



P.J. Solera-Álvarez^{1,2}, J.M. Barea-Azcón³, M. Escudero^{2,4} and J. Cabello^{2,4}

¹Máster en Conservación, Gestión y Restauración de la Biodiversidad, Universidad de Granada, Granada, España; ²Universidad de Almería; ³AMAYA; ⁴Centro Andaluz para la Evaluación y Seguimiento del Cambio Global (CAESCG); pedrosolera@correo.ugr.es



Introduction

Diurnal butterflies (Lepidoptera)¹

- Knowledge of taxonomy and its ecology.
- Indicators of biodiversity conservation status.
- Extensive databases and monitoring networks.

Diurnal butterfly monitoring program



Enhanced monitoring programs

Monitoring **ecosystem functioning dynamics**

Remote sensing²

- Annual curves of spectral vegetation indices (e.g. NDVI).
- Obtaining functional ecosystem attributes.
- Monitoring programs based on satellite images.



Primary productivity measured through NDVI → main environmental control of diurnal butterfly diversity and abundance in the Sierra Nevada.



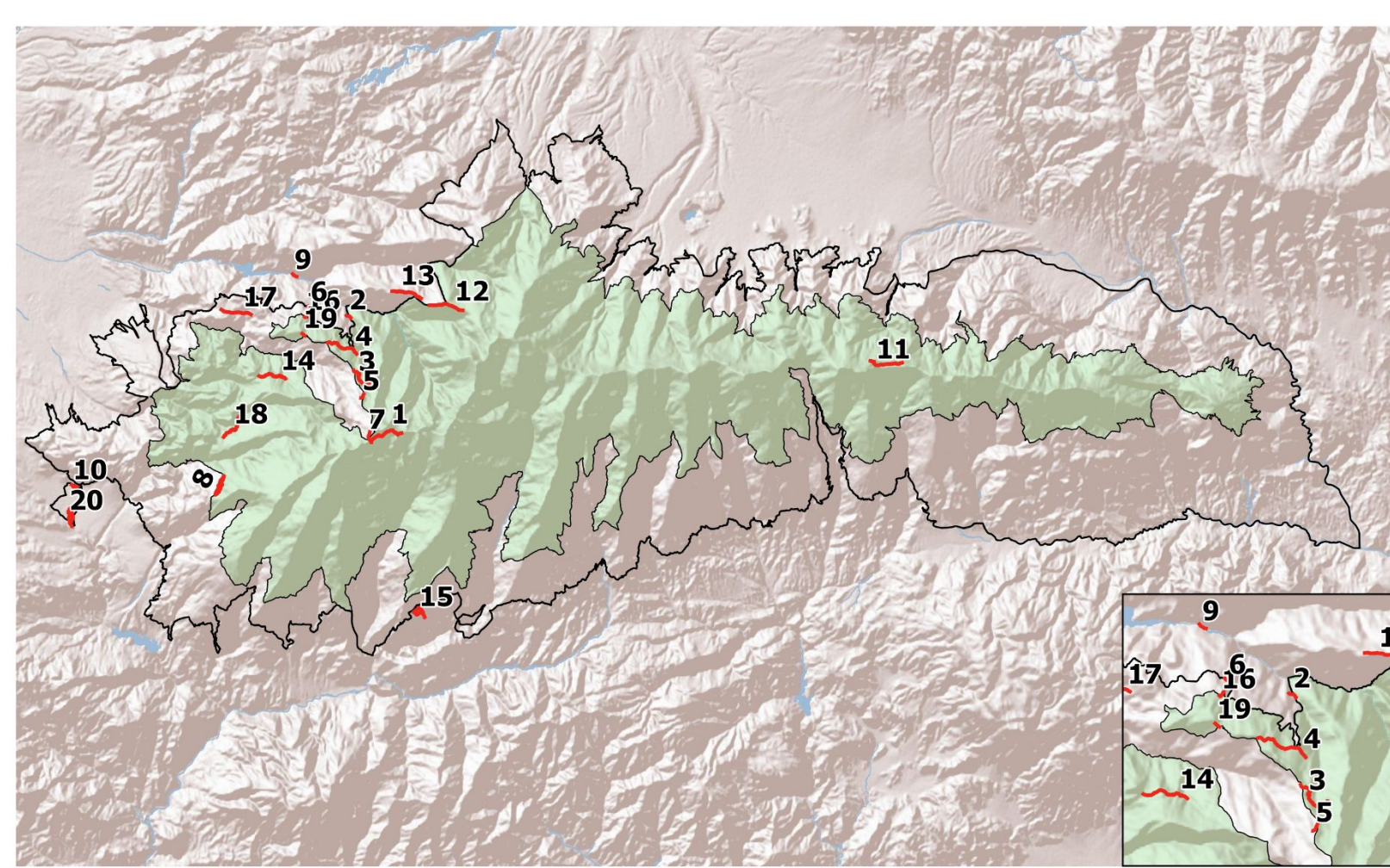
Guiding hypothesis: The energy available to consumers depends on the primary productivity of the vegetation, which considering the Monteith model (1972)³, can be estimated through NDVI.



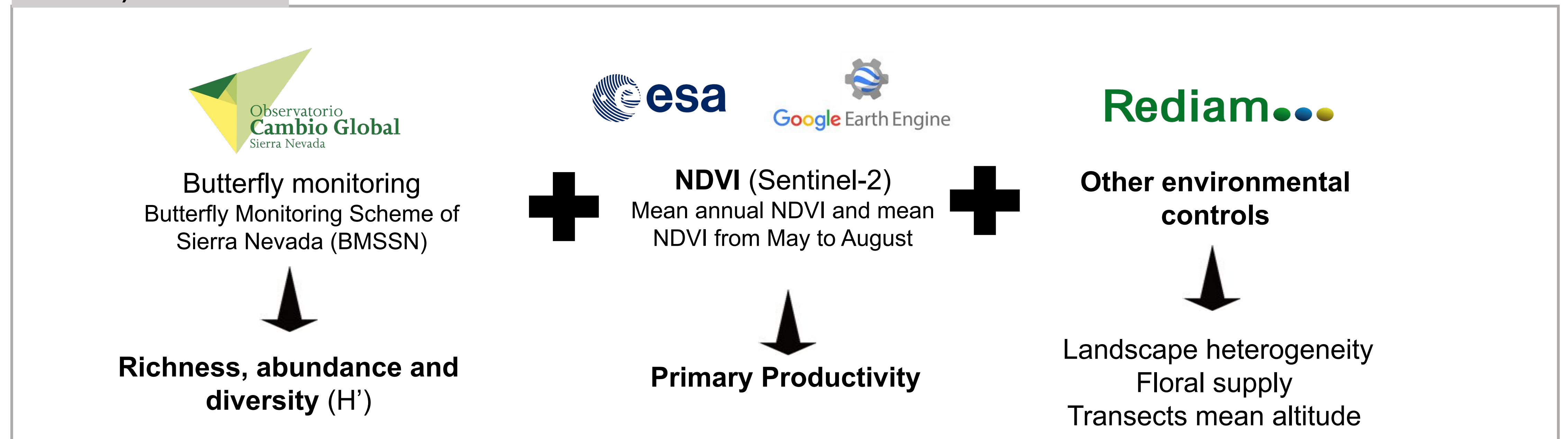
Source: J.M. Barea-Azcón

Methods

1) Study area: 20 transects in the Sierra Nevada.



2) Data



3) Statistical analysis

- Dependent variables: richness, abundance and diversity (H')
- Bivariate correlations (Pearson and Spearman's Rho)
- Simple Linear Regression for variables with normal distribution



Scenarios of data

Scenario 1 (n=17)

Removal of three transects from lowland-anthropized areas or near wetlands

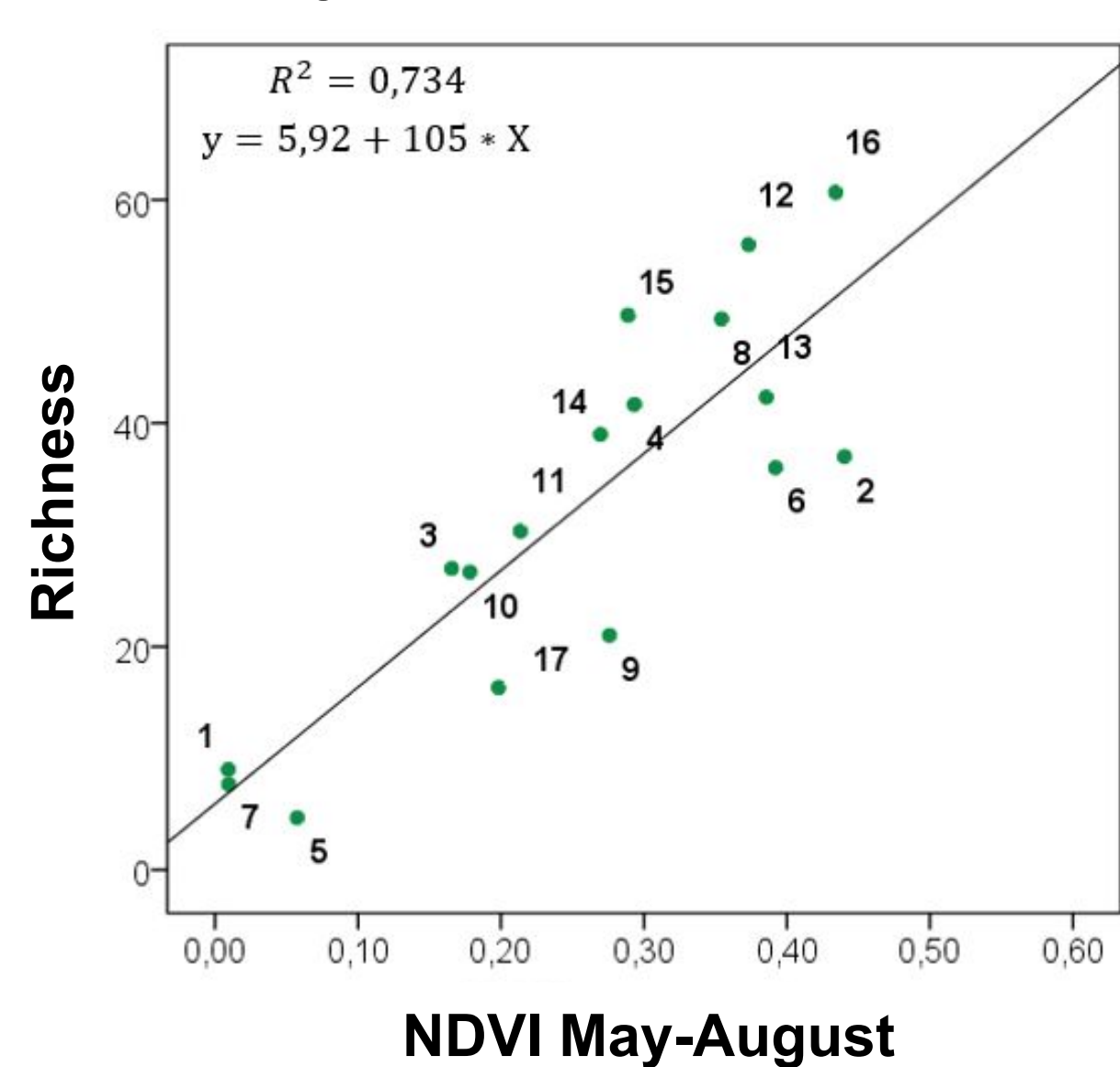
Scenario 2 (n=20)

All transects sampled under the butterfly monitoring program

Results and Discussion

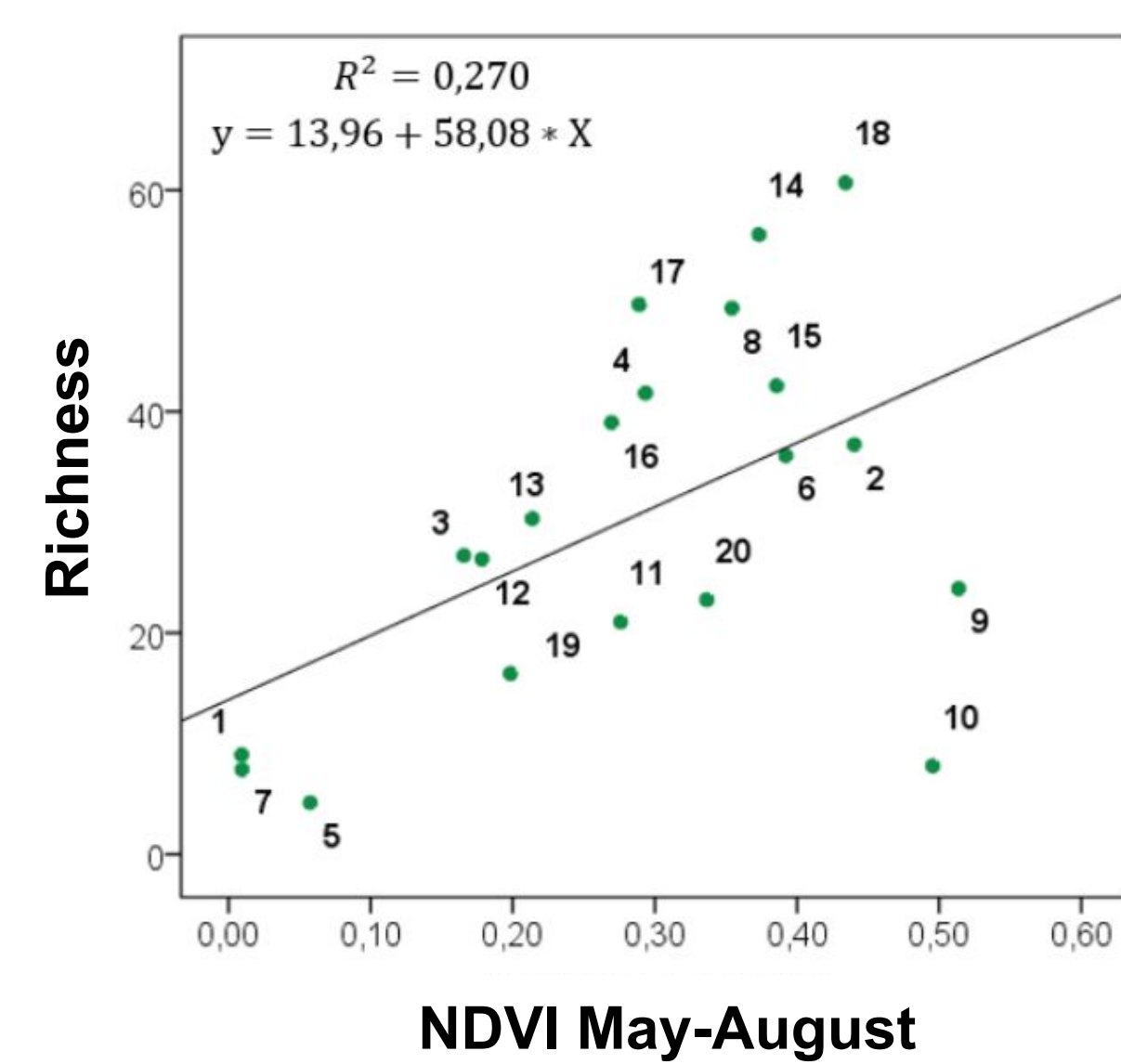
Scenario 1

Solid and positive relationship between NDVI and butterfly richness, abundance and diversity.



Scenario 2

Weak or non-significant relationships between butterflies and NDVI.

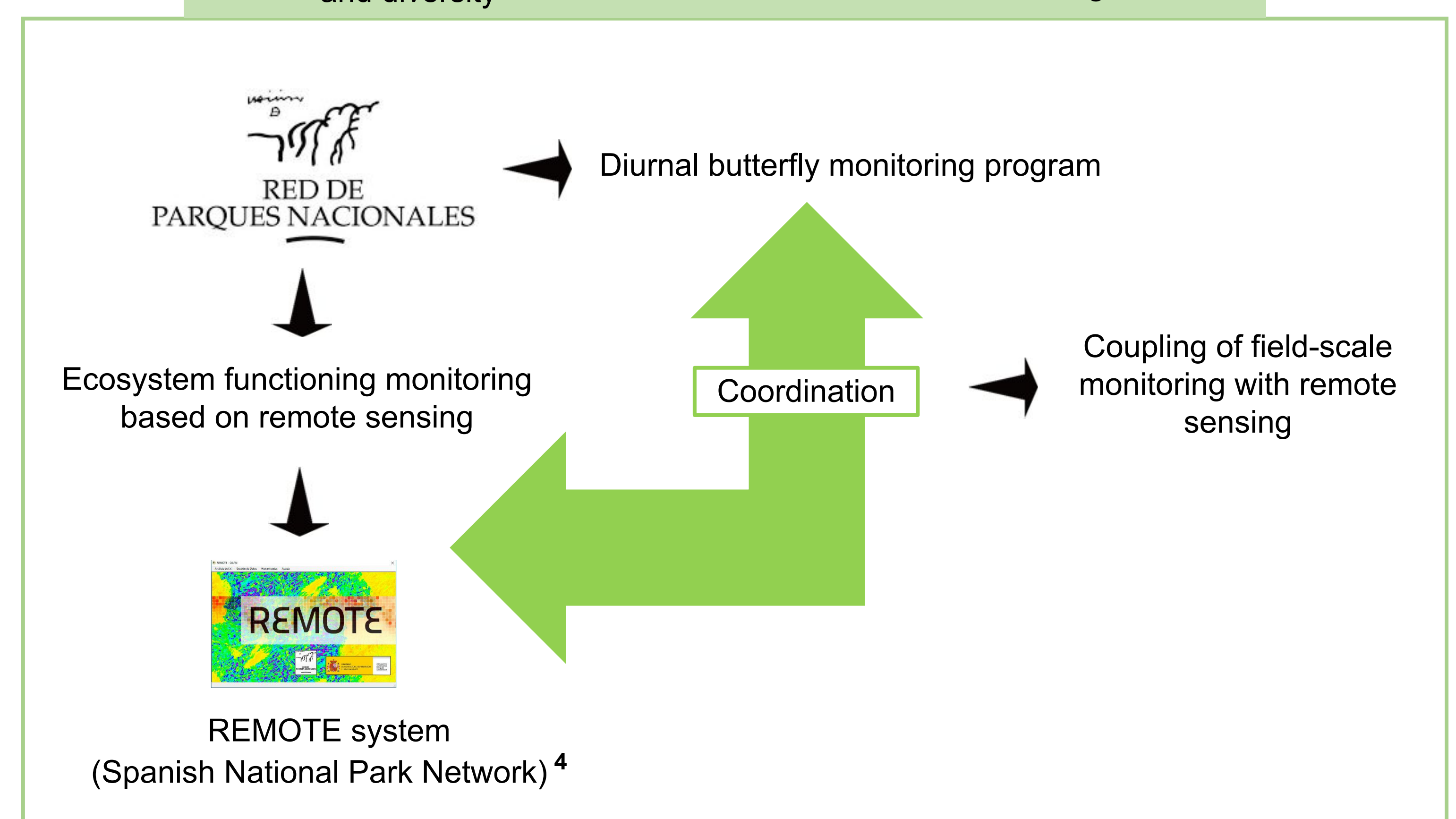


Other environmental variables

- Landscape heterogeneity → not an explanatory variable.
- Basophilic scrubs cover (greater floral supply) → only relevant for diversity (H').
- Altitude (highly correlated with NDVI indicators) → significant relationships with butterfly richness, abundance and diversity.

Butterfly richness, abundance and diversity

Ecosystem productivity measured through NDVI



Conclusions

1. From the **estimation of the greenness of the vegetation through NDVI**, we prove the **positive relationship of NDVI** subrogates of primary productivity with **diurnal butterflies richness, abundance and diversity** of the **Sierra Nevada** populations → especially NDVI from May to August.
2. **Other environmental controls** such as floristic richness, **can influence this relationship** and must be taken into account in this type of studies to improve models.
3. Possibility of **coordinating butterfly monitoring programs with others in the National Park Network based on satellite images** → **Future directions of research.**

Acknowledgements

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References

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- ⁴ Cabello, J., Alcaraz-Segura, D., Reyes, A., Lourenço, et al. *Revista de Teledetección*, **2016**, 46, 119-131.