**APPENDIX B – Supporting tables, figures, and methods**



**Figure B.1: Sampling intensity based on Kernel density estimations. This layer is additionally used as bias-file for the full-background modelling analyses to limit background point selection to meaningful areas for wild banana species.**

**Table B.1: List of variables included in the study.**

|  |  |
| --- | --- |
| BIO1 | Annual Mean Temperature |
| BIO2 | Mean Diurnal Range (Mean of monthly (max temp - min temp)) |
| BIO3 | Isothermality (BIO2/BIO7)\* 100 |
| BIO4 | Temperature Seasonality (standard deviation \*100) |
| BIO5 | Max Temperature of Warmest Month |
| BIO6 | Min Temperature of Coldest Month |
| BIO7 | Temperature Annual Range (BIO5-BIO6) |
| BIO8 | Mean Temperature of Wettest Quarter |
| BIO9 | Mean Temperature of Driest Quarter |
| BIO10 | Mean Temperature of Warmest Quarter |
| BIO11 | Mean Temperature of Coldest Quarter |
| BIO12 | Annual Precipitation |
| BIO13 | Precipitation of Wettest Month |
| BIO14 | Precipitation of Driest Month |
| BIO15 | Precipitation Seasonality (Coefficient of Variation) |
| BIO16 | Precipitation of Wettest Quarter |
| BIO17 | Precipitation of Driest Quarter |
| BIO18 | Precipitation of Warmest Quarter |
| BIO19 | Precipitation of Coldest Quarter |
| Elevation | Elevation above sea level |
| Slope |  |
| Aspect | Slope direction |
| MGVF | Maximum Green Vegetation Fraction |

***Table B.2: Determination of conservation status for wild* Musa *species.*** ***SRSex; Sampling representativeness score* ex-situ*, GRSex; Geographical representativeness score ex situ, ERSex; Ecological representativeness score ex situ******, FCSex; Final conservation score ex situ, SRSin: Sampling representativeness score* in-situ, *GRSin; Geographical representativeness score in situ, ERSin; Ecological representativeness score in situ, FCSin; Final conservation score in situ; FCSc; combined final conservation score.***

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Taxon | Total records with coordinates | Total ex situ germplasm (G) records with coordinates | Total reference (H) records with coordinates | SRSex | GRSex | ERSex | FCSex | SRSin | GRSin | ERSin | FCSin | FCSc |
| Musa acuminata *subsp*. acuminata | 46.00 | 13.00 | 33.00 | 28.26 | 16.43 | 27.27 | 23.99 | 17.39 | 14.69 | 90.91 | 41.00 | 32.49 |
| Musa acuminata *subsp*. burmannica | 25.00 | 1.00 | 24.00 | 4.00 | 11.97 | 100.00 | 38.66 | 32.00 | 14.92 | 75.00 | 40.64 | 39.65 |
| Musa acuminata *subsp*. errans | 11.00 |  | 11.00 | 0.00 | 0.00 | 0.00 | 0.00 | 36.36 | 18.01 | 100.00 | 51.46 | 25.73 |
| Musa acuminata *subsp*. halabanensis | 8.00 |  | 8.00 | 0.00 | 0.00 | 0.00 | 0.00 | 37.50 | 11.84 | 100.00 | 49.78 | 24.89 |
| Musa acuminata *subsp*. malaccensis | 52.00 | 11.00 | 41.00 | 21.15 | 30.85 | 33.33 | 28.45 | 17.31 | 17.73 | 77.78 | 37.60 | 33.03 |
| Musa acuminata *subsp*. microcarpa | 51.00 | 4.00 | 47.00 | 7.84 | 17.95 | 22.22 | 16.01 | 27.45 | 13.16 | 88.89 | 43.17 | 29.59 |
| Musa acuminata *subsp*. siamea | 12.00 | 1.00 | 11.00 | 8.33 | 12.43 | 60.00 | 26.92 | 41.67 | 30.69 | 100.00 | 57.45 | 42.19 |
| Musa acuminata *subsp*. truncata | 25.00 | 8.00 | 17.00 | 32.00 | 47.62 | 100.00 | 59.87 | 48.00 | 21.56 | 100.00 | 56.52 | 58.20 |
| Musa acuminata *var*. sumatrana | 14.00 |  | 14.00 | 0.00 | 0.00 | 0.00 | 0.00 | 28.57 | 13.78 | 100.00 | 47.45 | 23.73 |
| Musa acuminata *var*. tomentosa | 14.00 |  | 14.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.29 | 11.01 | 100.00 | 41.77 | 20.88 |
| Musa aurantiaca | 20.00 |  | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.00 | 16.57 | 75.00 | 42.19 | 21.10 |
| Musa bakeri | 30.00 | 25.00 | 5.00 | 83.33 | 100.00 | 100.00 | 94.44 | 33.33 | 6.67 | 100.00 | 46.67 | 70.56 |
| Musa balbisiana *var*. balbisiana | 58.00 | 17.00 | 41.00 | 29.31 | 13.66 | 54.55 | 32.50 | 13.79 | 9.73 | 81.82 | 35.11 | 33.81 |
| Musa banksii | 164.00 |  | 164.00 | 0.00 | 0.00 | 0.00 | 0.00 | 37.80 | 9.48 | 88.89 | 45.39 | 22.70 |
| Musa basjoo | 15.00 |  | 15.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.10 | 66.67 | 23.92 | 11.96 |
| Musa beccarii | 24.00 |  | 24.00 | 0.00 | 0.00 | 0.00 | 0.00 | 37.50 | 15.32 | 100.00 | 50.94 | 25.47 |
| Musa boman | 8.00 |  | 8.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 50.00 | 16.76 | 8.38 |
| Musa borneensis | 49.00 | 4.00 | 45.00 | 8.16 | 31.58 | 100.00 | 46.58 | 16.33 | 12.59 | 100.00 | 42.97 | 44.78 |
| Musa bukensis | 15.00 |  | 15.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Musa campestris | 48.00 |  | 48.00 | 0.00 | 0.00 | 0.00 | 0.00 | 22.92 | 16.20 | 100.00 | 46.37 | 23.19 |
| Musa cheesmanii | 26.00 |  | 26.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.69 | 12.71 | 100.00 | 40.13 | 20.07 |
| Musa coccinea | 7.00 | 1.00 | 6.00 | 14.29 | 4.76 | 60.00 | 26.35 | 42.86 | 11.09 | 80.00 | 44.65 | 35.50 |
| Musa exotica | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 80.00 | 11.24 | 100.00 | 63.75 | 31.87 |
| Musa flaviflora | 17.00 |  | 17.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.15 | 83.33 | 30.49 | 15.25 |
| Musa gracilis | 31.00 | 11.00 | 20.00 | 35.48 | 88.90 | 100.00 | 74.80 | 35.48 | 24.25 | 66.67 | 42.13 | 58.46 |
| Musa griersonii | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 25.00 | 24.14 | 100.00 | 49.71 | 24.86 |
| Musa hirta | 14.00 |  | 14.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.14 | 18.52 | 75.00 | 33.56 | 16.78 |
| Musa ingens | 14.00 |  | 14.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.36 | 75.00 | 25.45 | 12.73 |
| Musa itinerans | 157.00 | 38.00 | 119.00 | 24.20 | 14.81 | 35.29 | 24.77 | 28.66 | 10.78 | 88.24 | 42.56 | 33.66 |
| Musa jackeyi | 13.00 |  | 13.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 23.99 | 100.00 | 74.66 | 37.33 |
| Musa johnsii | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 40.00 | 37.76 | 100.00 | 59.25 | 29.63 |
| Musa kamengensis | 7.00 |  | 7.00 | 0.00 | 0.00 | 0.00 | 0.00 | 71.43 | 17.03 | 50.00 | 46.15 | 23.08 |
| Musa laterita | 33.00 |  | 33.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.06 | 7.03 | 75.00 | 29.36 | 14.68 |
| Musa lawitiensis | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.50 | 19.92 | 100.00 | 44.14 | 22.07 |
| Musa lolodensis | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.25 | 7.06 | 85.71 | 33.01 | 16.50 |
| Musa lutea | 10.00 |  | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.00 | 6.48 | 100.00 | 38.83 | 19.41 |
| Musa maclayi | 71.00 |  | 71.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.23 | 0.99 | 77.78 | 27.67 | 13.83 |
| Musa markkuana | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100.00 | 22.07 | 75.00 | 65.69 | 32.84 |
| Musa markkui | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 60.00 | 23.80 | 100.00 | 61.27 | 30.63 |
| Musa monticola | 13.00 |  | 13.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.38 | 13.93 | 100.00 | 43.11 | 21.55 |
| Musa nagensium | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 62.50 | 9.90 | 85.71 | 52.71 | 26.35 |
| Musa ornata | 20.00 |  | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 | 40.00 | 3.07 | 100.00 | 47.69 | 23.84 |
| Musa paracoccinea | 22.00 |  | 22.00 | 0.00 | 0.00 | 0.00 | 0.00 | 45.45 | 5.96 | 100.00 | 50.47 | 25.24 |
| Musa peekelii subsp. angustigemma | 21.00 |  | 21.00 | 0.00 | 0.00 | 0.00 | 0.00 | 9.52 | 1.28 | 42.86 | 17.89 | 8.94 |
| Musa peekelii *subsp*. peekelii | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 60.00 | 1.60 | 75.00 | 45.53 | 22.77 |
| Musa puspanjaliae | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.00 | 12.22 | 50.00 | 27.41 | 13.70 |
| Musa rosea | 6.00 |  | 6.00 | 0.00 | 0.00 | 0.00 | 0.00 | 33.33 | 26.47 | 100.00 | 53.27 | 26.63 |
| Musa rubra | 20.00 |  | 20.00 | 0.00 | 0.00 | 0.00 | 0.00 | 35.00 | 25.05 | 87.50 | 49.18 | 24.59 |
| Musa salaccensis | 19.00 |  | 19.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.53 | 16.52 | 100.00 | 42.35 | 21.18 |
| Musa sanguinea | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 6.25 | 15.71 | 100.00 | 40.65 | 20.33 |
| Musa schizocarpa | 78.00 |  | 78.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.56 | 6.23 | 72.73 | 27.17 | 13.59 |
| Musa sikkimensis | 13.00 |  | 13.00 | 0.00 | 0.00 | 0.00 | 0.00 | 53.85 | 12.05 | 100.00 | 55.30 | 27.65 |
| Musa splendida | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.00 | 4.38 | 50.00 | 24.79 | 12.40 |
| Musa textilis | 16.00 |  | 16.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.40 | 100.00 | 39.47 | 19.73 |
| Musa thomsonii | 6.00 |  | 6.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 14.99 | 100.00 | 38.33 | 19.17 |
| Musa tuberculata | 5.00 |  | 5.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 7.90 | 100.00 | 35.97 | 17.98 |
| Musa velutina | 19.00 |  | 19.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 12.53 | 100.00 | 37.51 | 18.76 |
| Musa violascens | 30.00 | 13.00 | 17.00 | 43.33 | 97.93 | 1.00 | 47.42 | 0.00 | 21.70 | 100.00 | 40.57 | 43.99 |
| Musa yunnanensis | 19.00 |  | 19.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 2.37 | 50.00 | 17.46 | 8.73 |

**Methods B.1: *in*- and *ex-situ* conservation status assessment (Khoury et al., 2019; 2020)**

Three *ex-situ* conservation metrics were calculated: Sampling Representativeness Score (SRS), Geographical Representativeness Score (GRS), and Ecological Representativeness (ERS). Buffers (“CA50”) of 0.5 degrees (~50 km radius) were made around samples included in germplasm collections (G).

$$SRS \_{ex}=\left[\frac{number of germplas maccessions\left(G\right)}{number of total reference records\left(H\right)} \right]× 100 $$

$$GRS \_{ex}=\left[\frac{total area (km^{2}) of CA50 of all G records}{total area (km^{2}) of species distribution model (SDM)}\right] × 100$$

$$ERS \_{ex}=\left[\frac{number of ecoregions represented within CA50 of G records}{number of ecoregions represented within SDM}\right] × 100$$

For species with a very narrow distribution pattern, the “CA50” buffer around germplasm collected samples might have a larger total area than the area of the distribution model. This will result in overestimations of GRSex. For these species, GRSex is scaled to 100, indicating that these species are fully conserved *ex-situ*.

Total area (in km²) and number of terrestrial ecoregions (as presented by Olson et al., 2001) present in each SDM were determined using the binary maps created using the 10 percentile training presence thresholds. As suggested by Khoury et al. (2019), buffers of 0.5 degrees were determined for all species for which no significant distribution model could be generated. For these species, the total area and number of ecoregions were extracted from these buffers rather than from their SDM.

The Final *ex-situ* Conservation Score (FCSex) was determined by calculating the mean of these three conservation metrics.

$$FCS \_{ex}=\left[\frac{SRS + GRS\_{ex} + ERS\_{ex}}{3} \right]$$

Similarly, SRS, GRS and ERS were calculated for *in-situ* conservation status of each species.

$$SRS \_{in}=\left[\frac{number of occurrences in protected area}{total number of occurrences} \right]× 100 $$

$$GRS \_{in}=\left[\frac{area (km^{2}) located in protected areas}{total area (km^{2}) of SDM}\right] × 100$$

$$ERS \_{in}=\left[\frac{number of ecoregions represented in SDM located in protected areas}{number of ecoregions represented within SDM}\right] × 100$$

The Final *in-situ* Conservation Score was then determined by calculating the mean of these two metrics.

$$FCS \_{in}=\left[\frac{SRS \_{in}+GRS\_{in} + ERS\_{in}}{3} \right]$$

The Final Combined Conservation Score (FCSc) for each banana species was then calculated by averaging both FCSin and FCSex. Species with a FCSc < 25 were considered high priority for conservation whereas species with a FCSc > 50 were considered as low priority. A FCSc > 75 indicates species that are properly conserved.

$$FCS \_{c}=\left[\frac{FCS \_{ex}+FCS \_{in} }{2} \right]$$

 To assess whether wild *Musa* species are in general sufficiently conserved, the indicator score was calculated:

$$Indicator =\left(\frac{number of species with FCS\_{c} \geq 50}{total number of species}\right)×100$$