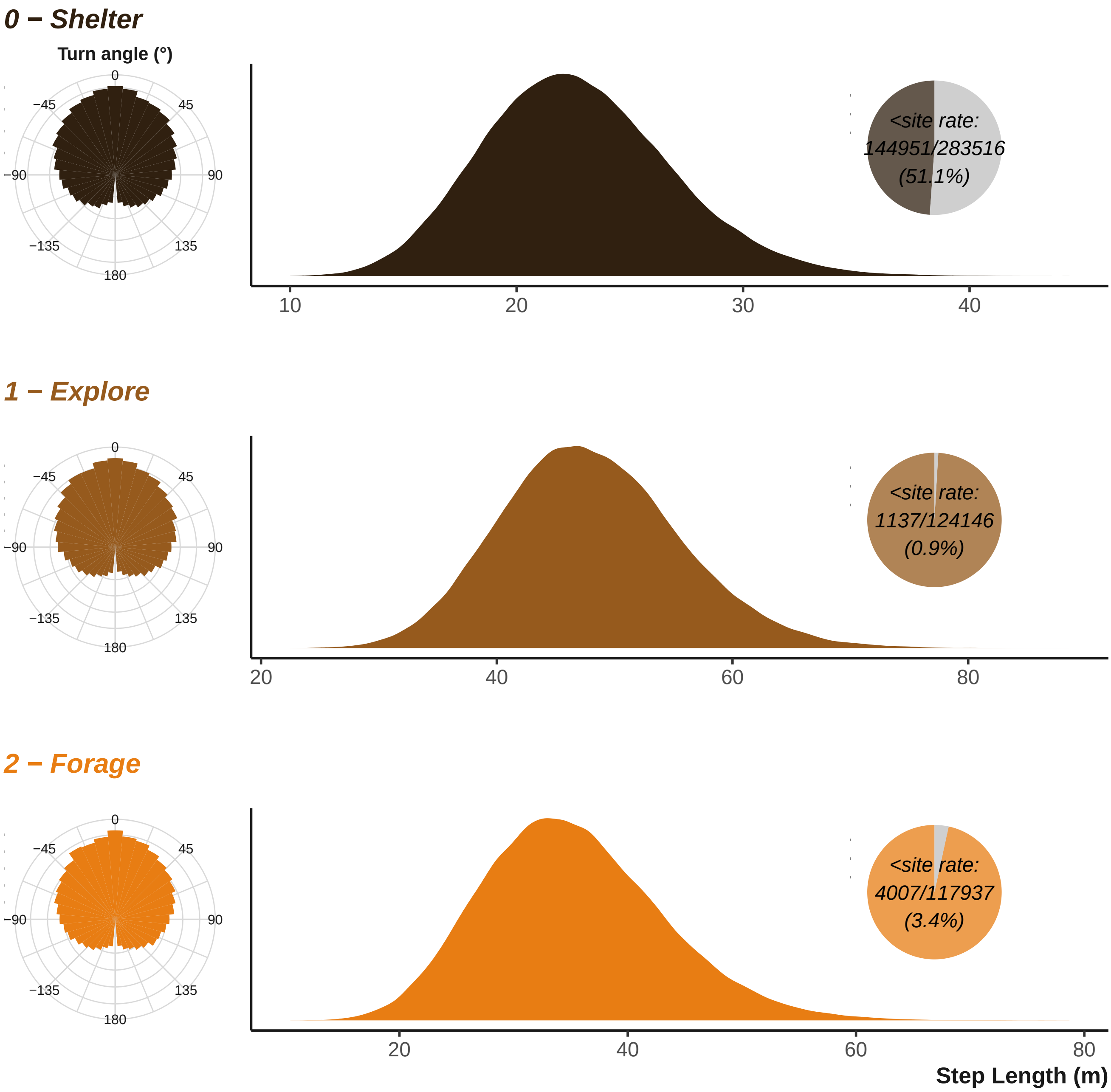

Figure S7. The king cobra example's observed turn angles and step lengths resulting from the simulation. Step lengths are scaled back to the input units. Inset pie chart show the number of step lengths that were below the shelter site size; the sub-shelter site step lengths are excluded from the density plot. Note that x axis is not consistent between the three plots.