Climate change resilient lake-wetland management: lessons from “Prespa Waterbirds”

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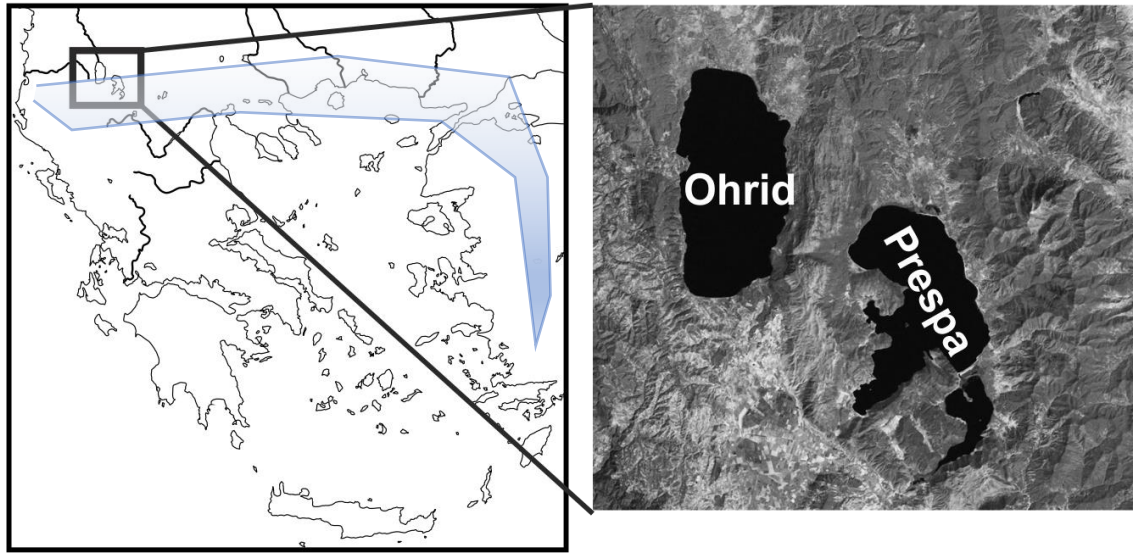
Guidelines devised to make wetland management of Lesser Prespa Lake sustainable & effective under future climate change.

Lake belt: from S Balkans to W Turkey

- Ancient lakes (>1Ma)
- Biodiversity hotspots
- Affected by climate/human impacts



Prespa Lakes (Albania, Greece, North Macedonia)

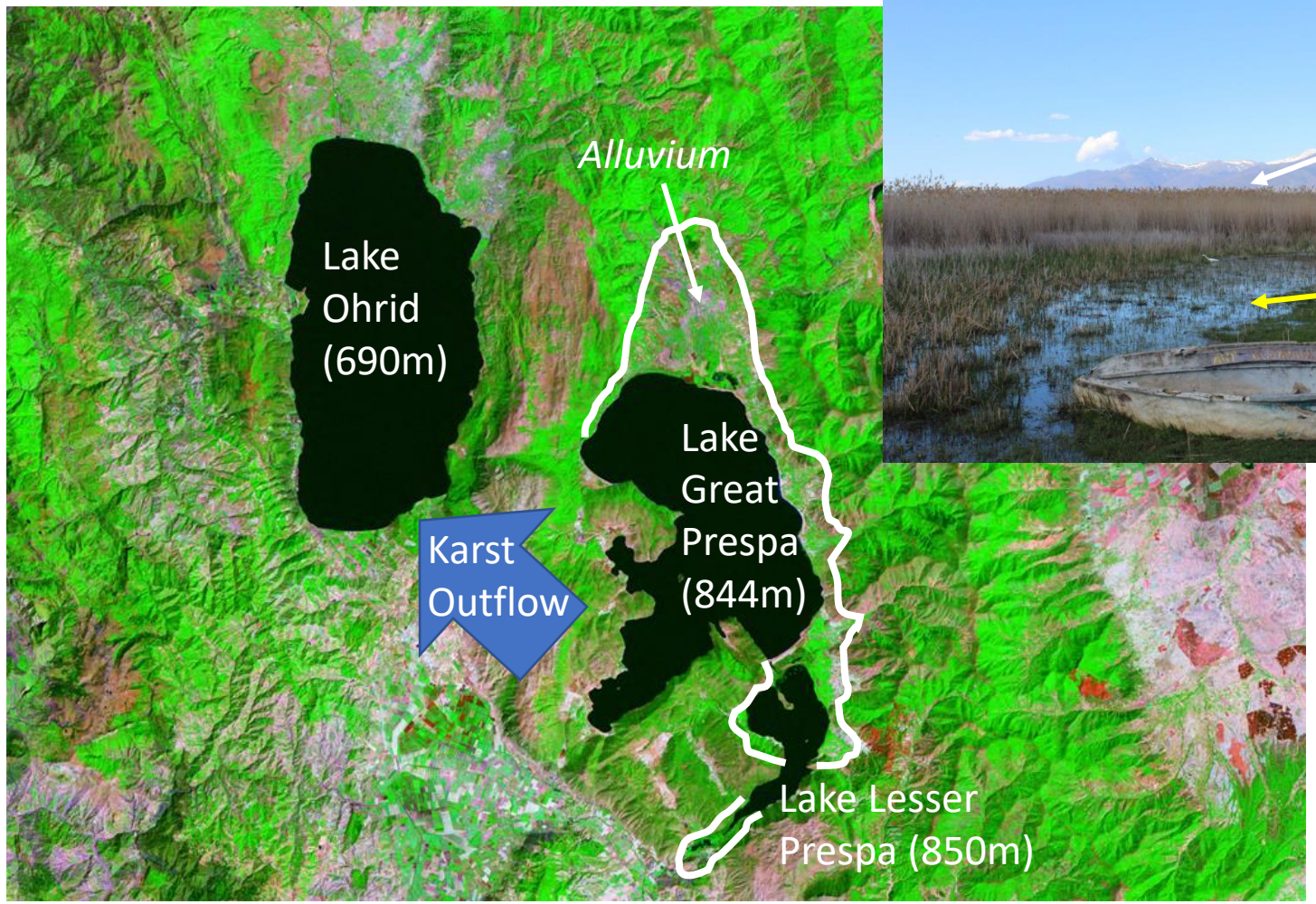
- **Global Biodiversity Hotspot**
- **Internally draining basin** (~1300km^2), surrounded by high mountains (2400m).
- **Lesser Prespa Lake** (Level: 850m, Surface: 52 km^2, volume: 330*10^6 m^3, depth: max. 8m) – shallow, low-gradient shores.
- **Great Prespa Lake** (Level: 844m, Surface: 254 km^2, volume: 2990*10^6 m^3, depth: max. 54m) – deep, steep shores.

LIFE Prespa Waterbirds (LIFE15 NAT/GR/000936: "Bird conservation in Lesser Prespa: benefiting local communities and building a climate change resilient ecosystem“)
https://www.prespawaterbirds.gr/

Alluvial lake-shores & Wetlands: to the N, E & S

Wetlands in alluvium (to N, E and S of lakes), sourced from granitic mountains (limestone mountains in W).

The Prespa Lakes are separated by an alluvial isthmus that contains a channel with a culvert/sluice (1969).



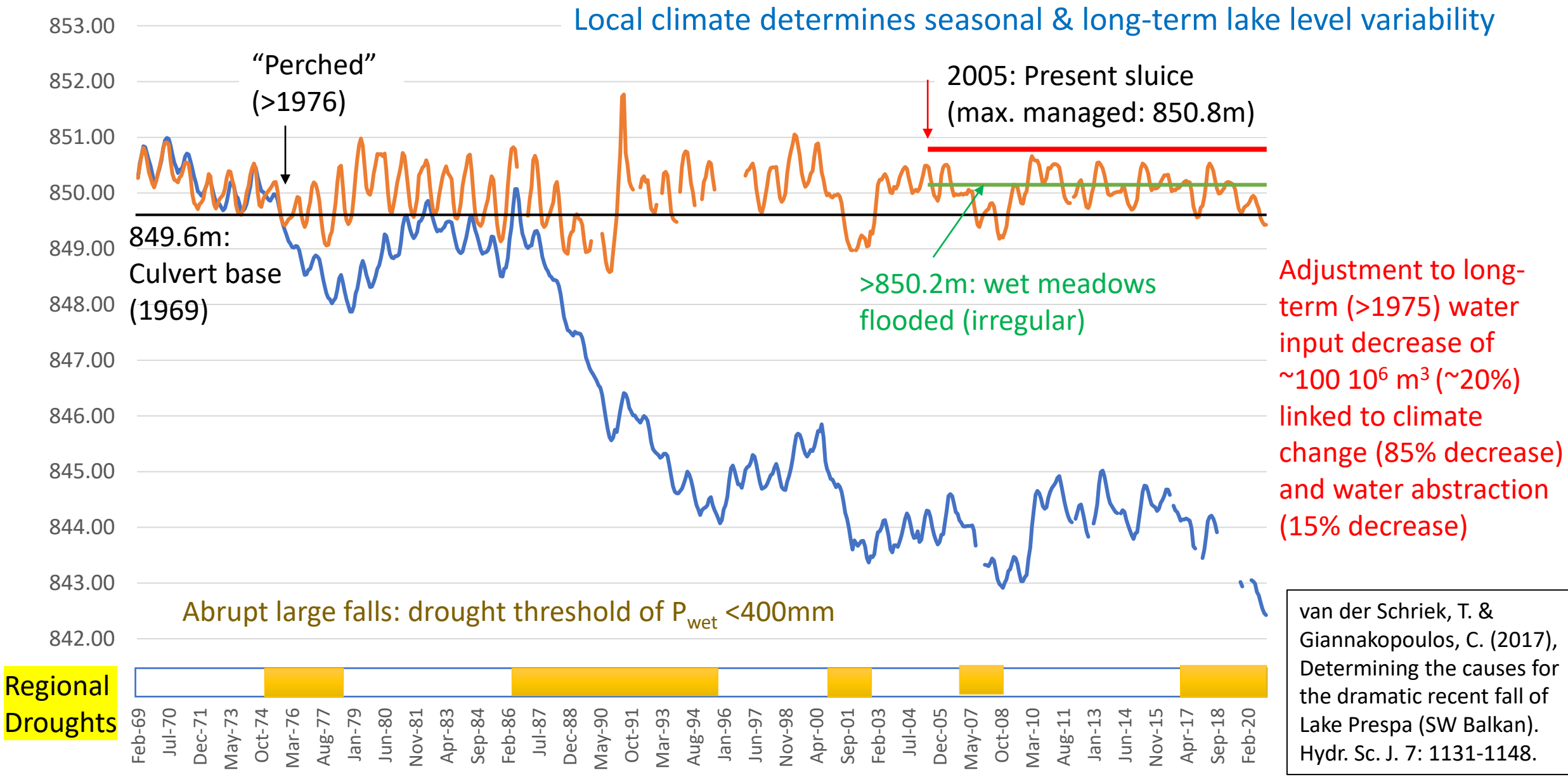
Reedbeds around shallow Lesser Prespa offer crucial bird nesting sites.

Seasonally flooded "wet meadows" (landward of the reed-belt) are important fish spawning grounds and bird foraging areas.

Climate change negatively impacts on:

(i) food availability due to decreasing "wet meadow" areas (foraging & fish spawning);
(ii) breeding output due to reedbed wildfires destroying nests.

Water Level (Feb 1969 – Dec 2020): Greater (blue) and Lesser (orange) Prespa Lakes



van der Schriek, T. & Giannakopoulos, C. (2017), Determining the causes for the dramatic recent fall of Lake Prespa (SW Balkan). Hydr. Sc. J. 7: 1131-1148.

Future threats to the lake-wetland system of Lesser Prespa

Reedbed expansion, reduced wet meadow flooding, increased biomass storage and build-up of nutrients

- **Sluice operation: Unprecedented** long-term stabilization of shorelines (45yrs) & **decrease** in (seasonal-annual) water level variability;
- **Abandonment** of traditional wet-meadow clearance that followed seasonal lake levels.

Future climate projections (2071-2100):

- Large annual increases in temperature (+2-5 ^{o}C) & open-water evaporation (+7-14%);
- Decreasing annual precipitation (minus 50-85mm);
- Frequency of dry years (P_{wet} & P_{annual} <25 $^{0}/_{00}$) increasing by 5-10%.

Lake impact projections indicate (**i**) a ~10% increase in freq. of low water levels (below sluice base) & reduced seasonal water level variability, and (**ii**) an increase in surface water temp. (+2-5 ^{o}C).

This will negatively affect fish spawning, bird foraging and -breeding

- **More frequent fire-access to nests (low lake levels), and less frequent wet meadows flooding;**
- **Intensification and speeding-up of eutrophication processes** ([i] the decrease in water volume will increase rel. nutrient concentrations, and [ii] higher lake temperatures favour the release of stored nutrients, decrease oxygen and induce higher absorption rates by plants thus increasing phytoplankton and aquatic macrophytes populations)**;**
- **Earlier start & shorter duration of the fish spawning period due to changing & higher lake temperatures.**

Climate-proof wetland management guidelines for Lesser Prespa

Vegetation management should aim for presence of wet meadows in the altitudinal range 848-851m (covering all projected future water levels);

- Reedbed zones should be cleared from the shore and up to 30 cm below seasonal low lake-levels, thus ensuring the availability of wet meadows during the following spring/summer, irrespective of wet/dry conditions.
- Clearance of zones should ideally be on a rotational basis, for the gradual rejuvenation and thinning-out of the reeds.

Fire-risk management should be integrated; cleared channels and wet meadows double as fire-breaks.

- Cultivated land should if possible be separated by (wet) meadows from the reed beds.
- To prevent the lateral spread of fires, reedbeds in streams and channels should be removed.
- Vegetation in drainage ditches should be removed, as fires often spread from these sites.

Vegetation management should remove of large quantities of nutrients (green plant material) from the lake system (fodder / fertiliser). This will help the lake ecosystem cope better with the impacts of climate change.

For more information on modelling and impact projections, please download relevant deliverables at:

https://www.prespawaterbirds.gr/deliverables-weg-14795.html