Summary of camera trap data, SAGW, 2022

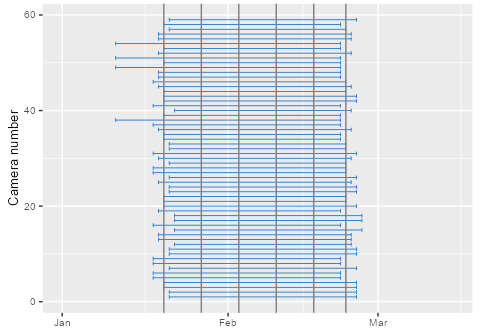
2023-06-20

# Effort

A total of 59 cameras were deployed in SAGW between 11 January and 22 January and were retrieved between 22 February and 26 February, 2022. We delineated a total of 5 sampling occasions that were each 7 days long.

**Table** **.** Start and end dates for each sampling occasion in the Tucson Mountain District of Saguaro National Park, 2022.

| **Occasion** | **Start** | **End** |
| --- | --- | --- |
| 1 | 2022-01-20 | 2022-01-26 |
| 2 | 2022-01-27 | 2022-02-02 |
| 3 | 2022-02-03 | 2022-02-09 |
| 4 | 2022-02-10 | 2022-02-16 |
| 5 | 2022-02-17 | 2022-02-23 |



**Figure** **.** Camera deployments and sampling occasions in the Tucson Mountain District of Saguaro National Park, 2022. Each horizontal blue line represents the period over which a camera was operational, from the date the camera was deployed through the date the camera was retrieved. Gray vertical lines denote the beginning and end of the 5 consecutive sampling occasions.

# Detections

We detected a total of 11 mammal species on the 59 cameras during the 5 sampling occasions.

**Table** **.** Mammal species detected in the Tucson Mountain District of Saguaro National Park between 20 January and 23 February, 2022. No. photos is the total number of photographs obtained (multiple photos may occur at the same camera location in the same day). No. detections is the number of detections that could be used in an occupancy modeling framework (maximum of one photographic detection per camera location per sampling period). No. locations is the unique number of camera locations where the species was photographed.

| **Common name** | **Scientific name** | **No. photos** | **No. detections** | **No. locations** |
| --- | --- | --- | --- | --- |
| Javelina | *Peccary tajacu* | 685 | 53 | 26 |
| Mule deer | *Odocoileus hemionus* | 548 | 68 | 36 |
| Black-tailed jackrabbit | *Lepus californicus* | 191 | 36 | 15 |
| Coyote | *Canis latrans* | 188 | 68 | 31 |
| Gray fox | *Urocyon cinereoargenteus* | 170 | 67 | 31 |
| Desert cottontail | *Sylvilagus audubonii* | 117 | 56 | 21 |
| Unknown jackrabbit | *Lepus sp.* | 113 | 31 | 12 |
| Bobcat | *Lynx rufus* | 48 | 23 | 15 |
| Feral dog | *Canis familiaris* | 9 | 3 | 2 |
| American badger | *Taxidea taxus* | 3 | 3 | 3 |
| Unknown skunk | *Mephitidae* | 1 | 1 | 1 |

# Modeling approach

## Occupancy models

For each species with a sufficient number of detections (here, 7 species), we used single-season occupancy models to estimate the probability of occurrence and the probability of detection given occurrence (MacKenzie et al.  2002). To estimate these parameters, we generated encounter histories for each camera location, where a “1” denotes that the species was detected at least once during a sampling occasion and a “0” indicates that the species was not detected. For example, an encounter history of “10011” would indicate that a species was photographed at least once during the first, fourth, and fifth sampling occasions and was not photographed during the second and third sampling occasions.

We used a Bayesian framework to estimate model parameters, as this made it easier to estimate derived parameters (e.g., proportion of area occupied across the entire park) with associated uncertainties and to incorporate random effects that can account for uncertainties beyond that explained by covariates in the model. We fit models in R using the spOccupancy package (Doser et al. 2022). For each model, we ran 3 Markov chains initiated at random values for 8000 iterations. We discarded the first 4000 iterations and retained 1 of every 8 iterations thereafter, using the remaining 1500 samples (across all the chains) to summarize the posterior distribution.

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|……………………………………… | 86% (unnamed-chunk-3) |  
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## Output for CALA

**Table** **.** Parameter estimates (on the logit scale) from a model for coyotes in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | 1.18 | 0.61 | 0.04, 2.42 | 1.01 | 1375 | 0.98 |
| Occurrence | elev\_z | -1.63 | 0.67 | -3.04, -0.45 | 1.01 | 1294 | 1.00 |
| Occurrence | vegclass2 | -2.08 | 0.99 | -4.03, -0.19 | 1.01 | 1379 | 0.98 |
| Occurrence | vegclass3 | -1.43 | 0.92 | -3.26, 0.34 | 1.01 | 1500 | 0.94 |
| Detection | (Intercept) | -0.38 | 0.17 | -0.73, -0.04 | 1.00 | 1500 | 0.99 |

## Output for LECA

**Table** **.** Parameter estimates (on the logit scale) from a model for black-tailed jackrabbits in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | -1.26 | 0.40 | -2.07, -0.52 | 1.00 | 1500 | 1.00 |
| Occurrence | slope\_z | -1.03 | 0.49 | -2.12, -0.15 | 1.00 | 1500 | 0.99 |
| Occurrence | wash\_z | 0.77 | 0.44 | 0.04, 1.74 | 1.01 | 1374 | 0.98 |
| Detection | (Intercept) | -0.23 | 0.28 | -0.76, 0.28 | 1.00 | 1470 | 0.80 |

## Output for LYRU

**Table** **.** Parameter estimates (on the logit scale) from a model for bobcats in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | -0.36 | 0.65 | -1.38, 1.26 | 1.01 | 532 | 0.77 |
| Occurrence | roadbound\_z | -0.96 | 0.62 | -2.47, 0.09 | 1.00 | 782 | 0.96 |
| Detection | (Intercept) | -1.44 | 0.38 | -2.19, -0.74 | 1.00 | 624 | 1.00 |

## Output for ODHE

**Table** **.** Parameter estimates (on the logit scale) from a model for mule deers in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | 1.10 | 0.53 | 0.28, 2.34 | 1.00 | 1170 | 1.00 |
| Occurrence | elev\_z | -0.78 | 0.45 | -1.72, 0.07 | 1.00 | 1655 | 0.97 |
| Detection | (Intercept) | -0.75 | 0.19 | -1.11, -0.38 | 1.01 | 1359 | 1.00 |

## Output for PETA

**Table** **.** Parameter estimates (on the logit scale) from a model for javelinas in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | 0.10 | 0.40 | -0.57, 0.96 | 1.02 | 1240 | 0.56 |
| Occurrence | elev\_z | 0.93 | 0.45 | 0.22, 1.95 | 1.00 | 1331 | 0.99 |
| Detection | (Intercept) | -0.59 | 0.23 | -1.04, -0.17 | 1.02 | 1256 | 1.00 |

## Output for SYAU

**Table** **.** Parameter estimates (on the logit scale) from a model for desert cottontails in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | -0.57 | 0.30 | -1.16, 0 | 1.00 | 1500 | 0.97 |
| Occurrence | pois\_z | 0.76 | 0.33 | 0.17, 1.46 | 1.00 | 1349 | 0.99 |
| Detection | (Intercept) | -0.37 | 0.29 | -0.96, 0.17 | 1.00 | 1500 | 0.91 |
| Detection | deploy\_exp | 0.51 | 0.22 | 0.11, 0.98 | 1.00 | 1346 | 0.99 |

## Output for URCI

**Table** **.** Parameter estimates (on the logit scale) from a model for gray foxs in the Tucson Mountain District of Saguaro National Park, 2022. SD = Standard deviation; 95% CI = 95% credible interval. Rhat values between 1 and 1.05 indicate that the model has converged. ESS = effective sample size; values > 400 are usually sufficient. f values indicate the proportion of posterior samples that are < 0 if the mean is < 0 or the proportion of samples that are > 0 if the mean is > 0. All continuous covariates were standardized by their respective means and standard deviations prior to analysis.

| **Parameter** | **Covariate** | **Mean** | **SD** | **95% CI** | **Rhat** | **ESS** | **f** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Occurrence | (Intercept) | 0.59 | 0.43 | -0.14, 1.59 | 1.01 | 978 | 0.95 |
| Occurrence | elev\_z | 1.05 | 0.50 | 0.22, 2.21 | 1.02 | 941 | 1.00 |
| Detection | (Intercept) | -0.91 | 0.27 | -1.43, -0.37 | 1.00 | 1459 | 1.00 |
| Detection | day\_z | -0.23 | 0.16 | -0.53, 0.08 | 1.00 | 1500 | 0.92 |
| Detection | deploy\_exp | 0.40 | 0.18 | 0.07, 0.76 | 1.00 | 1575 | 0.99 |