Biodiversity, biological indices, and recovery

- The 2022 thematic report on biological recovery, Gaute Velle, Norway (not available)
- Extended ICP IM – development of the program, Salar Valinia, Sweden (not available)
- Environmental monitoring at Sierra de Guadarrama National Park, Ignacio Granados, Spain
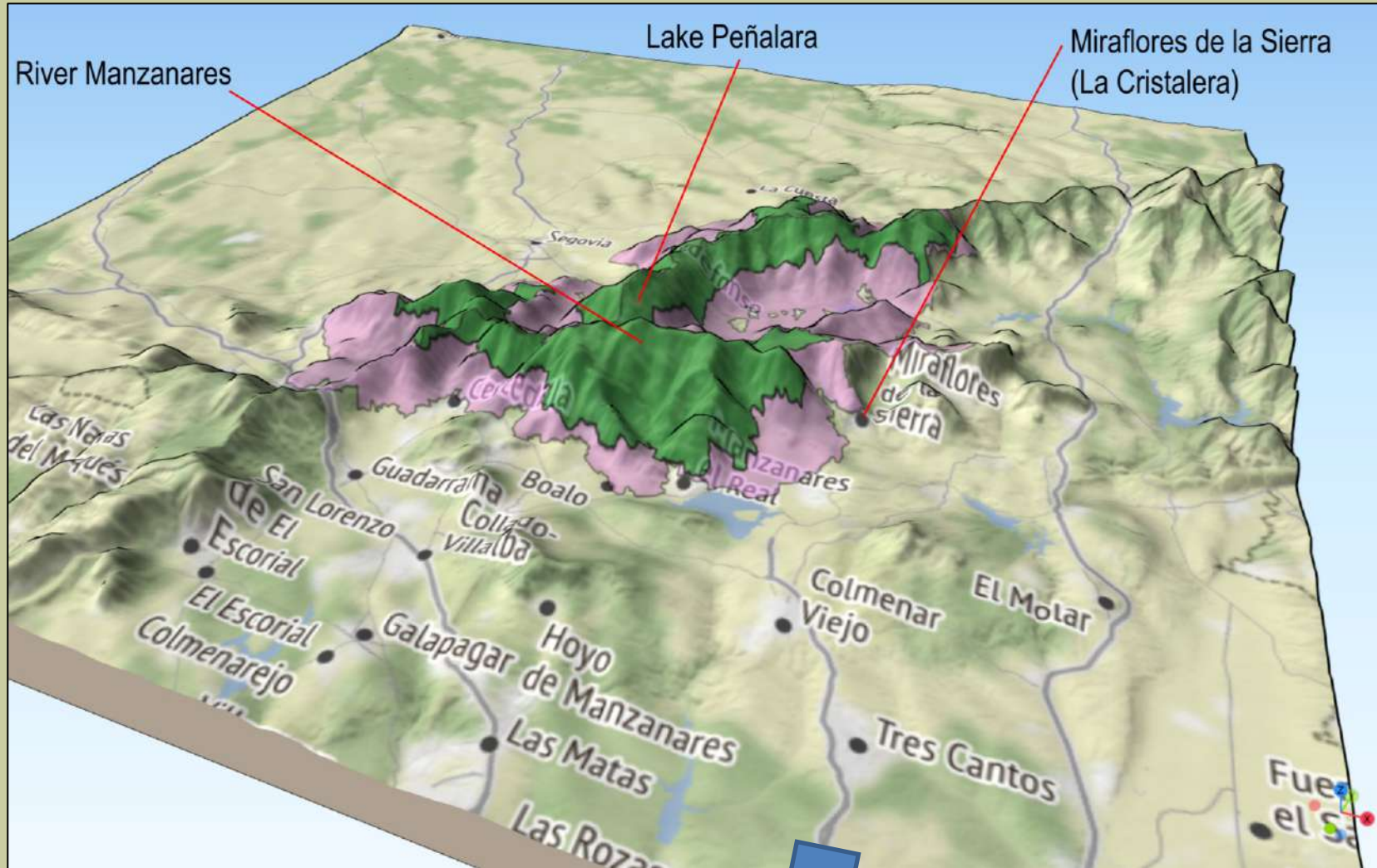
Ignacio Granados & Ángel Rubio

Research, Monitoring, and Evaluation Centre

Sierra de Guadarrama National Park

Environmental monitoring at Sierra de Guadarrama National Park – Focus on aquatic ecosystems
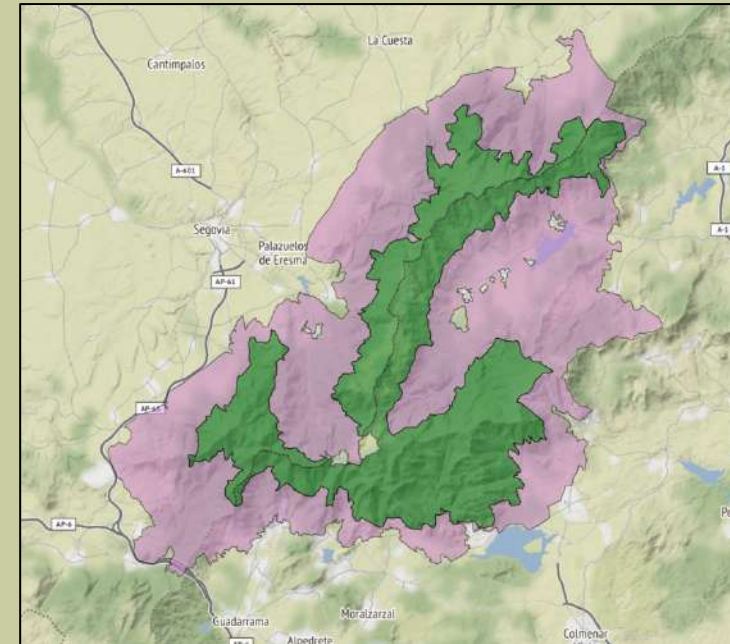
Sierra de Guadarrama National Park

River Manzanares

Lake Peñalara

Miraflores de la Sierra
(La Cristalera)

Madrid 15Km

Green: Sierra de Guadarrama National Park
Pink: Peripheral Protection Zone

- 340 km^2 (Madrid 218 km^2, Segovia 122 km^2)
- Glacial vestiges (Peñalara) and granite batholith (La Pedriza)

- Mediterranean high mountain ecosystems:
  - *Pinus sylvestris* pinewoods & Pyrenean oak woods
  - Sclerophyllous scrub and high-mountain grassland
  - Rock vegetation communities
  - High-mountain ponds and lakes. Headwater streams

Sierra de Guadarrama National Park

- Protected Area since 1930. Growing protection over decades. National Park in 2013
- Conservation values
    - Frontier between northern and southern biota
    - High biodiversity. Threatened and endangered species
    - Fragile ecosystems
    - Landscapes shaped by long human interaction
- Pressures
    - Recreational pressure (2.3 million visitors per year)
    - Conflicts between conservation and resource use
    - Exotic invasive species
    - Climate change (+2.17°C between 1980-1989 and 2010-2019)
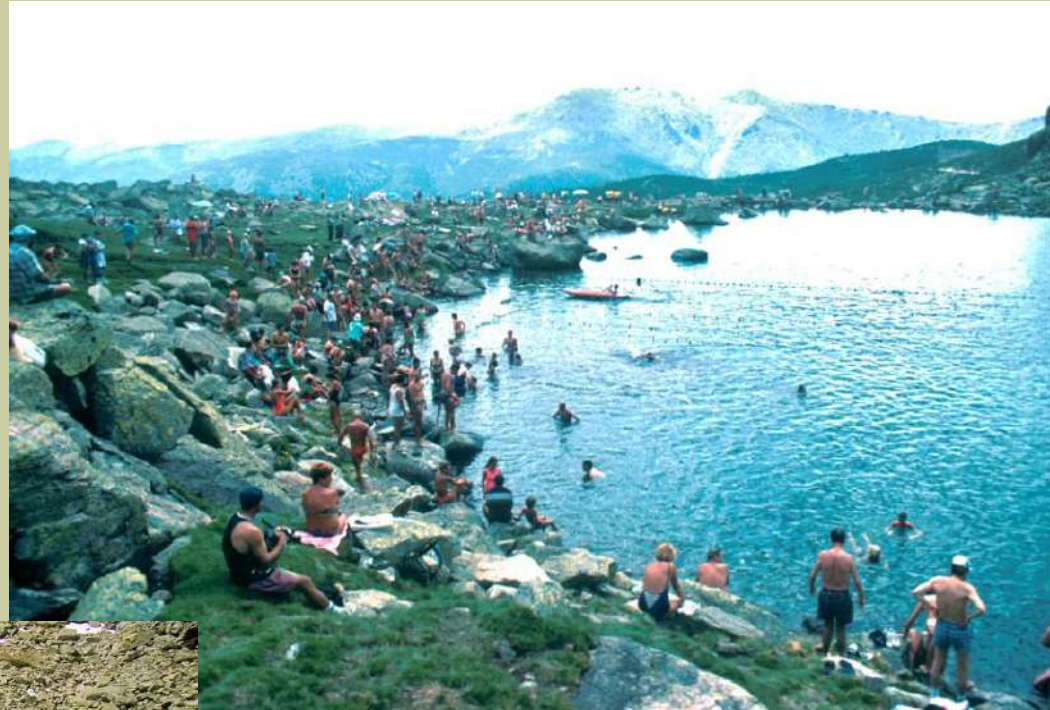   - Signs of atmospheric pollution

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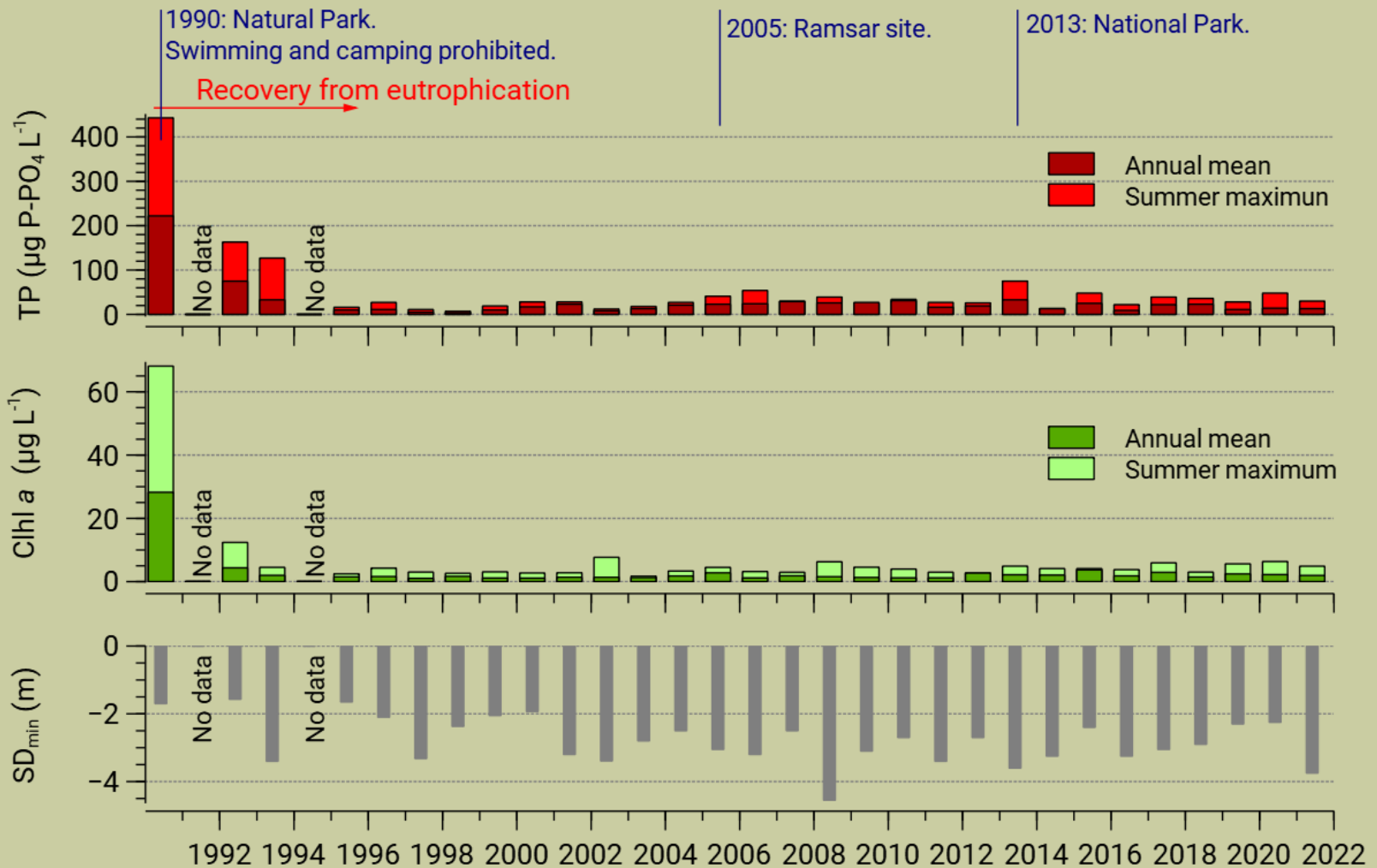# 1970 → 1990: Severe recreational impacts

- Nearby ski resort
- Lake eutrophication
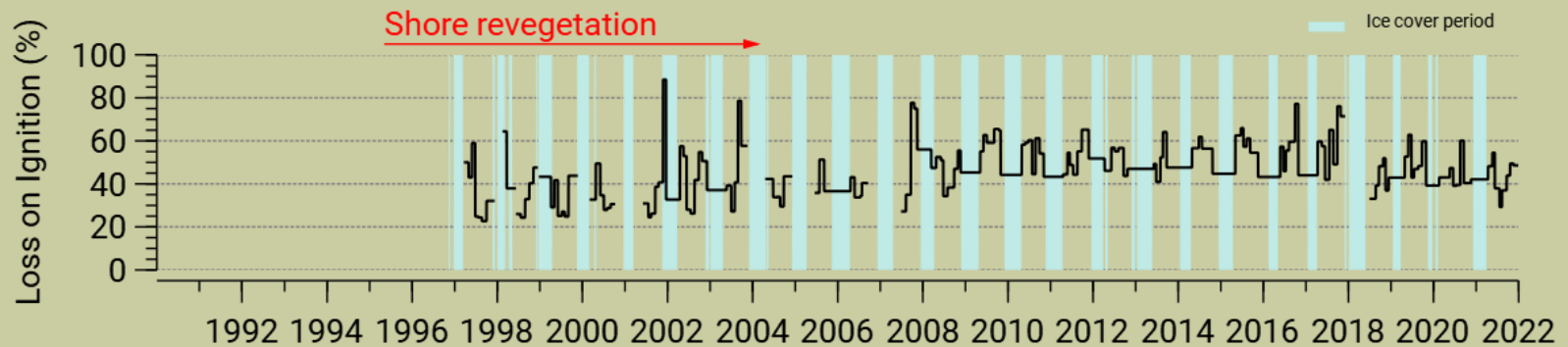- Shore erosion
- Invasive species (fish)

Since 1990

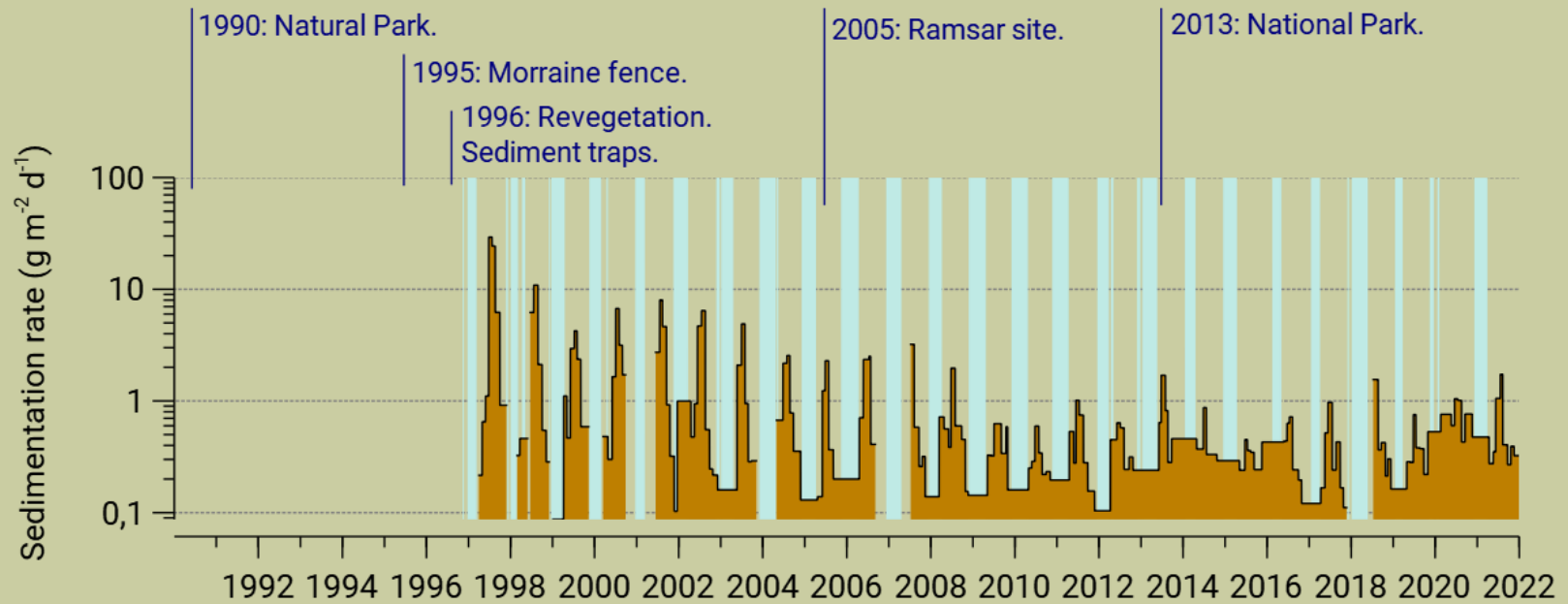- Ski resort dismantle
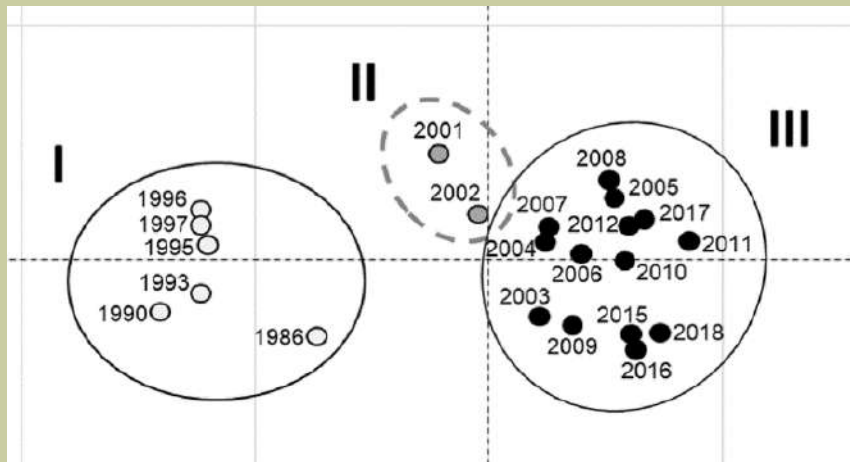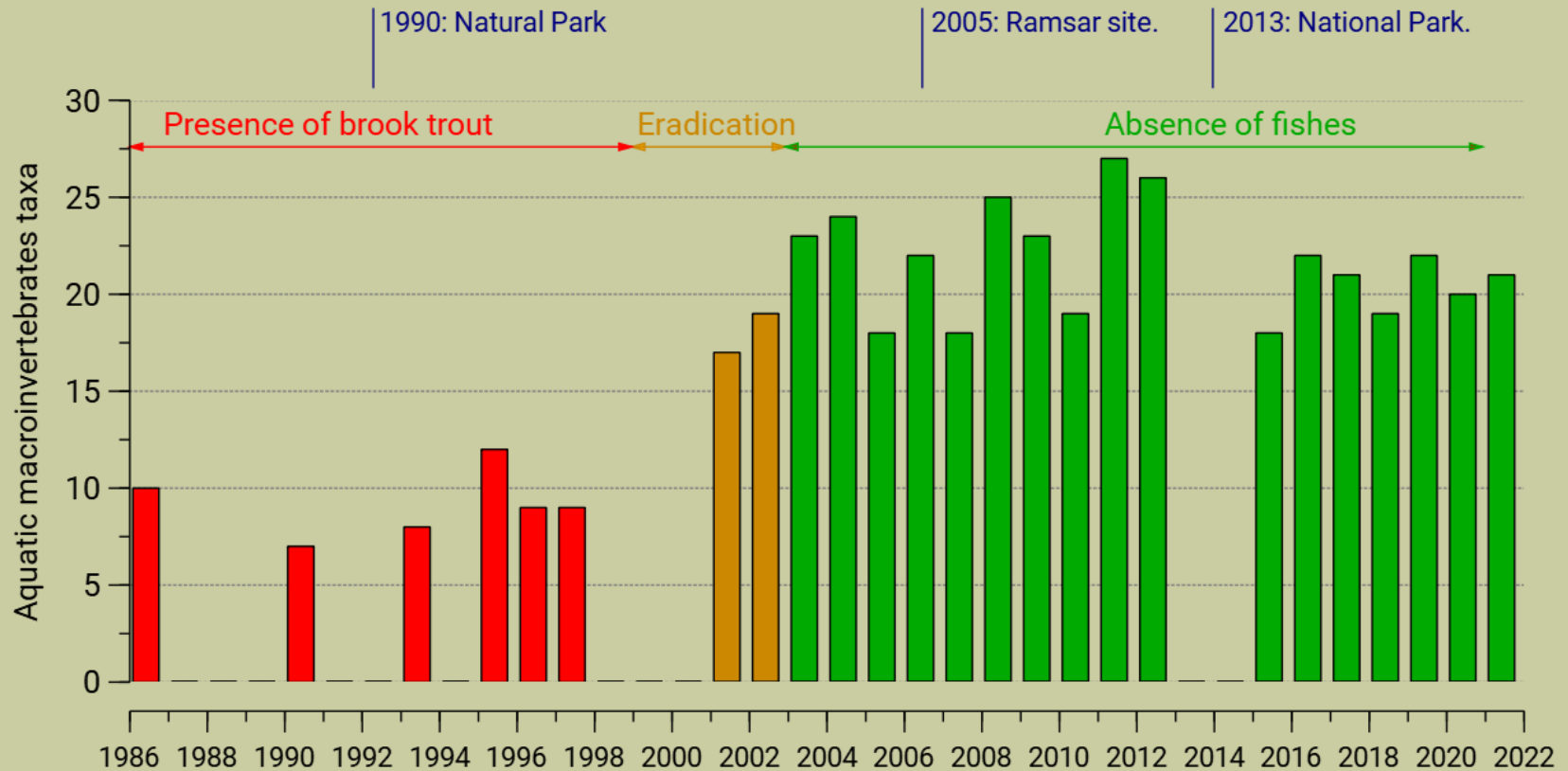- Restoration project
- Management of recreational use

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Lake Peñalara – Monitoring the lake restoration

Lake Peñalara – Monitoring the lake restoration

Lake Peñalara – Monitoring the lake restoration

1990: Natural Park

2005: Ramsar site.

2013: National Park.

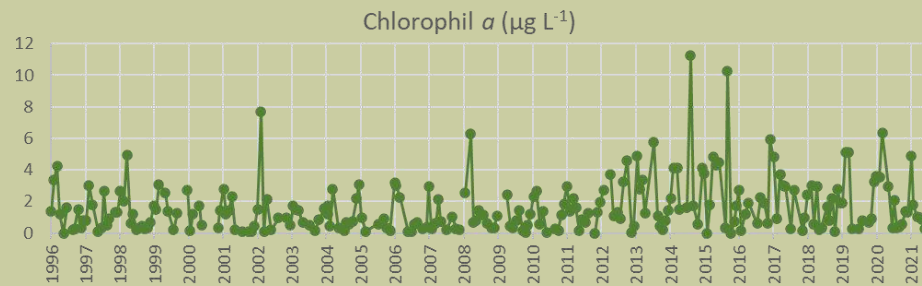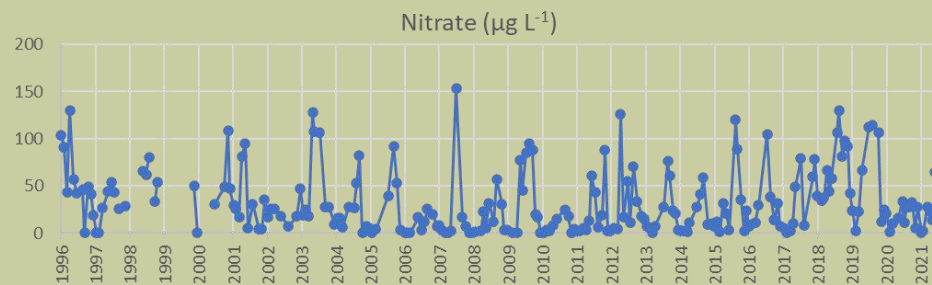Presence of brook trout — Eradication — Absence of fishes

Fuzzy Correspondence Analysis (FCA)
*Affinity of the sampled years
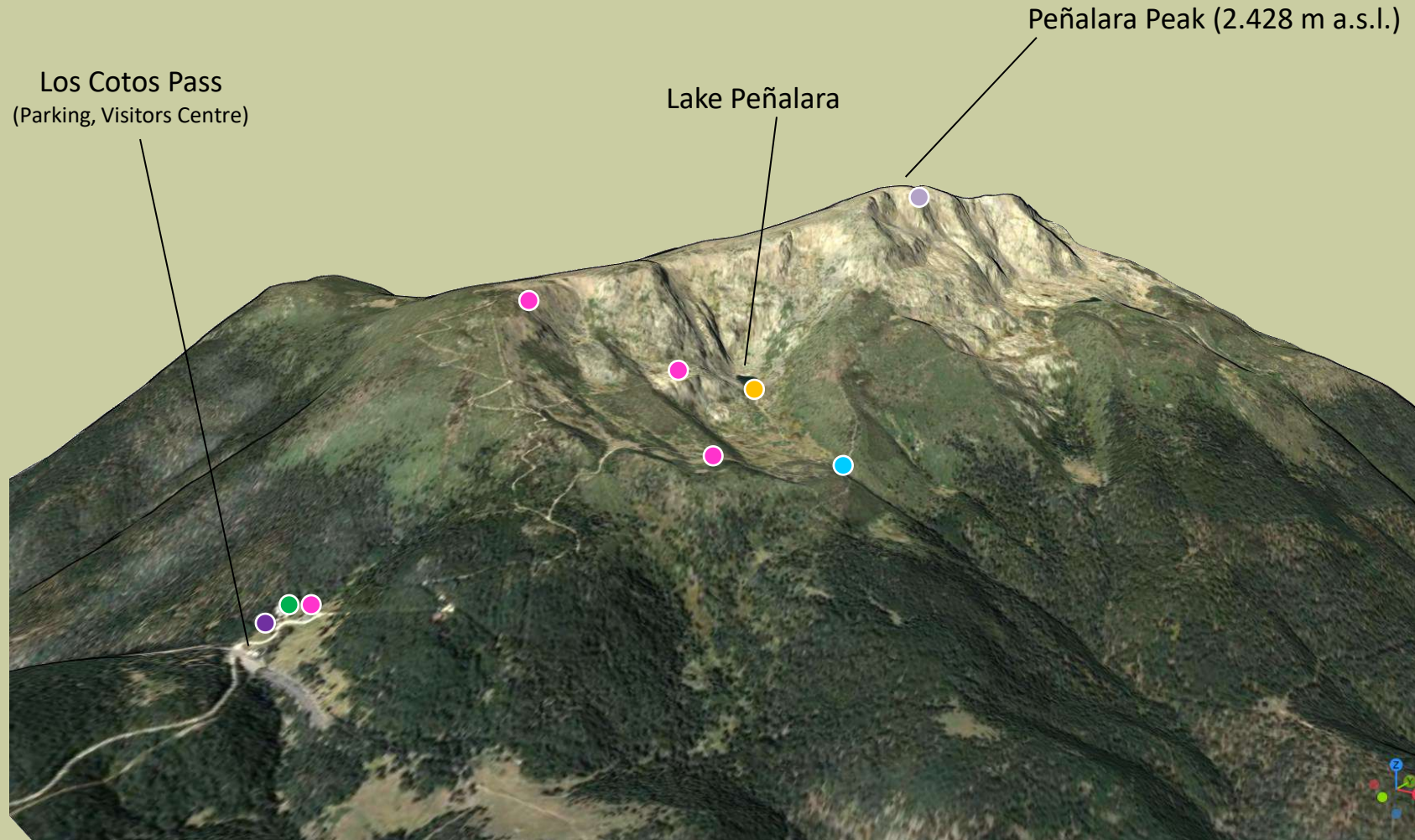for the different biological and ecological
traits*

Monitoring – Monthly sampling (Lake Peñalara)

- Ice cover, water level
- Temperature, oxygen and conductivity profile. pH.
- Hydrochemistry (alkalinity, some ions, phosphorus, nitrogen, pigments)
- Secchi disk.
- Sediment traps
- Plankton
- Benthic invertebrates (summer)

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Monitoring – Instrumental deployment

Peñalara Peak (2.428 m a.s.l.)

Los Cotos Pass
(Parking, Visitors Centre)

Lake Peñalara

Peñalara Massif

🟡 Aquatic temperature loggers. Oxygen and conductivity loggers. Light loggers.

🔴 Automatic Weather Station / 🟣 `Remote' Weather Station

🔵 Gauging Station

🟢 Air Quality. Atmospheric Deposition.

🟣 Laboratory

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Lozoya Valley
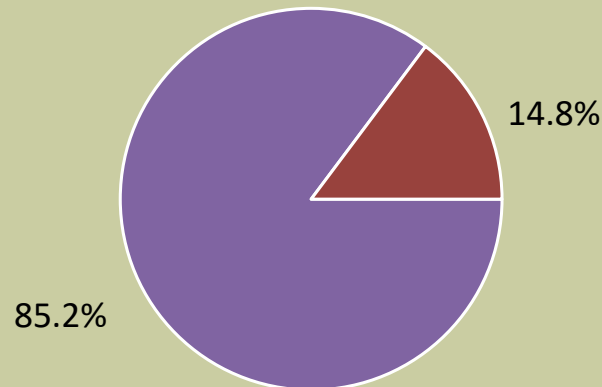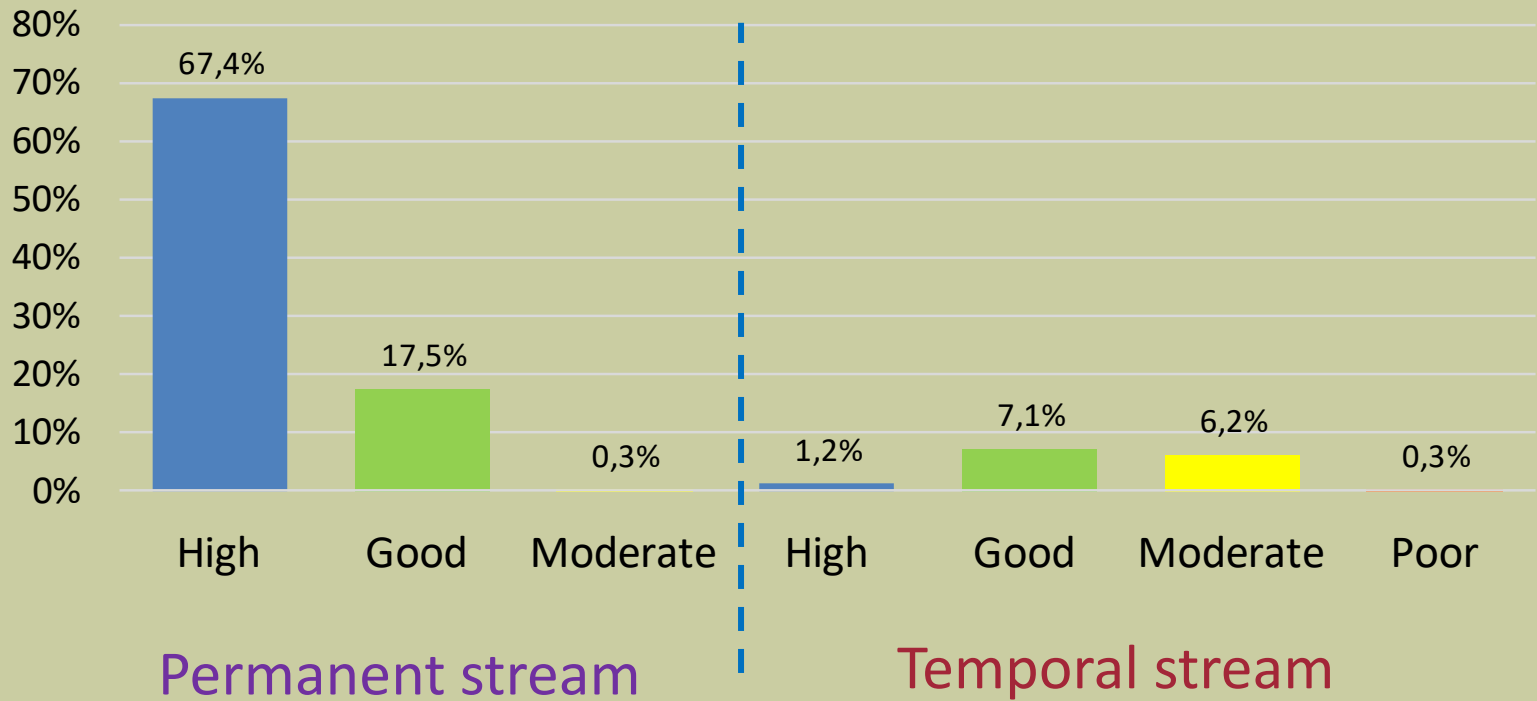

Guadarrama Valley

Manzanares Valley

- 26 Sampling stations (Madrid)
  - River Lozoya axis and tributaries
  - River Manzanares
  - Around the national park border
- Ecological status indexes (WFD)
- Hydrochemistry (selected stations)

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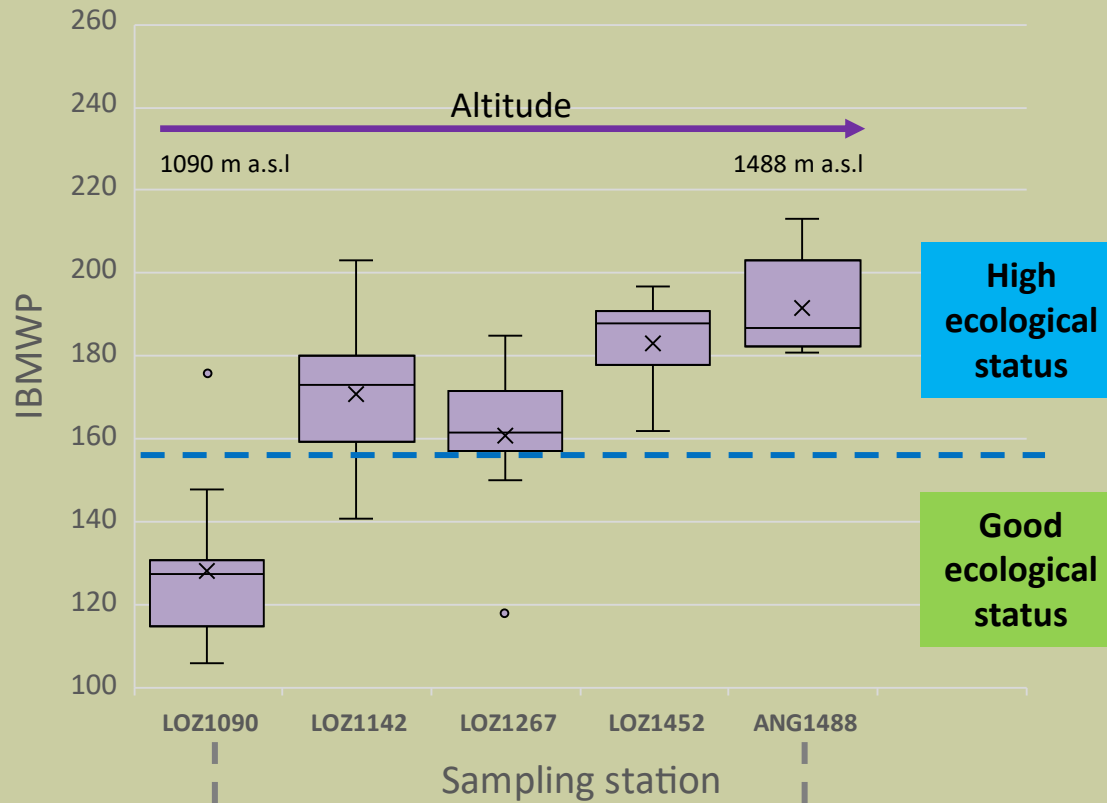Junta de Castilla y León

Monitoring – Annual sampling (Rivers)

Ecological status (2006-2021)

Monitoring – Factors affecting ecological status

Distribution of IBMWP values
River Lozoya (2005-2016)

- Temporality
- Altitude
- Rocky areas / Vegetation
- Bank disturbance
- Recreational activities

High ecological status

Good ecological status

* IBMWP=Ecological quality index (WFD) from Spain

Monitoring – Recovery since bath prohibition

Bathing prohibition and river restoration
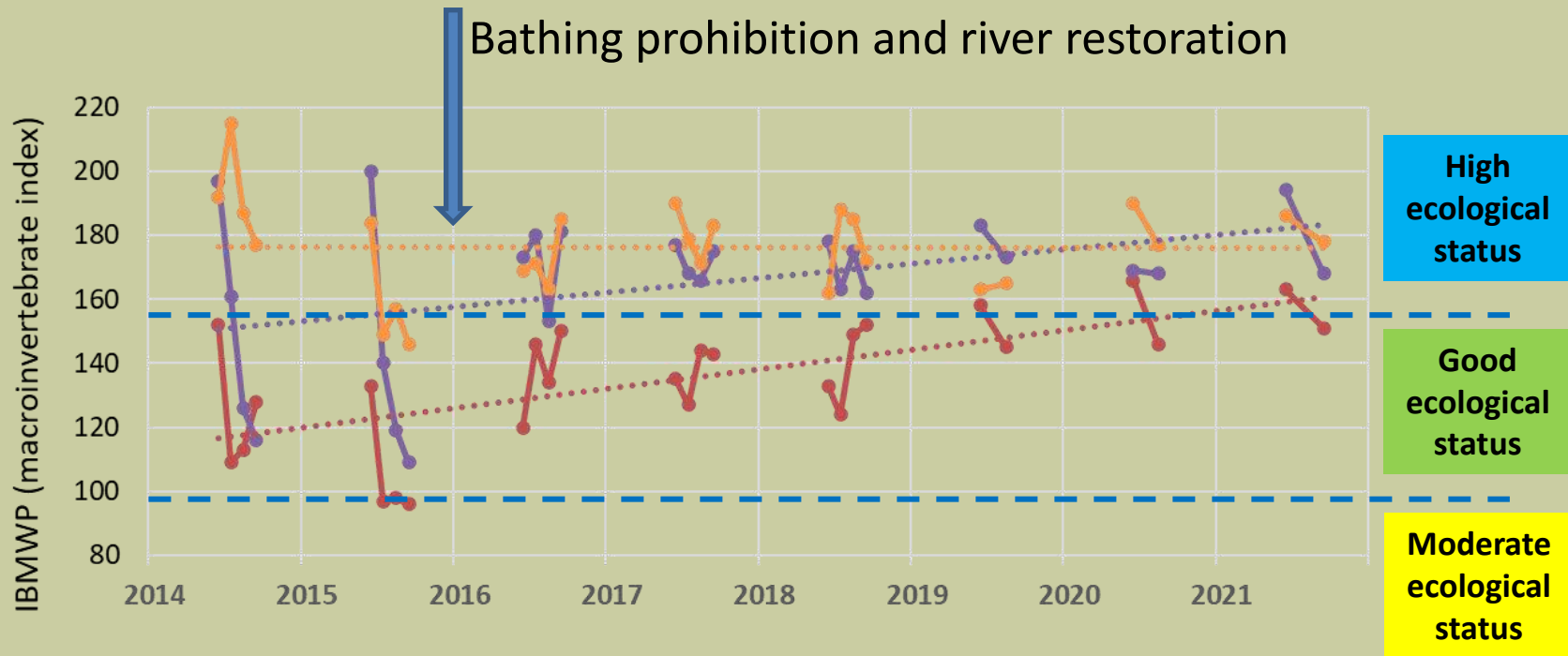
MAN1210. 1.2 km upstream of the bathing area (Charca verde)

MAN1076. 1.0 km downstream of the bathing area (Charca verde)

MAN0965. 3.0 km downstream MAN1076 (very active bathing area)

Monitoring - Climate change in Sierra de Guadarrama

Navacerrada Pass, 1894 m a.s.l. , 6km away from Peñalara. AEMET. 1945-2021

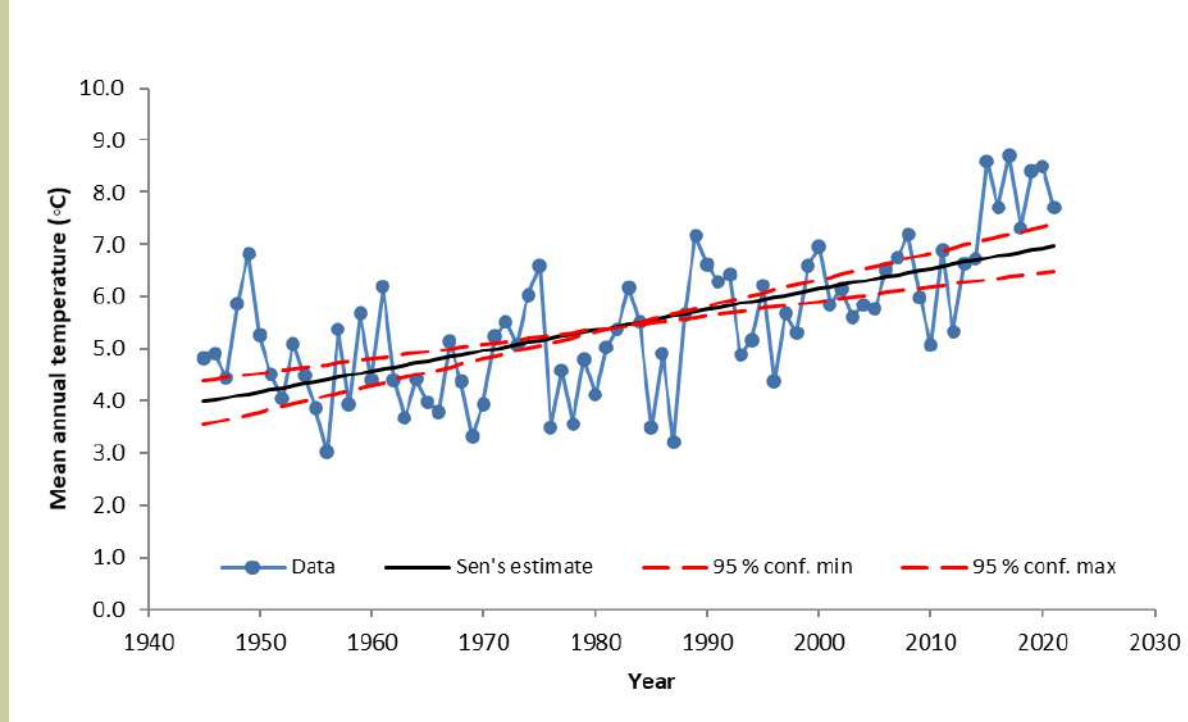|	°C/Decade	
January	0.73	***
February	0.77	**
March	0.72	***
April	0.26	*
May	0.11	
June	-0.05	
July	0.30	**
August	0.31	***
September	0.28	**
October	0.31	**
November	0.33	**
December	0.56	**
Spring	0.13	*
Summer	0.31	***
Autumn	0.39	***
Winter	0.75	***
ANNUAL	**0.39**	***

Probability:
+ P <0.1
* P<0.05
** <0.01
*** p<0.001
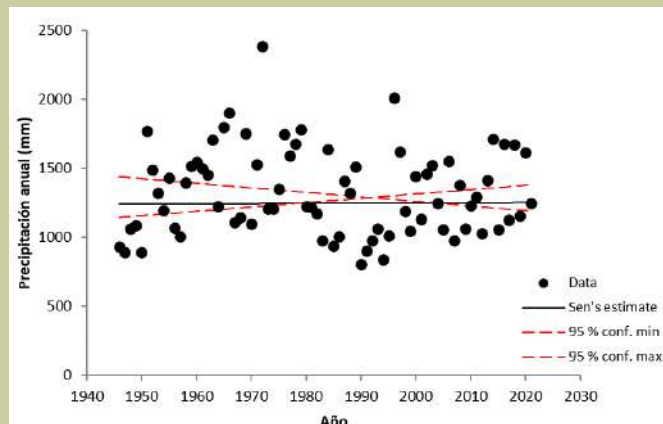
Non significant trend in precipitation

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Water temperature - Lake Peñalara

Monthly mean surface water temperature of the warmest month.
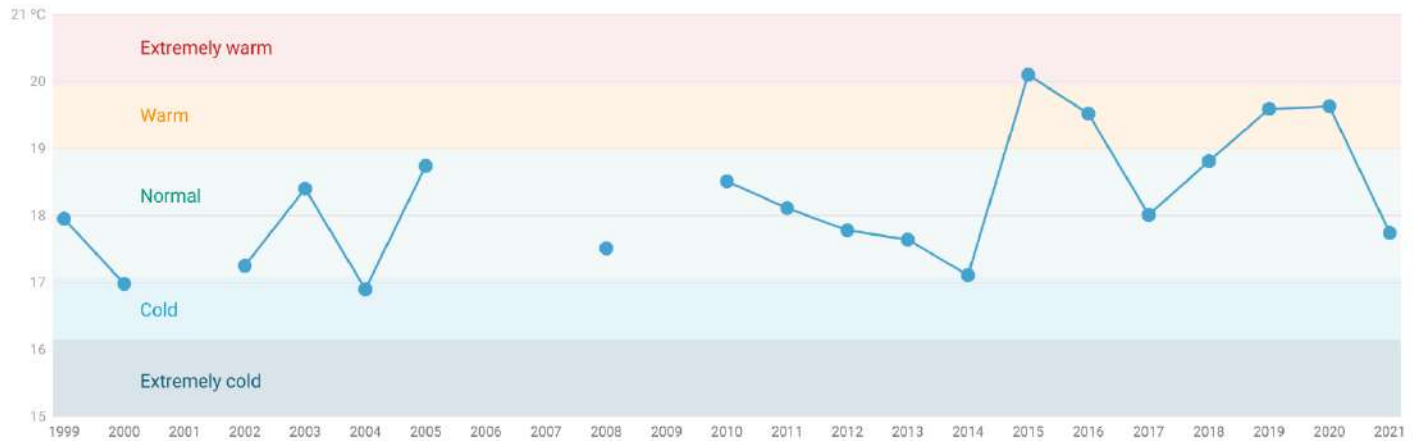
Monthly mean of the month with the highest temperatures at 0.5 m depth. Available values between 1998 and 2016 indicate that on average the mean temperature of the warmest month is 18.04 °C. Thresholds have been established to consider a year within normality, as anomalous (±1σ, =68%), or extraordinarily anomalous (±2σ, =95%).

Gráfico: Centro de Investigación, Seguimiento y Evaluación · Fuente: Parque Nacional de la Sierra de Guadarrama · Creado con Datawrapper

Ice cover duration

Lake Peñalara
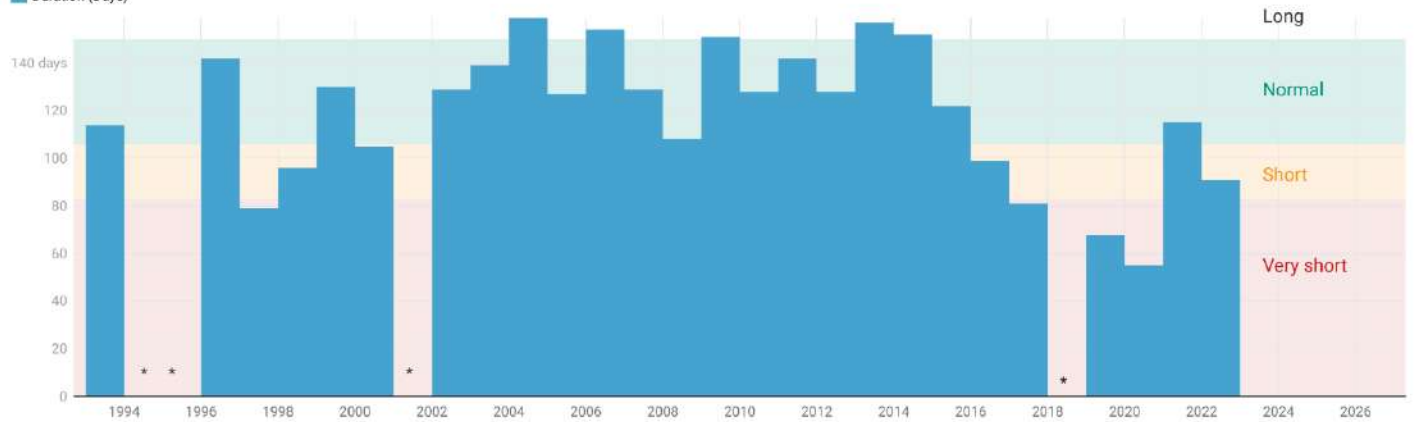
The ice cover duration is the number of days with ice between the first day when the lake is 100% ice-covered and the last day of the season when the lake has some ice. With the 1993-2016 data series, thresholds have been established to consider a year within normality, as anomalous (±1σ, =68%), or extraordinarily anomalous (±2σ, =95). * An asterisk indicates no data.

Chart: Centro de Investigación, Seguimiento y Evaluación · Source: Parque Nacional de la Sierra de Guadarrama · Created with Datawrapper

- Automatic visitor counters (pressure and light beam)
- Visitor estimation trough anonymized mobile phone data
- Visitor characterization with field surveys

Daily visitors to the national park (2020)

COVID-19 Lockdown
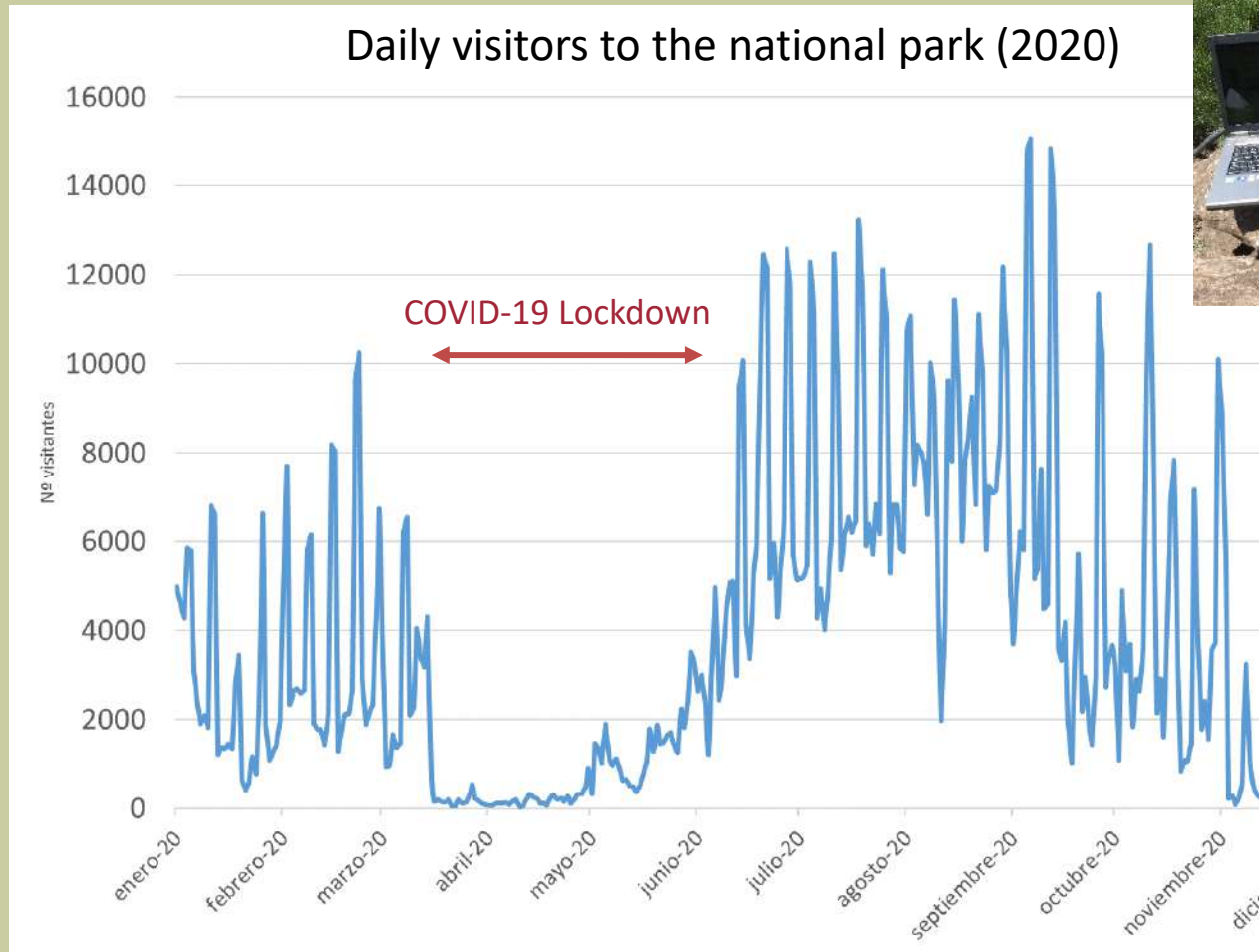
- Singular fauna (black vulture, wolf, wild goat, roe deer, amphibians, ...)
- Invasive exotic species

Wild goat density population

Cuerda Larga-Pedriza.

The sustainable density threshold for the National Park populations (16 ind/km²) has been obtained through the analysis of the herbivore carrying capacity and the analysis of the demographic parameters of the population, as well as by comparison with densities in other natural high mountain populations.
Gráfico: Centro de Investigación, Seguimiento y Evaluación • Fuente: Parque Nacional de la Sierra de Guadarrama • Creado con Datawrapper
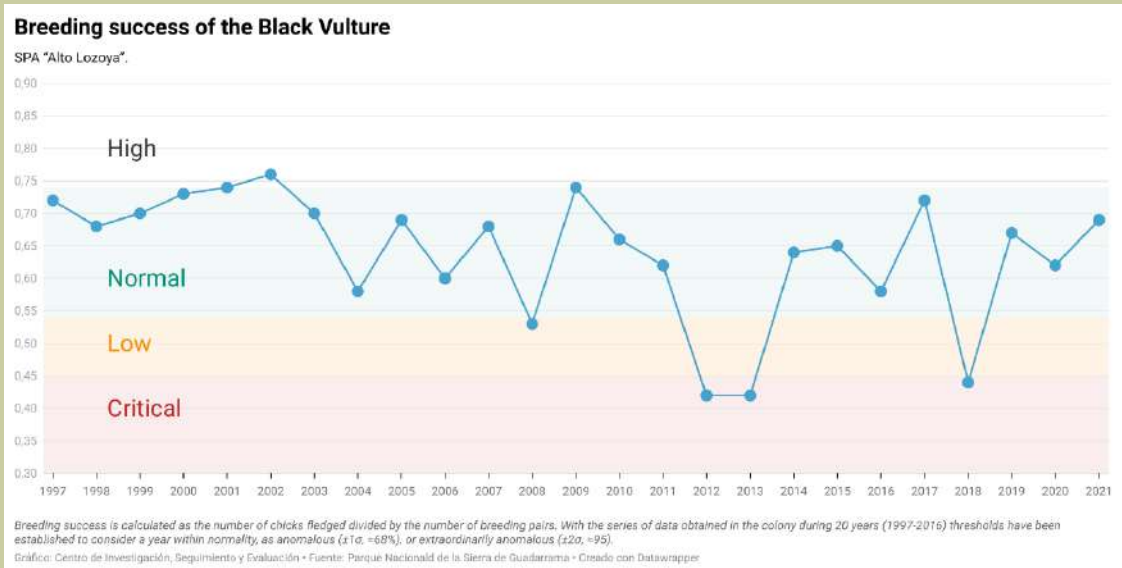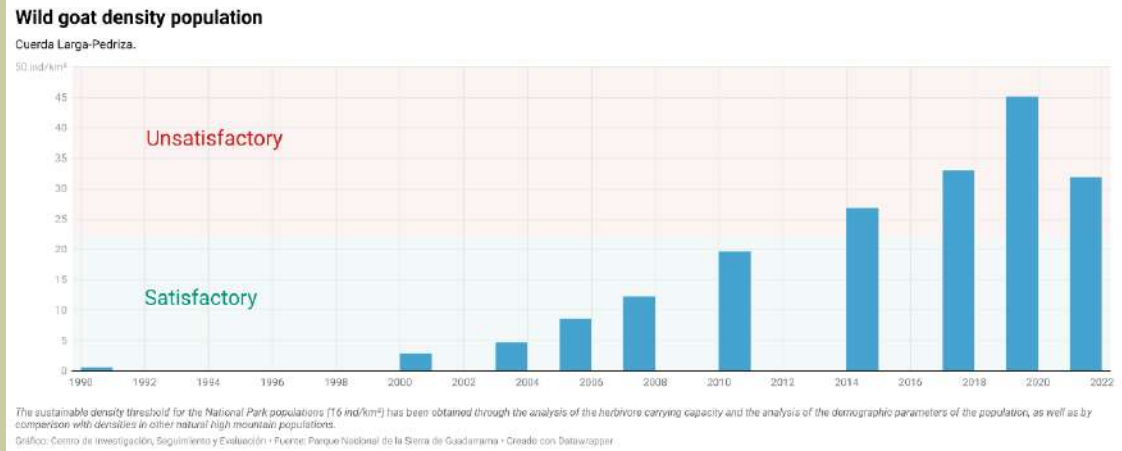

Breeding success of the Black Vulture

SPA "Alto Lozoya".

Breeding success is calculated as the number of chicks fledged divided by the number of breeding pairs. With the series of data obtained in the colony during 20 years (1997-2016) thresholds have been established to consider a year within normality, as anomalous (±1σ, =68%), or extraordinarily anomalous (±2σ, =95).
Gráfico: Centro de Investigación, Seguimiento y Evaluación • Fuente: Parque Nacional de la Sierra de Guadarrama • Creado con Datawrapper

- Rare and endangered flora species populations
- Surface area and habitat fragmentation
- Condition of forest stands

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