**Supplementary Figure 1**



**Fig. S1** Current distribution of ten invasive Poaceae species in the Neotropical region according to data available from GBIF (2022).

**Supplementary Table 1**
Date and place of introduction of the 10 invasive species of Poaceae in the Americas

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Species** | **Origin** | **Date of introduction in America** | **Place of introduction** | **Reason** | **Reference** |
| *Andropogon gayanus* | Tropical Africa, Southern Sahara | 1973 | Colombia and Planaltina (Goiás, Brazil) | Forage | \*Fairey, D.T., Loch, D.S., Hampton, J.G., Ferguson, J.E. 1997. Forage Seed Production Tropical and subtropical species. CABI, 479p. |
| *Arundo donax* | Probably South and East Asia, and Mediterranean (controversial) | 1820 | California USA | Ornamental and technological (wind instruments and tools) | \*Perdue, R.E. *Arundo donax*—Source of musical reeds and industrial cellulose. Econ Bot 12, 368–404 (1958). https://doi.org/10.1007/BF02860024 \* Rojas-Sandoval, J., Acevedo-Rodríguez, P. 2014. *Arundo donax*. CABI - Invasive Species Compendium. |
| *Hyparrhenia rufa* | Tropical, southern Africa and Madagascar | Accidentally in the 18th century and intentionally around 1900 | Puerto Rico (Brazil from 1950) | First by ships transporting enslaved people and later as fodder (escape from plantations) | \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140. \*Rojas-Sandoval, J., Acevedo-Rodríguez, P. 2014. *Hyparrhenia rufa*. CABI - Invasive Species Compendium. |
| *Megathyrsus maximus* | Tropical Africa up to South Subtropical Africa | Accidentally around 1700 and then intentionally from the 19th century | Brazilian Coast | First by ships transporting enslaved people and later as fodder (escape from plantations) | \*Parsons JJ (1972) Spread of African grasses to the American tropics. Journal of Range Management 25: 12–17. \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140.  |
| \*Rojas-Sandoval, J., Acevedo-Rodríguez, P. 2013. *Megathyrsus maximus*. CABI - Invasive Species Compendium. |
| *Melinis minutiflora* | West tropical Africa, Cameroon and Angola  | 1812 | Brazil (Southeast) | The first introduction, probably accidental; in the 20th century intentionally introduced as a forage | \*Parsons JJ (1972) Spread of African grasses to the American tropics. Journal of Range Management 25: 12–17. \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140.  |
| \*Rojas-Sandoval, J., Acevedo-Rodríguez, P. 2013. *Melinis minutiflora*. CABI - Invasive Species Compendium. |
| **Species** | **Origin** | **Date of introduction in America** | **Place of introduction** | **Reason** | **Reference** |
| *Melinis repens* | Tropical Africa, to South Subtropical Africa  | 1875 | Florida (USA) | Forage and ornamental | \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140.  |
| \*Kaufman, S. 2012. *Melinis repens*. CABI - Invasive Species Compendium. |
| *Urochloa brizantha* | Tropical Africa |  1952 |   | Forage  | \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140.  |
| \* do Valle, C. B., Jank, L., & Resende, R. M. S. (2009). O melhoramento de forrageiras tropicais no Brasil. Revista Ceres, 56(4), 460-472. |
| *Urochloa decumbens* | East and Central Africa, African Great Lakes | 1950 | Brazil (São Paulo and Pará) | Forage | \*Williams; Baruch Z, 2000. African grass invasion in the Americas: ecosystem consequences and the role of ecophysiology. Biological Invasions, 2:123-140.  |
| \*Rojas-Sandoval, J. 2015. *Urochloa decumbens*. CABI - Invasive Species Compendium. |
| *Urochloa humidicola* | East and Southeast tropical Africa | 1965 | Brazil (São Paulo and Pará) | Forage | \*Dias Filho, M.B. 1983. Limitações e potencial de *Brachiaria humidicola* para o trópico úmido brasileiro, Belém, EMBRAPA-CPATU, 28 p. \* Bogdan, A.V. 1977. Tropical pasture and fodder plants; grass and legumes. N. York, Longman, p. 578. |
| *Urochloa ruziziensis* |  Eastern Africa |  1980  | Tropical America (1985 Brazil) | Forage |  \*Miles, J. W. (2006). Mejoramiento genético en Brachiaria: objetivos, estrategias, logros y proyecciones. Pasturas Tropicales, 28(1), 26-30. |

**Supplementary Table 2**

Link to the occurrence records for each invasive grass species extracted from the public database Global Biodiversity Information Facility (GBIF) on September 2021

|  |  |
| --- | --- |
| *Andropogon gayanus*  | GBIF.org (10 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.d3aw9x |
| *Arundo donax*  | GBIF.org (17 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.qyzt3j |
| *Hyparrhenia rufa*  | GBIF.org (22 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.g56e5z |
| *Megathyrsus maximus*  | GBIF.org (23 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.5m6m5r |
| *Melinis minutiflora*  | GBIF.org (23 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.4n9jum |
| *Melinis repens* | GBIF.org (23 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.9pxv47 |
| *Urochloa brizantha* | GBIF.org (27 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.87ccpj |
| *Urochloa decumbens*  | GBIF.org (27 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.hdq9nz |
| *Urochloa humidicola* | GBIF.org (28 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.n2w7nw |
| *Urochloa ruziziensis*  | GBIF.org (28 September 2021) GBIF Occurrence Download https://doi.org/10.15468/dl.du53jj |

**Supplementary Table 3**

List of bioclimatic variables (BIO) from the WorldClim database (http://www.worldclim.org; Fick and Hijmans, 2017). The six variables selected for the models are highlighted in bold

|  |
| --- |
| **Variables** |
| BIO1 = Annual Mean Temperature (°C) |
| **BIO2 = Mean Diurnal Range (Mean of monthly (max temp - min temp)) (°C)** |
| **BIO3 = Isothermality (BIO2/BIO7) (\*100) (°C)**  |
| BIO4 = Temperature Seasonality (standard deviation \*100) (°C)  |
| BIO5 = Maximum Temperature of Warmest Month (°C) (AB) |
| BIO6 = Minimum Temperature of Coldest Month (°C)  |
| BIO7 = Annual Temperature Range (BIO5-BIO6) (°C)  |
| **BIO8 = Mean Temperature of Wettest Quarter (°C)** |
| BIO9 = Mean Temperature of Driest Quarter (°C) |
| BIO10 = Mean Temperature of Warmest Quarter (°C) |
| BIO11 = Mean Temperature of Coldest Quarter (°C) |
| BIO12 = Annual Precipitation (mm)  |
| BIO13 = Precipitation of Wettest Month (mm)  |
| BIO14 = Precipitation of Driest Month (mm)  |
| **BIO15 = Precipitation Seasonality (coefficient of variation) (mm)**  |
| BIO16 = Precipitation of Wettest Quarter (mm) |
| BIO17 = Precipitation of Driest Quarter (mm) |
| **BIO18 = Precipitation of Warmest Quarter (mm)**  |
| **BIO19 = Precipitation of Coldest Quarter (mm)** |

**Supplementary Table 4** Sensitivity analysis of the nine selected models and of the consensus model for 10 invasive grass species in the Neotropical region. Values of true skill statistic (TSS), receiver operating characteristic (ROC) and ROC sensitivity (ROC\_S) for each algorithm projection. ROC sensitivity = probability that a test result will be positive when the species is present (true positive rate, expressed as a percentage). Agay = *Andropogon gayanus*, Adon = *Arundo donax*, Hruf = *Hyparrhenia rufa*, Mmax = *Megathyrsus maximus*, Mmin = *Melinis minutiflora*, Mrep = *Melinis repens*, Ubri = *Urochloa brizantha*, Udec = *Urochloa decumbens*, Uhum = *Urochloa humidicola*, Uruz = *Urochloa ruziziensis*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Algorithm** | **Metric** | **Agay** | **Adon**  | **Hruf** | **Mmax**  | **Mmin**  | **Mrep** | **Ubri** | **Udec**  | **Uhum** | **Uruz**  |
| **CTA** | **TSS** | 0.39 | 0.65 | 0.49 | 0.50 | 0.62 | 0.56 | 0.58 | 0.56 | 0.36 | 0.34 |
| **ROC\_T** | 0.71 | 0.86 | 0.78 | 0.78 | 0.83 | 0.81 | 0.82 | 0.80 | 0.69 | 0.67 |
| **ROC\_S** | 72.17 | 78.26 | 80.13 | 78.08 | 82.25 | 82.38 | 77.28 | 80.05 | 74.79 | 68.75 |
| **GBM** | **TSS** | 0.56 | 0.65 | 0.53 | 0.53 | 0.67 | 0.58 | 0.66 | 0.64 | 0.51 | NA |
| **ROC\_T** | 0.83 | 0.91 | 0.84 | 0.83 | 0.89 | 0.86 | 0.88 | 0.88 | 0.80 | NA |
| **ROC\_S** | 81.88 | 76.00 | 82.02 | 80.29 | 83.06 | 86.53 | 78.33 | 82.85 | 76.67 | NA |
| **RF** | **TSS** | 0.59 | 0.74 | 0.62 | 0.62 | 0.72 | 0.65 | 0.69 | 0.66 | 0.54 | 0.54 |
| **ROC\_T** | 0.85 | 0.94 | 0.88 | 0.89 | 0.92 | 0.91 | 0.90 | 0.89 | 0.82 | 0.76 |
| **ROC\_S** | 82.81 | 74.97 | 83.81 | 80.51 | 87.75 | 83.70 | 79.73 | 84.96 | 77.00 | 75.42 |
| **FDA** | **TSS** | 0.46 | 0.56 | 0.45 | 0.45 | 0.60 | 0.49 | 0.58 | 0.55 | 0.40 | 0.58 |
| **ROC\_T** | 0.79 | 0.85 | 0.78 | 0.77 | 0.85 | 0.80 | 0.85 | 0.82 | 0.73 | 0.79 |
| **ROC\_S** | 68.95 | 71.65 | 73.06 | 72.39 | 80.12 | 84.89 | 75.61 | 72.03 | 70.17 | 71.75 |
| **GAM** | **TSS** | 0.53 | 0.58 | 0.46 | 0.46 | 0.61 | 0.52 | 0.60 | 0.58 | 0.46 | 0.45 |
| **ROC\_T** | 0.81 | 0.86 | 0.79 | 0.78 | 0.86 | 0.82 | 0.85 | 0.84 | 0.76 | 0.72 |
| **ROC\_S** | 76.44 | 77.42 | 74.25 | 75.15 | 80.27 | 86.09 | 76.00 | 75.42 | 83.92 | 71.83 |
| **ANN** | **TSS** | 0.45 | 0.49 | 0.43 | 0.40 | 0.55 | 0.46 | 0.49 | 0.46 | 0.37 | 0.37 |
| **ROC\_T** | 0.76 | 0.80 | 0.77 | 0.74 | 0.83 | 0.76 | 0.78 | 0.78 | 0.72 | 0.68 |
| **ROC\_S** | 83.05 | 73.81 | 83.02 | 80.47 | 83.72 | 87.07 | 82.32 | 83.14 | 83.79 | 77.75 |
| **GLM** | **TSS** | 0.45 | 0.52 | 0.39 | 0.33 | 0.59 | 0.40 | 0.59 | 0.55 | 0.40 | 0.58 |
| **ROC\_T** | 0.79 | 0.81 | 0.74 | 0.71 | 0.85 | 0.77 | 0.85 | 0.82 | 0.73 | 0.81 |
| **ROC\_S** | 75.93 | 83.45 | 83.53 | 66.18 | 80.56 | 85.75 | 74.01 | 70.96 | 86.25 | 78.33 |
| **Algorithm** | **Metric** | **Agay** | **Adon**  | **Hruf** | **Mmax**  | **Mmin**  | **Mrep** | **Ubri** | **Udec**  | **Uhum** | **Uruz**  |
| **MaxEnt** | **TSS** | 0.50 | 0.54 | 0.44 | 0.43 | 0.55 | 0.51 | 0.60 | 0.55 | 0.43 | 0.62 |
| **ROC\_T** | 0.48 | 0.83 | 0.77 | 0.76 | 0.83 | 0.81 | 0.86 | 0.84 | 0.76 | 0.83 |
| **ROC\_S** | 78.23 | 77.52 | 75.29 | 72.37 | 77.33 | 82.72 | 75.09 | 69.58 | 74.54 | 76.83 |
| **S R E** | **TSS** | 0.40 | 0.32 | 0.25 | 0.17 | 0.31 | 0.30 | 0.38 | 0.25 | 0.30 | 0.34 |
| **ROC\_T** | 0.70 | 0.66 | 0.62 | 0.59 | 0.65 | 0.65 | 0.69 | 0.63 | 0.65 | 0.67 |
| **ROC\_S** | 78.12 | 77.81 | 81.81 | 80.17 | 81.78 | 80.91 | 80.00 | 81.25 | 72.92 | 70.67 |
| **Consensus** | **Sensitivity (mean)** | 78.19 | 76.63 | 78.87 | 76.46 | 81.88 | 84.89 | 77.30 | 77.37 | 79.67 | 74.83 |
| **Sensitivity (SD)** | 5.12 | 3.52 | 4.48 | 3.71 | 3.11 | 1.77 | 2.74 | 6.12 | 6.79 | 36.45 |
| **Reliability or robustness** | good | good | good | good | good | good | good | good | good | good |