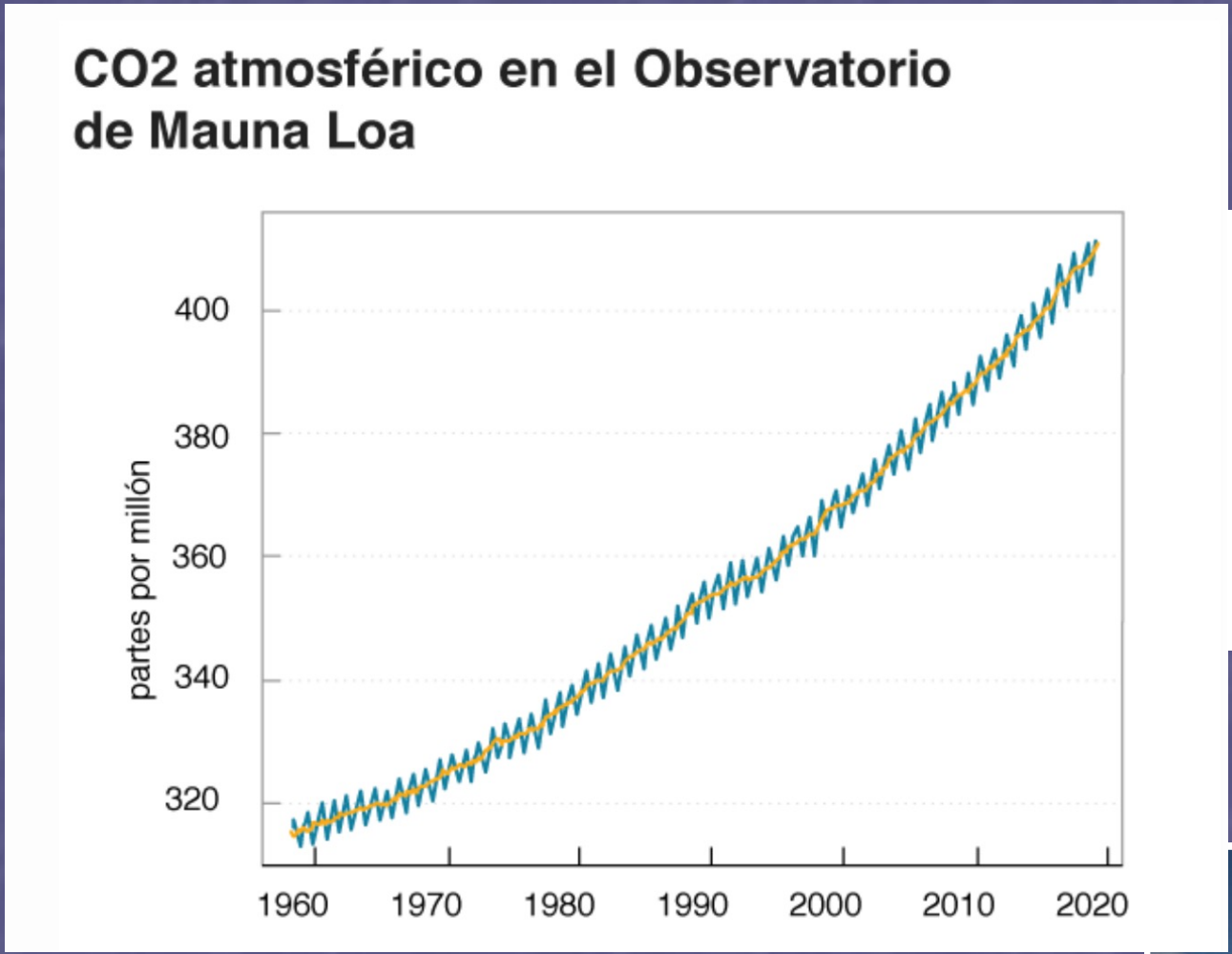
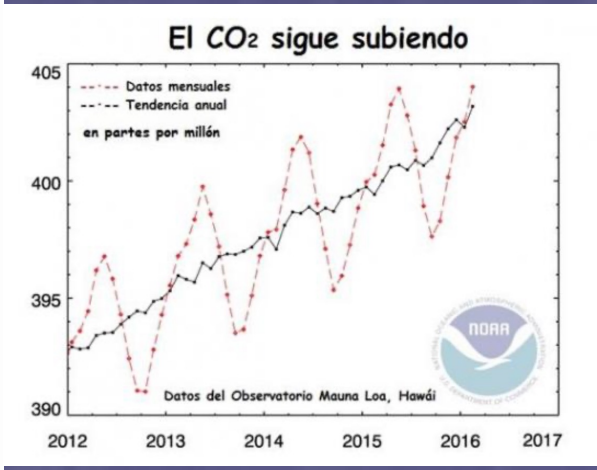
XI SEMINARIO DE SEGUIMIENTO A LARGO PLAZO EN LA RED DE PARQUES NACIONALES

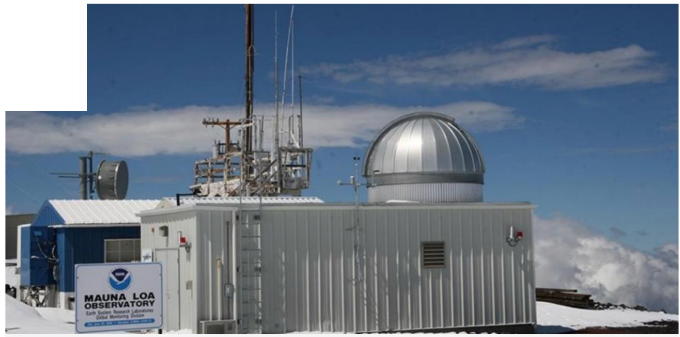
Investigación, seguimiento y conservación de los ecosistemas de Sierra Nevada en escenarios de cambio global.

Regino Zamora
Universidad de Granada

El seguimiento del cambio global.. ¿Para qué sirve??







Observatorio de Mauna Loa, de la NOAA, en Hawái

Seguimiento del cambio natural.. que sigue presente..

La importancia de los estudios a largo plazo

Long-Term Studies Contribute Disproportionately to Ecology and Policy

BRENT B. HUGHES, RODRIGO BEAS-LUNA, ALLISON K. BARNER, KIMBERLY BREWITT, DANIEL R. BRUMBAUGH, ELIZABETH B. CERNY-CHIPMAN, SARAH L. CLOSE, KYLE E. COBLENTZ, KRISTIN L. DE NESNERA, SARAH T. DROBNITCH, JARED D. FIGURSKI, BECKY FOCHT, MAYA FRIEDMAN, JAN FREIWALD, KRISTEN K. HEADY, WALTER N. HEADY, ANNALIESE HETTINGER, ANGELA JOHNSON, KENDRA A. KARR, BRENNA MAHONEY, MONICA M. MORITSCH, ANN-MARIE K. OSTERBACK, JESSICA REIMER, JONATHAN ROBINSON, TULLY ROHRER, JEREMY M. ROSE, MEGAN SABAL, LEAH M. SEGUI, CHENCHEN SHEN, JENNA SULLIVAN, RACHEL ZUERCHER, PETER T. RAIMONDI, BRUCE A. MENGE, KIRSTEN GRORUD-COLVERT, MARK NOVAK, AND MARK H. CARR

Sin embargo: Los procesos a largo plazo no pueden estudiarse con ciclos de financiación a corto plazo y sin mantener una coherencia temporal en la búsqueda de los mismos objetivos científicos y de seguimiento (Likens 1989).

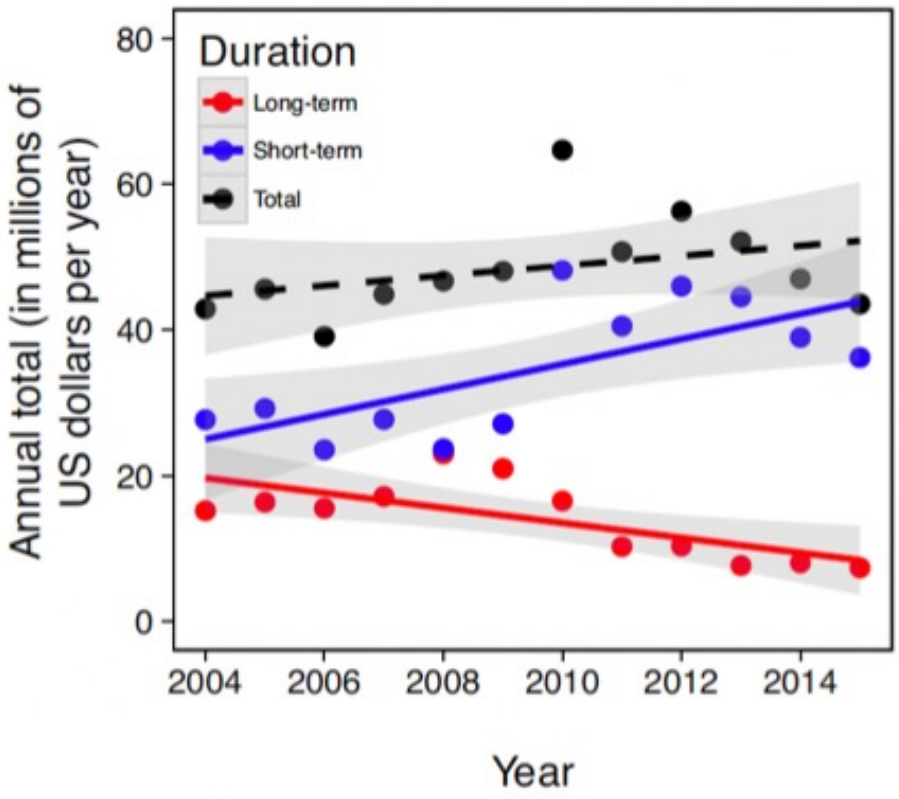


Figure 2. Trends in NSF funding for short- (4 years or shorter) and long-term (longer than 4 years) LTEES studies, as well as total funding, for DEB and Biological Oceanography programs. The solid lines are significant ($p < .05$) trends, and the dashed lines are nonsignificant ($p > .05$) trends. The gray areas represent 95% CI.

Los estudios ecológicos a largo plazo han contribuido al desarrollo de avances fundamentales en la ecología (Hughes et al. 2017).

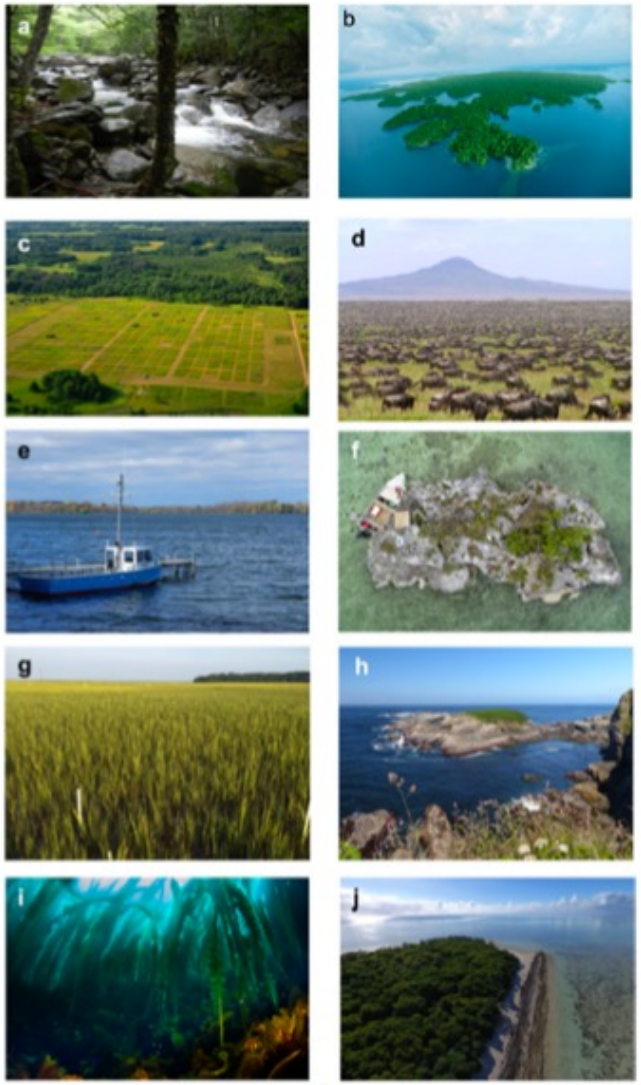
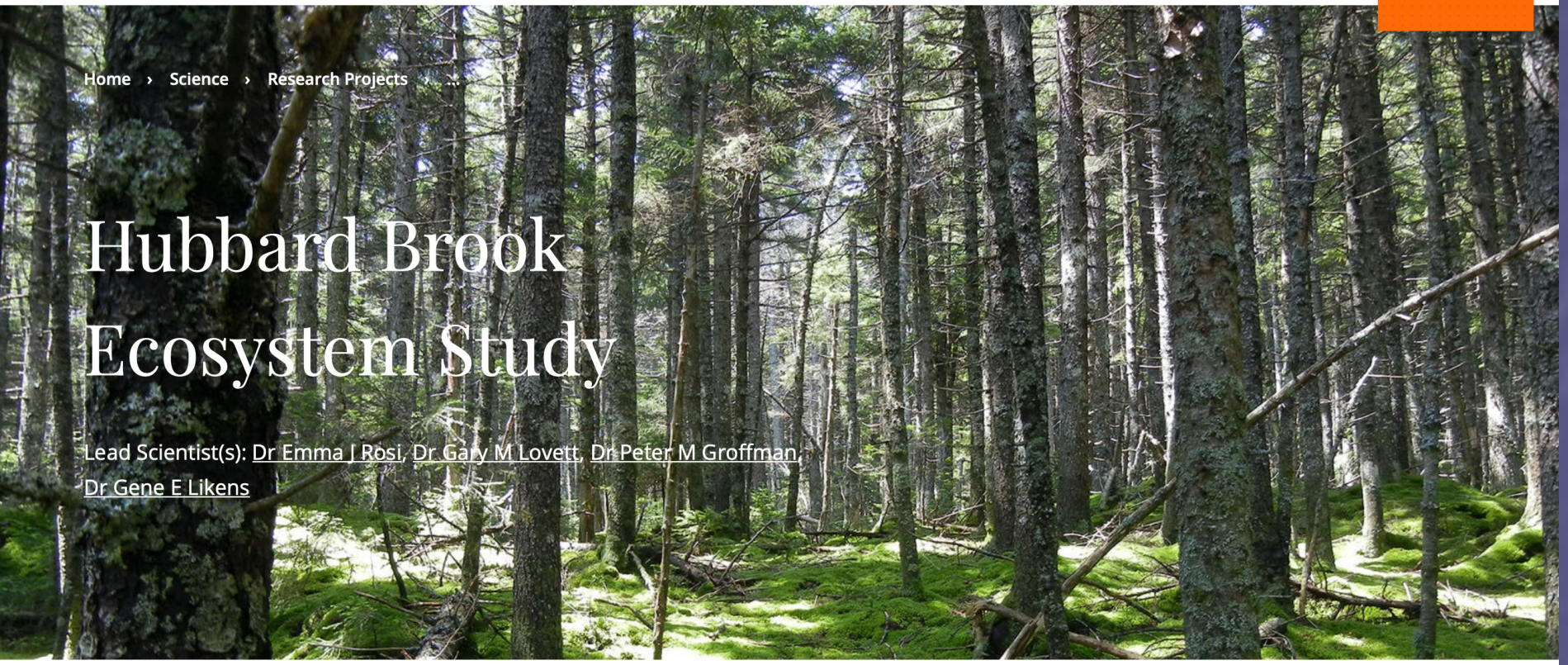


Figure 1. Examples of long-term ecological research sites, which have contributed significantly to advancing ecology and informing environmental policy: (a) temperate forest, Hubbard Brook Experimental Forest (Photograph: Claire Nemes); (b) tropical forest, Barro Colorado Island (Photograph: Christian Ziegler); (c) temperate grassland, Cedar Creek (Photograph: Jacob Miller); (d) tropical savannah, Serengeti (Photograph: Anthony Sinclair); (e) temperate lake, Lake Mendota (Photograph: Stephen Carpenter); (f) tropical islands, Staniel Island (Photograph: Louie Yang); (g) subtropical estuary, Sapelo Island (Photograph: Christine Angelini); (h) temperate rocky intertidal, Tatoosh Island (Photograph: Timothy Wootton); (i) temperate kelp forest, Aleutian Islands (Photograph: Joe Tomoleoni); (j) tropical coral reef, Heron Island (Photograph: Sam Chapman).

La importancia de los estudios a largo plazo



El estudio de los procesos naturales requiere de un seguimiento a largo plazo porque:

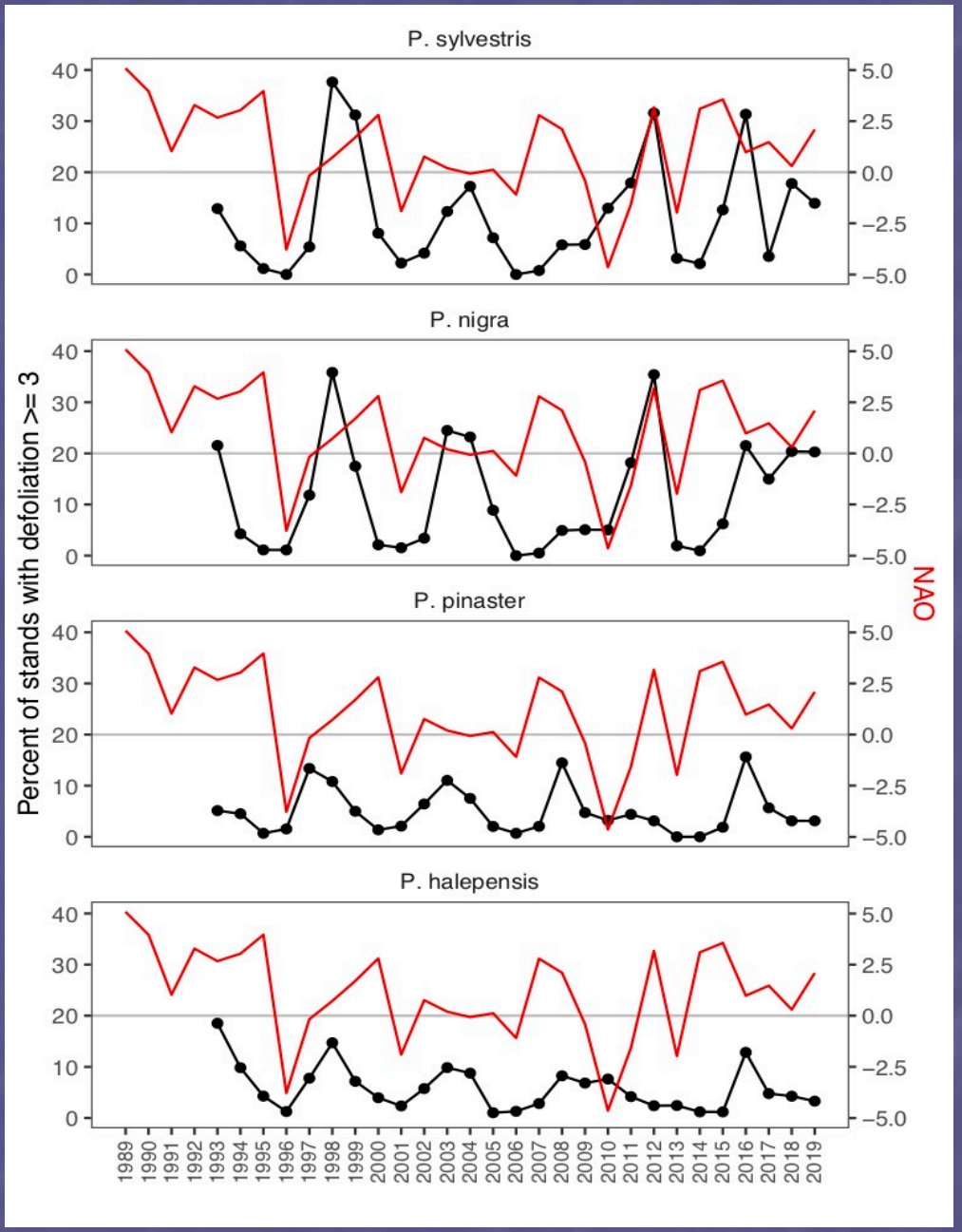
1) Su tasa de cambio es muy lenta

2) Por el desfase de tiempo existente entre un cambio ambiental dado y la respuesta ecológica correspondiente.

3) Porque es probable que ocurran dinámicas transitorias

4) Se necesitan períodos de tiempo prolongados para poder registrar el impacto de los eventos extremos, que suelen ser raros.

Por lo tanto, las evaluaciones ambientales necesitan una larga memoria para desenredar los cambios a largo plazo de los cambios a corto plazo y para revelar el alcance total de las respuestas ecológicas y bióticas (Hillebrand et al. 2017).



Los estudios ecológicos a largo plazo también son fundamentales para tomar decisiones en contextos de gestión ambiental, y desempeñan un papel vital en la política ambiental (Hughes et al. 2017).

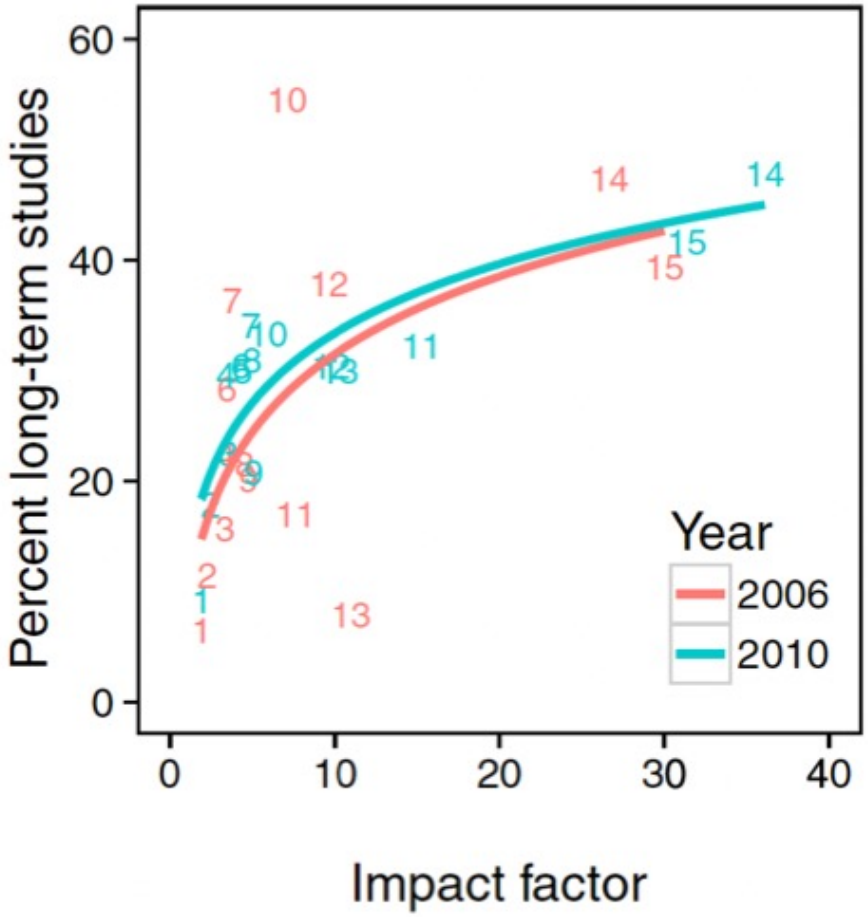
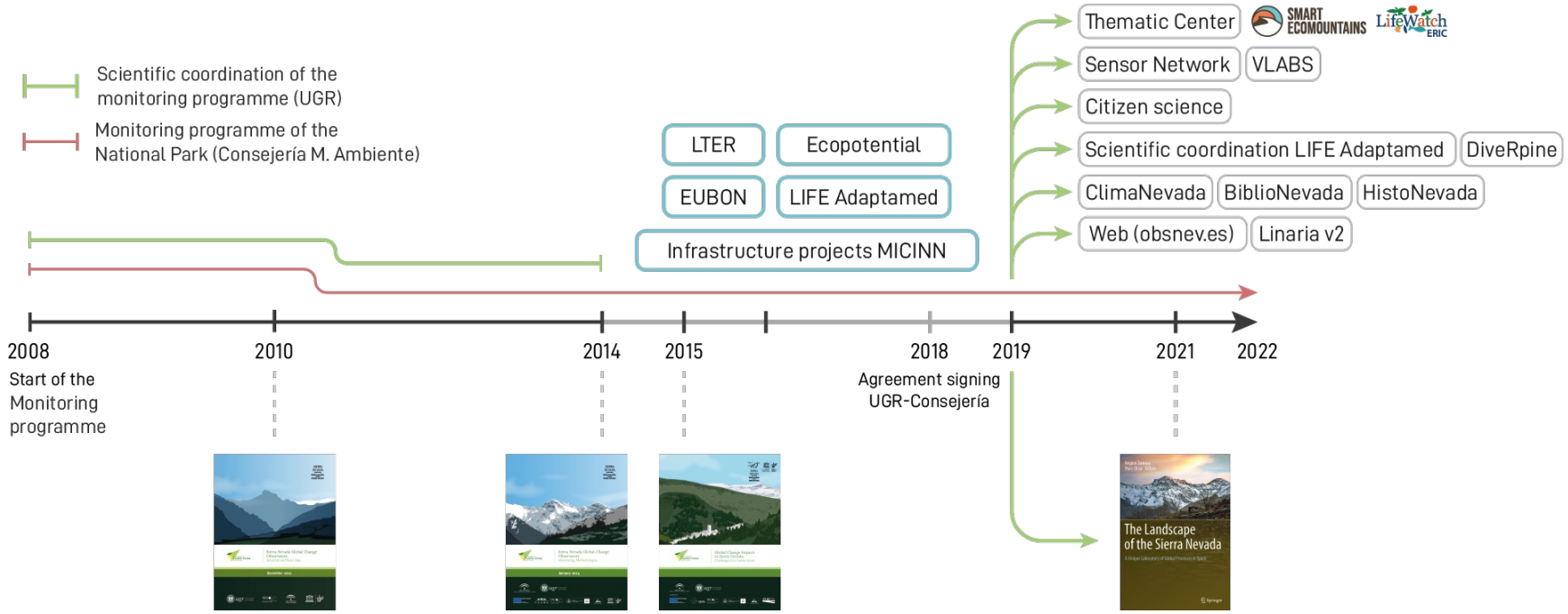


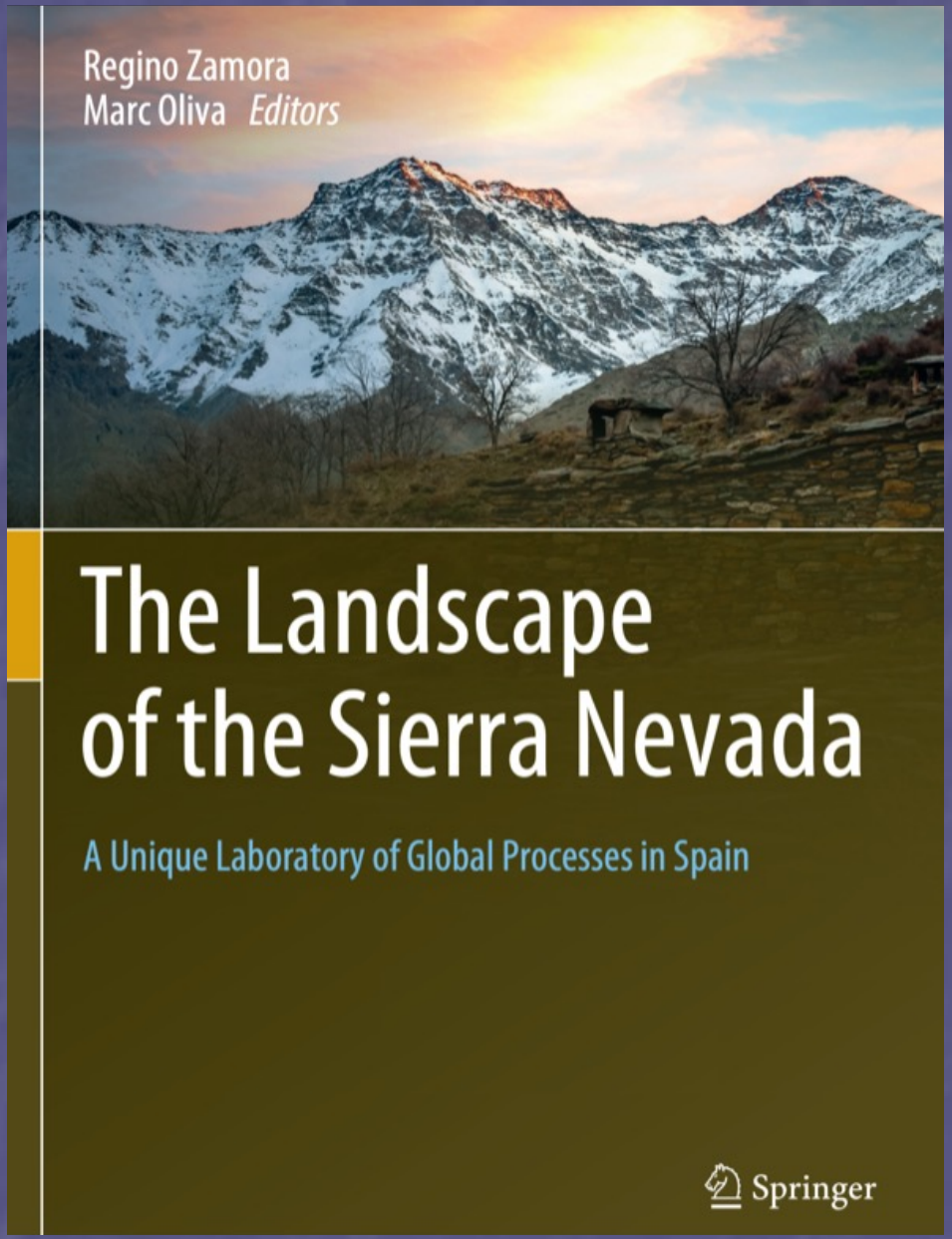
Figure 3. The relationship between a journal's impact factor and the percentage of its articles whose studies exceeded a duration of 4 years, averaged over 2 years (2006 and 2010). The numbers indicate individual journals (table 1).

Los diez mandamientos

- Objetivos basados en preguntas científicas bien definidas.
- Objetivos tanto básicos como aplicados.
- Protocolos y diseños de muestreo consistentes a lo largo del tiempo.
- Coherencia y calidad de la recopilación de datos a largo plazo que sea robusta a la rotación del personal.
- Asegurar la capacidad de poder adoptar protocolos adicionales para poder abordar preguntas e hipótesis emergentes.
- Mantener una documentación rigurosa y detallada de los diseños de muestreo, métodos de recolección de datos, calibraciones y validaciones que nos permita hacer una interpretación rigurosa de los datos.
- Diseñar un programa de gestión y difusión de datos adaptable y bien desarrollado (Data Management Plan).
- Participación atractiva e inclusiva de la comunidad científica, gestores y ciudadanía.
- Implementar una estructura de gestión y gobernanza adaptable y funcional que sea responsable de la planificación estratégica de la investigación y la gestión.
- Establecer fuentes de financiación fiables y resistentes a largo plazo.
- Crear herramientas educativas para las generaciones futuras.

Evolución del Observatorio de Cambio Global Sierra Nevada https://obsnev.es/



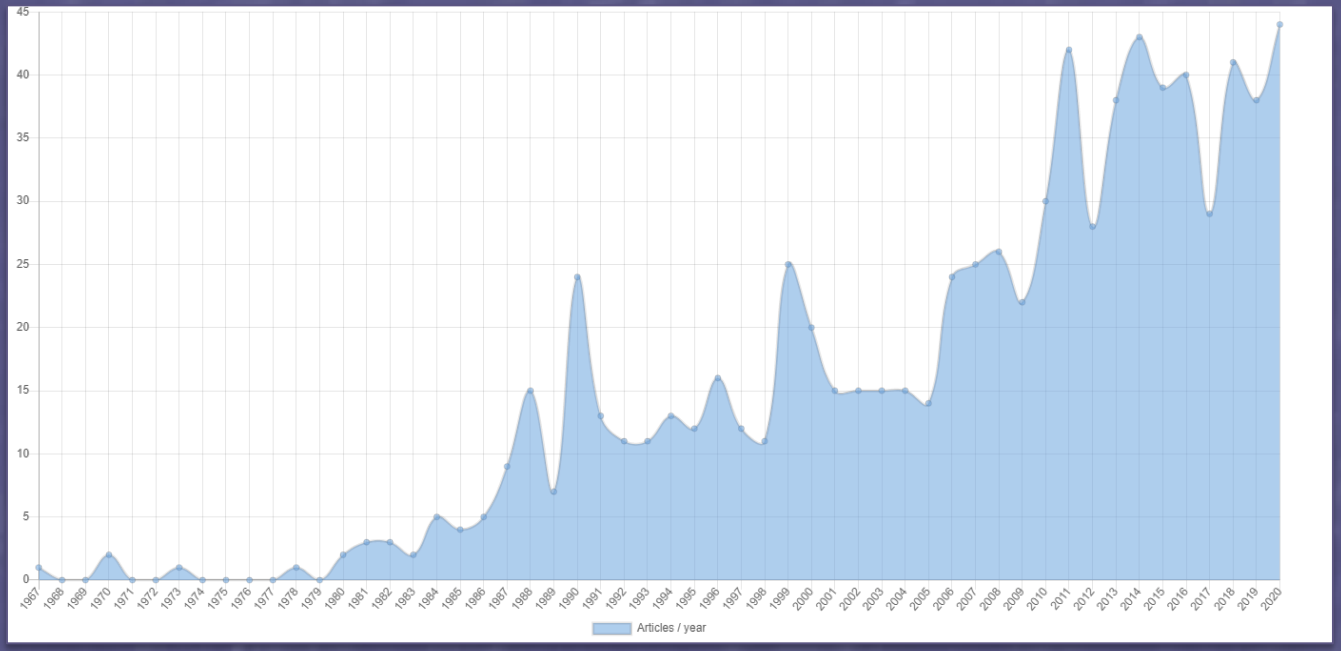


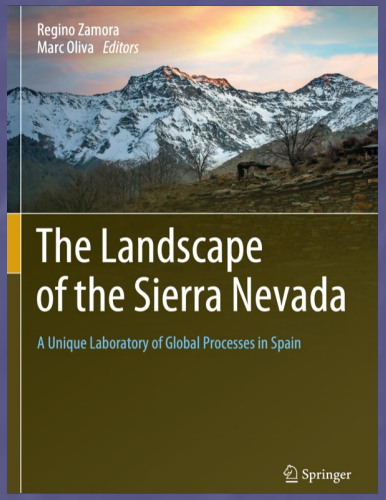
«This book is unique by assembling information on all abiotic drivers (climate and geology, both current and past), the biological inventory (plants and animals, both aquatic and terrestrial), and the human dimension in mountains. To my best knowledge, this is the first and so far only monographic for a mountain range that takes such an interdisciplinary approach.»

Christian Körner
Basel, Switzerland

Antecedentes: Publicaciones científicas desde los años 70

Conocimiento científico generado en Sierra Nevada





Evolución del número de publicaciones científicas durante el periodo de estudio

Cambios en el clima

Cambios en el clima

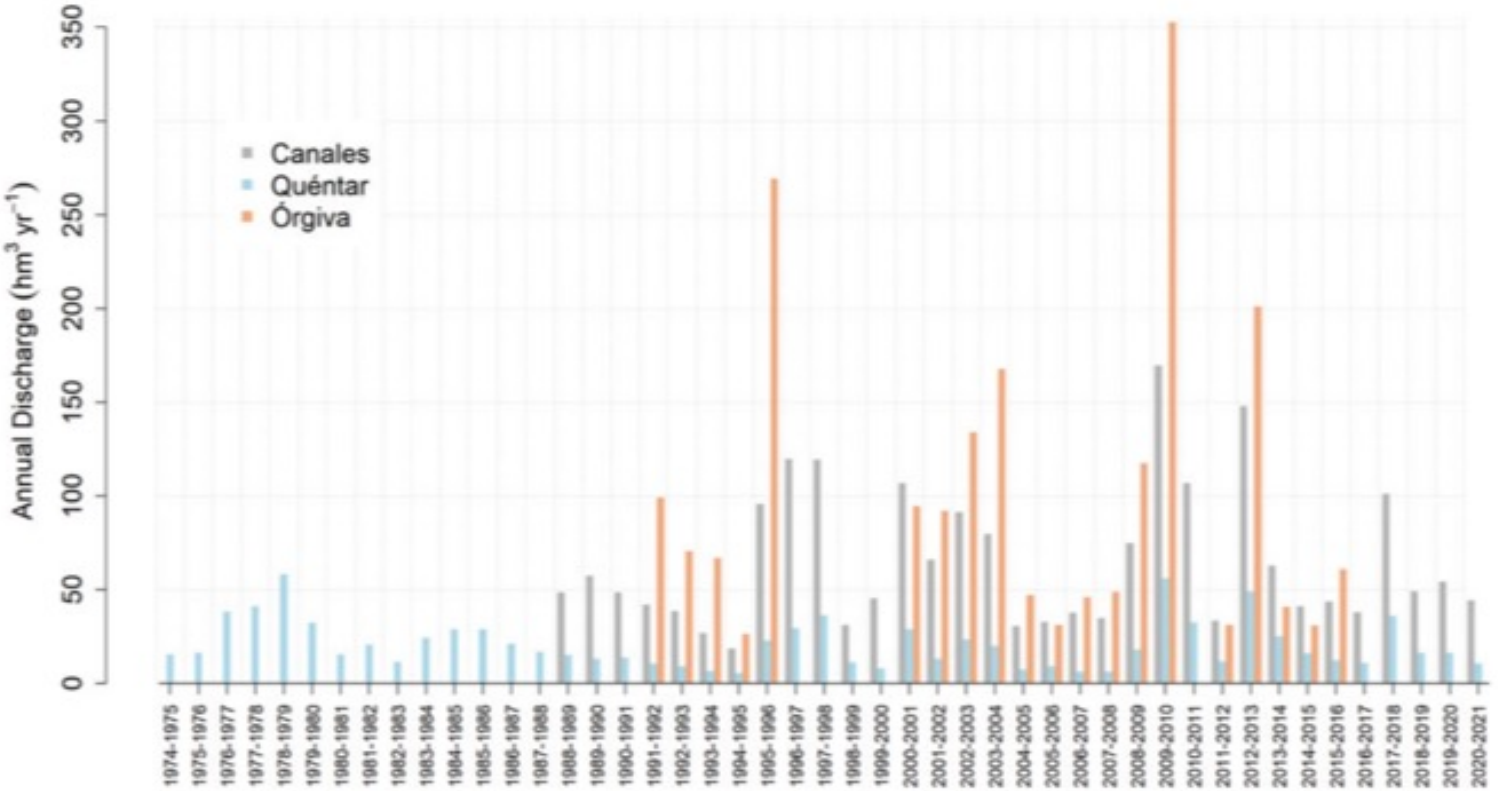


Fig. 6 Annual discharge in selected river sections in the western regions in the Sierra Nevada area during the period 1974–2020 estimated from observed daily flow series (years with no data correspond to ungauged periods or scarce observations): inflow to the Canales and Quéntar reservoirs in the Genil river basin, and Órgiva gauge station in the Guadalfeo river basin (R4 and R5, respectively, in Fig. 1)

Investigación y monitoreo de la biodiversidad

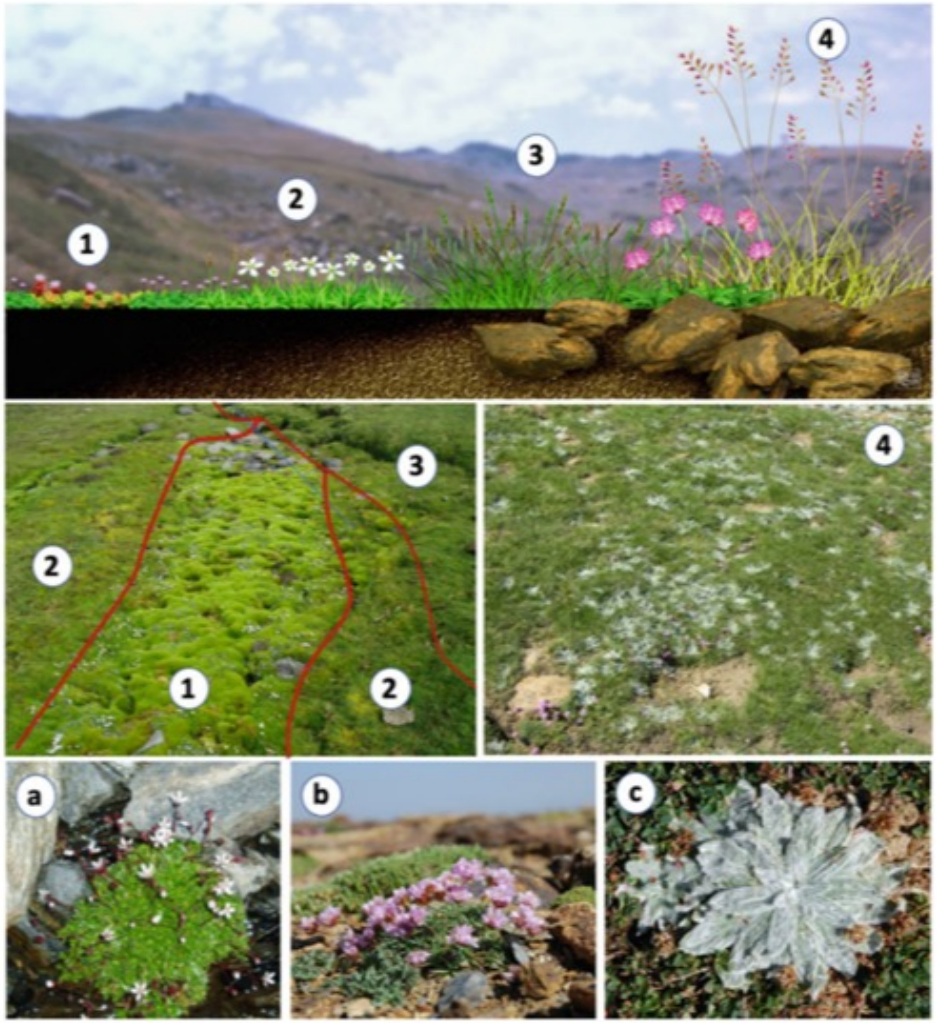


Fig. 3 Sequence of micro-communities composing high-mountain hygrophilous pasturelands, from the damped areas (left) to the temporary moisture ones (right). (1) Bryophyte communities with *Sedum melanantherum* and *Saxifraga stellaris* subsp. *robusta*, (2) Incipient peat bogs with *Cyperaceae*, (3) Pasturelands with *Nardus stricta* and *Festuca frigida*, (4) Pasturelands with *Agrostis nevadensis* and *Armeria splendens* (from Salazar and Valle 2004). **a** *Saxifraga stellaris* subsp. *robusta*, **b** *Armeria splendens*, **c** *Plantago nivalis*

Investigación y monitoreo de la biodiversidad

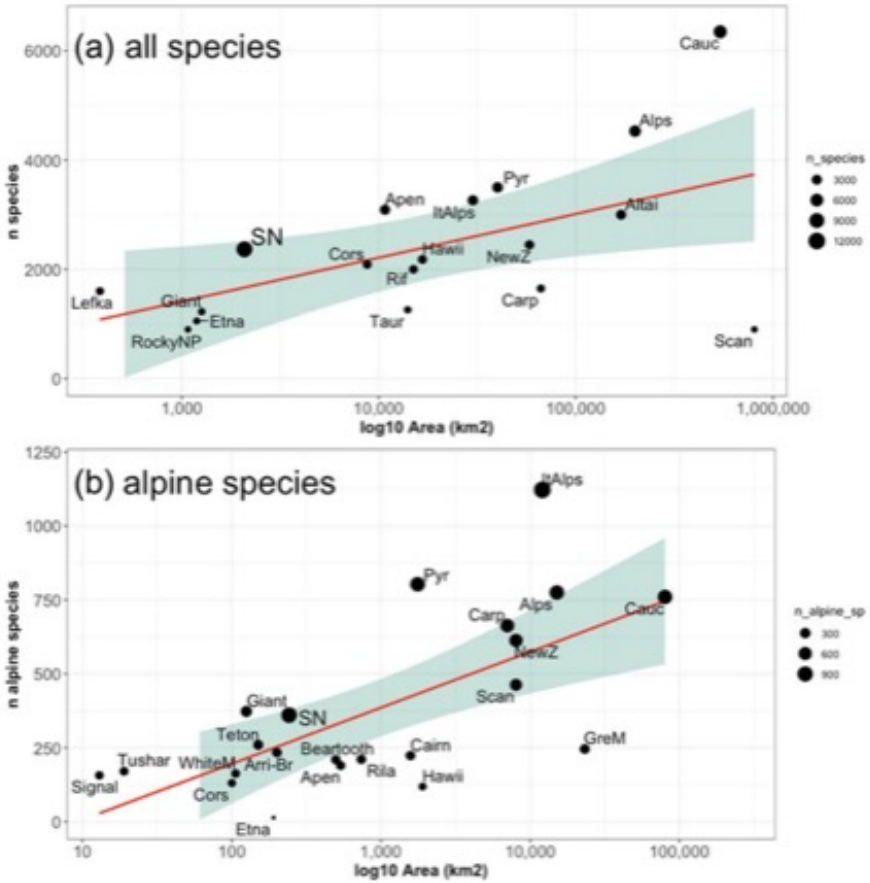


Fig. 1 Relationship between area and plant species richness for different mountain ranges, taking into account **a** all the species and **b** only species inhabiting alpine area. (Red line shows a linear fit and and shaded area the standard error of the mean). Alps = Alps, Altai = Altai mountains, Apen = Central Apennines, Arri-Br = Arrigeth, Brooks range (Alaska), Balkan = Balkan Peninsula mountains, Cauc = Caucasus, Cors = Corsica high mountains, Etna = Etna (Sicily), Giant = Giant Mountains, GreM = Greece high mountains, Hawii = Hawaii mountains, ItAlps = Italian Alps, Lefka = Lefka Ori (Crete), NewZ = New Zealand Alps, Olym = Olympic Range (USA), RockyNP = Rocky Mountains National Park (USA), Pyr = Pyrenees, Rila = Rila Mountains, Scan = Scandes (Scandinavian mountains), Cairn = Cairngorms (Scottish Highlands), SN = Sierra Nevada (Spain), Signal = Signal Mountain (Canadian Rockies), Carp = South-Eastern Carpatians, Taur = Taurus, Tushar = Tushar Mountains (SW Utah, USA), Ural = Urals, Ruby = Ruby Range (Colorado, USA), Teton = Teton Range (Wyoming, USA), Beartooth = Beartooth Plateau (Montana, USA), WhiteM = White Mountains (California, USA)

Investigación y monitoreo de la biodiversidad

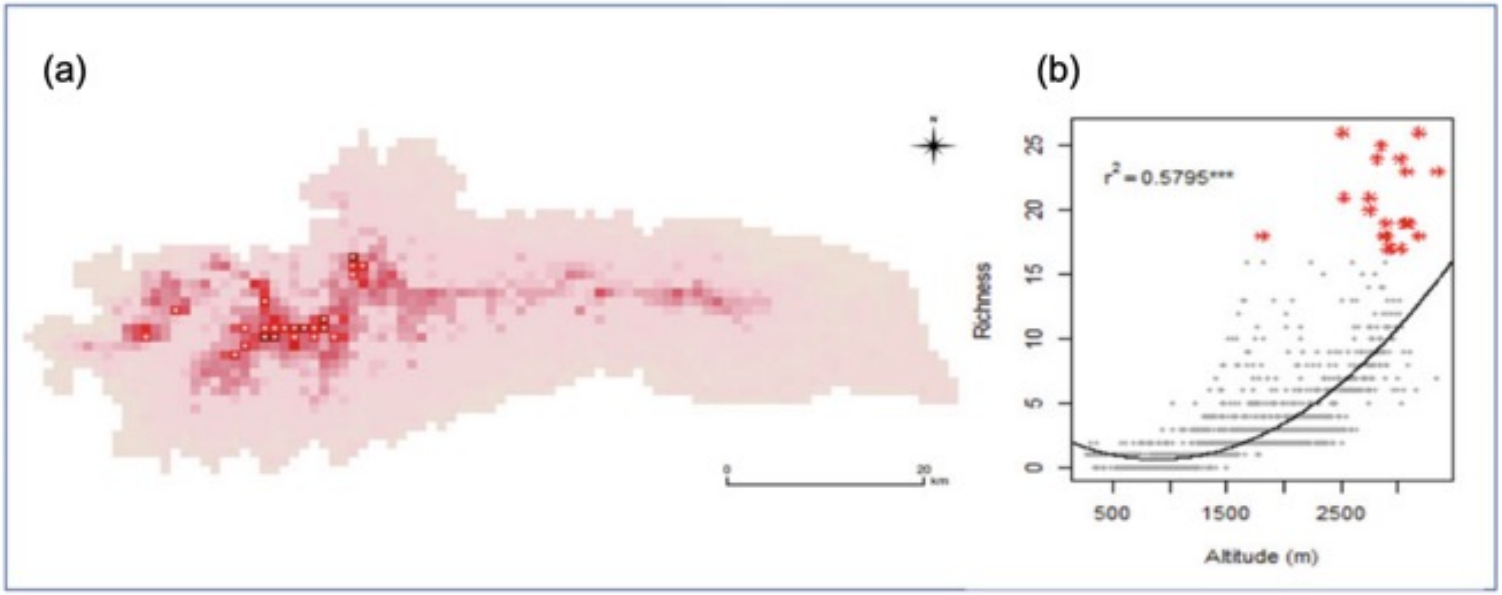


Fig. 2 **a** Distribution of endemic richness in Sierra Nevada, white crosses symbolize nano-hotspots. **b** Relationships between endemic-vascular-plant richness (EVPR) and altitude. Stars symbolize the nano-hotspots (from Cañadas et al. 2014)

Investigación y monitoreo de la biodiversidad

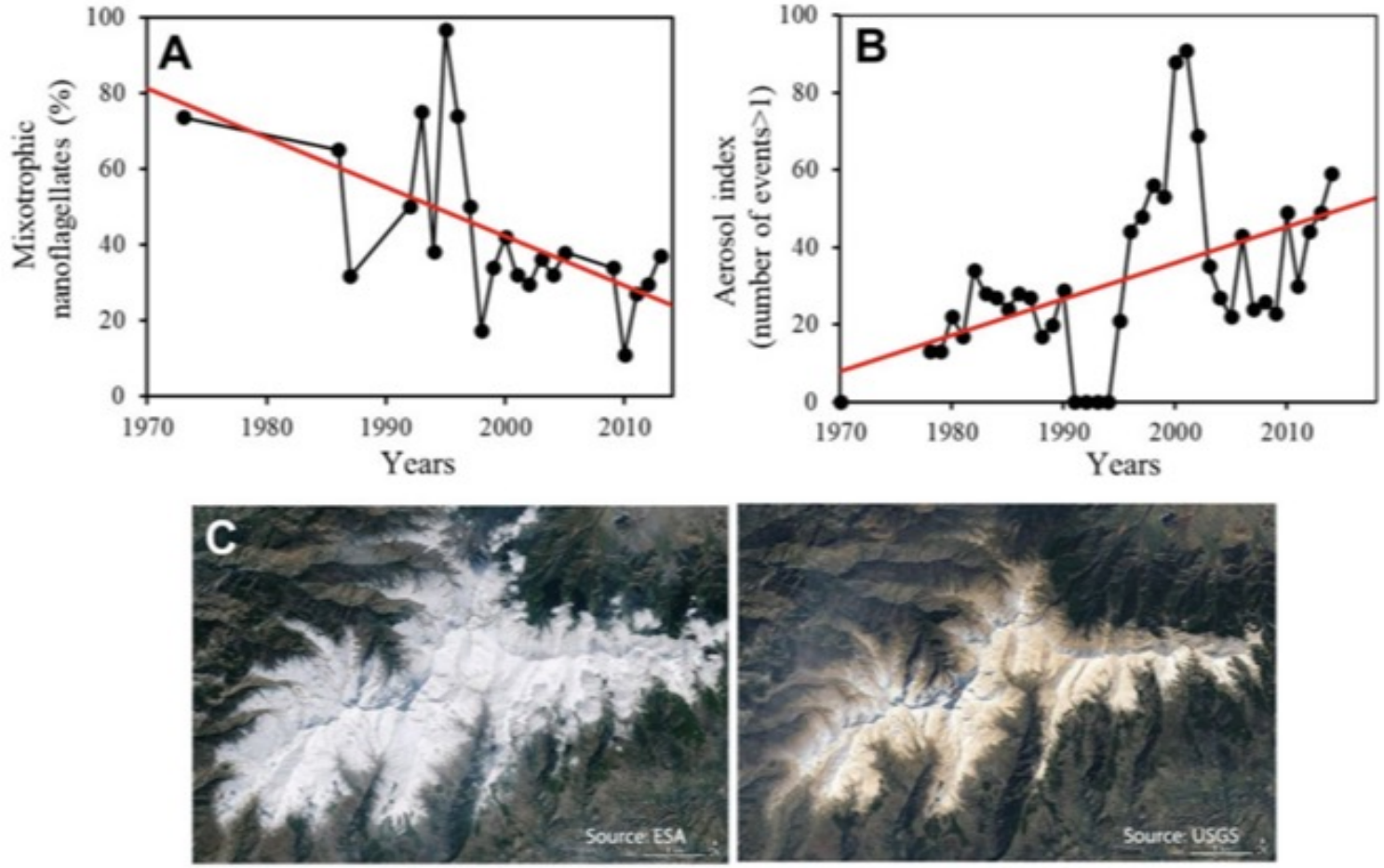


Fig. 3 Interannual trends in the percentage of mixotrophic nanoflagellates (**a**) and Aerosol index (AI), number events >1 (measured as a sum of daily events of AI >1) (**b**) during ice-free seasons in the last decades in Lake La Caldera. Red lines are fitted linear trends. Modified from Carrillo et al. (2017). **c** Aerial photography captured by the Sentinel 2-A (Left; courtesy of European Space Agency, ESA) and Landsat 8 (Right; courtesy of the U.S. Geological Survey) satellites corresponding to February 18 and February 27, 2017, after an intrusion of atmospheric dust over the Sierra Nevada National Park. Published in González-Olalla et al. (2018)

Investigación y monitoreo de la biodiversidad

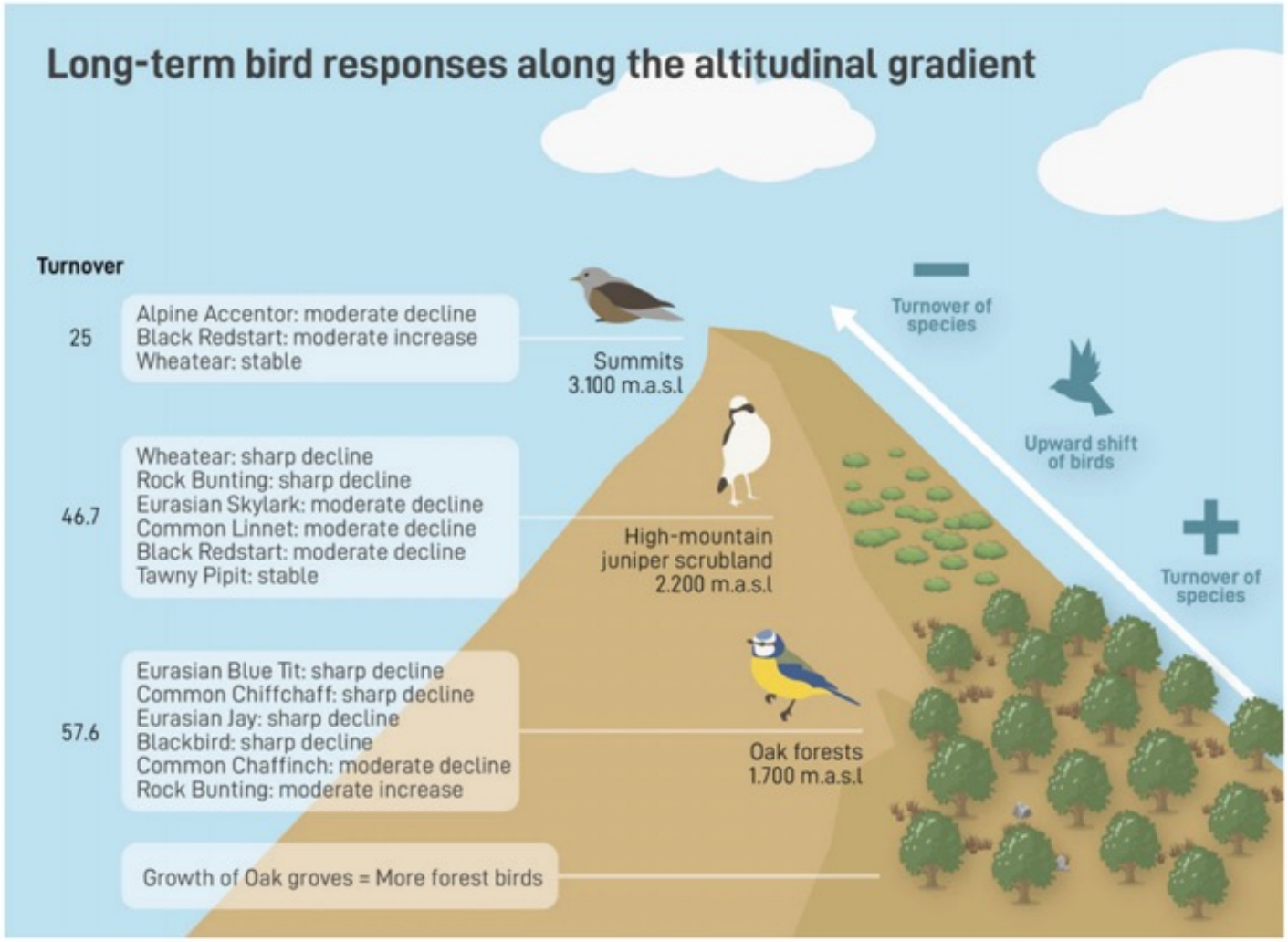


Fig. 3 Temporal and elevational changes in breeding bird populations of Sierra Nevada. Species turnover and population trends are indicated

Investigación y monitoreo de la biodiversidad

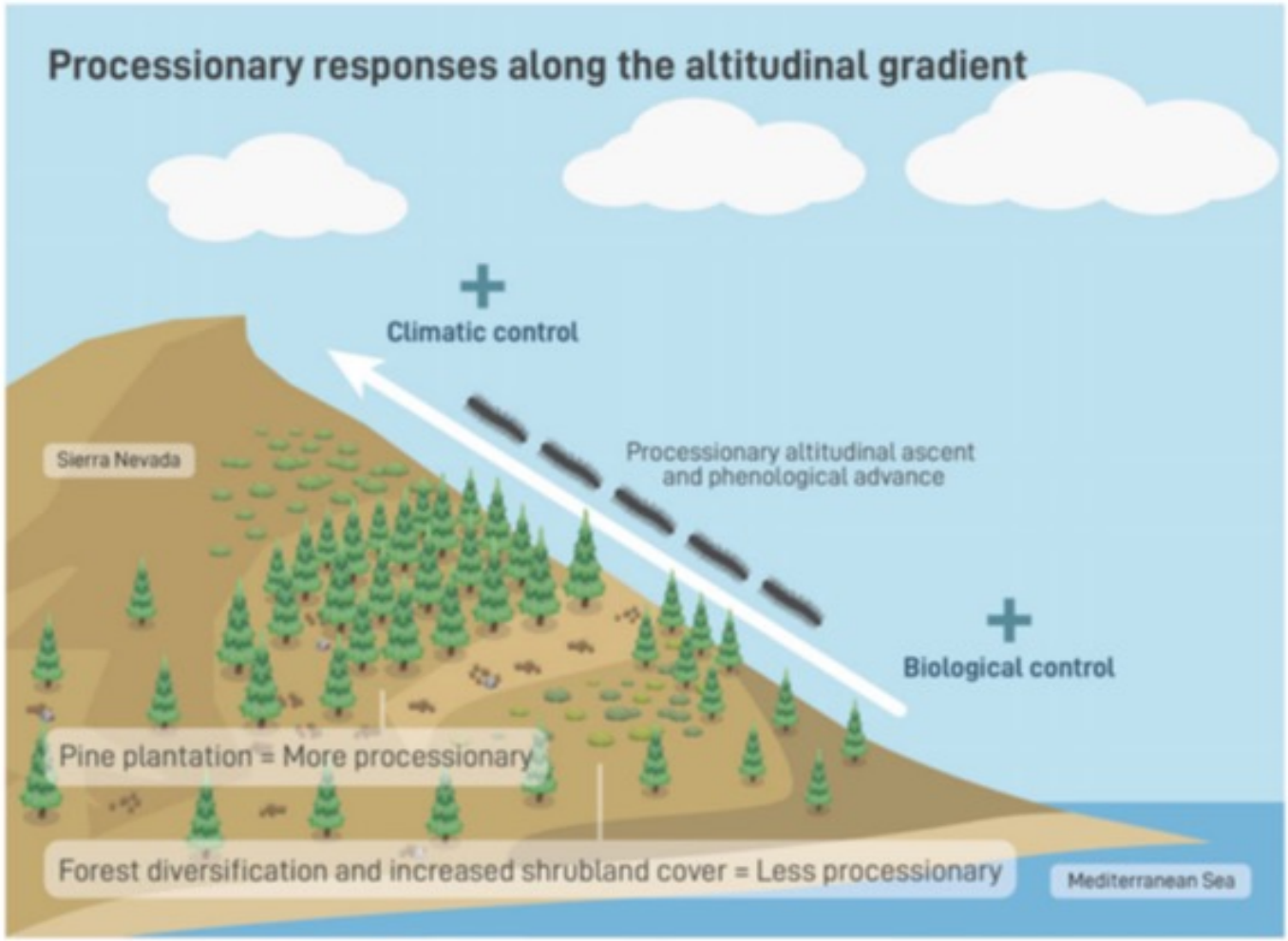


Fig. 10 Elevational changes in the PPM population in relation to major drivers (land use change and climatic change) in Sierra Nevada

Investigación y monitoreo de la biodiversidad

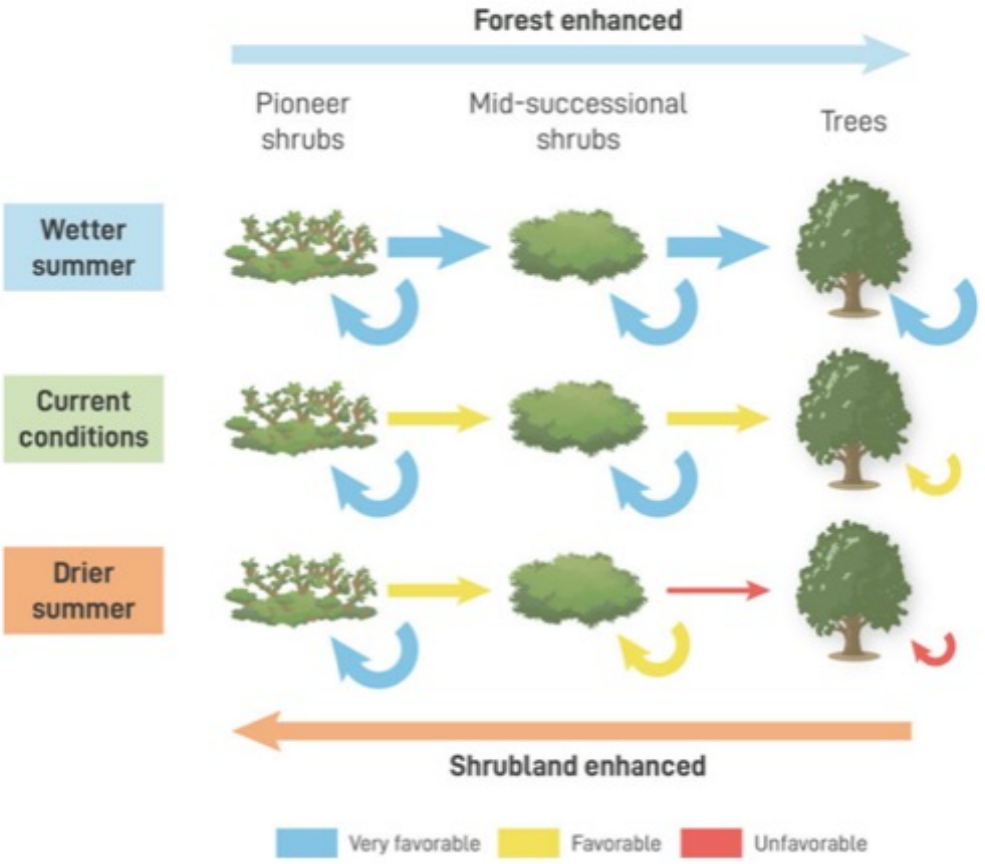
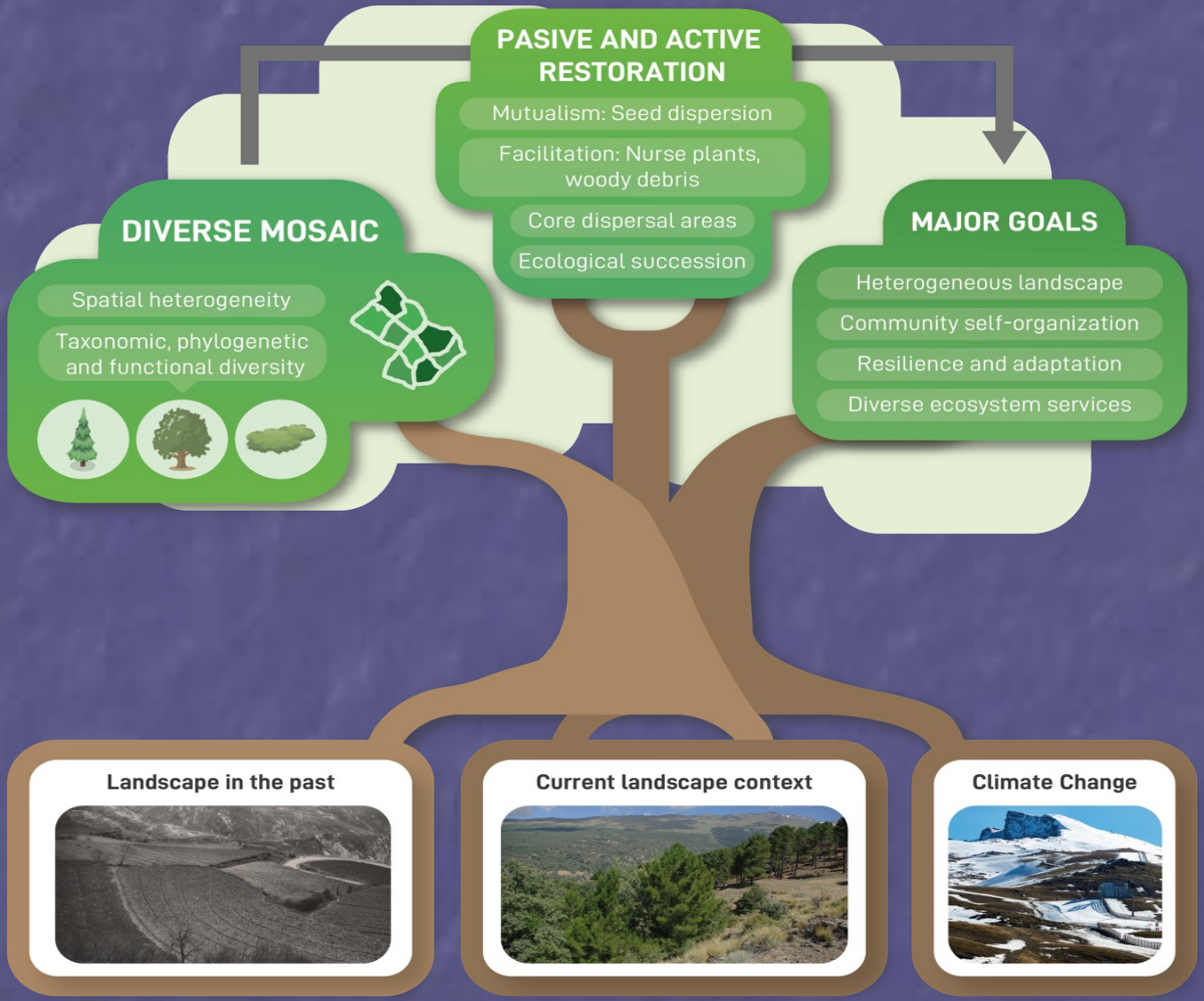


Fig. 3 Schematic diagram representing the community dynamics within the different climate scenarios predicted for the coming decades in Mediterranean areas. Arrows represent the hypothesised dynamics: within functional groups, represents the self-regeneration capacity; between groups, represents the probability of transition between stages. Arrow width is proportional to success probability, from unfavourable to very favourable. Studies suggest that: (1) wet summer conditions would represent a good opportunity for tree species regeneration, allowing forest maintenance and colonization or expansion to nearby degraded habitats; (2) a drier summer scenario, however, would limit forest regeneration and probably hinder the colonization of nearby open and shrubland habitats; (3) a drier scenario would in turn be very favourable for shrubland expansion, enhancing both shrubland maintenance and colonization and expansion, even to nearby forest environments. Modified from Matías et al. (2012)

EL clima del pasado no será el clima del futuro. La gestión basada en la ciencia (gestión adaptativa) es necesaria porque la experiencia pasada puede no servir como guía para las nuevas condiciones futuras



SMART ECOMOUNTAINS

UNIVERSIDAD DE GRANADA

LifeWatch ERIC

IMC Innsbruck 2022 International Mountain Conference

INTERNATIONAL MOUNTAIN CONFERENCE
SEPTEMBER 11 - 15 2022
>> SYNTHESIZE MOUNTAINS OF KNOWLEDGE <<

Smart Ecomountains: The LifeWatch-ERIC Thematic Center on Mountain Ecosystems

Ana Mellado, Andrea Ros Candeira, Manuel Merino Ceballos, Pablo Guerrero Alonso, Ricardo Moreno Llorca, Regino Zamora

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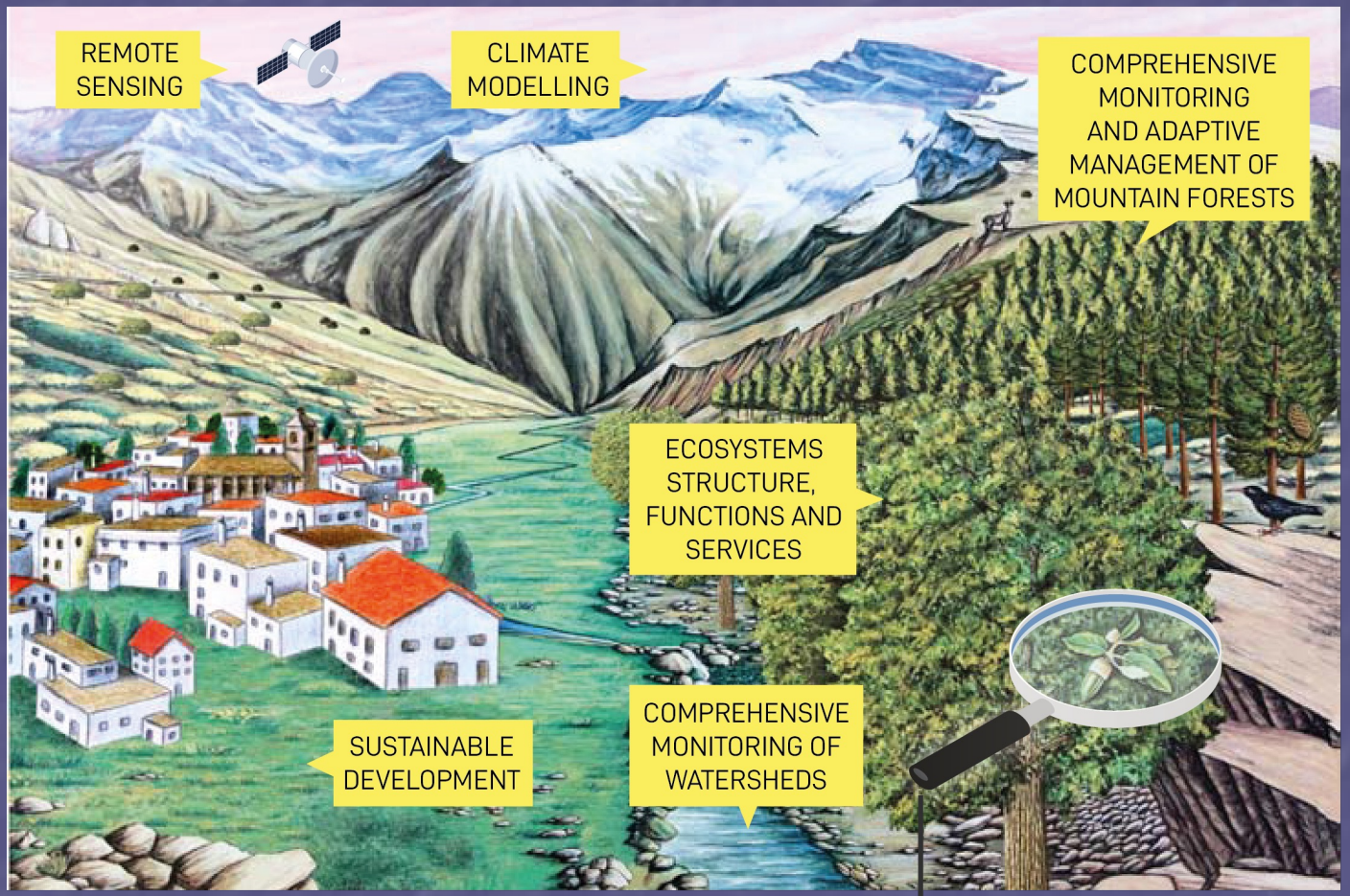
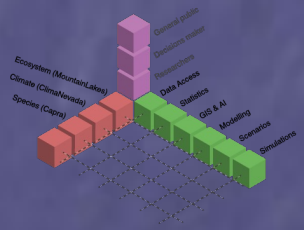
MONITORING AND CONSERVATION OF BIODIVERSITY

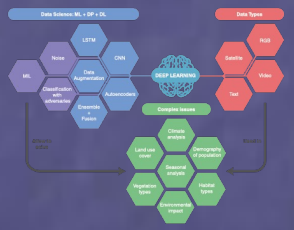


VIRTUAL RESEARCH ENVIRONMENT

Data Management Plan



Artificial Intelligence



Los ecosistemas nevadenses como proveedores de beneficios ambientales a la región circundante

Los ecosistemas nevadenses como banco de pruebas para el desarrollo y puesta a punto de nuevas herramientas conceptuales y metodológicas para la conservación y el desarrollo sostenible

Identificación de variables esenciales

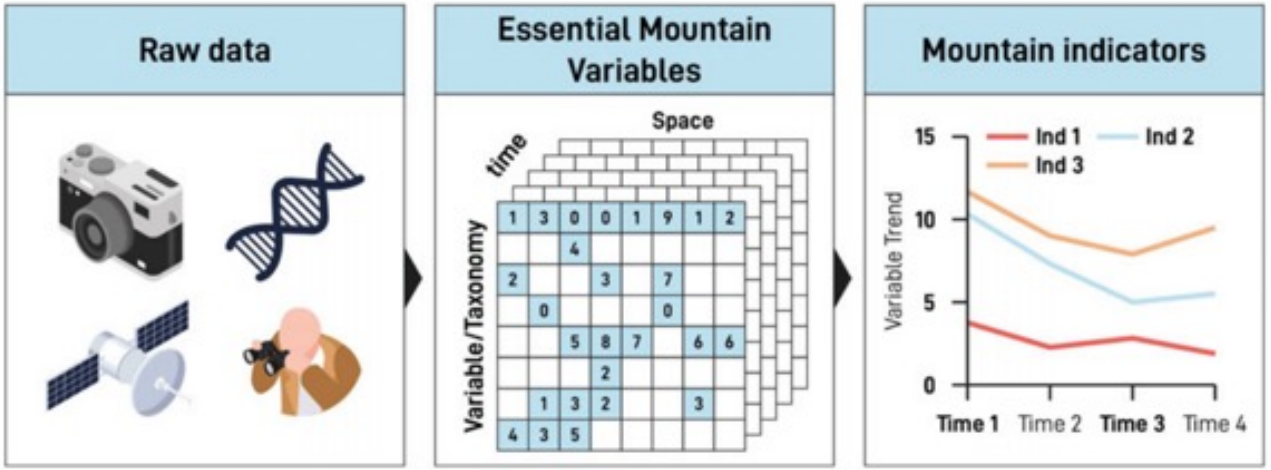


Fig. 5 Essential Mountain Variables (EMV) are derived from raw data obtained through different observation methods, including field surveys, automated instruments, satellite remote sensing and DNA sequencing. These data are harmonized, standardized and organized as Essential Mountain Variables data products, which can be used in various ways to derive indicators that quantify spatiotemporal changes in species distributions, population abundances or other aspects of biodiversity (Figure adapted from Kissling et al. 2018)

Integración del conocimiento científico con el local

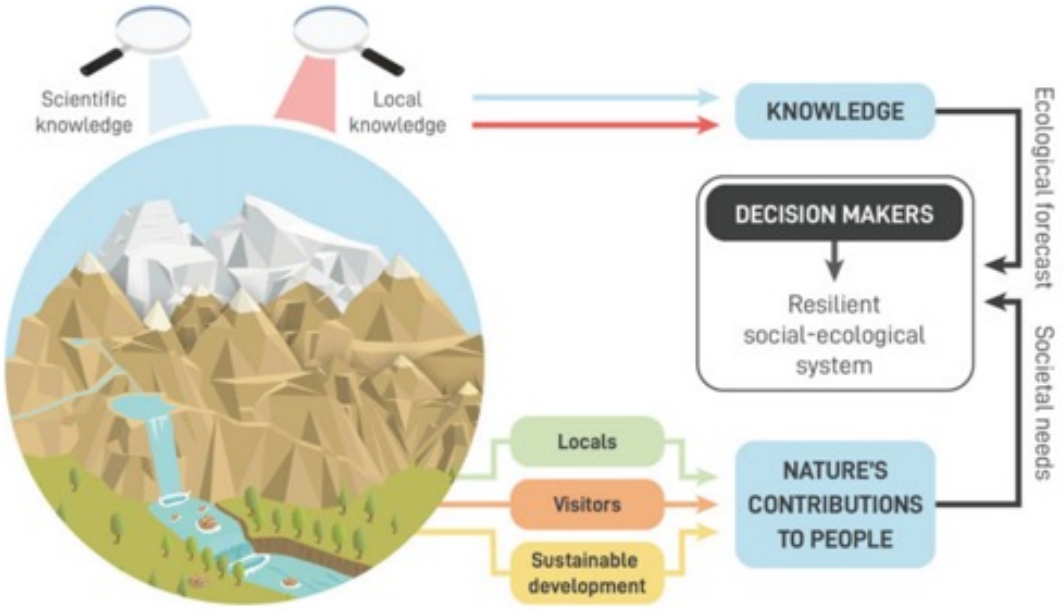


Fig. 7 To guarantee biodiversity conservation and a good quality of life for all people, decision-makers should: (1) consider plural perspectives combining scientific knowledge with that of local communities, which together can improve our understanding of how mountain ecosystems change and how these changes affect society; and (2) consider the needs of the various types of mountain users, with the ultimate goal of maintaining resilient social-ecological mountain systems

Conocimiento Local

Fig. 1 **a** *Acequia de careo* without water to carry out repair works. **b** Members of Bérchules' irrigation community cleaning an *acequia de careo*. **c** *Aliviadero* on the side. **d** *Aliviadero* overflow and flow limiter. **e** *Partidor* of *acequia de careo* of the Poqueira ravine. **f** Water catchment for an *acequia de careo*. **g** *Acequia de careo* of Bérchules

XIX FERIA ANDALUZA DE LA BIODIVERSIDAD AGRÍCOLA

"Semillas de tradición, cosecha de futuro"

23-24-25 DE SEPTIEMBRE DE 2022
CÁDIAR (GRANADA)

- Agromercado -

- Conferencias, mesas redondas y talleres -

- Exposición e intercambio de semillas de variedades locales -

- Degustaciones y concursos -

- Actividades infantiles, conciertos y mucho más -

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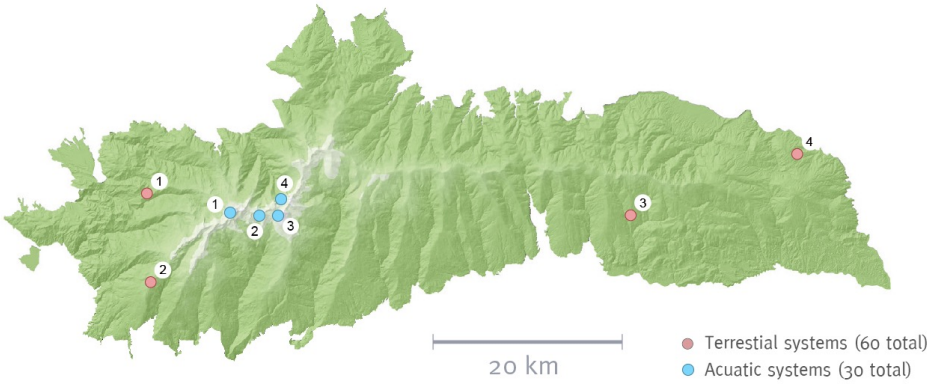
Conectando macro y microclima con las respuestas bióticas



Cortijuela
1700 m

Lanjarón
2400 m

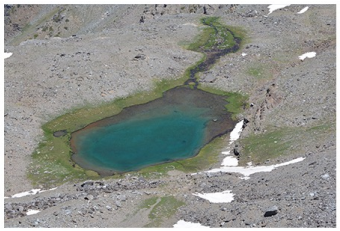
El Encinar
1700 m

Aljibe de Montenegro
975 m

Laguna de las Yeguas
2914 m

Laguna de Río Seco
2987 m

Laguna de la Caldera
3050 m

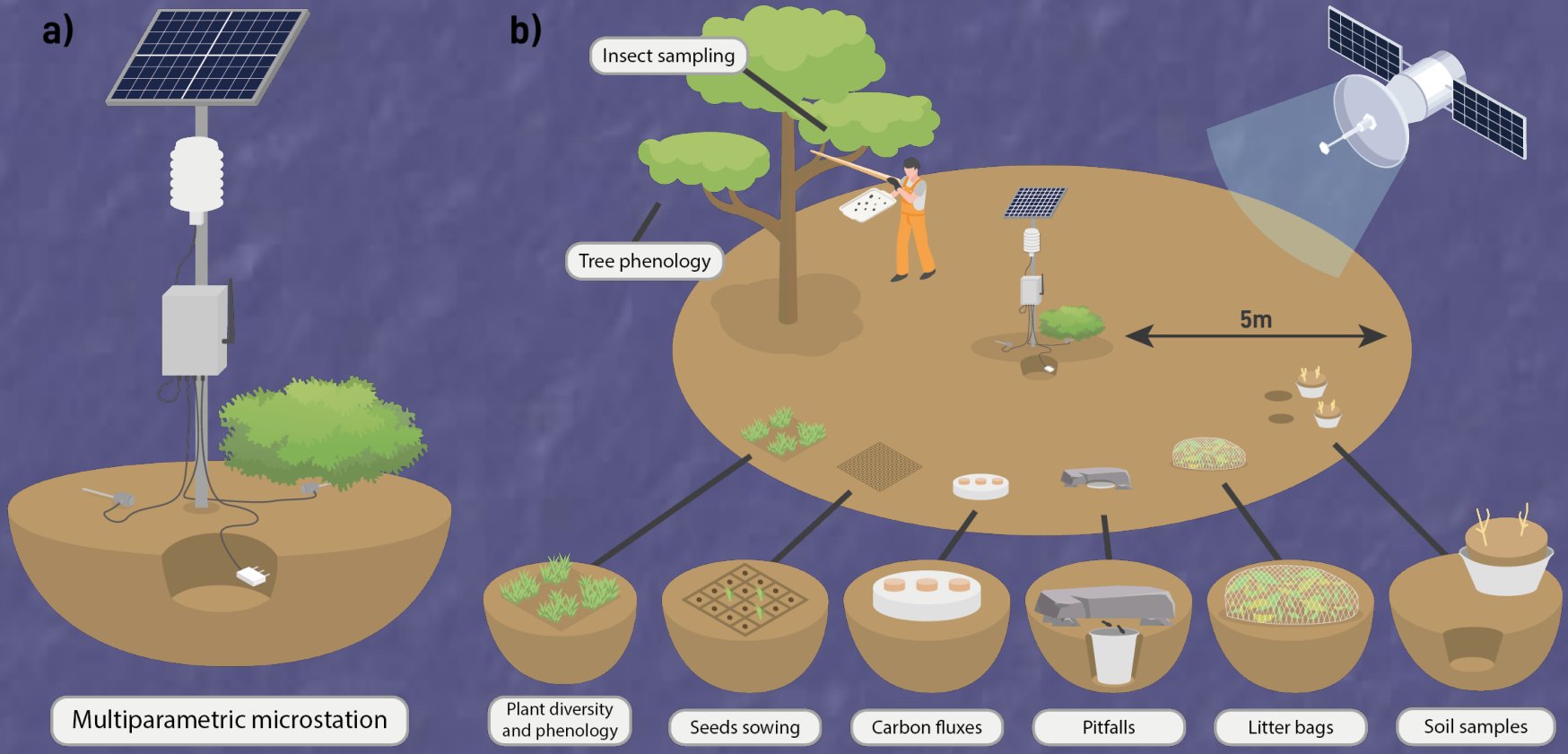


Laguna de la Mosca
2918 m

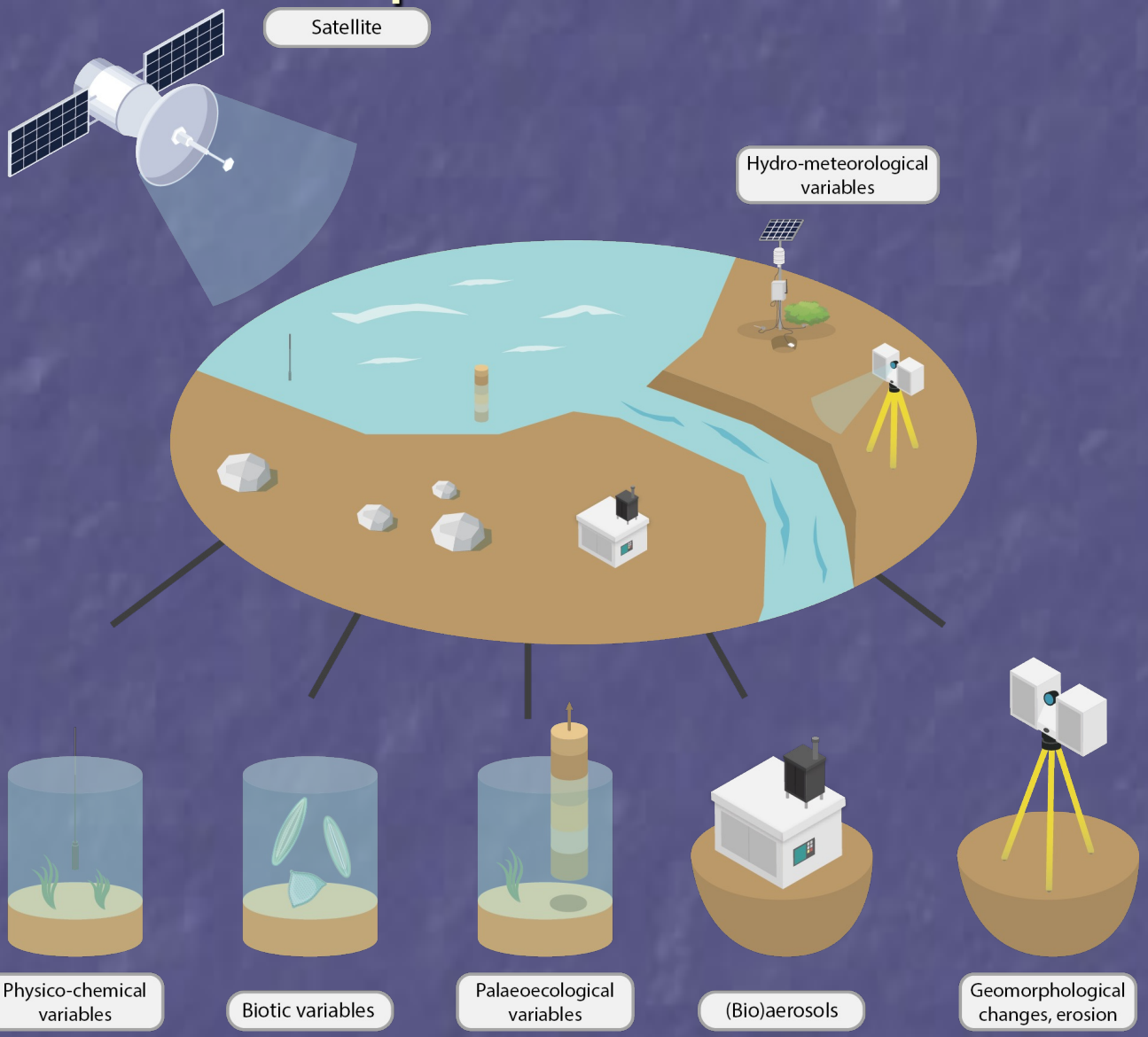
Conectando macro y microclima con las respuestas bióticas

Conectando macro y microclima con las respuestas bióticas

Conectando macro y microclima con las respuestas bióticas



Conectando macro y microclima con las respuestas bióticas



Agradecimientos

A todos los investigadores, gestores, técnicos y agentes que colaboran en el Observatorio de Cambio Global de Sierra Nevada.

A todas las fuentes de financiación regionales, nacionales y europeas.

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Gracias