El diagrama BAM en el contexto de multiescala y distintos escenarios de modelación

30 min

ORGANIZACIÓN

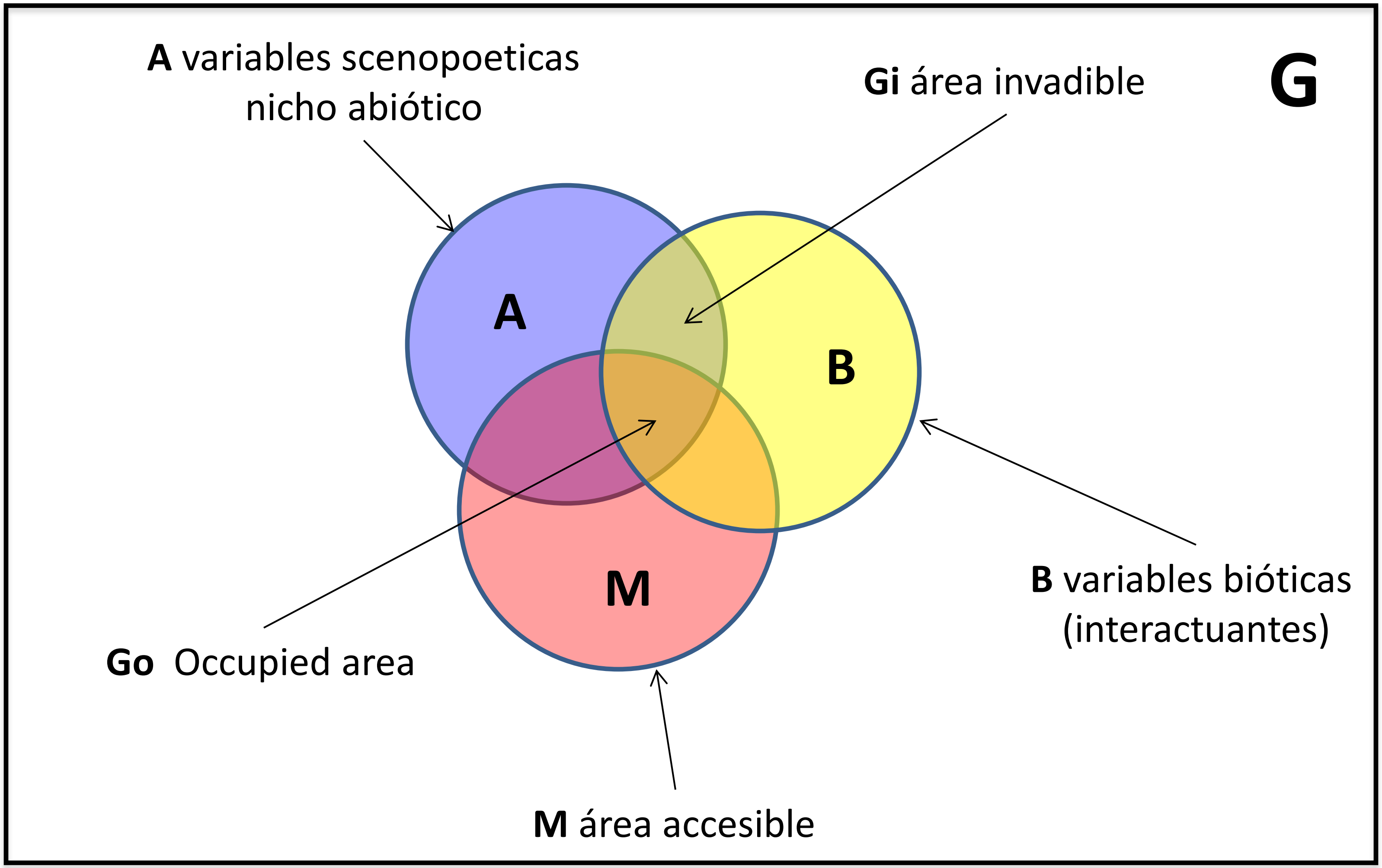
Áreas de distribución y escenarios BAM

- Implicaciones prácticas
- Configuraciones BAM
- “M”
- Extrapolación*

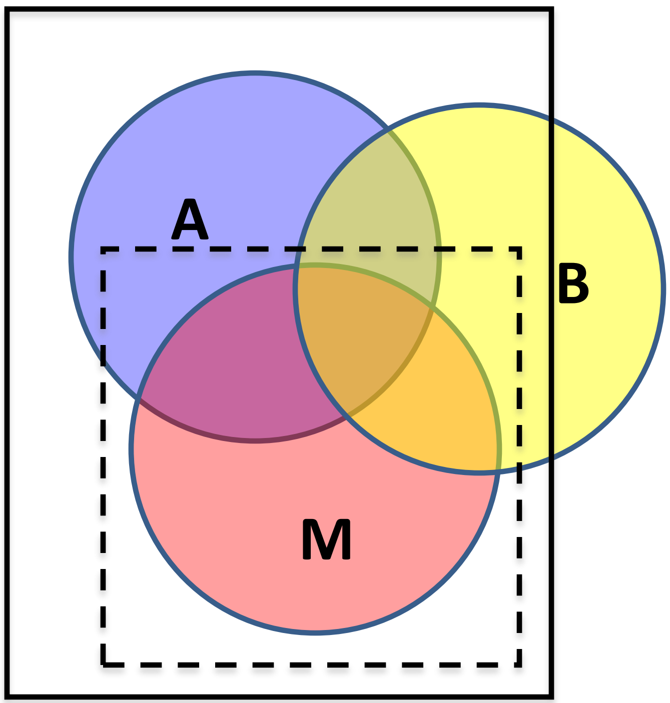
El diagrama BAM como función de la escala

- Ejemplo

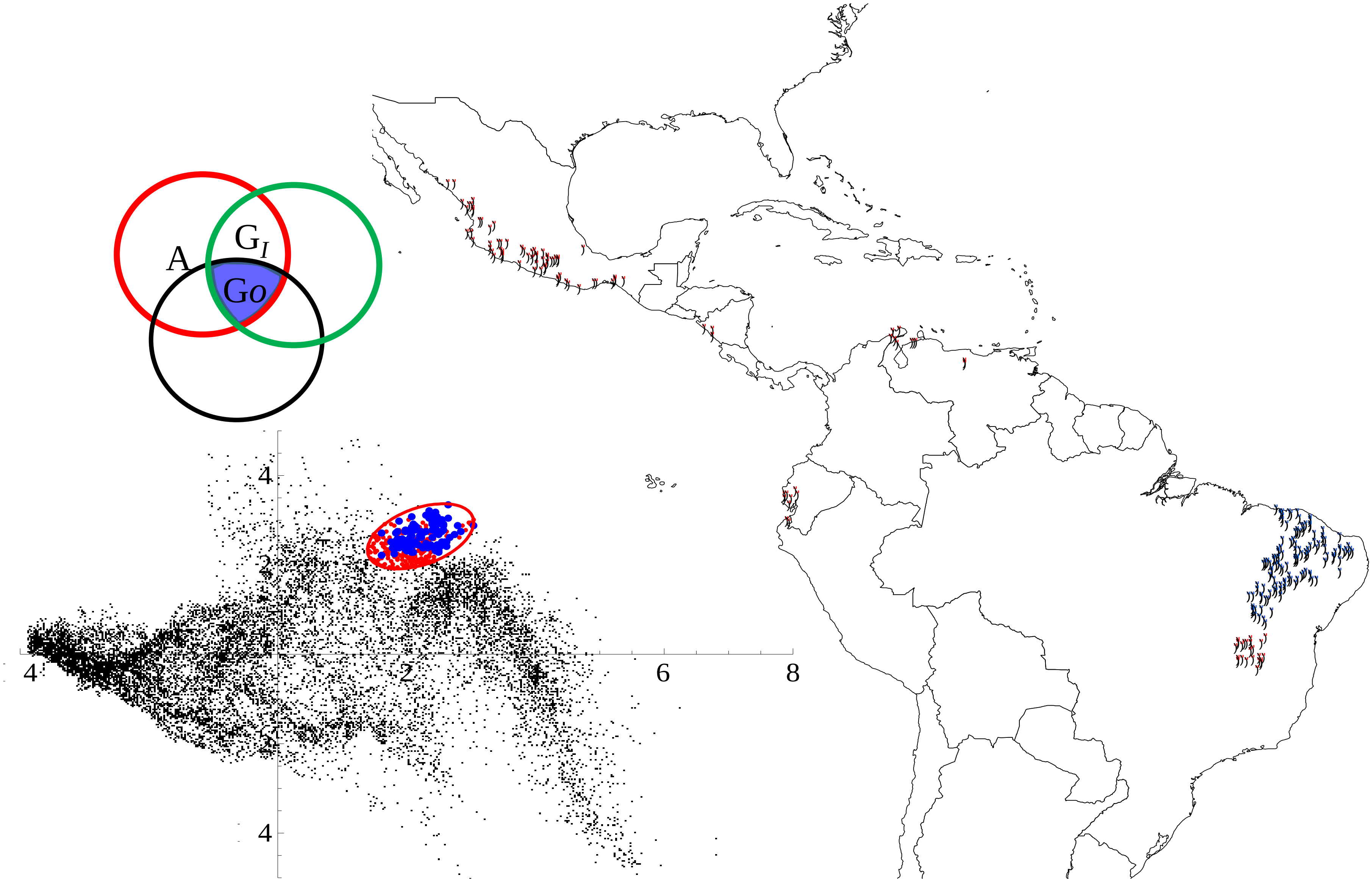
Marco conceptual – diagrama BAM



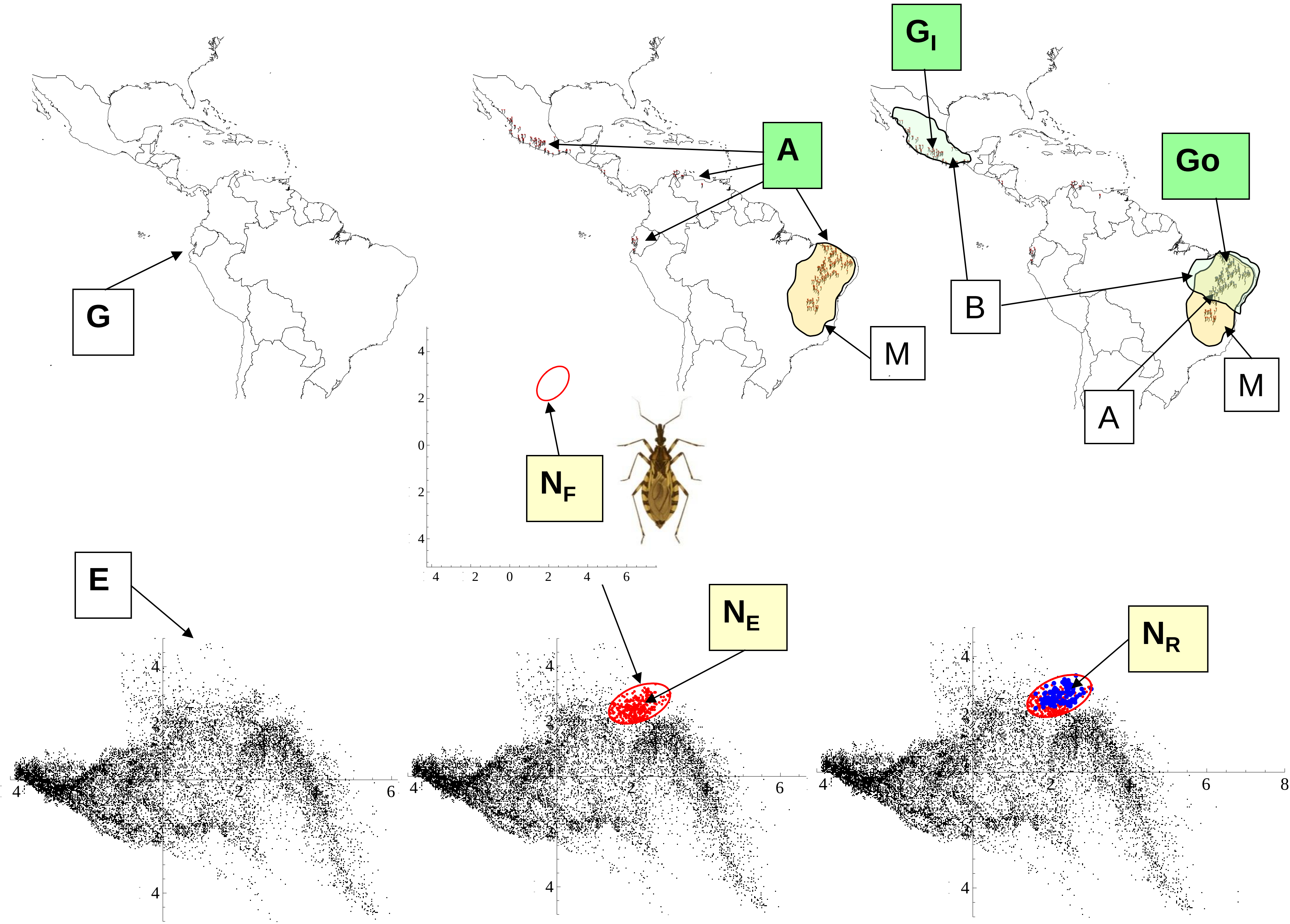
Marco conceptual – diagrama BAM



Dualidad de Hutchinson



Colwell & Rangel, 2009; Soberon & Nakamura, 2009



G
A
M
G$_I$
Go
B
A
M
N$_F$
E
N$_E$
N$_R$

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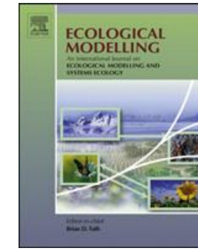

Variation in niche and distribution model performance: The need for a priori assessment of key causal factors

E.E. Saupe, V. Barve, C.E. Myers, J. Soberón, N. Barve, C.M. Hensz, A.T. Peterson*, H.L. Owens, A. Lira-Noriega

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A B S T R A C T

Ecological niche models and species distribution models are becoming important elements in the toolkit of biogeographers and ecologists. Although burgeoning in use, much variation exists in implementation of these techniques, leading to considerable diversity of methodology and discussion of what is the 'best' approach. In this analysis, we explore implications of different configurations of major factors that constrain species' distributions—abiotic factors and dispersal limitation—for the success or failure of these models. We analyze variation in performance among modeling approaches as a function of the relative configuration of these two factors and the spatial extent of training region, with the result that a clear understanding of the abiotic-dispersal configuration is a prerequisite to effective model implementations; the effects of spatial extent of the training region are less consistent and clear. Model development will be powerful only when set in an appropriate and explicit biogeographic and population ecological context.

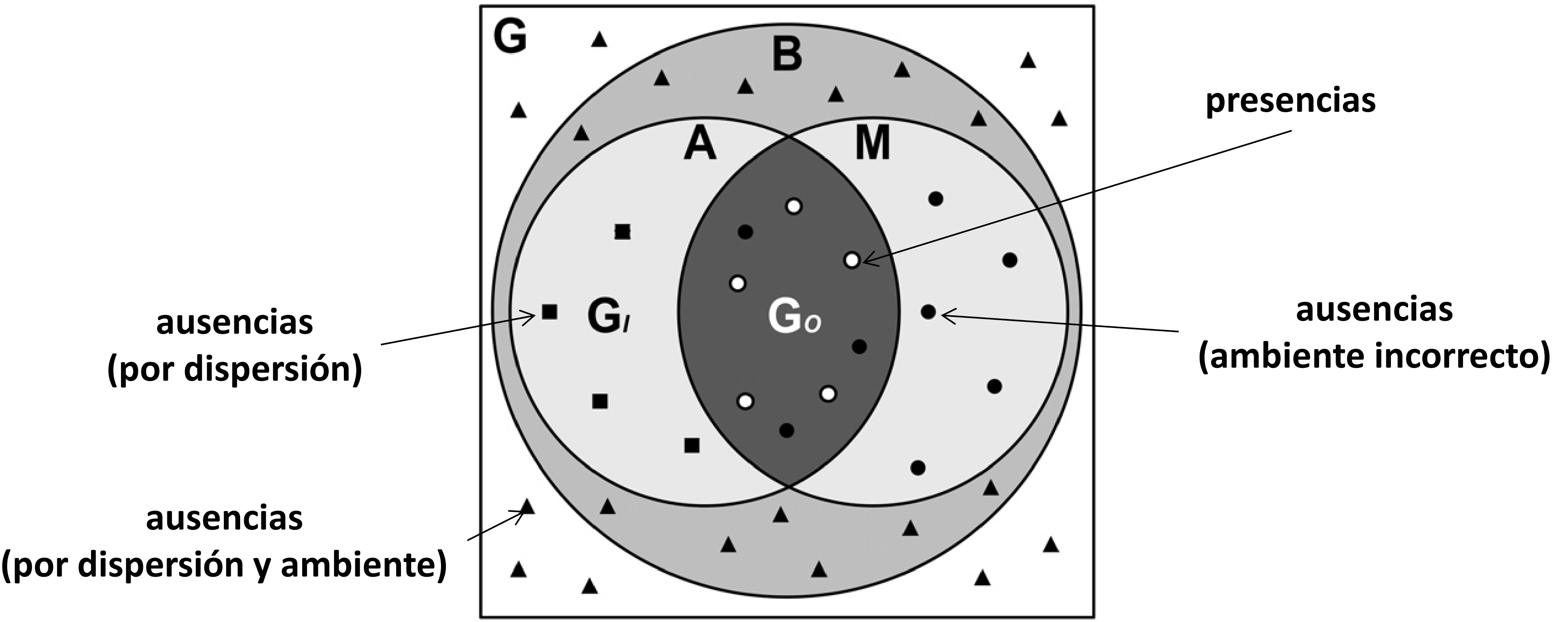
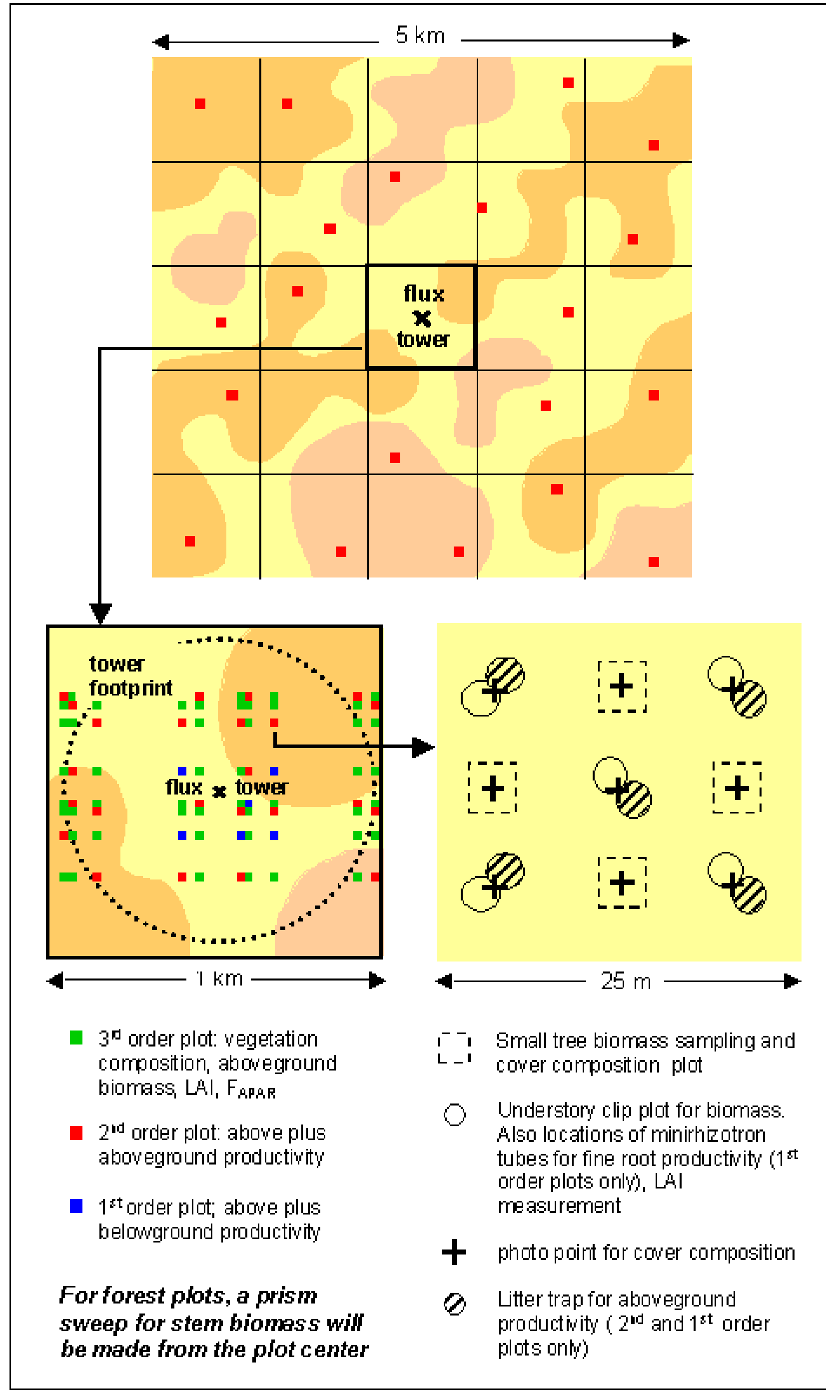


Fig. 1. A simplified BAM diagram in which the effects of biotic interactions (**B**) do not constrain distributional potential of species strongly. The circle **A** represents the parts of the world that contain the abiotic conditions required for a species' survival and growth. The circle **M** represents the region that has been accessible to the species over a relevant period of time. The intersection of these two regions is the occupied area $\mathbf{G}_O$, which nonetheless includes areas of non-presence, for diverse reasons (e.g., metapopulation dynamics). The area $\mathbf{G}_I$ has the correct suite of environmental conditions, but has not been explored by the species. Open circles represent presence data, closed circles indicate absences due to incorrect environment, closed squares indicate absences due to lack of dispersal capacity, and triangles indicate absences owing to both incorrect conditions and limited dispersal.

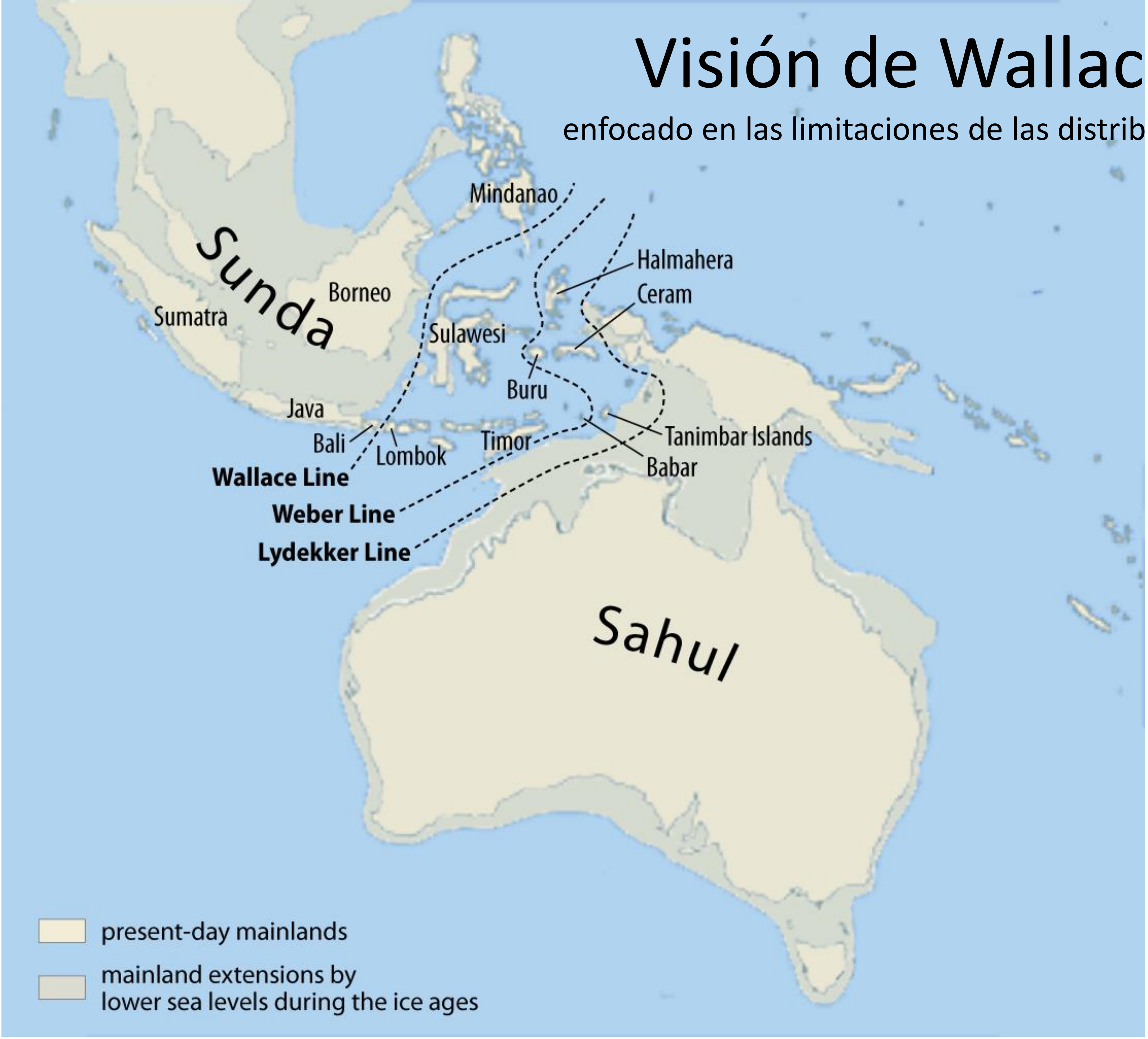
Visión de Hutchinson

donde lo biótico y abiótico son correctos
visión del ecólogo

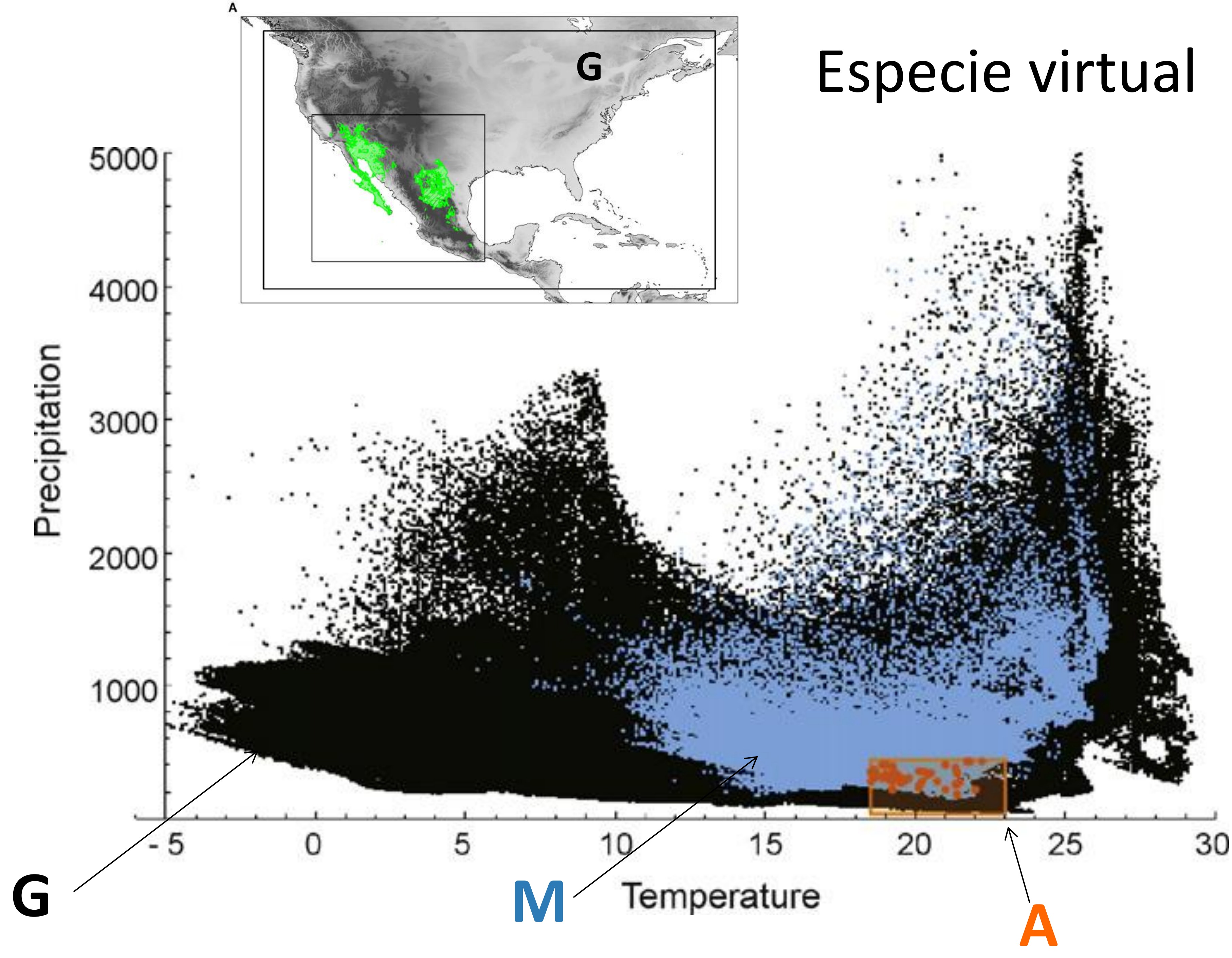


Visión de Wallace

enfocado en las limitaciones de las distribuciones



Especie virtual



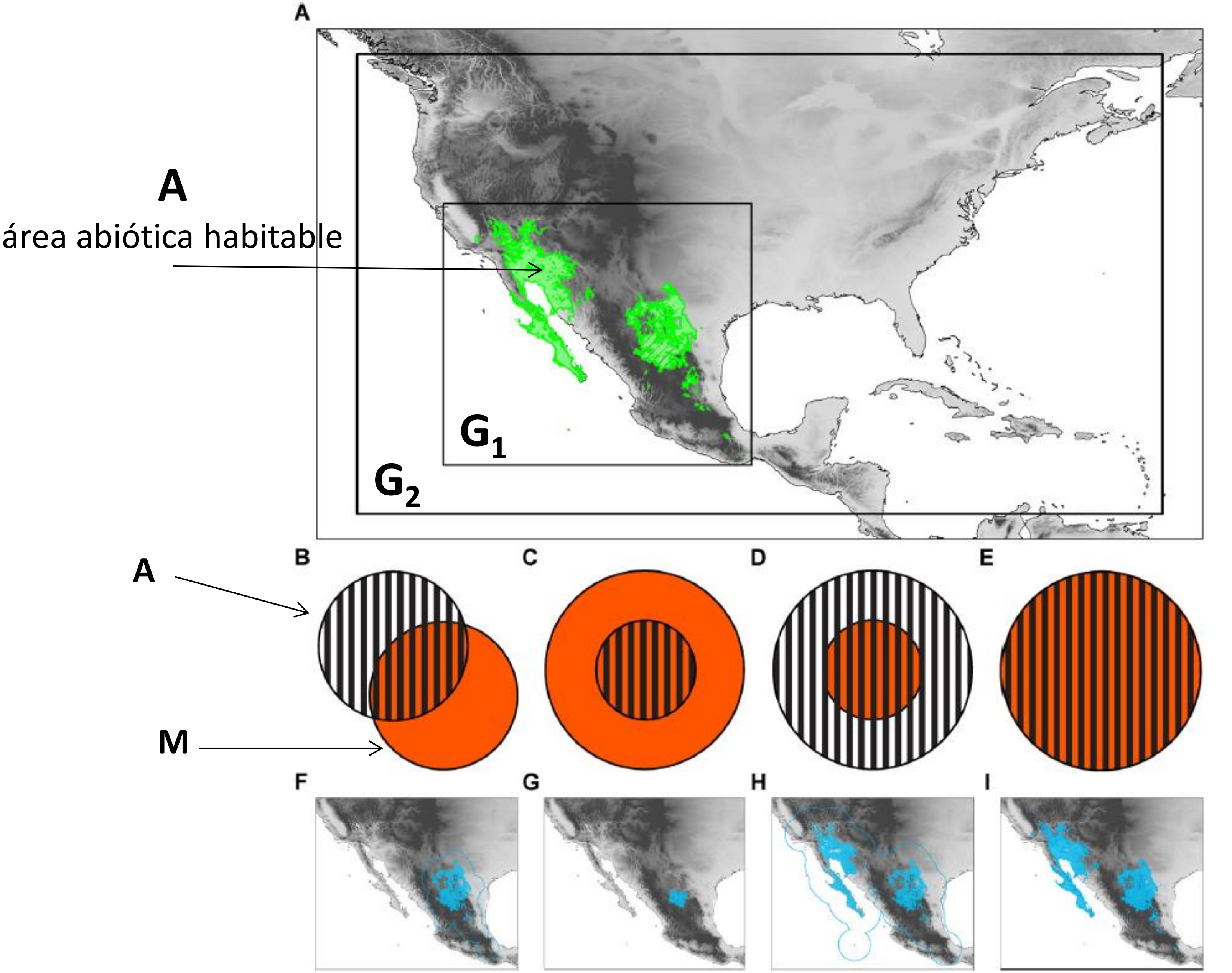
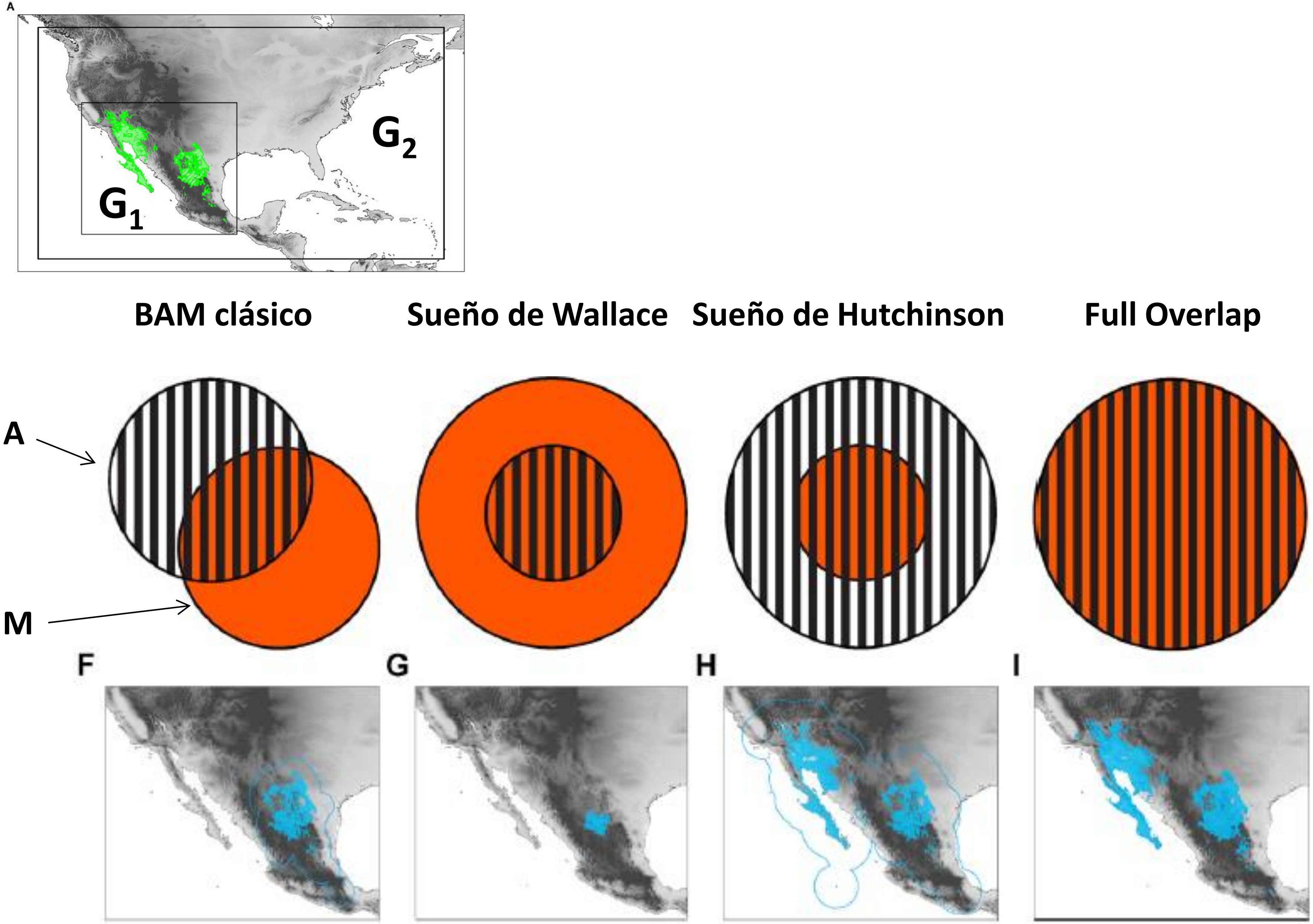


Fig. 2. Distributional areas and associated BAM scenarios for the Desert species. (A) Map showing $\mathbf{G}_1$ (small box), $\mathbf{G}_2$ (larger box), and the abiotic habitable area (**A**, in green). (B–E) Schematic diagrams summarizing the four BAM scenarios used (**A** is represented by the orange circle, **M** is represented by the hatched circle): (B) Classic BAM (CB), (C) Wallace's Dream (WD), (D) Hutchinson's Dream (HD), and (E) Full Overlap (FO). (F–I) Maps of distributional areas associated with each of the BAM scenarios (**M** is represented by the solid blue outline, hatched blue area indicates the inhabited area $\mathbf{G}_0$): (F) CB, (G) WD, (H) HD, and (I) FO. (The color version of this figure is available in the web version of this article.)



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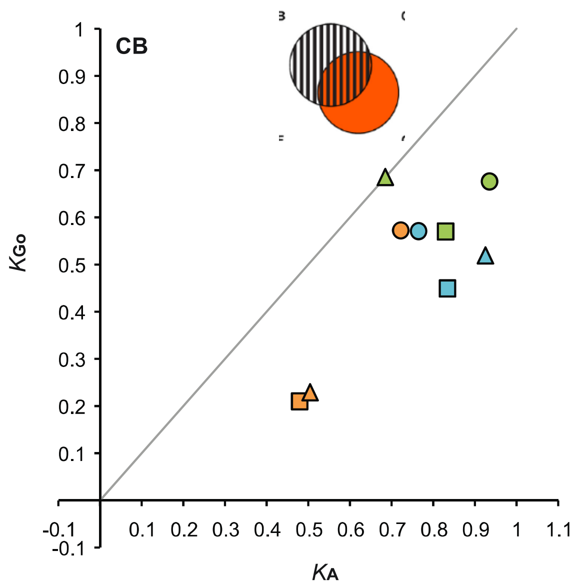
Abilidad predictiva entre escenarios

Kappa
0 = aleatorio
1 = correspondencia alta

A = potencial
Go = ocupada



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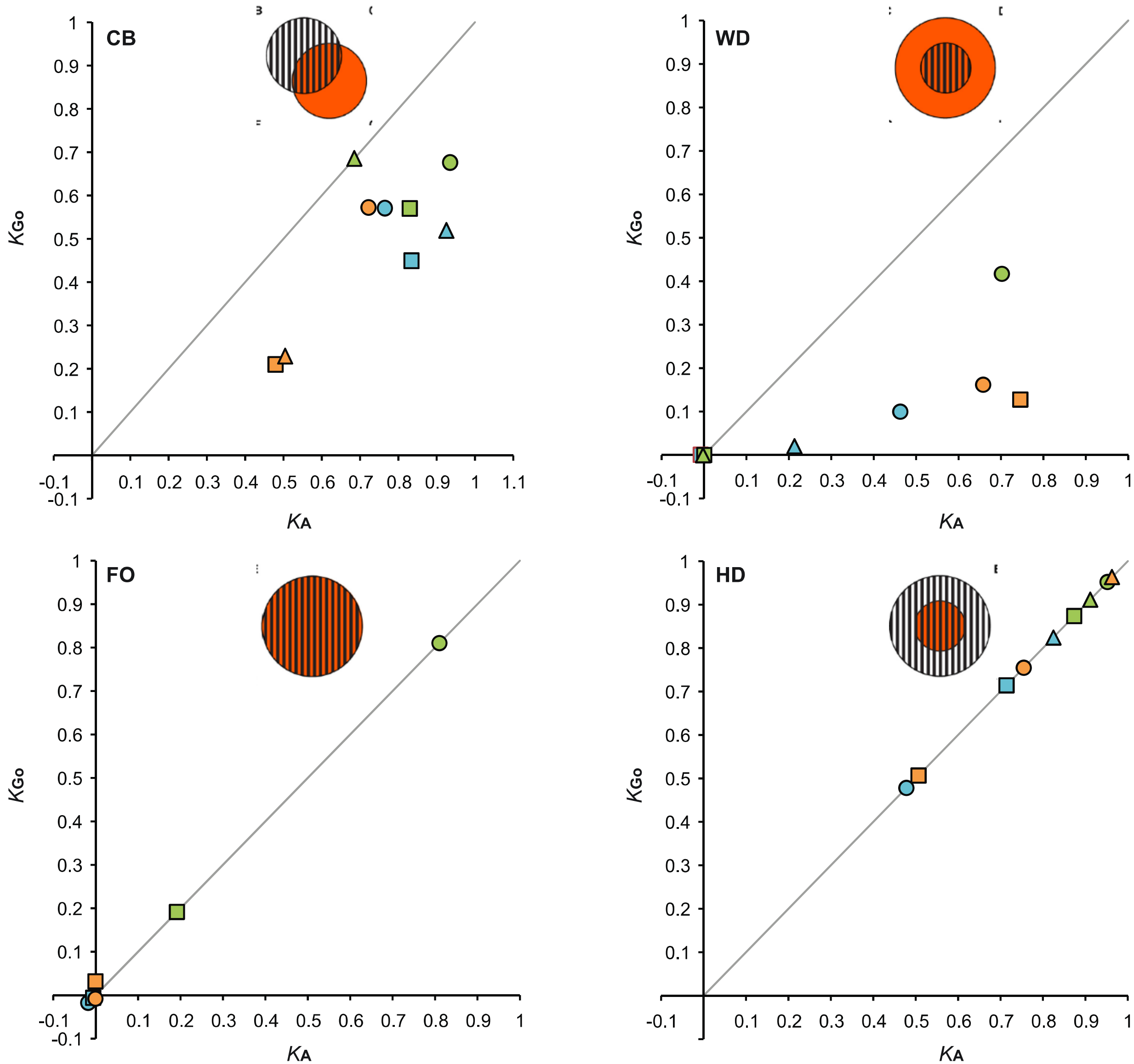
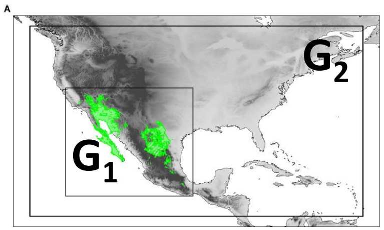


Fig. 4. Predictive ability of models as measured by kappa values comparing the model output to the potential ($K_{\mathbf{A}}$) and occupied (K_{G_O}) areas when trained in **M**, for each of the four BAM scenarios. Blue = Desert species; green = Southeast species; orange = Northwest species. Circles = GARP; squares = Maxent; triangles = GAM. (The color version of this figure is available in the web version of this article.)

Abilidad predictiva entre G_1 y G_2



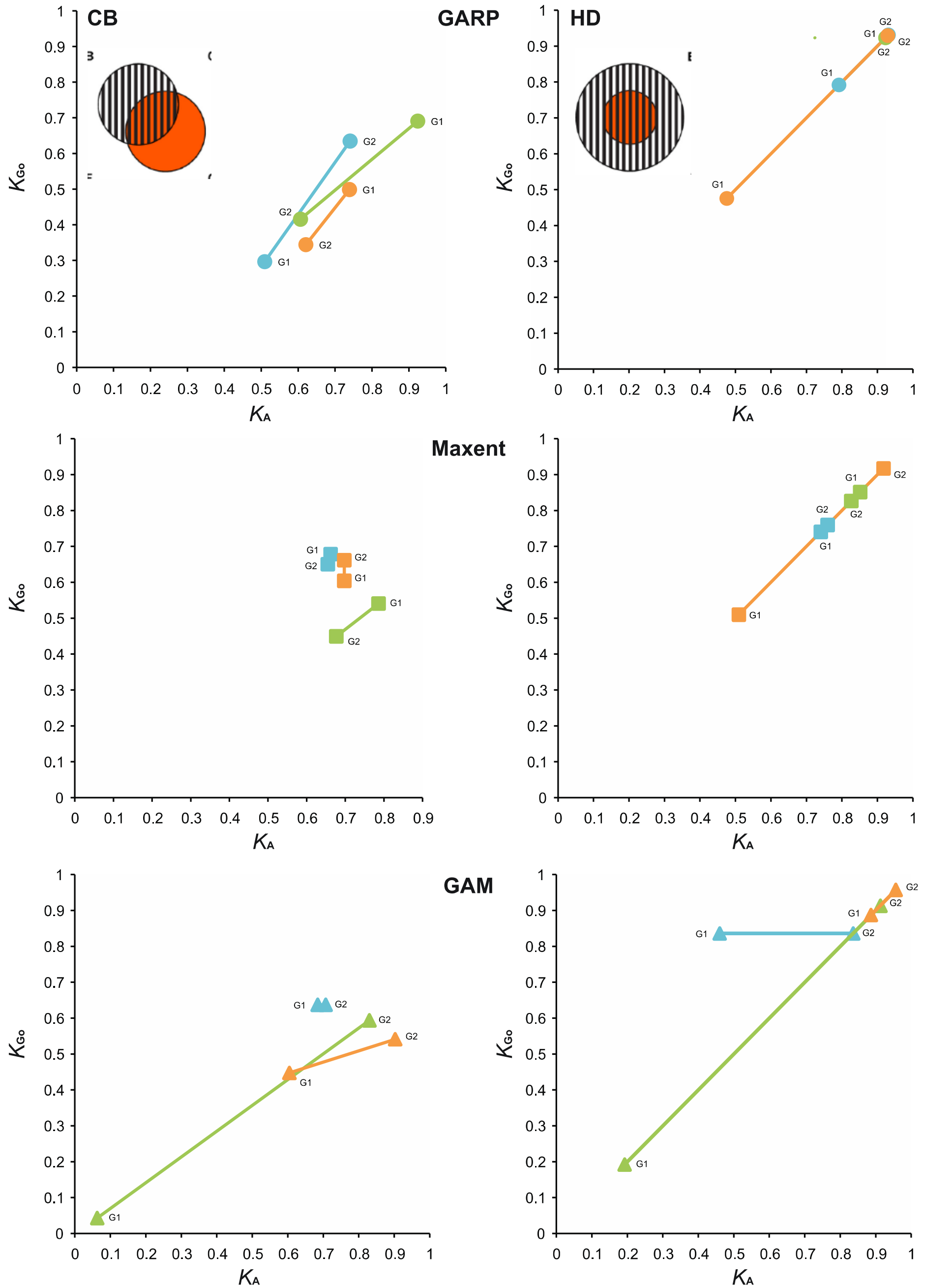
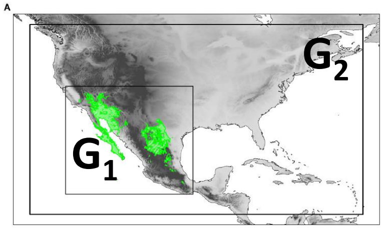
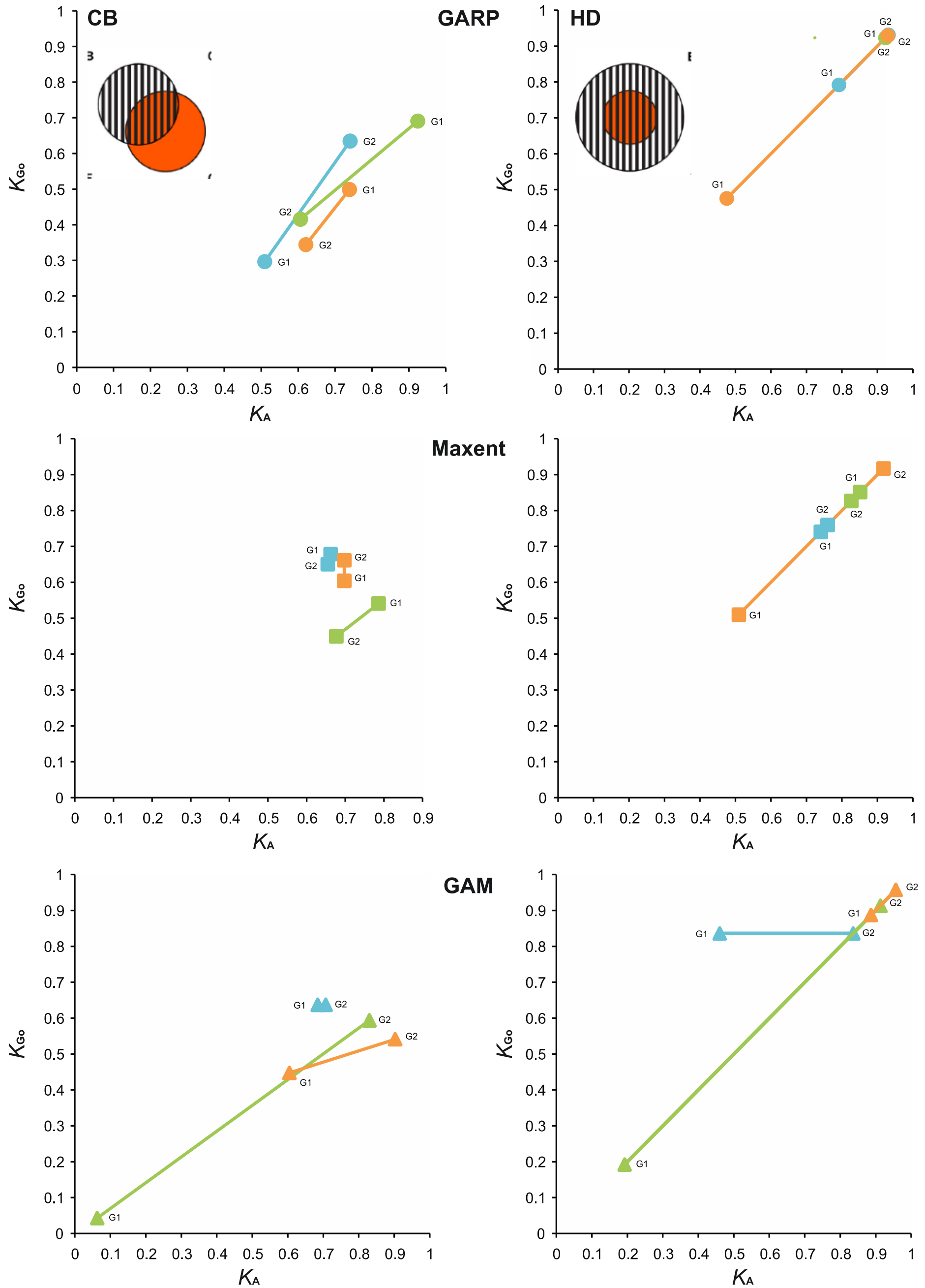


Fig. 5. Predictive ability of models as measured by kappa values comparing the model output to the potential (K_A) and occupied (K_{G_O}) areas for two different calibration areas (**G**$_1$ and **G**$_2$). Symbols as in Fig. 4. (The color version of this figure is available in the web version of this article.)

Abilidad predictiva entre G_1 y G_2





G_1 y G_2 mejores que M

M no informa directamente a los modelos

Fig. 5. Predictive ability of models as measured by kappa values comparing the model output to the potential (K_A) and occupied (K_{G_O}) areas for two different calibration areas (**G_1** and **G_2**). Symbols as in Fig. 4. (The color version of this figure is available in the web version of this article.)

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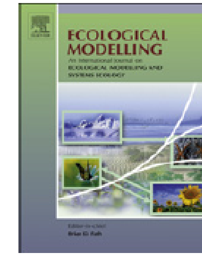


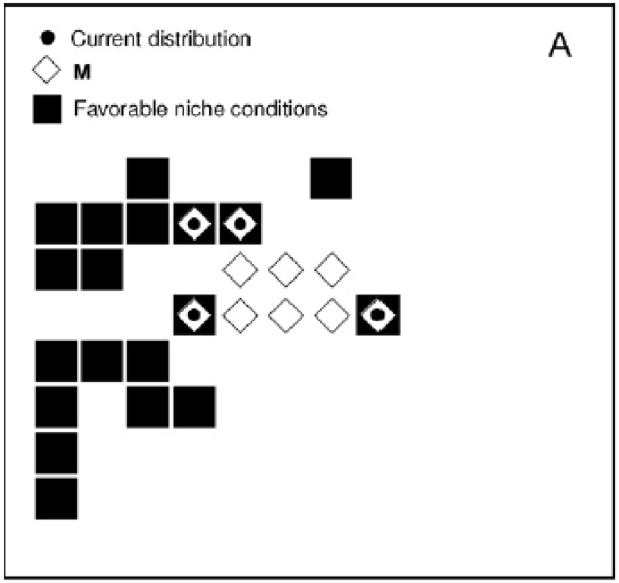
The crucial role of the accessible area in ecological niche modeling and species distribution modeling

Narayani Barve[a], Vijay Barve[a,1], Alberto Jiménez-Valverde[a,1], Andrés Lira-Noriega[a], Sean P. Maher[a,2], A. Townsend Peterson[a,*], Jorge Soberón[a], Fabricio Villalobos[b]

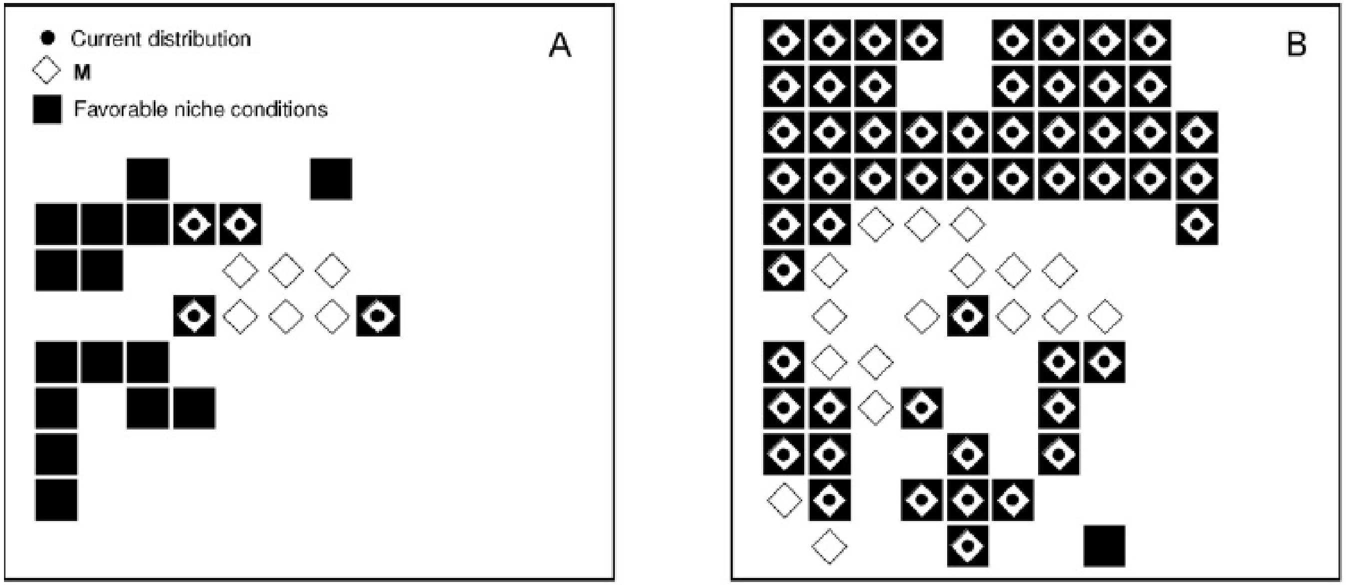
[a] Biodiversity Institute, University of Kansas, Lawrence, KS 66045, USA
[b] Posgrado en Ciencias Biológicas and Instituto de Ecología, Universidad Nacional Autónoma de México, Apartado Postal 70-275, CP 04510 México City, Mexico

M representa las regiones accesibles a la especie en un periodo "relevante" de tiempo.

Implicaciones: (1) exptrapolación y (2) sobrelapamiento



Current distribution
M
Favorable niche conditions
A


Current distribution
M
Favorable niche conditions
A
B

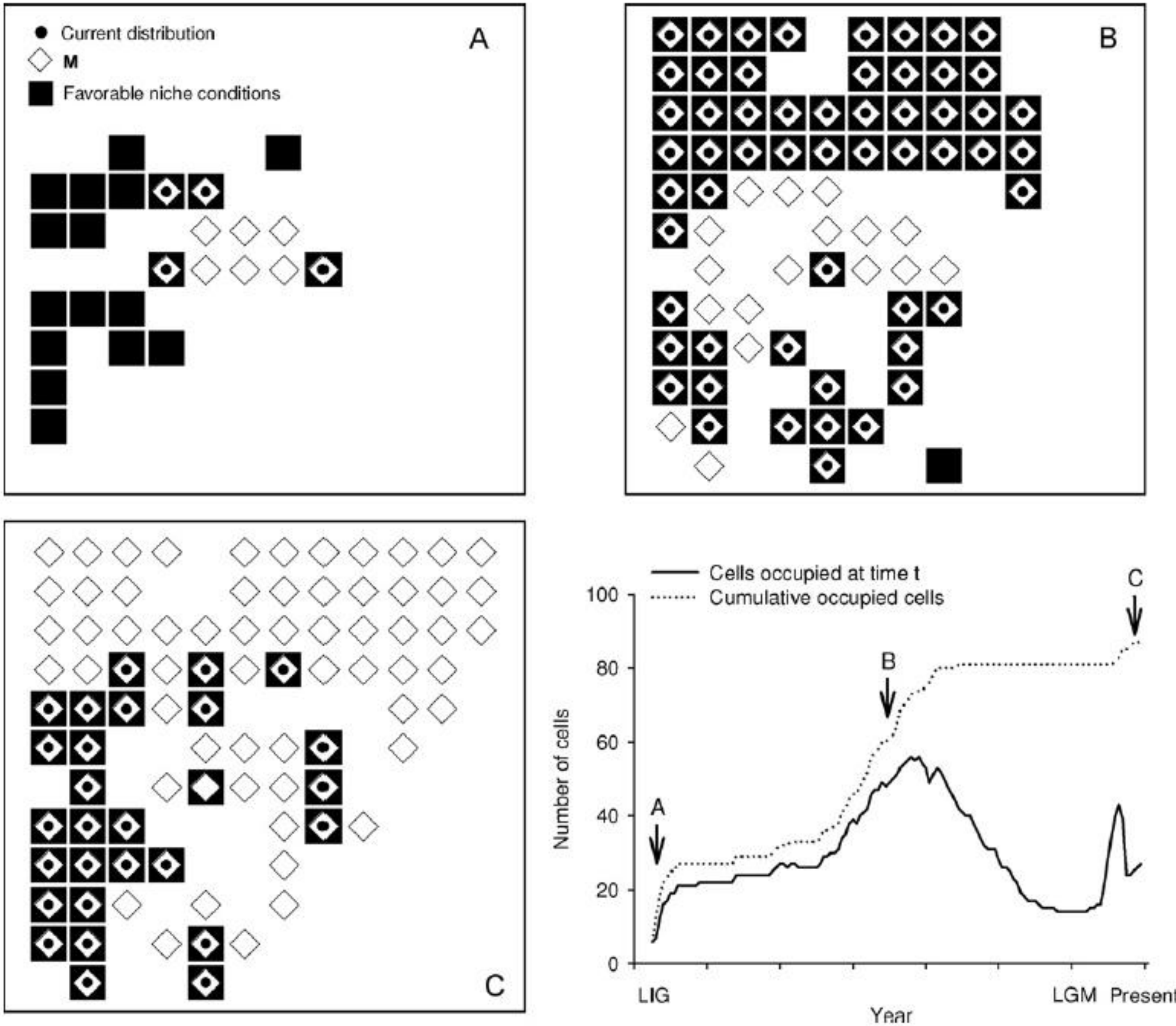
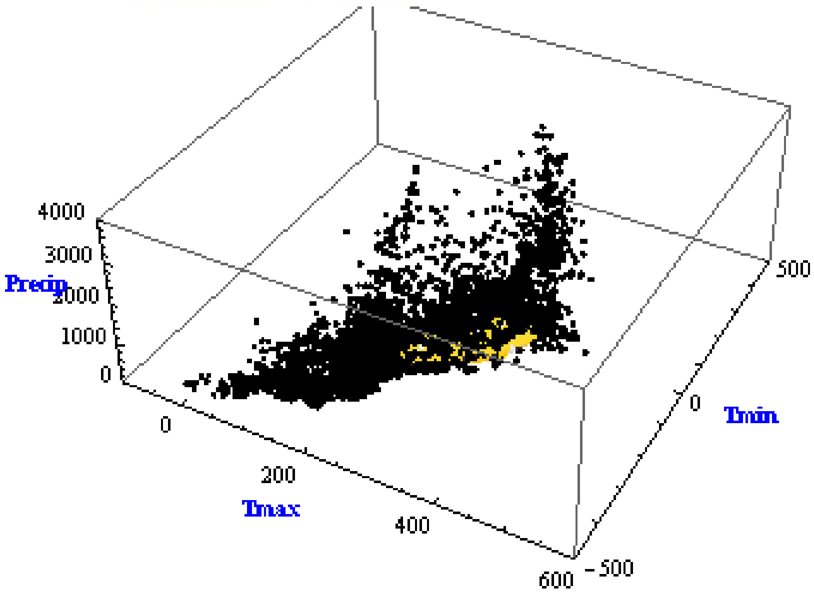


Fig. 7. Simulation results, showing the number of cells occupied by the species at a particular time and the cumulative tracking of cells that have been occupied by it at any point previously in the simulation. Shown are the continuous traces of cells occupied at any point in time and cumulatively, as well as three time "snapshots" showing actual distributions.

Antilocapra americana



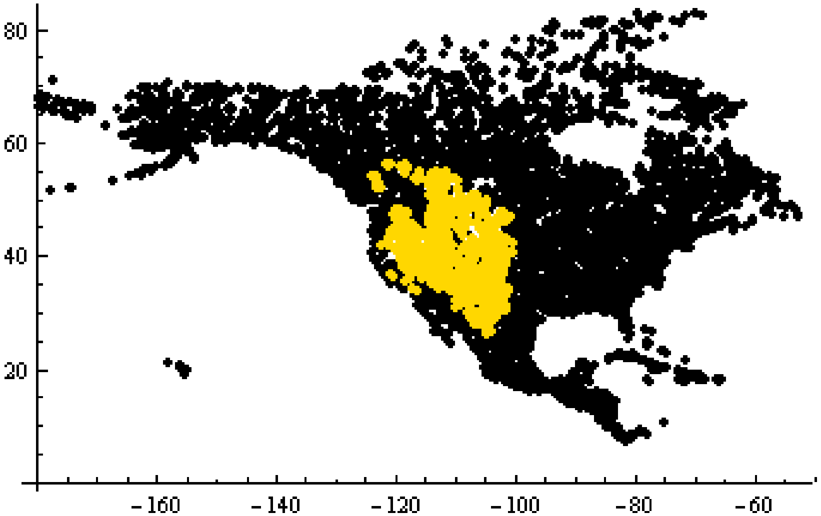


Illustration from Audubon Images

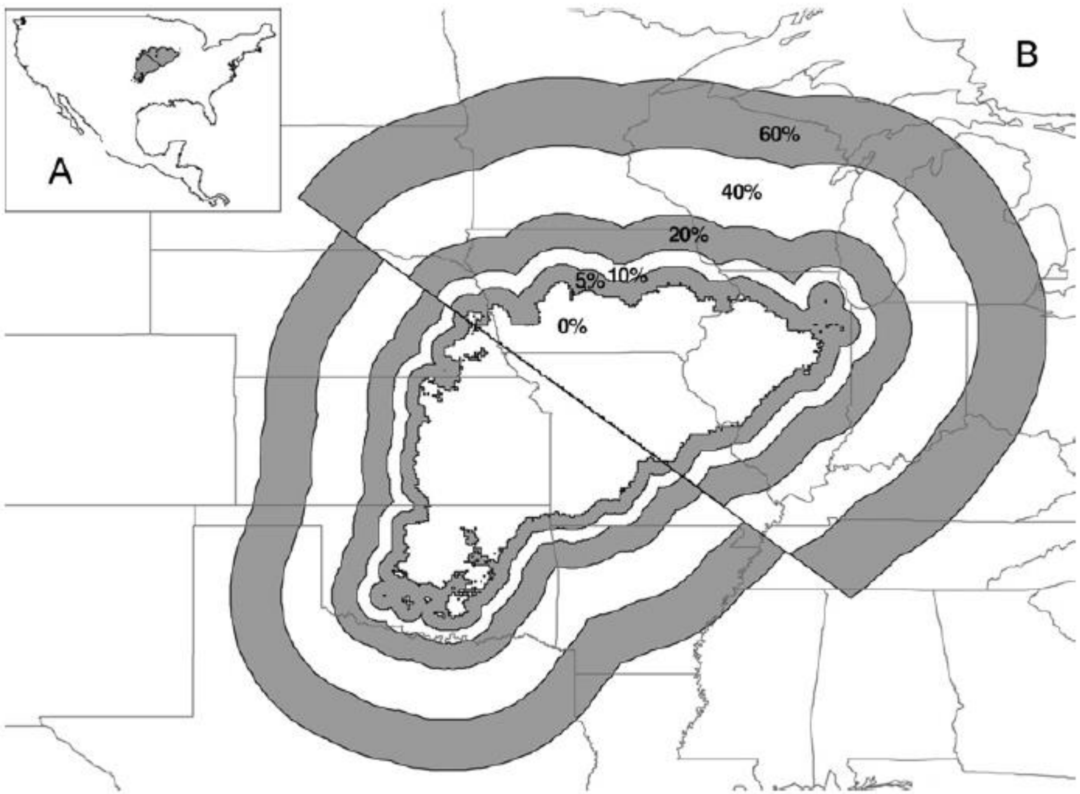
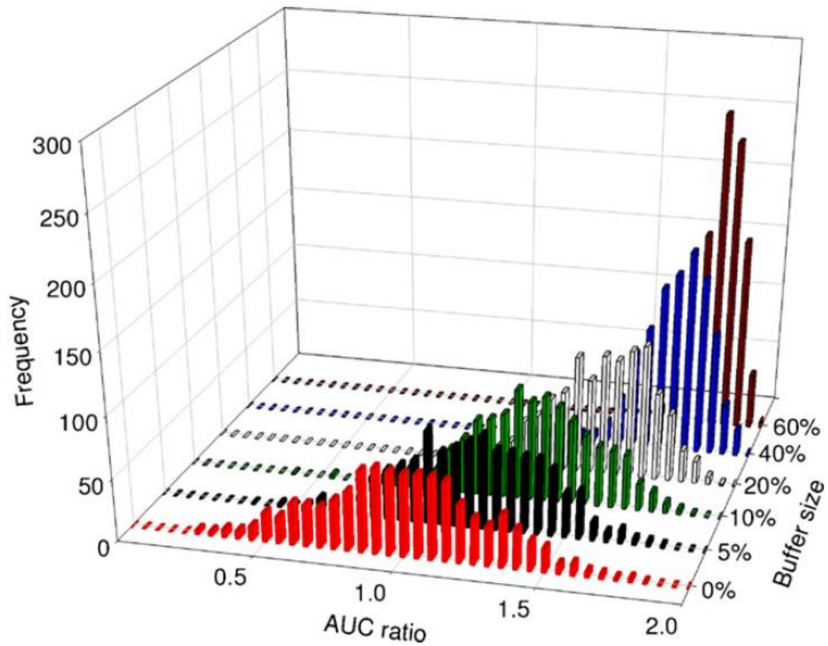
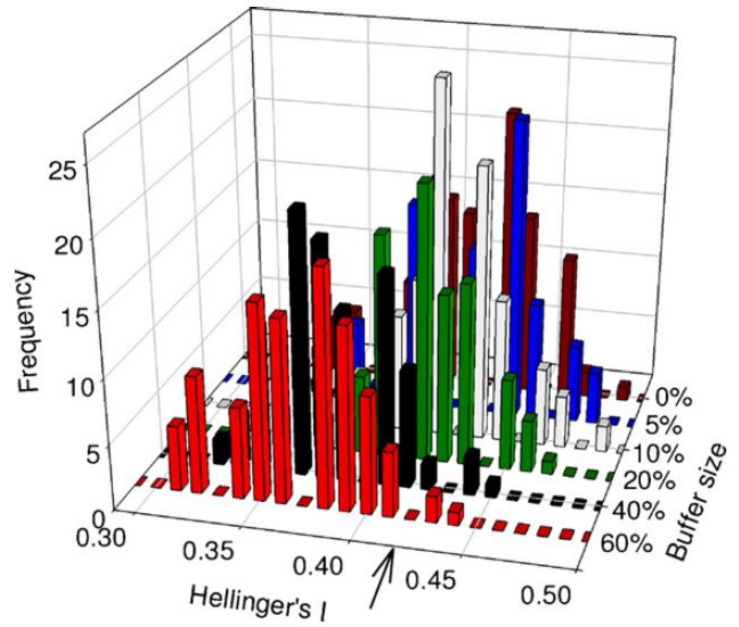


Fig. 2. Distributions of two virtual species generated from the set of environments most similar to the climate of Lawrence, Kansas (B; details in text). The two species share the same fundamental niche, but are separated by a hypothetical barrier to dispersal (line running northwest to southeast). The distributional area of each virtual species is shown in relation to the 6 extents across which examples of model calibration, evaluation, and comparison are developed (0%, 5%, 10%, 20%, 40%, and 60%). Inset (A) shows the location of the ranges of the two "species" relative to North America.



Significancia del modelo como función del área de entrenamiento (**M**)

Fig. 4. Effect of the extent of study area in model validation. AUC values tend to increase, meaning a higher model significance, as model testing area increases.

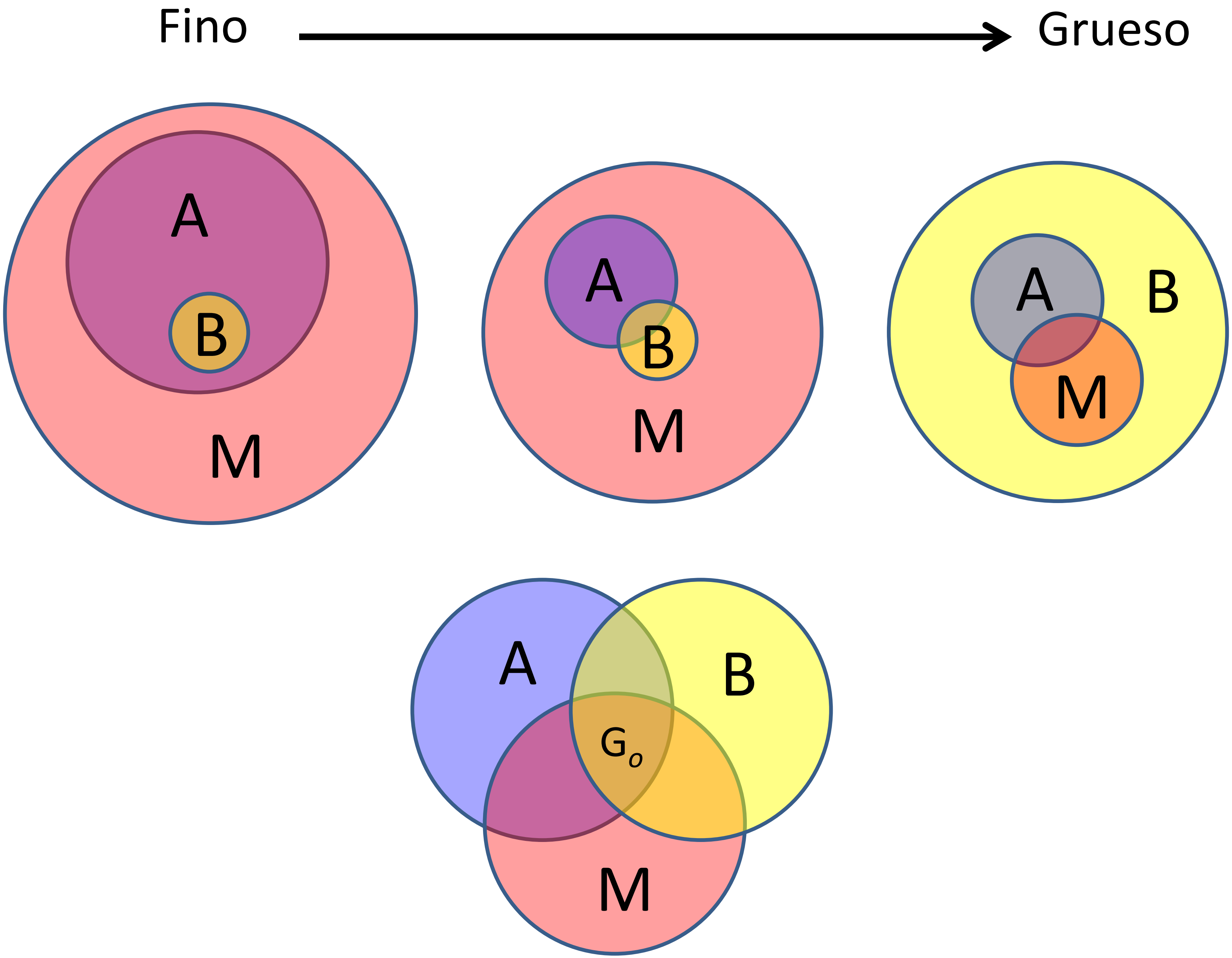


Sobrelapamiento como función del área de entrenamiento (**M**)

Fig. 5. Comparison of the similarity of the two virtual species depending on the background area used to select pseudoabsences (i.e., different buffer sizes around the distribution of the southwestern species) for the *I* index from Warren et al. (2008) implemented in ENMTools. Note that the buffer size axis is reversed from that of Fig. 4, but that again the likelihood of the observed *I* value being a consequence of random differences decreases markedly with buffer size.

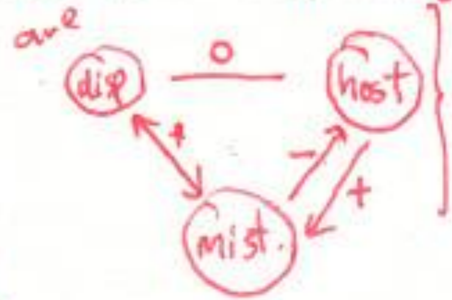
El diagrama BAM como función de la escala

Ejemplo


Fino
Grueso
A
B
M
A
B
M
A
B
M
A
B
G_o
M

Phoradendron californicum.

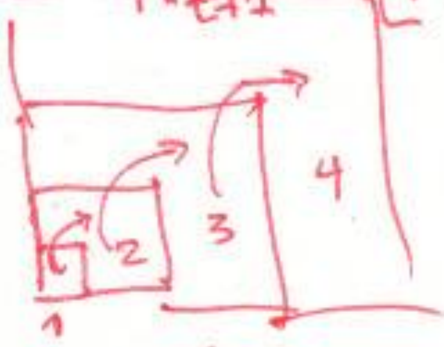
mistletoe = muérdago



biología

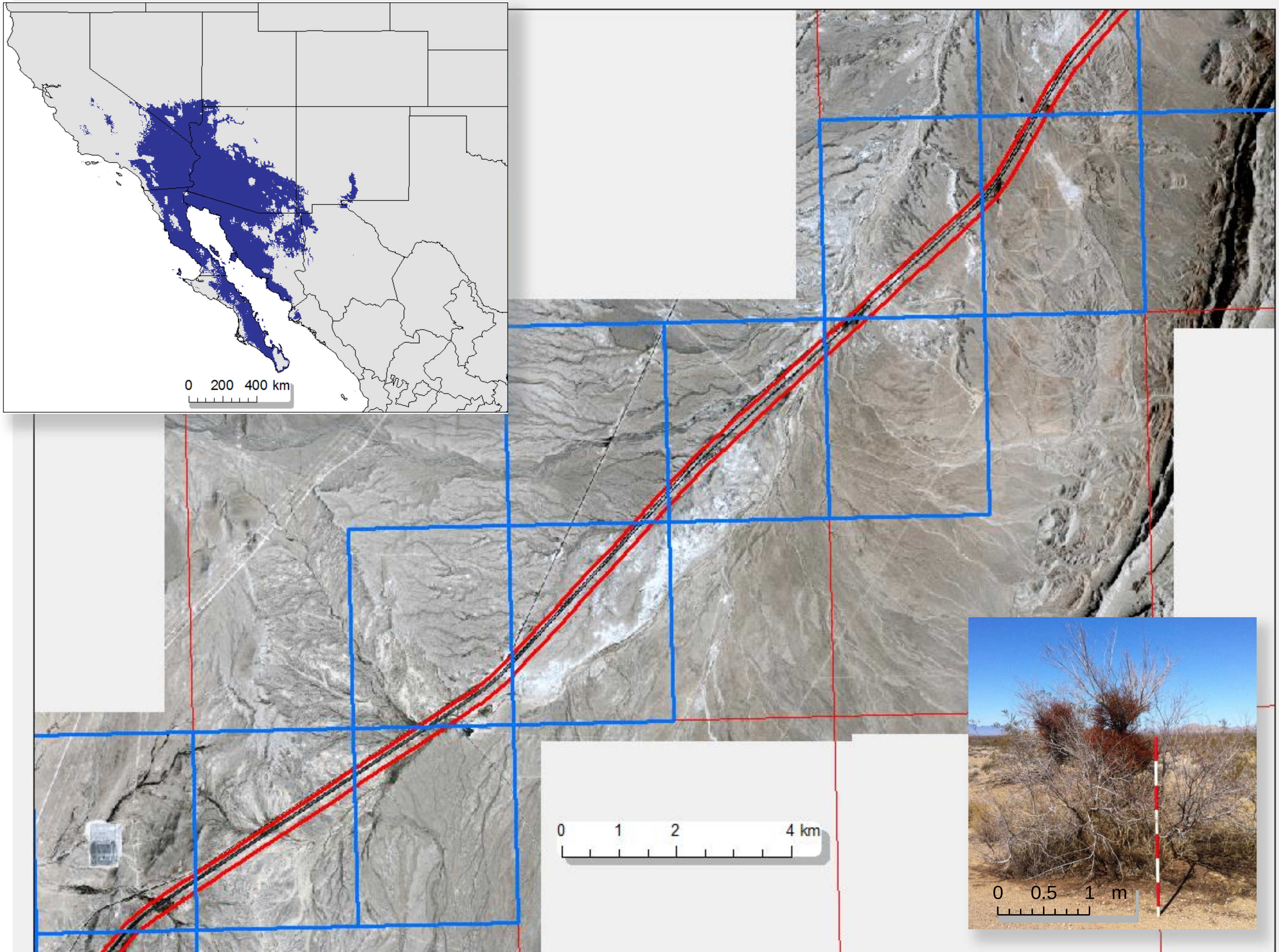
?

$$N_{t+1} = [N_{t_i} + N_{new_i} + N_{out_i} - D]A$$

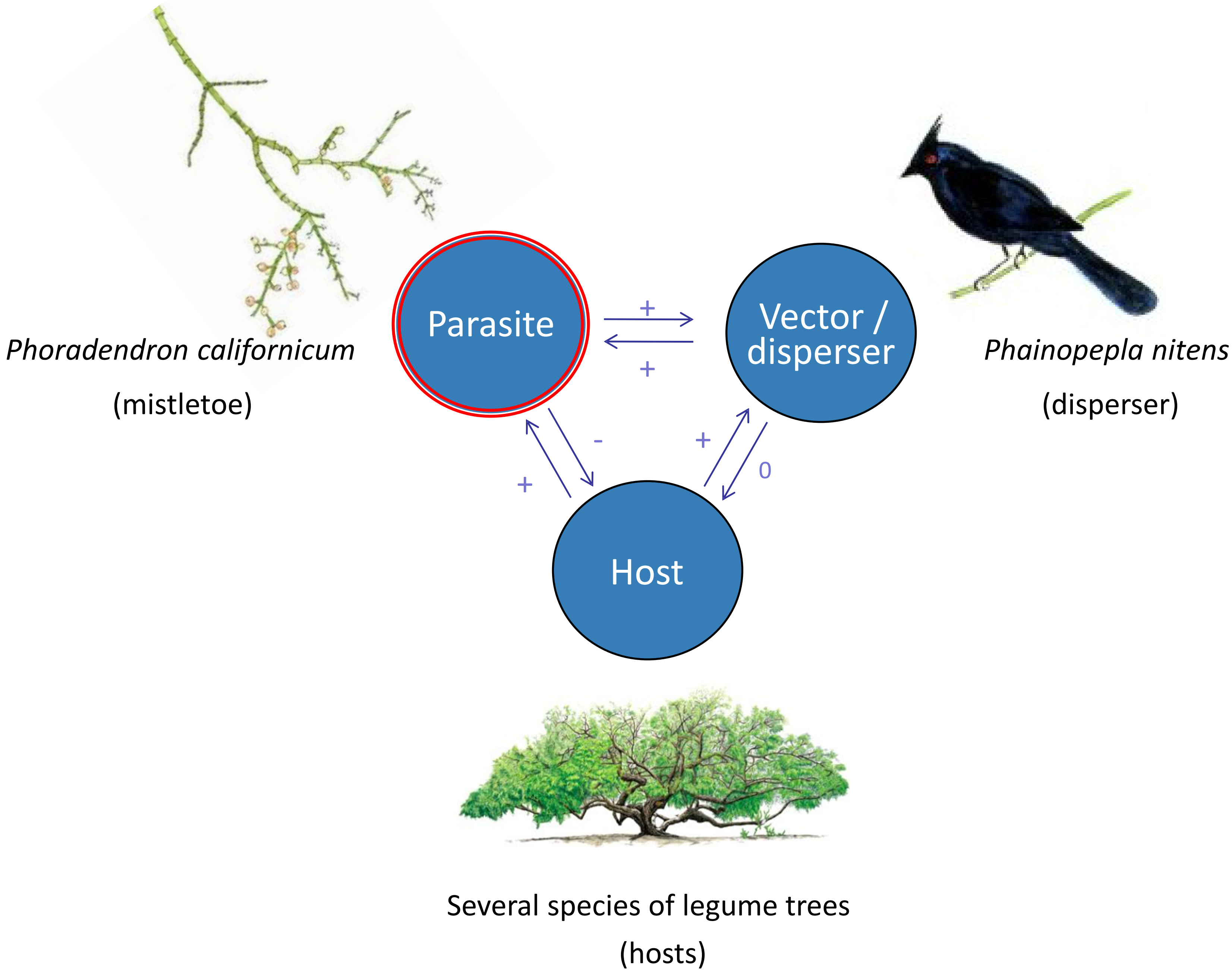


scaling.

concept.



0 200 400 km
0 1 2 4 km
0 0.5 1 m

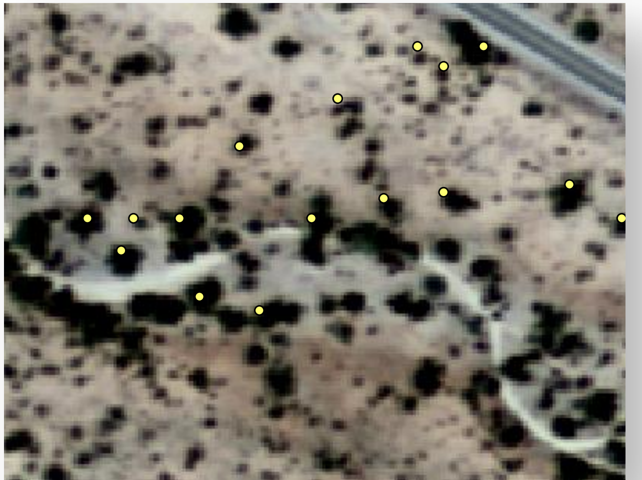


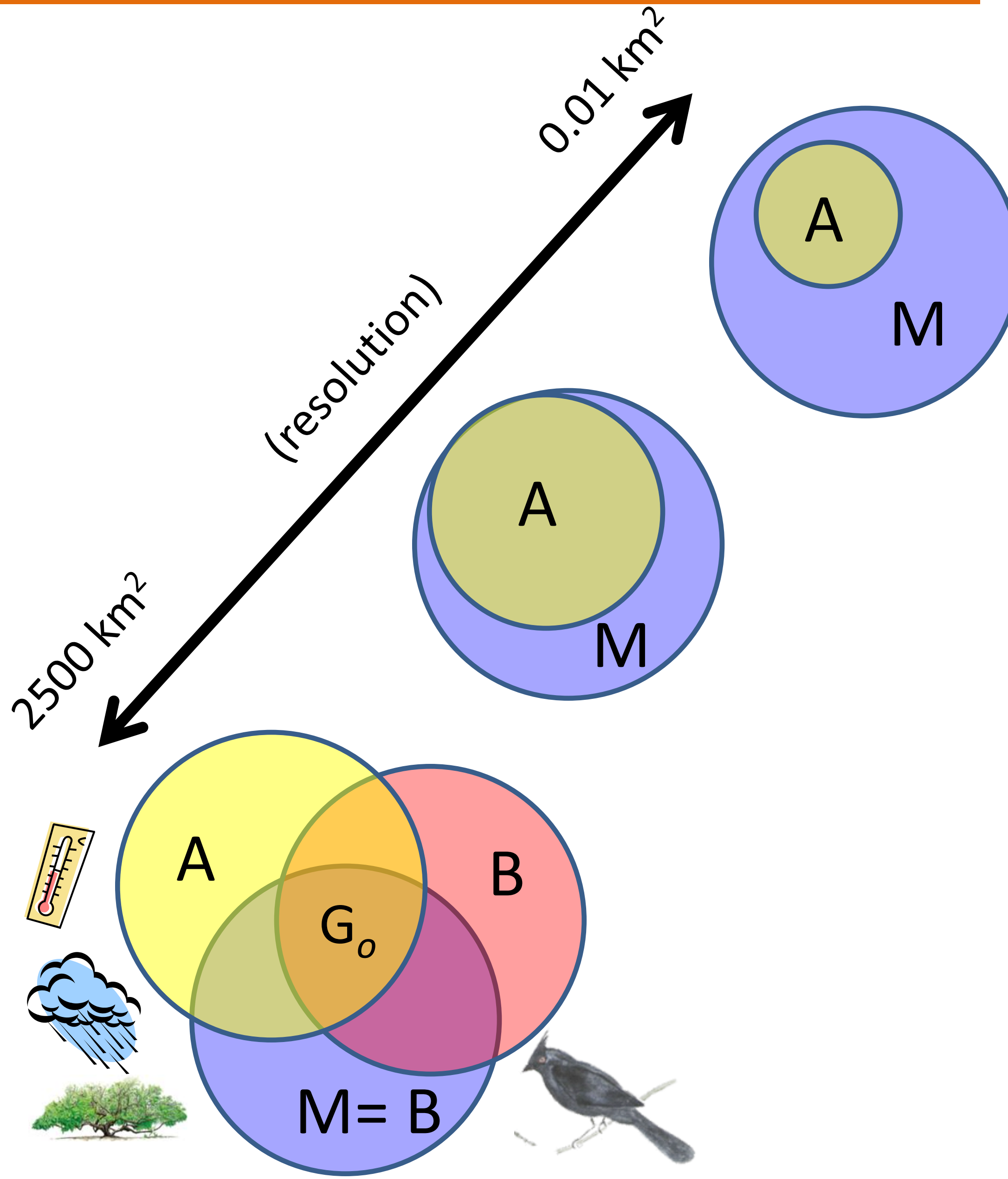
Parasite
Vector / disperser
Host
+
+
-
+
+
0
Phoradendron californicum
(mistletoe)
Phainopepla nitens
(disperser)
Several species of legume trees
(hosts)


© Arthur Morris / Birds As Art
1 cm

Phoradendron californicum

Conceptual framework

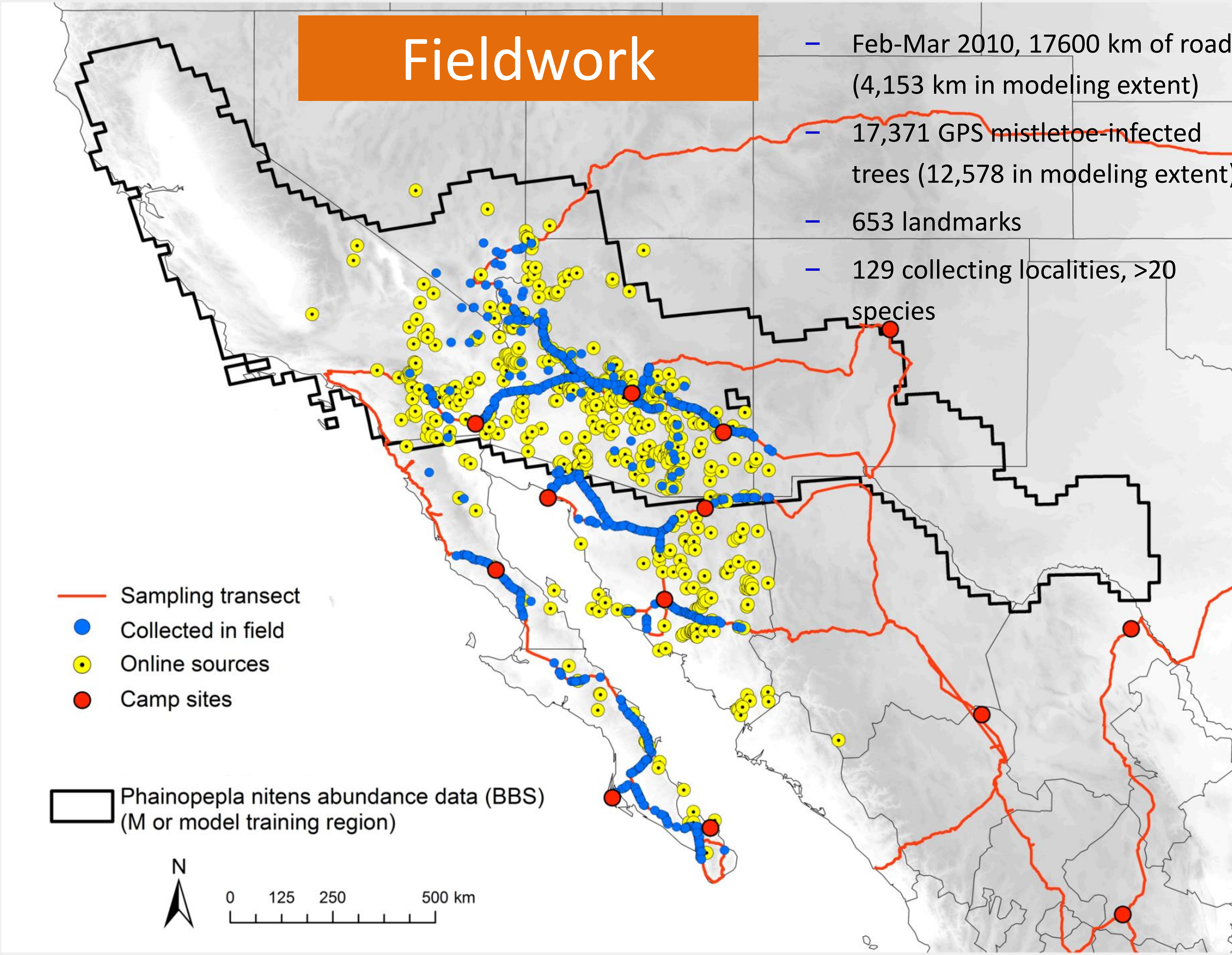




Soberón & Peterson (2005), Hutchinson (1978)

Fieldwork

- Feb-Mar 2010, 17600 km of roads (4,153 km in modeling extent)
- 17,371 GPS mistletoe-infected trees (12,578 in modeling extent)
- 653 landmarks
- 129 collecting localities, >20 species



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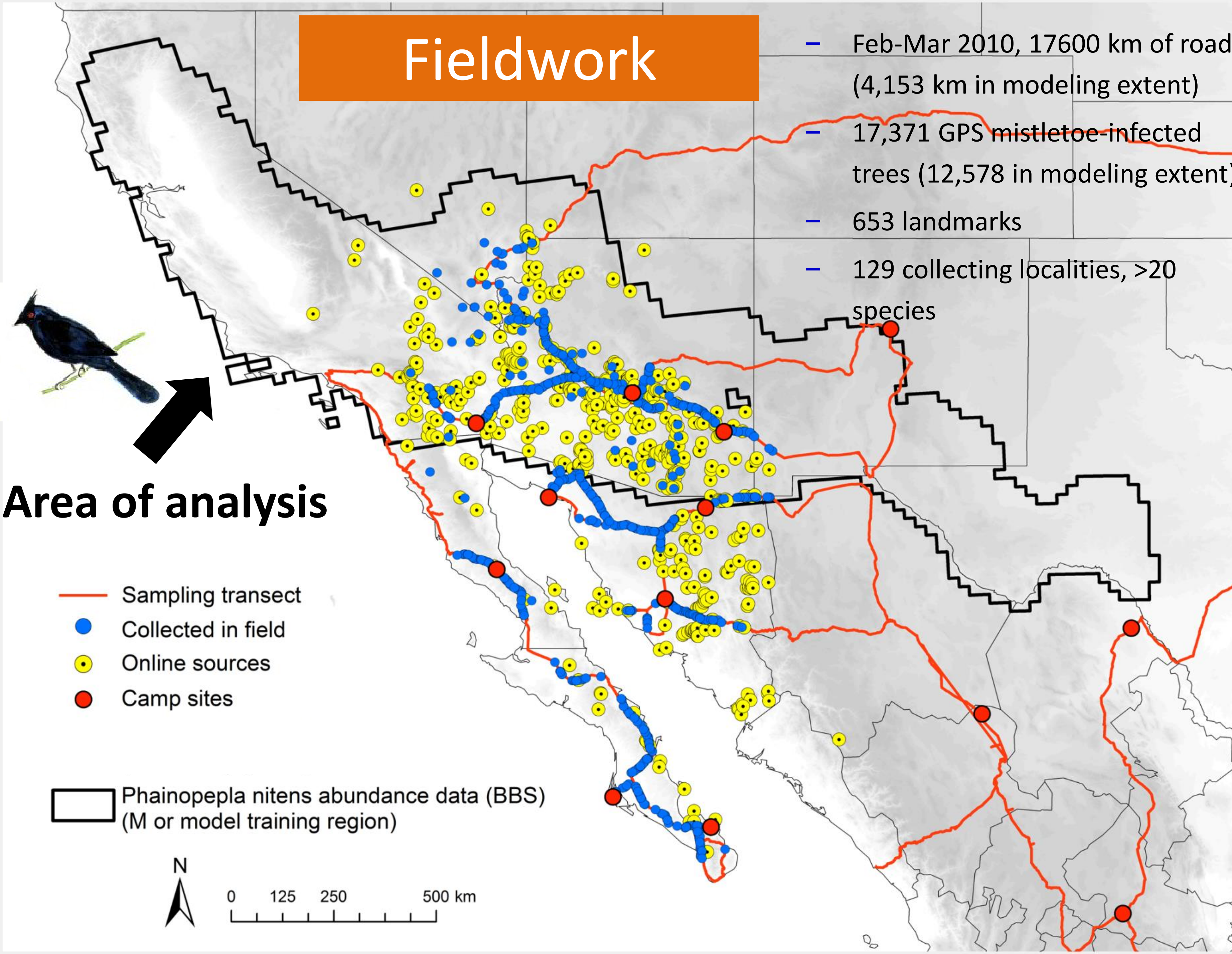
Area of analysis



Reflexiones

- Ventajas de un marco conceptual (diagrama BAM):

  - plantear preguntas y problemas

  - diseñar experimentos

  - comparar modelos y escenarios ("meta-análisis")