Host tree-based scenario modelling for predicting a key edible insect, mopane worm *Gonimbrasia belina* (Westwood, 1894) distribution in Southern Africa

Supplementary material

Q.J. Meltus[1] , B.T. Mudereri[1,2,3] , R. Mutamiswa[4,5] , E.M. Abdel-Rahman[1,6] , J. Matunhu[4] , R. Musundire[7] , S. Niassy[1,8,9] and H.E.Z. Tonnang[1,6]*

[1]International Centre of Insect Physiology and Ecology (ICIPE), P.O. Box 30772, 00100 Nairobi, Kenya; [2]International Potato Center (CIP), P.O. Box 1269, Kigali, Rwanda; [3]School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Private Bag 3, Wits, 2050, South Africa; [4]Tugwi Mukosi Multidisciplinary Research Institute, Midlands State University, P. Bag 9055, Gweru, Zimbabwe; [5]Department of Zoology and Entomology, Rhodes University, Makhanda, South Africa; [6]School of Agricultural, Earth and Environmental Sciences, University of Kwazulu-Natal, Pietermaritzburg 3209, South Africa; [7]Directorate of Research and Postgraduate Studies, Chinhoyi University of Technology, P. Bag 7724, Chinhoyi, Zimbabwe; [8]Department of Zoology and Entomology, University of Pretoria, Private Bag X20, Hatfeld 0028, South Africa; [9]Inter-African Phytosanitary Council of African Union (AU-IAPSC), African Union, P.O Box 4170, Yaoundé, Cameroon; *bester.mudereri@cgiar.org

TABLE S1 Bioclimatic variables selected for model development in the study

No.	Bioclimatic variables		C. mopane	D. cinerea	D. mespiliformis	J. globiflora	S. birrea	T. sericea	G. belina
	Code	Description							
1	BIO1	Annual Mean Temperature			✓				
2	BIO2	Mean Diurnal Range (Mean of monthly (max temp - min temp))			✓				
3	BIO3	Isothermality (BIO2/BIO7) (×100)	✓	✓	✓	✓	✓	✓	✓
4	BIO4	Temperature Seasonality (standard deviation ×100)	✓	✓	✓	✓	✓	✓	
5	BIO5	Max Temperature of Warmest Month							
6	BIO6	Min Temperature		✓	✓				

#	Code	Variable							
		of Coldest Month							
7	BIO7	Temperature Annual Range (BIO5-BIO6)							
8	BIO8	Mean Temperature of Wettest Quarter	✓	✓	✓			✓	
9	BIO9	Mean Temperature of Driest Quarter							
10	BIO10	Mean Temperature of Warmest Quarter	✓				✓		✓
11	BIO11	Mean Temperature of Coldest Quarter				✓			
12	BIO12	Annual Precipitation			✓	✓	✓		

No	Code	Name							
13	BIO13	Precipitation of Wettest Month		✓				✓	✓
14	BIO14	Precipitation of Driest Month		✓			✓		✓
15	BIO15	Precipitation Seasonality (Coefficient of Variation)	✓			✓			✓
16	BIO16	Precipitation of Wettest Quarter	✓			✓			
17	BIO17	Precipitation of Driest Quarter							
18	BIO18	Precipitation of Warmest Quarter	✓	✓			✓	✓	✓
19	BIO19	Precipitation of Coldest Quarter	✓		✓	✓			

FIGURES S1-S7

1   Dendrograms
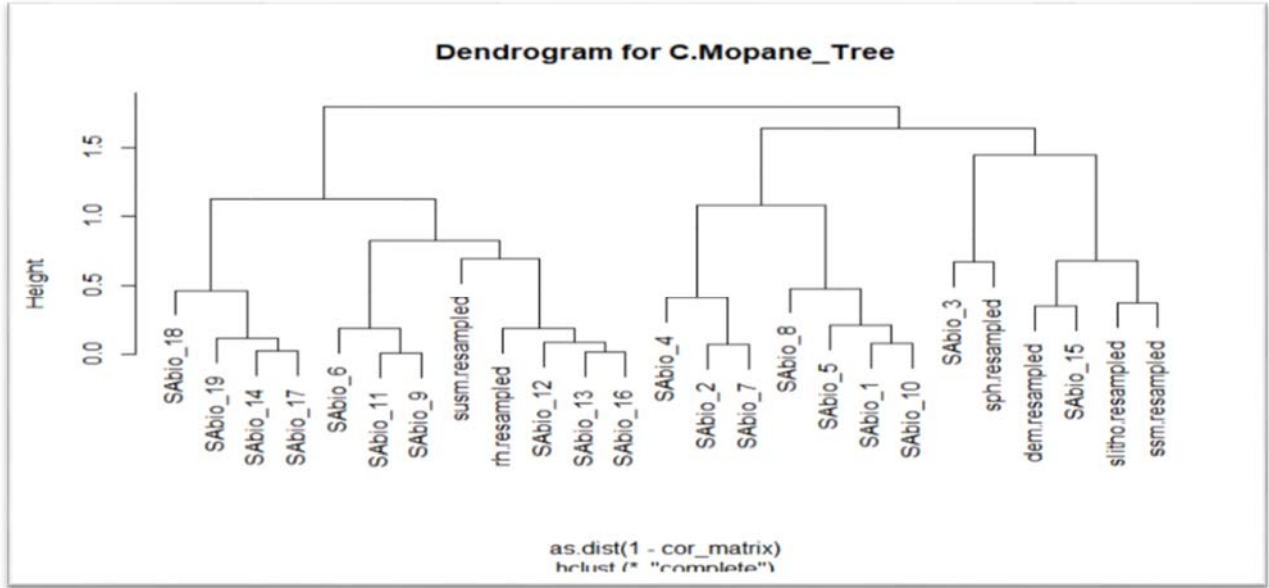
Dendrograms used to visualize multicollinearity

Dendrogram for C.Mopane_Tree

FIGURE S1   Dendrogram for *C. mopane* tree.

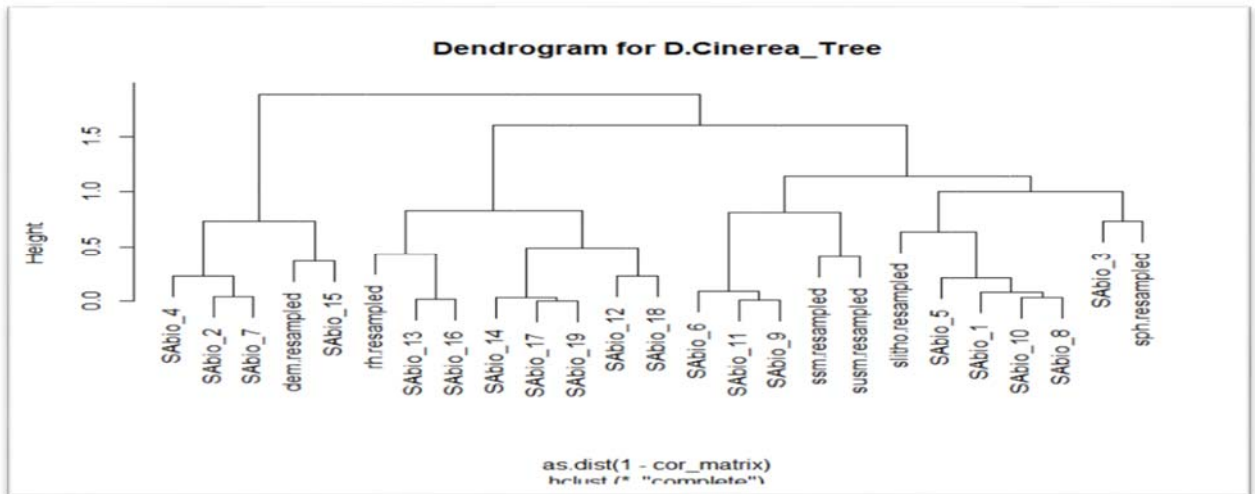**Dendrogram for D.Cinerea_Tree**

FIGURE S2   Dendrogram for D. cinerea tree.

Key[1]

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[1]dem.resampled = digital elevation model

lulcSA.resampled = consensus land use land cover (southern Africa)

slitho.resampled = Africa surface lithography (southern Africa)

SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

sph.resampled = soil Ph in H_2O

ssm.resampled = soil surface moisture
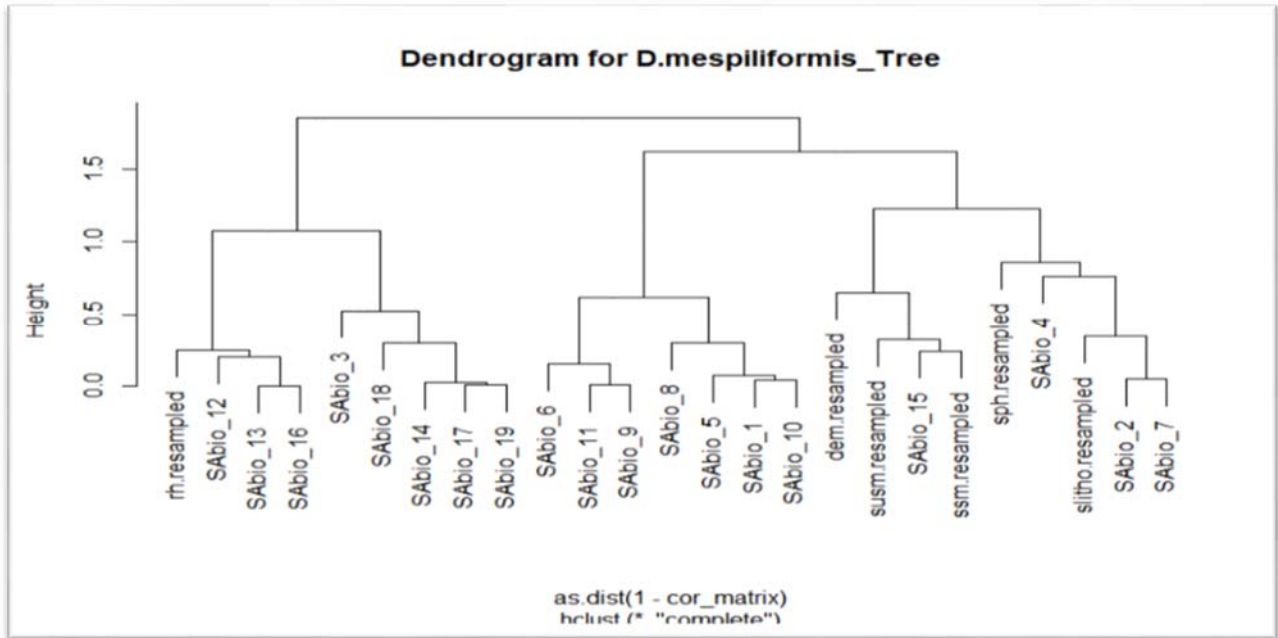
susm.resampled = soil subsurface moisture

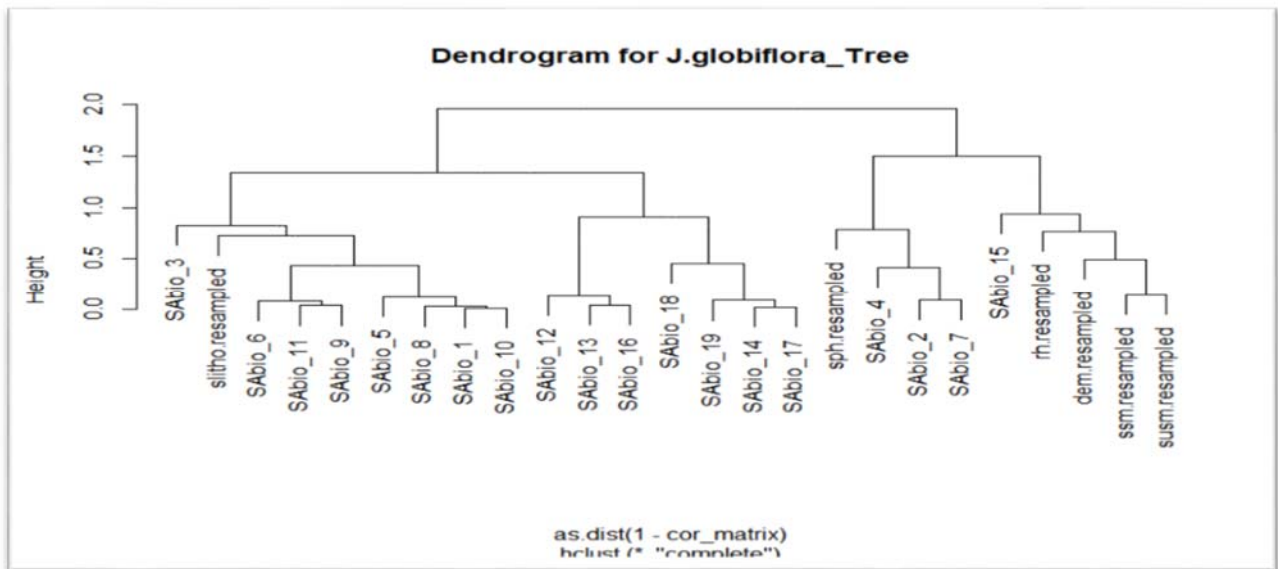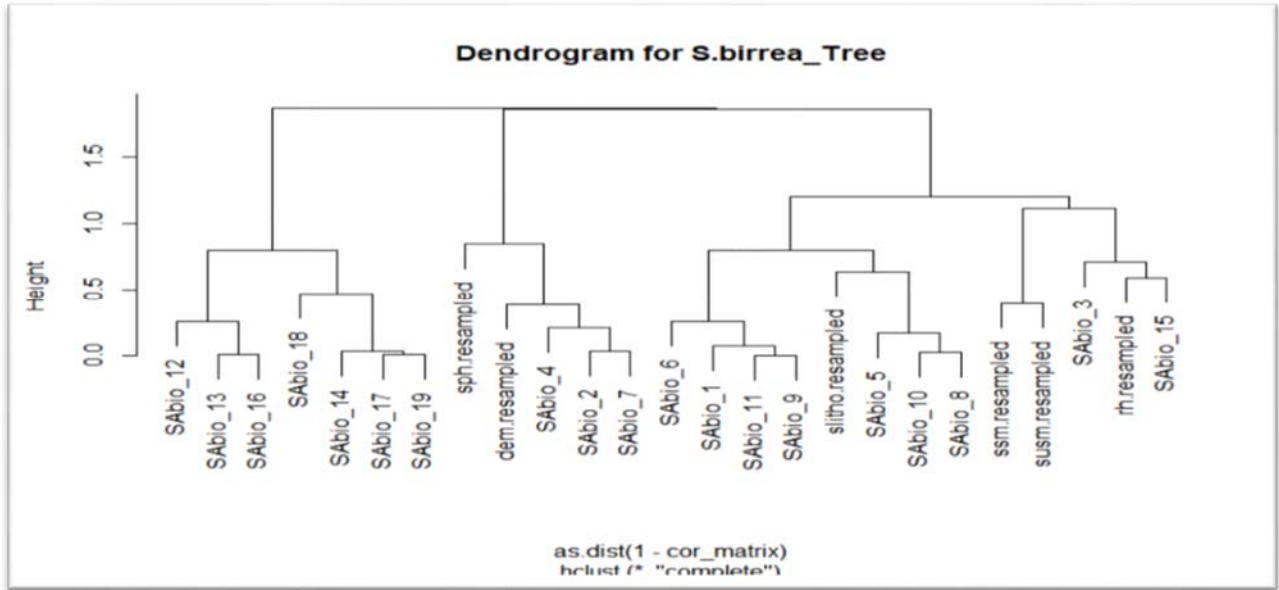FIGURE S3   Dendrogram for *D. mespiliformis* tree.

FIGURE S4   Dendrogram for *J. globiflora* tree.

Key[2]

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[2]dem.resampled = digital elevation model   sph.resampled = soil Ph in H_2O
lulcSA.resampled = consensus land use land cover (southern Africa)   ssm.resampled = soil surface moisture
slitho.resampled = Africa surface lithography (southern Africa)   susm.resampled = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

FIGURE S5   Dendrogram for *S. birrea* tree.
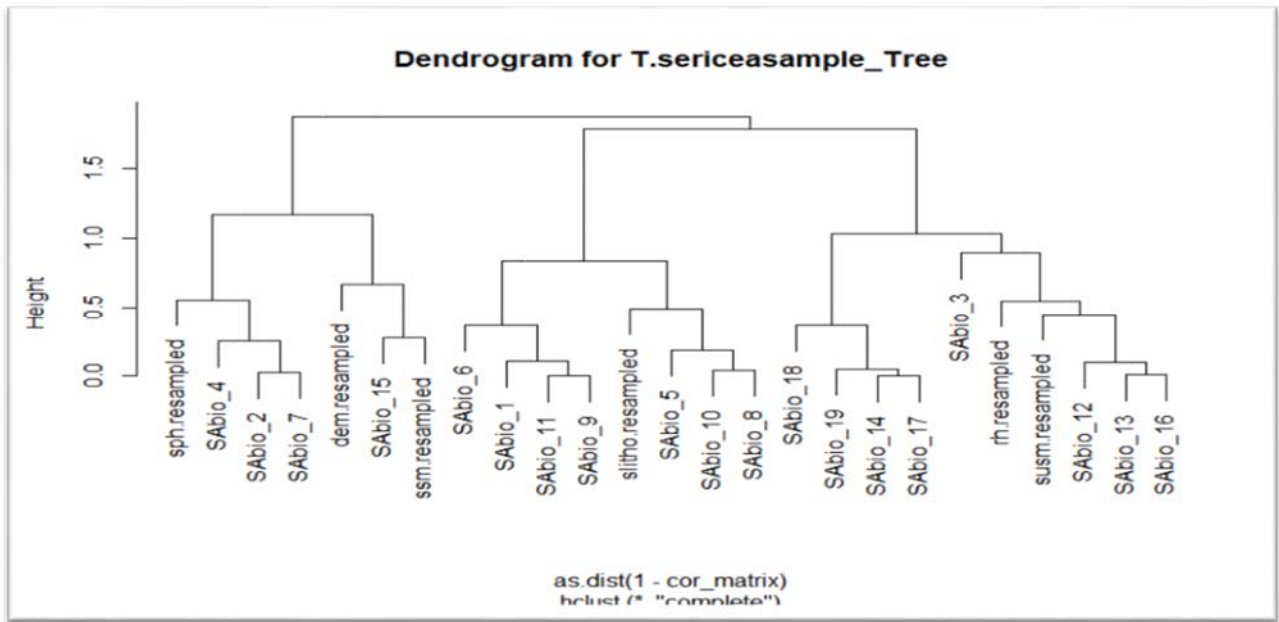
FIGURE S6   Dendrogram for *T. sericea* tree.

Key[3]

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[3]dem.resampled = digital elevation model   sph.resampled = soil Ph in H_2O
lulcSA.resampled = consensus land use land cover (southern Africa)   ssm.resampled = soil surface moisture
slitho.resampled = Africa surface lithography (southern Africa)   susm.resampled = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

FIGURE S7   Dendrogram for *G. belina*.

Key[4]

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[4]dem = digital elevation model   sph = soil Ph in H_2O
lulcSA = consensus land use land cover (southern Africa)   ssm = soil surface moisture
slitho. = Africa surface lithography (southern Africa)   susm = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

FIGURES S8-S12

1 Relative Variable Importance
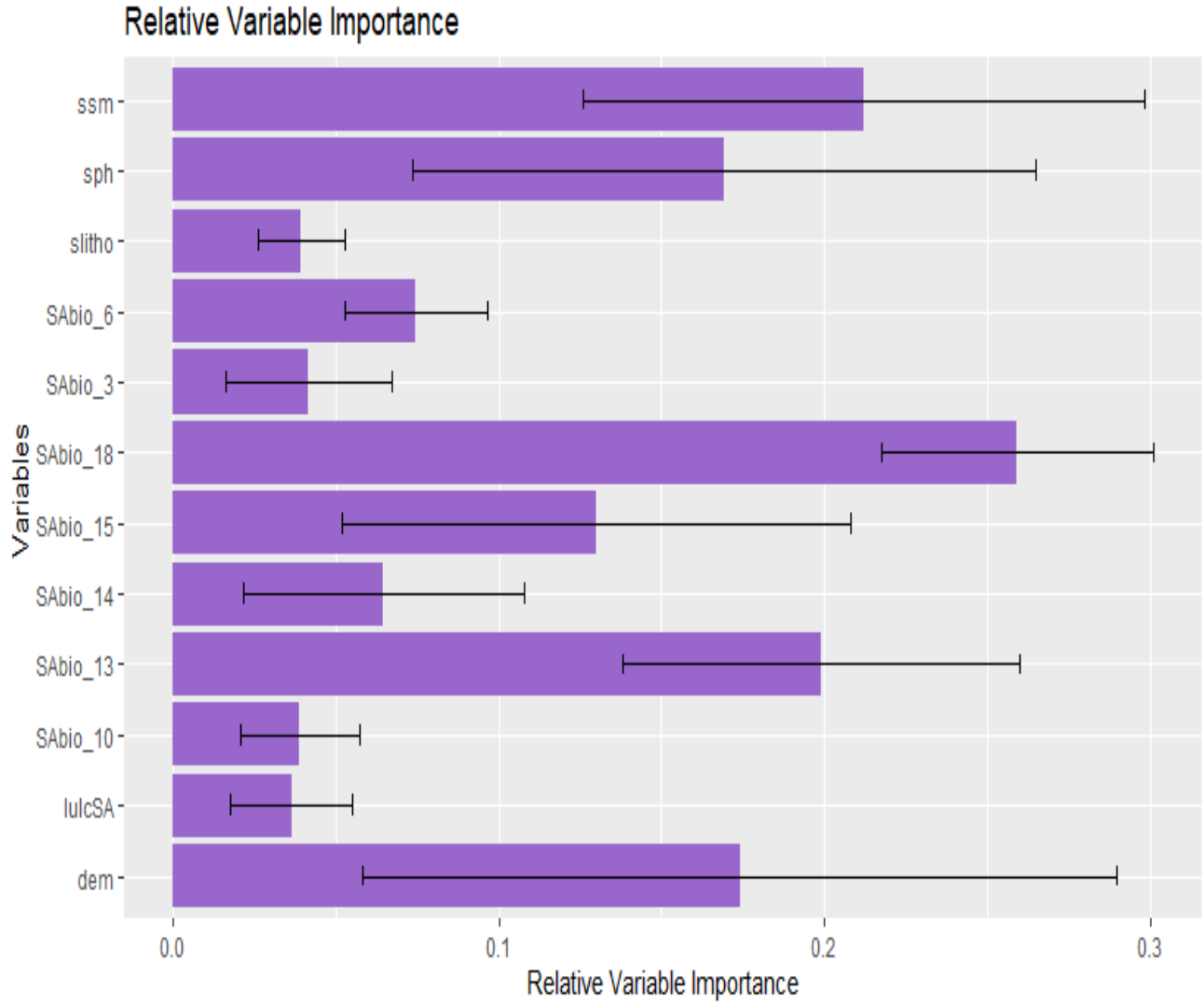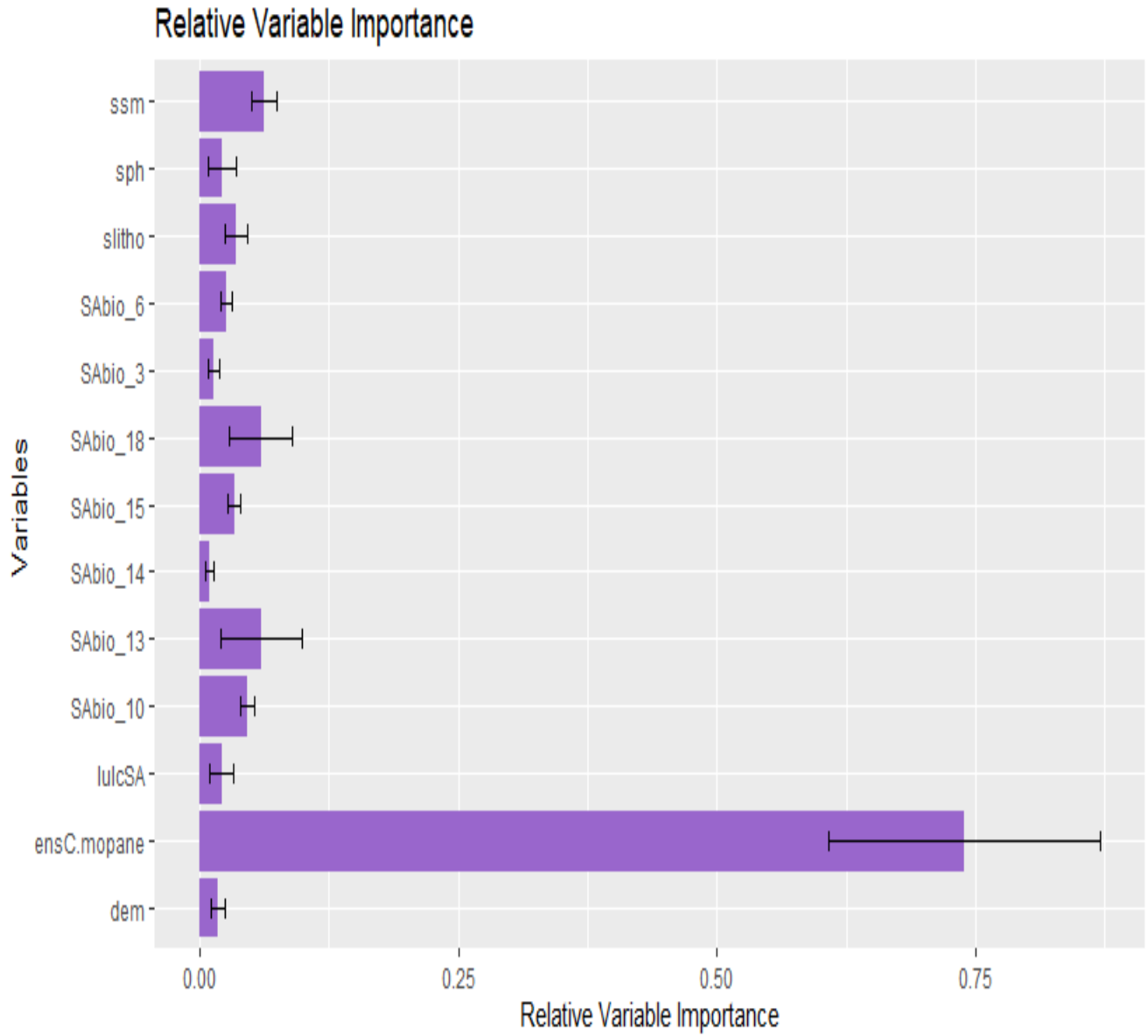
Scenario 1

Relative Variable Importance

FIGURE S8 Relative Variable Importance graph for scenario 1.

Key** for the variables used[5]

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[5]dem = digital elevation model   sph = soil Ph in H_2O
lulcSA = consensus land use land cover (southern Africa)   ssm = soil surface moisture
Slitho = Africa surface lithography (southern Africa)   susm = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

The rest represent the various host tree ensemble models.

Scenario 2

Relative Variable Importance

FIGURE S9   Relative Variable Importance graph for scenario 2.

Key** for the variables used[6]

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[6]dem = digital elevation model   sph = soil Ph in H_2O
lulcSA = consensus land use land cover (southern Africa)   ssm = soil surface moisture
Slitho = Africa surface lithography (southern Africa)   susm = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

The rest represent the various host tree ensemble models

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Scenario 3

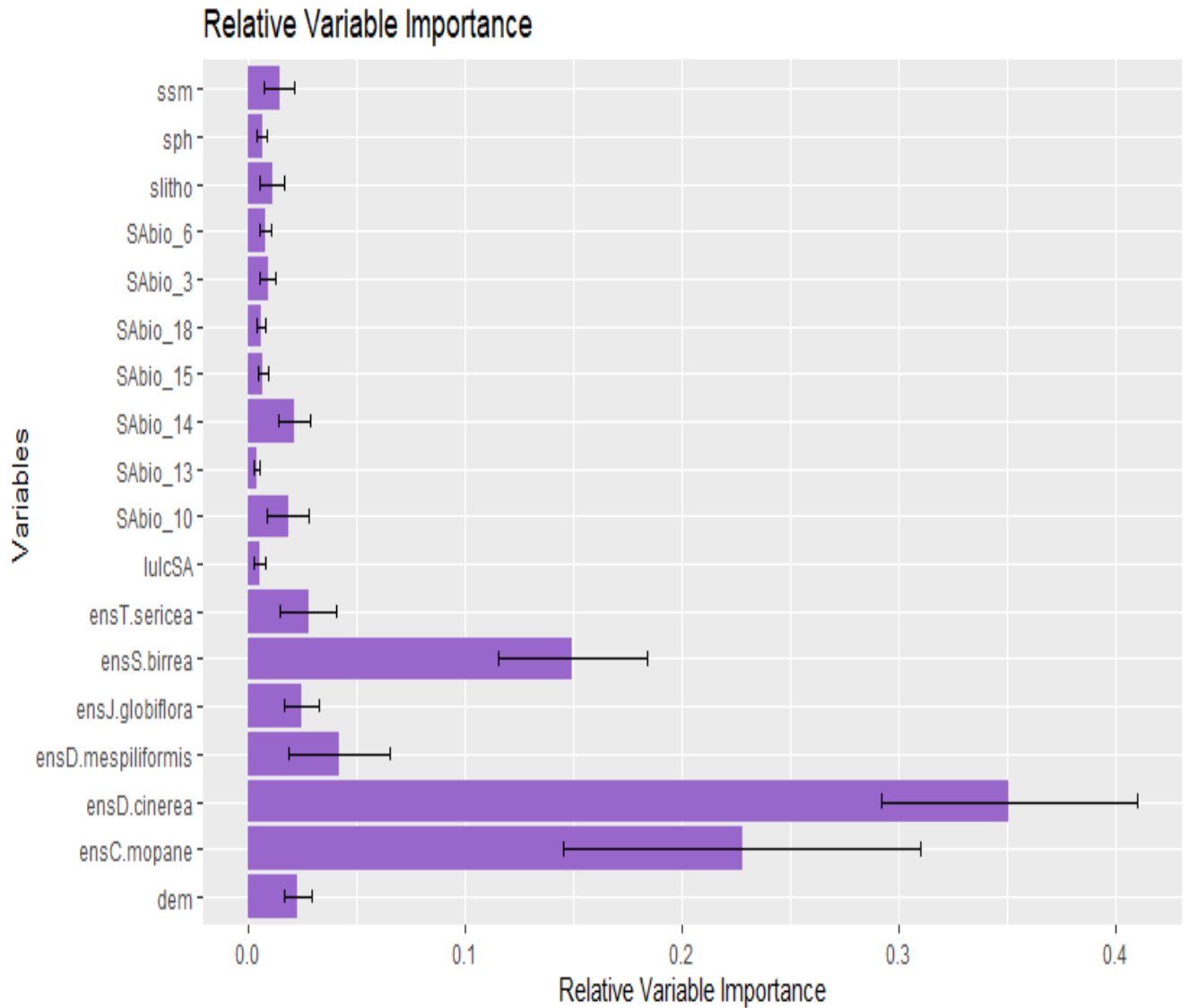## Relative Variable Importance

FIGURE S10   Relative Variable Importance graph for scenario 3.

Key** for the variables used[7]

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[7]dem = digital elevation model

lulcSA = consensus land use land cover (southern Africa)

Slitho = Africa surface lithography (southern Africa)

SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

sph = soil Ph in H_2O

ssm = soil surface moisture

susm = soil subsurface moisture

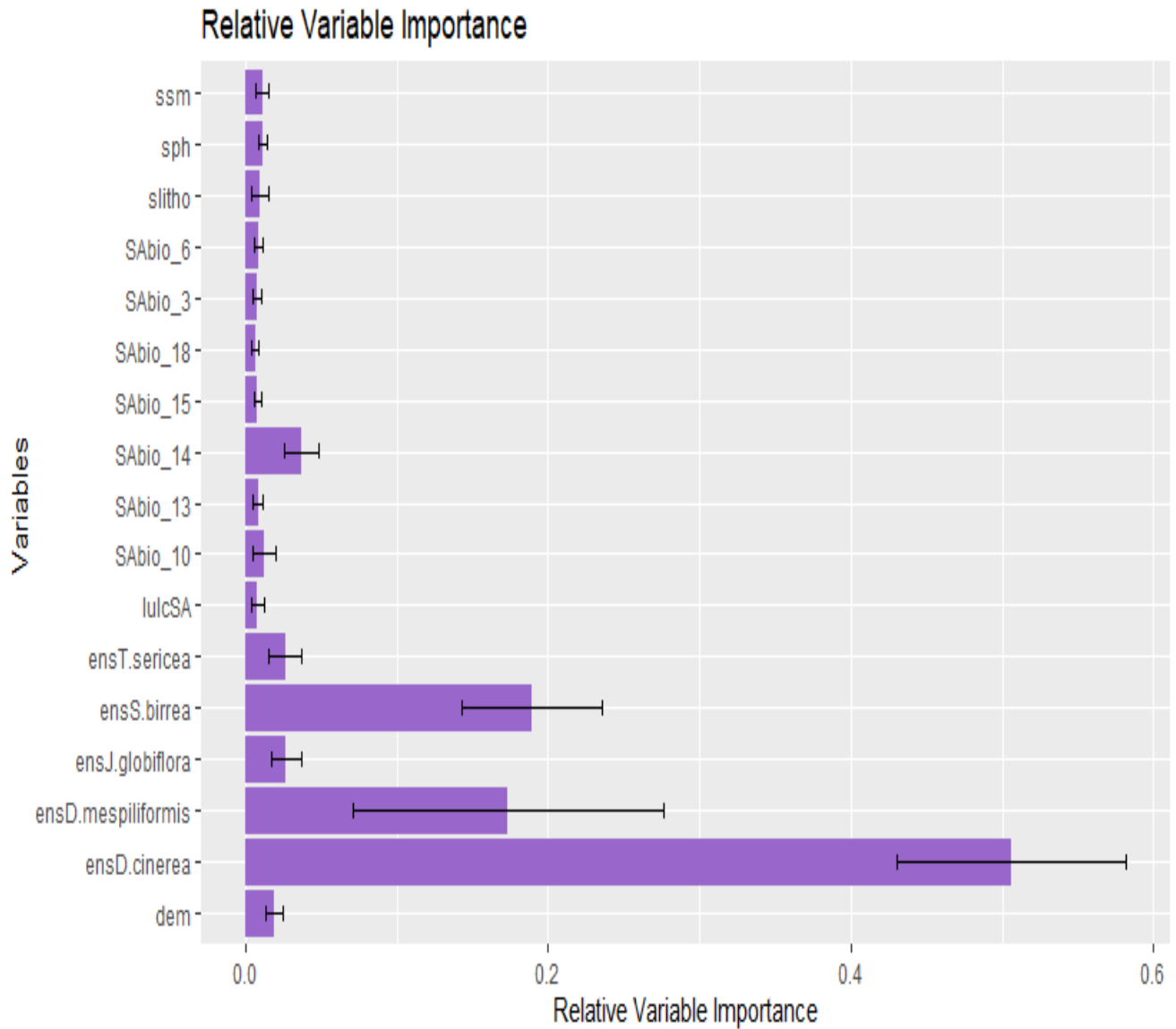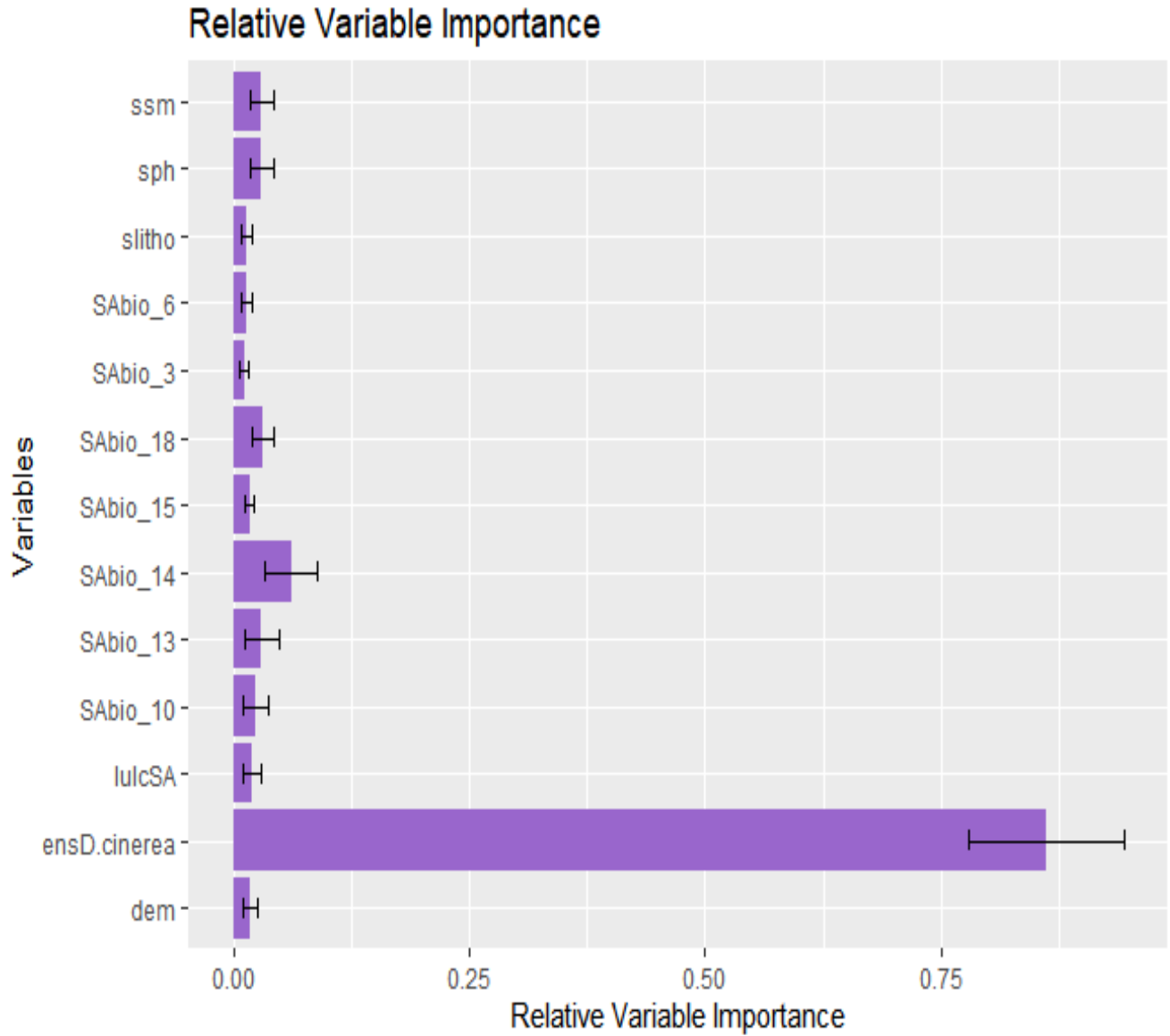The rest represent the various host tree ensemble models

Scenario 4

Relative Variable Importance

FIGURE S11   Relative Variable Importance graph for scenario 4.

Key** for the variables used[8]

Scenario 5

FIGURE S12   Relative Variable Importance graph for scenario 5.

Key** for the variables used[9]

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[9]dem = digital elevation model   sph = soil Ph in H_2O
lulcSA = consensus land use land cover (southern Africa)   ssm = soil surface moisture
Slitho = Africa surface lithography (southern Africa)   susm = soil subsurface moisture
SAbio1-SAbio10 = bioclimatic variables clipped to southern Africa

The rest represent the various host tree ensemble models

Scenario 5 (*Gonimbrasia belina* model with *Dichrostachys cinerea* as the only host tree explanatory variable).
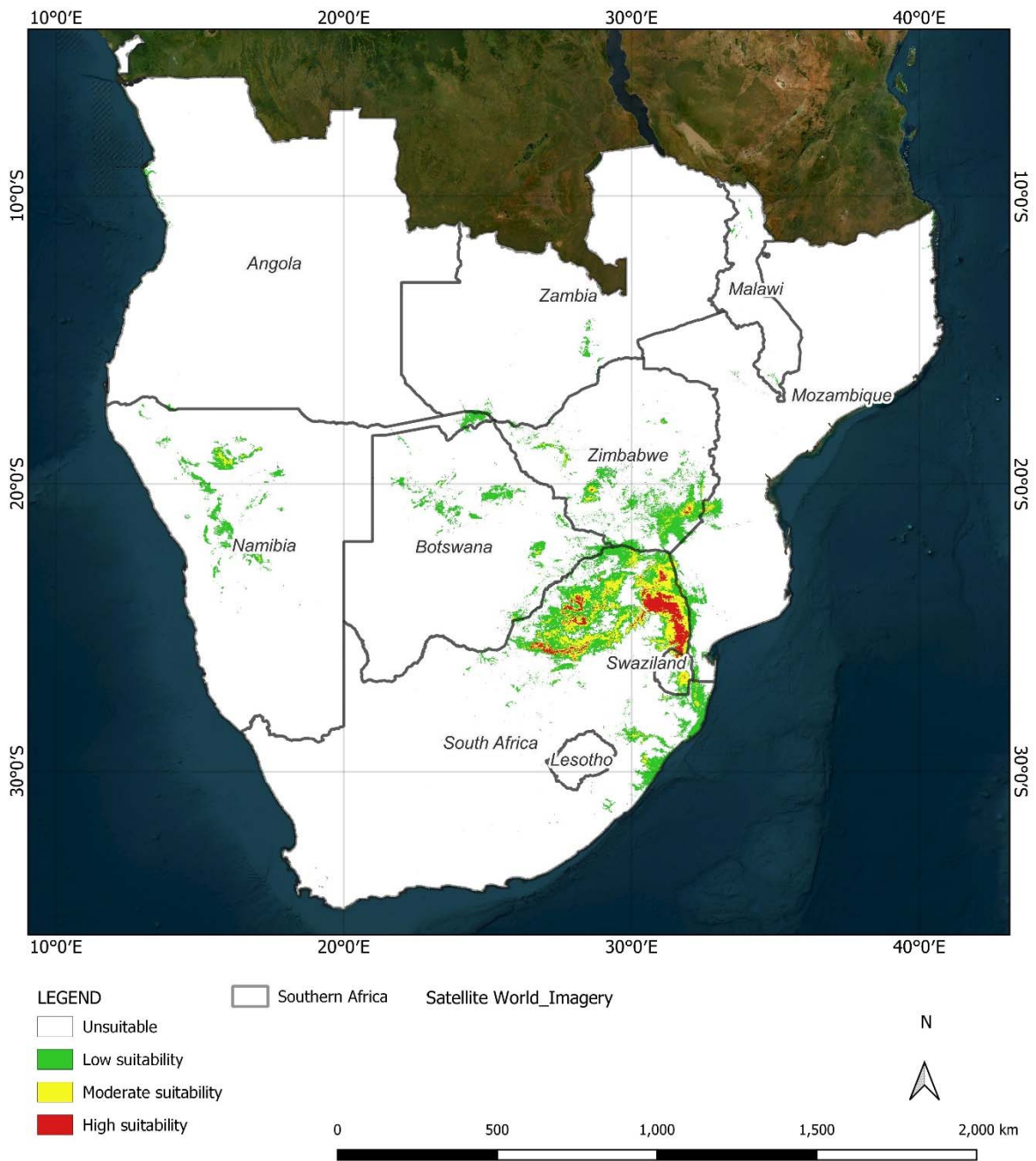

FIGURE S13   Suitability of mopane worm (*Gonimbrasia belina*)with the incorporation of the *Dichrostachys cinerea* as the only host tree explanatory variable in southern Africa. The base map used is the Esri World Satellite Imagery accessible within the QGIS software.