

Strategic screening of forages from international genebanks for low enteric methane emission

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Introduction

- CGIAR genebanks (Figure 1) hold vast forage diversity that can be explored to identify low methane forages (LMFs) with the potential to lower enteric CH₄ emissions while maintaining or improving animal productivity.
- CGIAR centers are screening ~10% of 71,000 forage accessions.

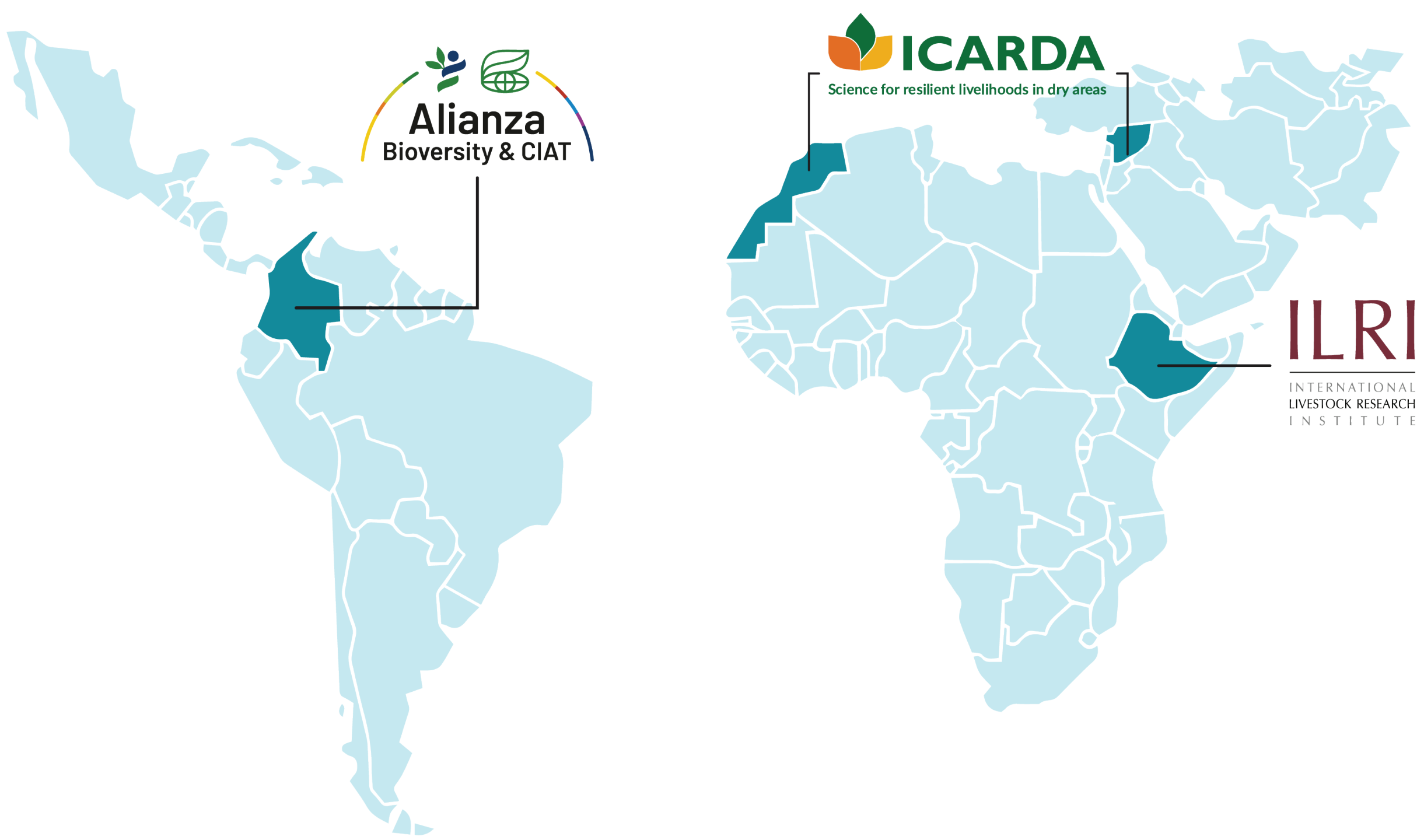


Figure 1. Location of the three CGIAR Genebanks'

Objective

To **screen** forage accessions from CIAT, ILRI, and ICARDA genebanks to identify low-methane and highly digestible candidates using an *in vitro* screening framework.

Methodology

- **Samples:** 172 forage accessions (58 herbaceous legumes, 52 grasses, and 62 shrubs, climbers, and other species). For this poster, data from CIAT were used, and the same approach was applied across the three CGIAR centers.
- **Screening:** *In vitro* syringe gas production method (24 h, triplicates, three independent runs) (Menke and Steingass, 1988 adapted).
- **Analysis:** An *in vitro* screening framework was applied to rank forages by methane reduction potential and digestibility. The framework comprises:
 - **Functional group stratification:** Grasses, herbaceous legumes, shrubs/climbers
 - **Three selection approaches** for the identification of LMFs (Figure 2)
 - **Core variables:** Truly Digested Dry Matter (%TDDM) and CH₄ intensity (ml/g TDDM), aims to assess Methane Intensity Reduction
 - **Methane intensity reduction:** calculated as % decrease of each forage's CH₄ intensity relative to a baseline.
 - **Baseline:** defined as the average of the 10% highest methane intensity values from ≥100 samples per functional group.

Approach 1 (Top priority) Low CH ₄ intensity + High digestibility (>60 %)	Approach 2 Medium to low Methane intensity + Low to Medium Digestibility (<60 %)	Approach 3 (Spin-off) Higher Methane intensity relative to above two approaches + High Digestibility (>60 %)
Weights: CH ₄ intensity = 2 (higher priority), TDDM = 1	Weight not provided to the key variables. Ranking done exclusively based on methane intensity.	Weights: TDDM = 2 (higher priority), CH ₄ intensity = 1
Category 1a: ≥35 % CH ₄ reduction (top candidates) Category 1b: 20–35 % reduction (secondary options)	Category 2: AMC-rich candidates with ≥20 % CH ₄ reduction, recommended for low dietary inclusion levels	Category 3: ≥20 % methane reduction. Productivity-enhancing forages lowering CH ₄ per unit of animal product
Post-ranking refinement: CH ₄ % in gas at 8 h and 24 h to confirm sustained mitigation, along with agronomic traits when available.		

Figure 2. Approaches for identifying LMF and categorization of identified forages.

Results

- Forage accessions from the CIAT genebank (Future Seeds) were ranked using three prioritization approaches and classified by functional groups. Figure 3 illustrates how the framework stratifies and ranks forages in different categories by functional groups and approaches.
- The preliminary results presented here correspond to Approach 1, Category 1a (≥35 % CH₄ reduction + High Digestibility >60 %). The top three priority forages identified were:
 - **Herbaceous Legumes:** *Indigofera spicata*, *Crotalaria incana*, *Coursetia caribaea*.
 - **Grasses:** *Urochloa* interspecific hybrids (two accessions), Mulato II.
 - **Shrubs and Climbers:** *Canavalia sp.*, *Canavalia brasiliensis*, *Indigofera suffruticosa*.

Selection by Functional Groups and Approaches

Accessions rank • Labels show count and % of group totals (n from Accession)

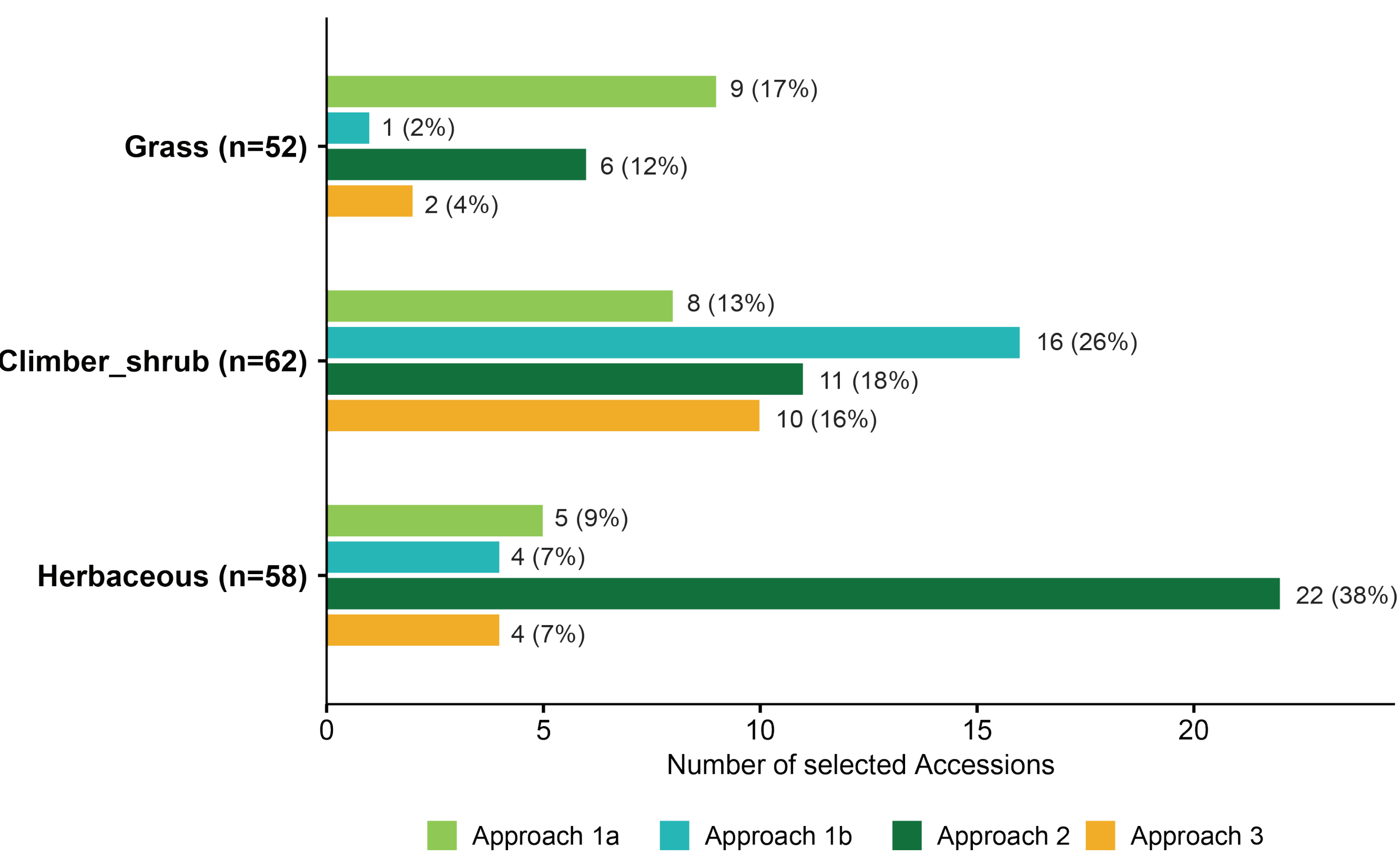


Figure 3. Distribution of forage accessions (n=172) across functional groups (grasses, herbaceous legumes, shrubs/climbers) and in categories using the approaches.

Conclusions

- The validated *in vitro* screening framework enables the efficient selection of the most promising forages for omics, genetic improvement, agronomic testing, and *in vivo* trials, contributing to nature-based solutions for farmers.

References

Menke, K. H., & Steingass, H. (1988). Estimation of the energetic feed value obtained from chemical analysis and *in vitro* gas production using rumen fluid. *Animal Research and Development*, 28, 7–55.

Acknowledgments

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