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Common borders. Common solutions.

Assessment on changes in wetland and floating vegetation cover

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and PONTOS colleagues

Odessa, 20 July 2022

AUA ACOPIAN CENTER for the ENVIRONMENT

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

DEMOCRITUS UNIVERSITY OF THRACE

GREEN ALTERNATIVE

1865

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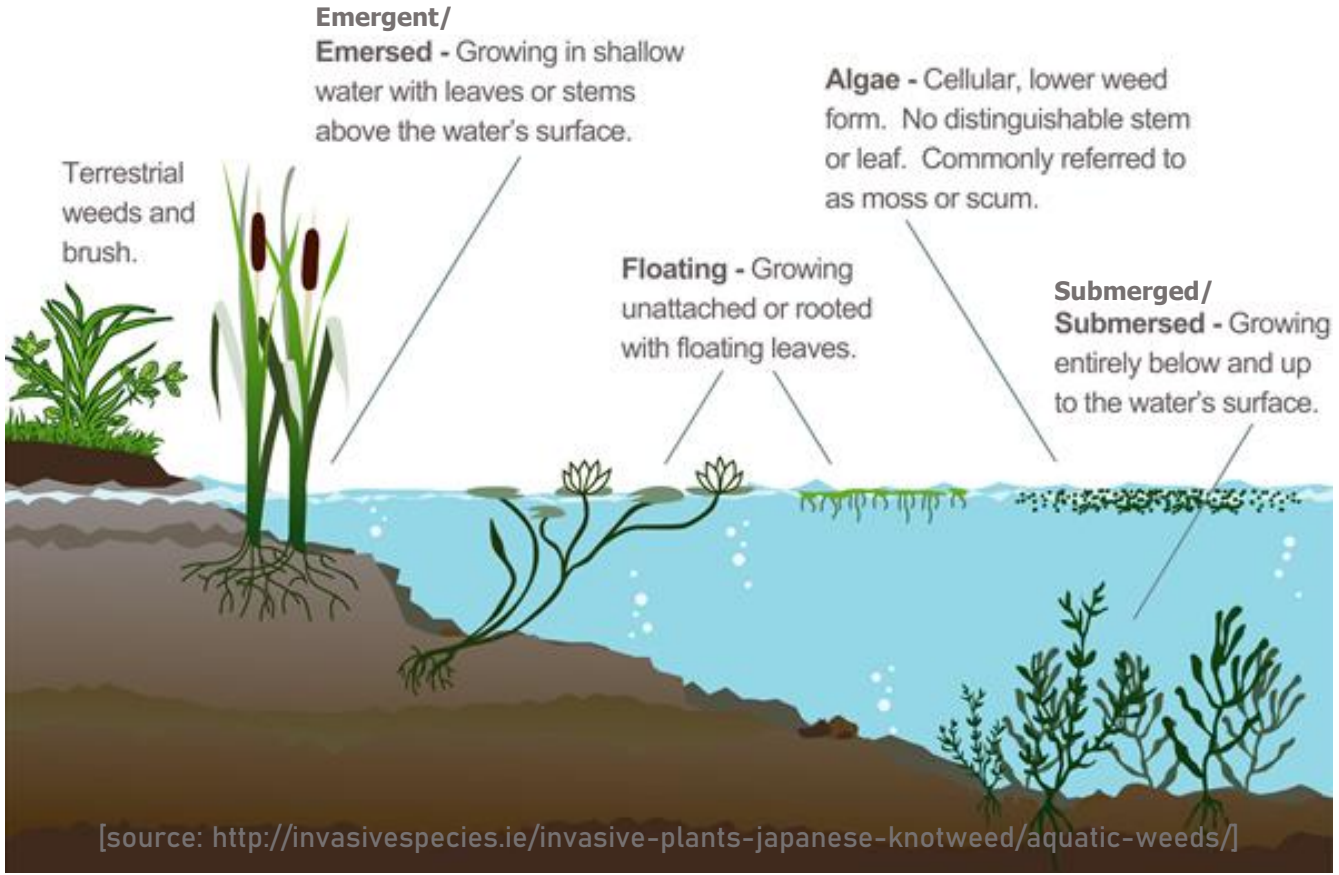
Challenges

- Complications of navigation of small vessels
- Complications of (commercial) fishing
- Excessive shading of the water body
- Excessive consumption of water-soluble oxygen
- Increased rates of siltation / sedimentation
- Substrate for filamentous algae
- Decreased surface water quality
- Decreased/ increased attractiveness for eco-tourists

Terminology:

Definitions of various aquatic vegetation types



[source: http://invasivespecies.ie/invasive-plants-japanese-knotweed/aquatic-weeds/]

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Aims:

- To estimate (inter-annual) changes in the area of emergent and floating vegetation cover during 2009-2021 in the pilot areas with identification of the most "vulnerable“/ overgrown areas
- To estimate annual dynamics of changes in emergent and floating vegetation cover over 2021

Additionally (optionally):

- To identify aquatic vegetation species using VHR satellite images and UAV-mosaics (selected sub-sites) and use them for validation of Sentinel-2 images
- To quantify the growth of aquatic vegetation biomass in pilots (where possible)
- To identify (semi-)submersed vegetation (where applicable) and to assess their area/density using UAV and satellite VHR images (selected sub-sites)


Ukraine: a) Coastline with beaches and recreational areas from Odessa city to the Danube river delta;
b) Dniester River Delta area and adjacent estuary
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Georgia: a) Entire coastline of Georgia;
b) Downstream part of Rioni river,
incl. delta area and Kolkheti NP
Greece: Nestos River, its Delta and
the coastal zone close to the Delta
Armenia: Sevan Lake and
its catchment area

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Data used

I. In-situ observations

- Field GPS tracking of aquatic vegetation boundaries by using a boat (historical data) [if available]
- Mapping of aquatic vegetation cover at selected sites by using UAVs (2021) [if applicable]
- Vegetation sampling at selected sites (2021) [optional]

II. Space-born observations

- VHR images (MAXAR) processing for selected sites at selected dates
- Satellite images (Sentinel-2 for 2015-2021; LandSat for 2009-2013) processing using CERTH algorithm

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Field data

Historical data for 2011-2021 (Ukrainian pilot case)

- Tracking of the boundaries of emergent and floating (+dense semi-submerged) vegetation with the boat-mounted GPS device of Eagle SeaCharter 640CDF GPS with horizontal accuracy of 3-5 meters (WAAS)
- Visual assessment of emergent and floating vegetation, its types and areas covered with a photo report
- Post-expeditionary processing of the results of field tracking with GIS software, production of vegetation maps, chronological analysis of changes







Historical Field data

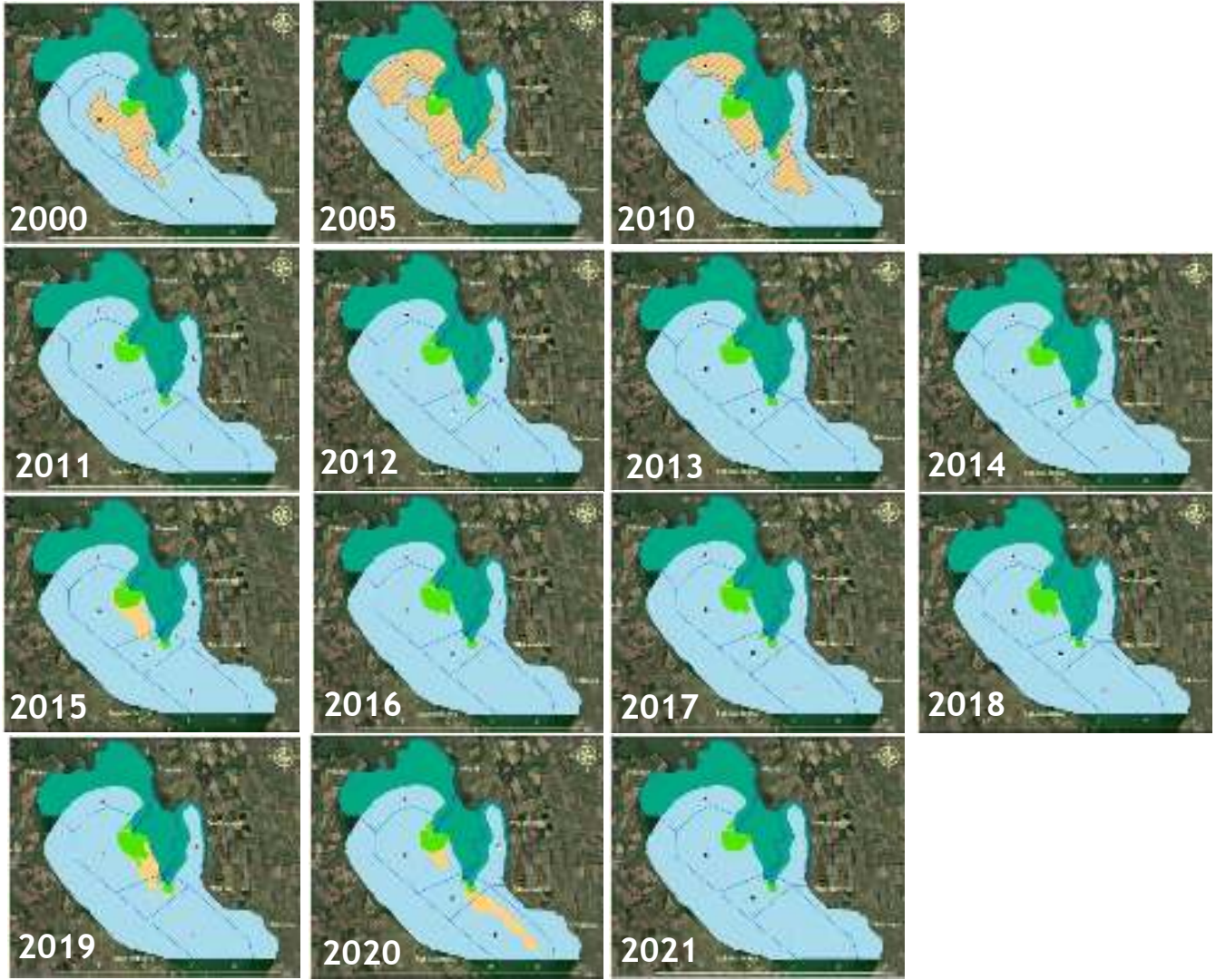
Satellite estimates (2005-2010)
GPS-tracking (2011-2021)

Areas of

Emergent

Floating

Floating with partially dense (semi)-submerged vegetation in the Dniester estuary in summer period of 2000-2021



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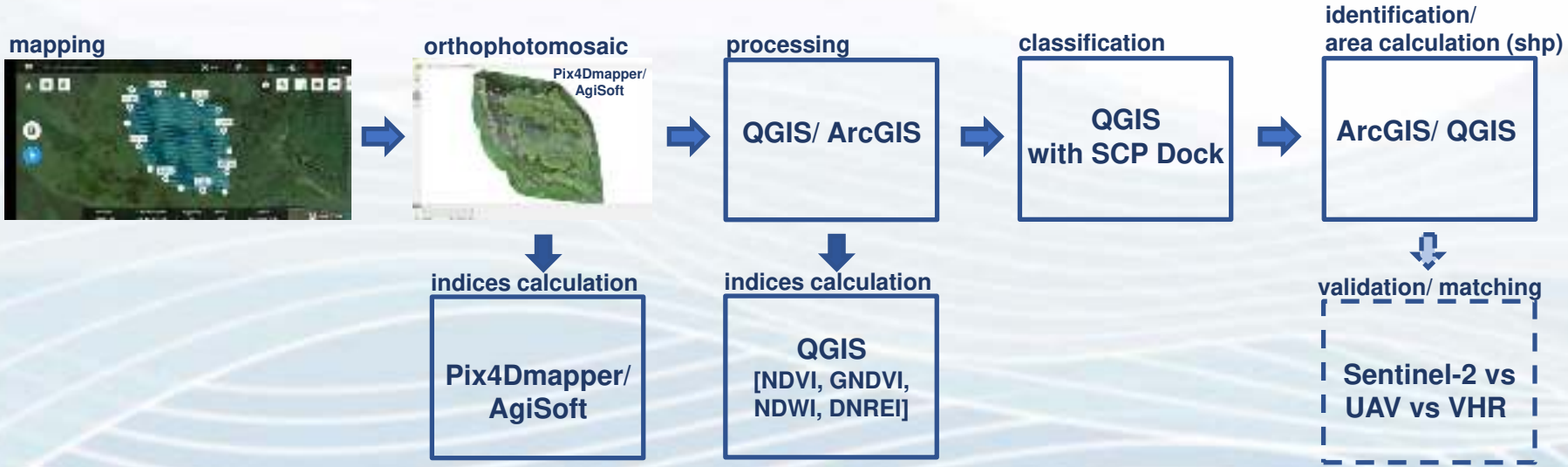
Field data

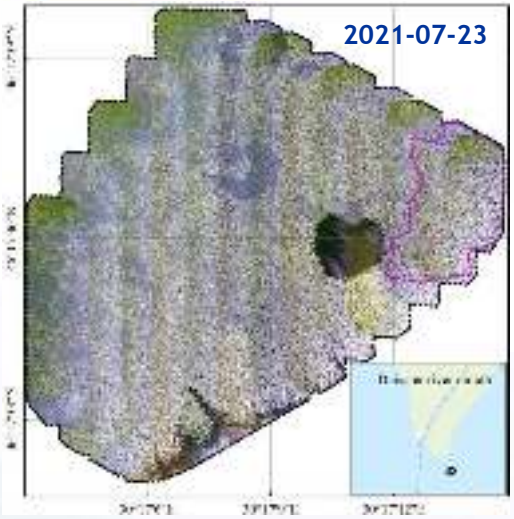
Mapping using Unmanned Aerial Vehicles (UAVs)

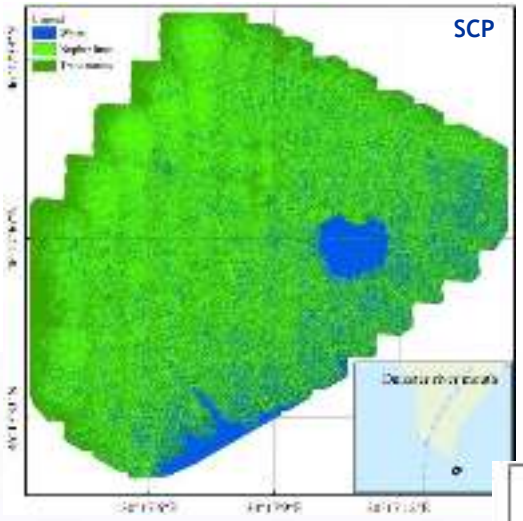
- Use of aerial images for detailed mapping (3-6 cm pixel^{-1}) of aquatic vegetation



Field data

UAV mapping: PONTOS-UA

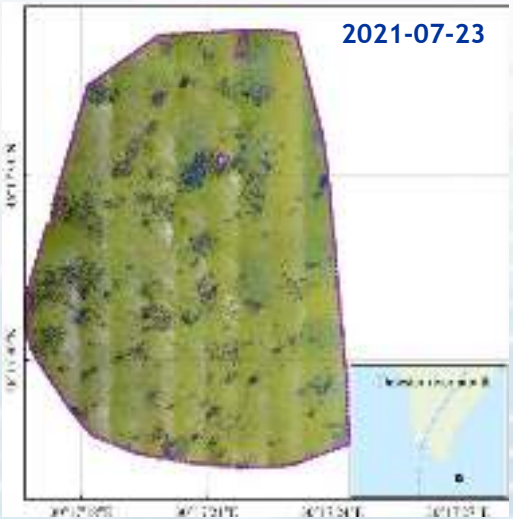


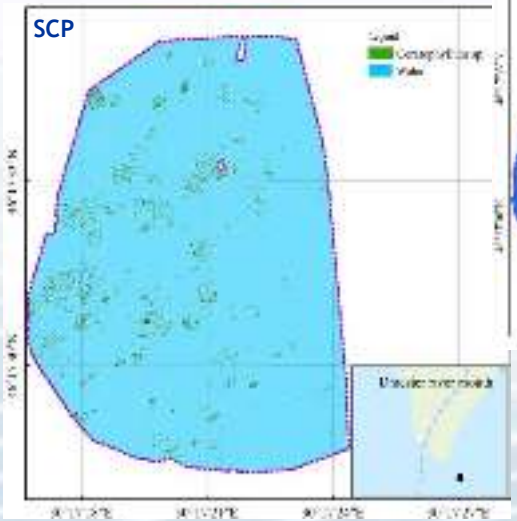


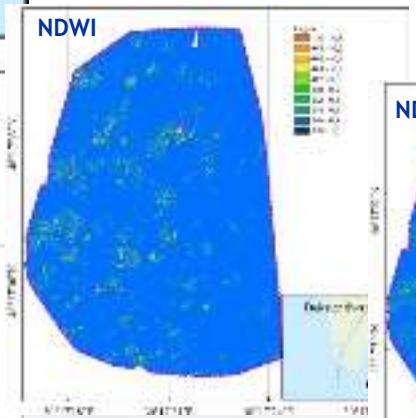
Water covered area: 18.8%

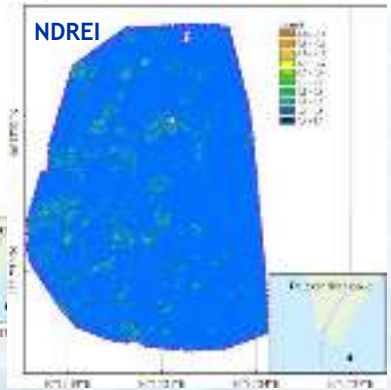
Nuphar lutea cover: 45.0%

Trapa natans cover: 36.2%







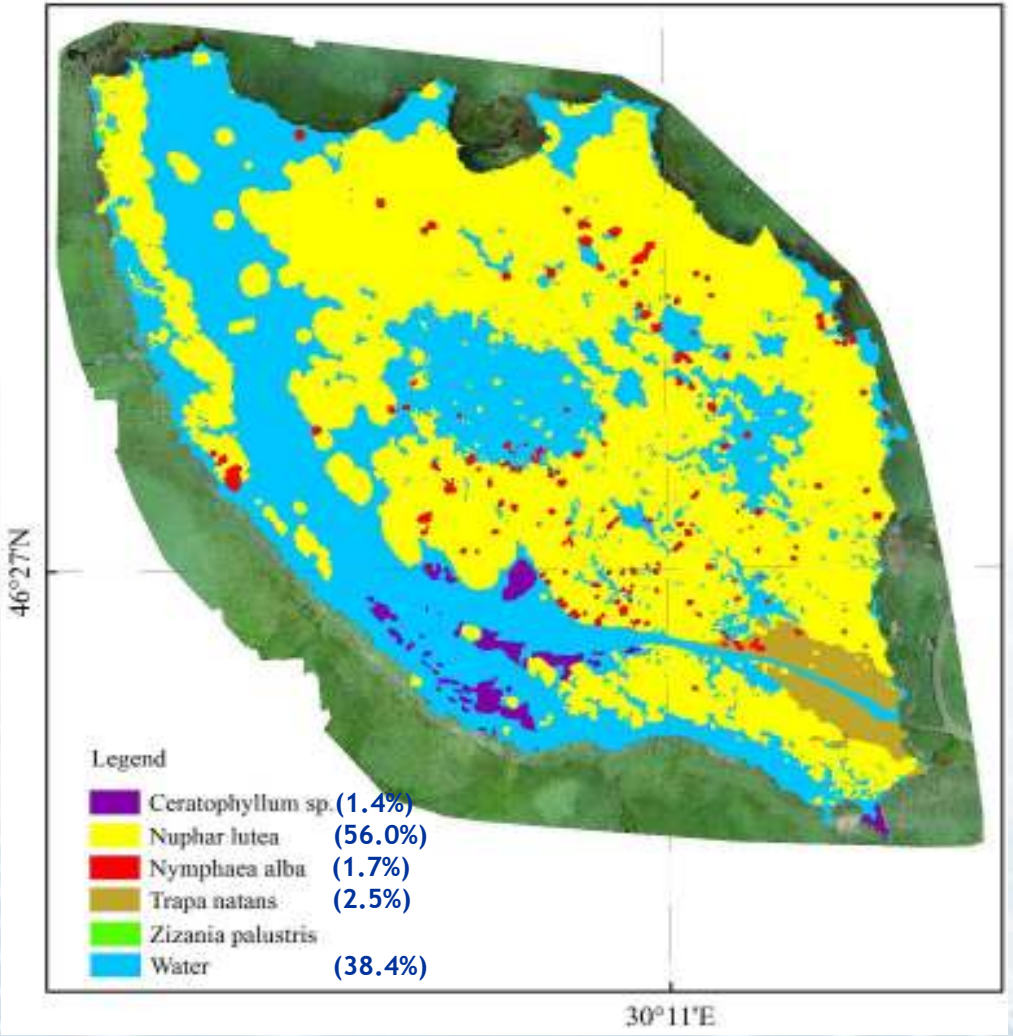


Water covered area: 97.0%

Ceratophyllum sp. cover: 3.0%

2021-06-11

RGB mosaic; 5 cm/pixel



Field data

UAV mapping: PONTOS-UA

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Field data

Vegetation sampling (e.g. Ukrainian pilot case)

Trapa natans

Nuphar lutea

Phragmites australis

Ceratophyllum demersum

Field data

Nutrient content (mg N/P/K kg^{-1} dry matter) in vegetation species sampled in the Bile lake and Dniester estuary (July 2021)

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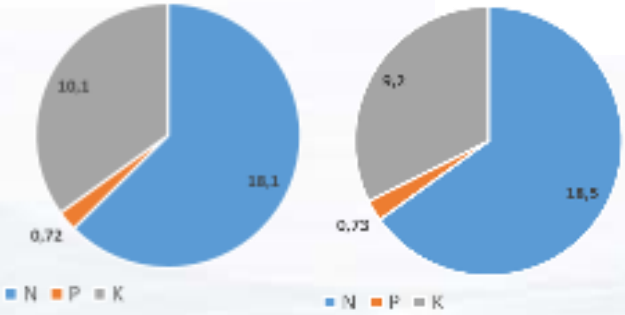
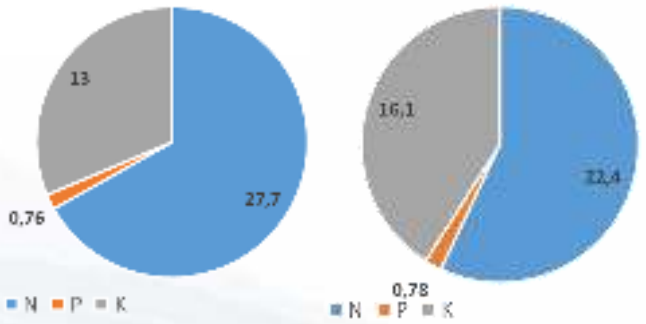
Phragmites australis



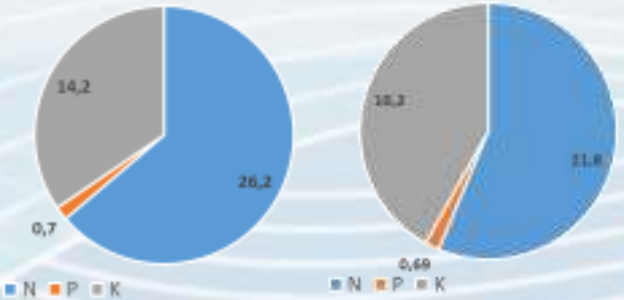
Bile lake Dniester est.

Trapa natans

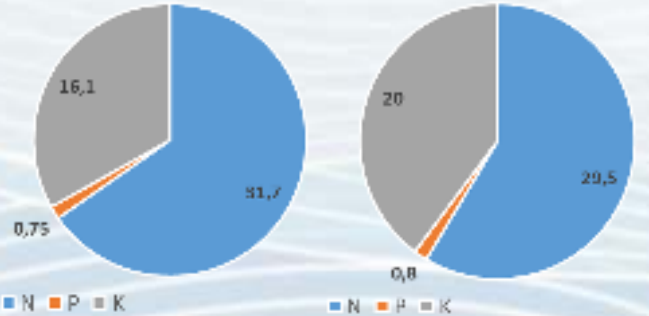


Bile lake Dniester est.

Nuphar lutea



Ceratophyllum demersum



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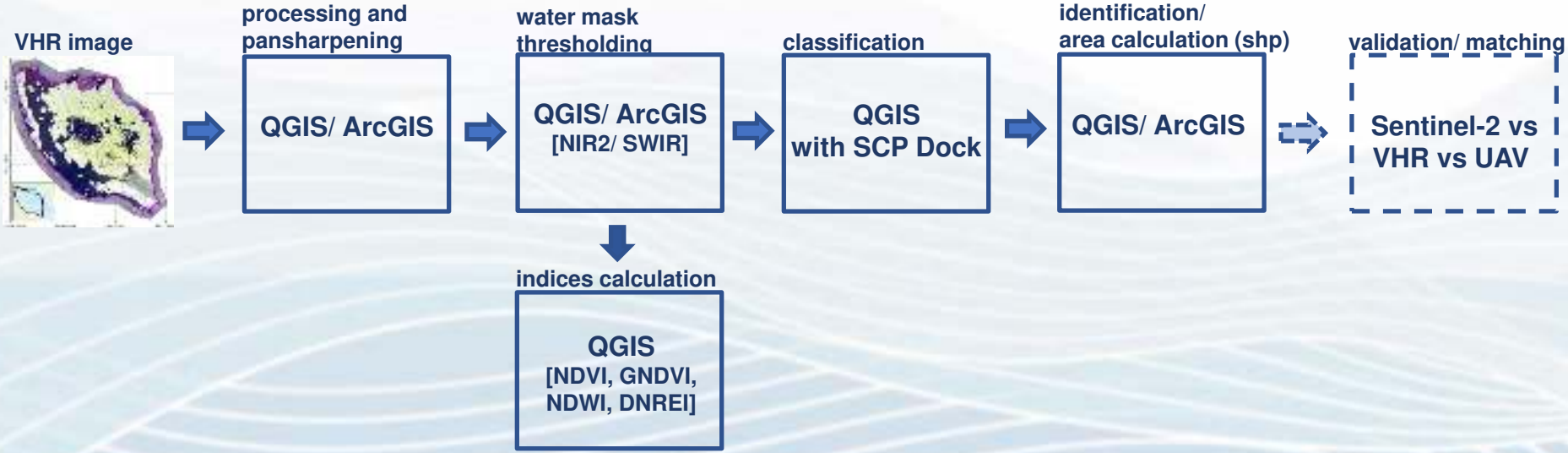
Space-born data

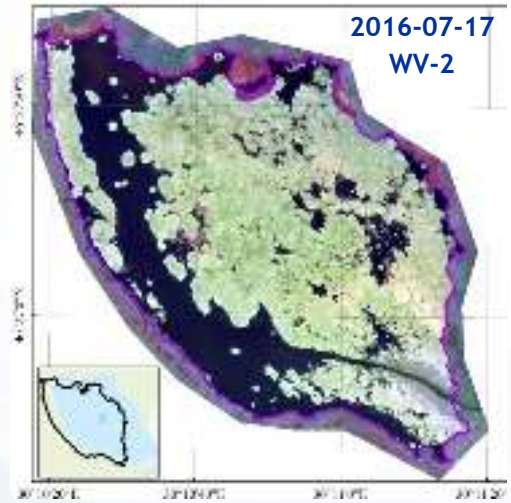
VHR images (MAXAR)

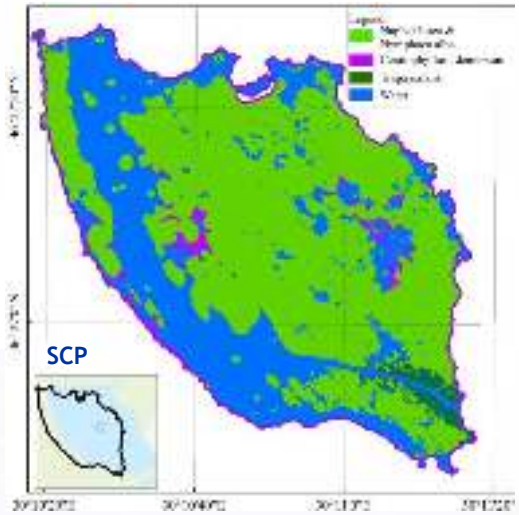
- Processing VHR images (totally 3) for selected areas (Bile lake and Dniester est.)

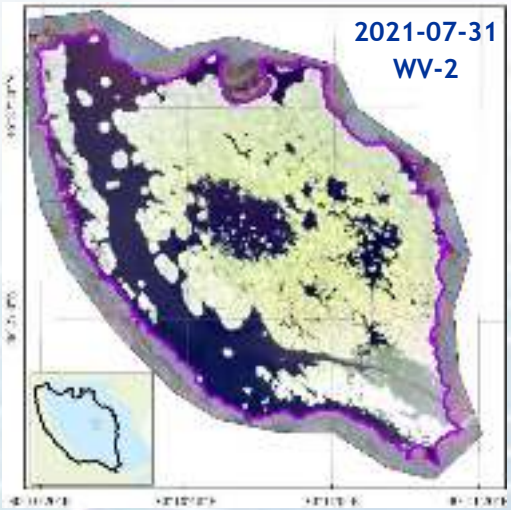


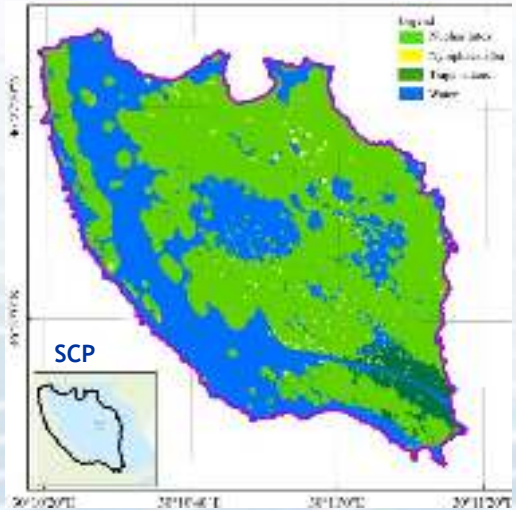
Space-born data

VHR images: PONTOS-UA









Species/ cover type	2016-07-17	2021-07-31
Nuphar lutea	61.5%	58.5%
Nymphaea alba		1.0%
Trapa natans	2.2%	3.6%
Ceratophyllum demersum	2.0%	Not identif.
Water covered area	34.3%	37.0%

Space-born data

VHR images: PONTOS-GE

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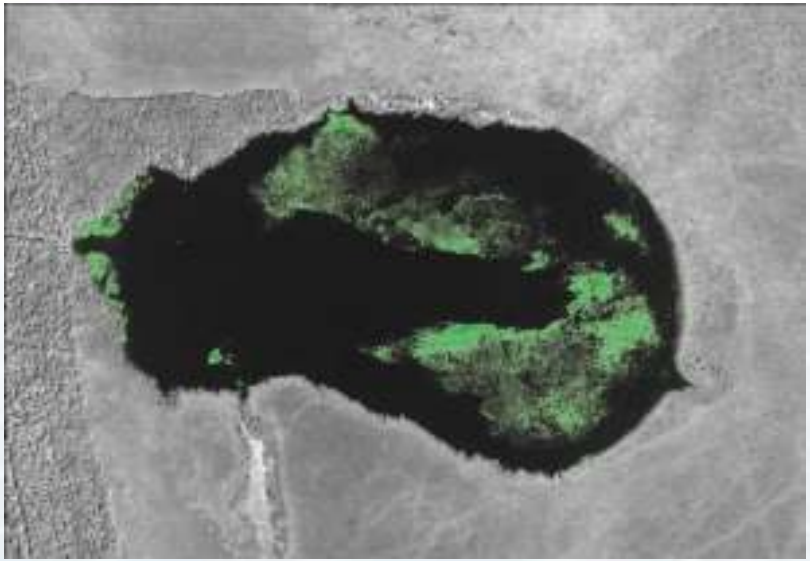

Partotskali lake covered with floating vegetation *(Trapa colchica, Stuckenia pectinate, Potamogeton natans, Ceratophyllum demersum, Nuphaea lutea etc.)*

- Largest habitat of floating vegetation in study area
- Carpet of the floating vegetation covered 16 out of 21.6 ha in 2016

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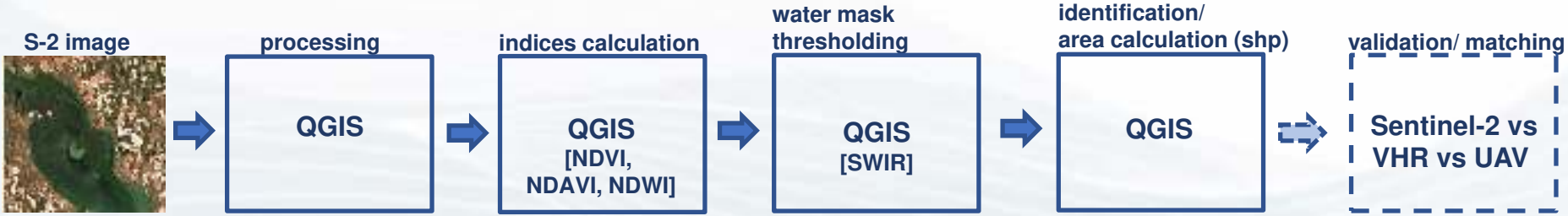
Space-born data

Sentinel-2 images (Copernicus)

- Processing of S-2 images using automatic approach with CERTH algorithm



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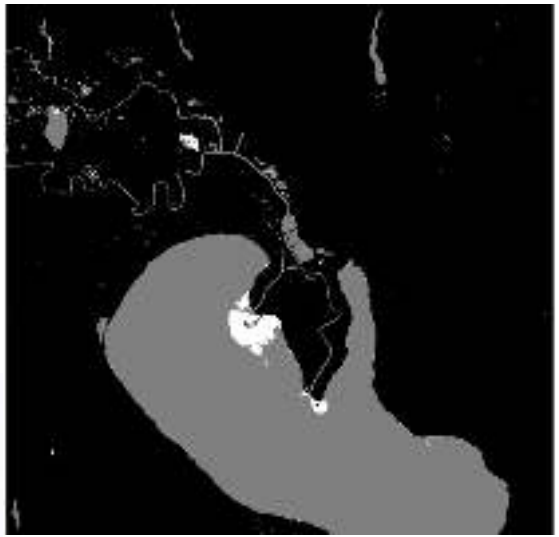
Space-born data

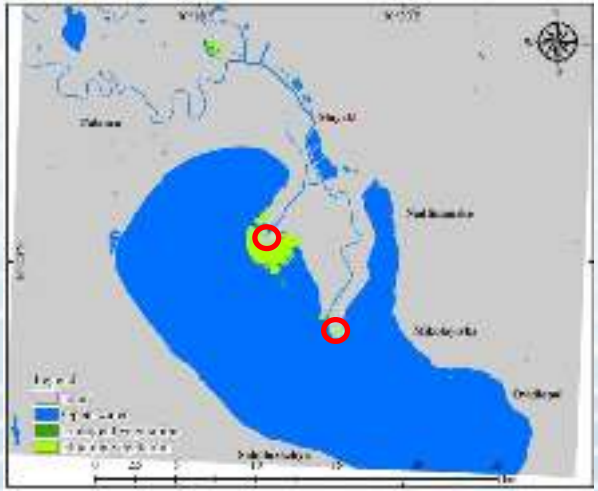
Sentinel-2: PONTOS-UA

Floating vegetation identification

S2: 2019-07-02



CERTH improved algorithm



ONU in-situ observations: 2019-07-17

emergent veg.

floating veg.

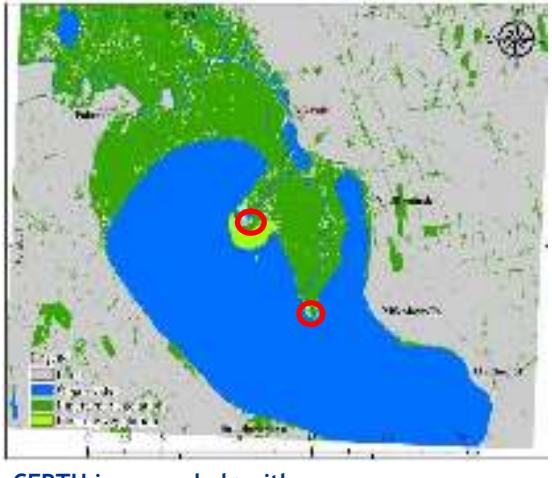
dense (semi-)submerged veg.

Space-born data

Sentinel-2: PONTOS-UA

S2: 2021.07.26

S2: 2021.08.05



CERTH improved algorithm

Floating vegetation identification

ONU in-situ observations: 2021-07-26

emergent veg.

floating veg.

dense (semi-)submerged veg.

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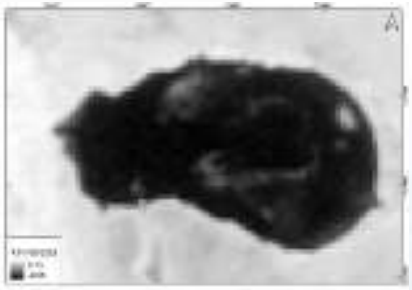
Space-born data

Sentinel-2: PONTOS-GE

Inter-annual and seasonal changes of NDVI in the Partotskali lake

S2-derived NDVI (2017 Aug)

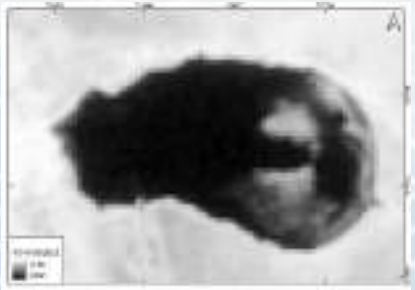
S2-derived NDVI (2018 Aug)



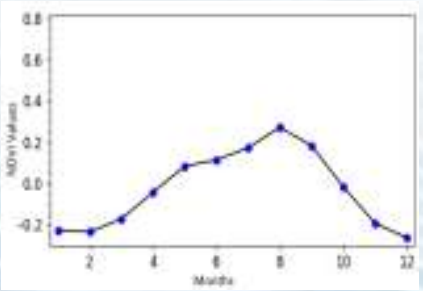
S2-derived NDVI (2019 Aug)

S2-derived NDVI (2020 Aug)

S2-derived NDVI (2021 Aug)



2017-21 averaged NDVI values by month



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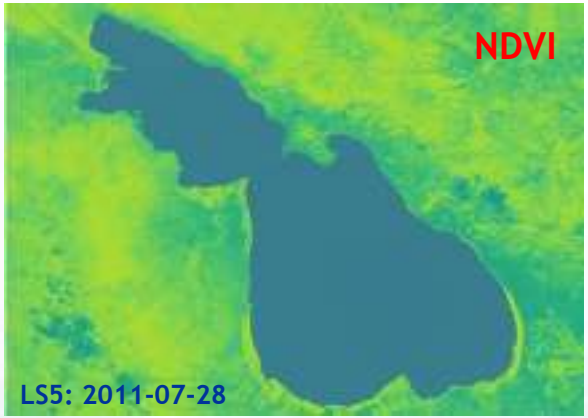
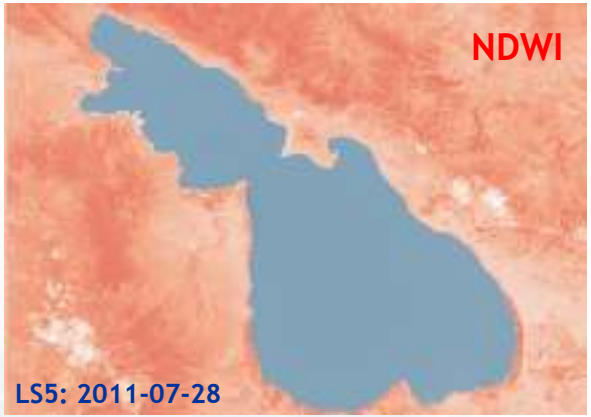
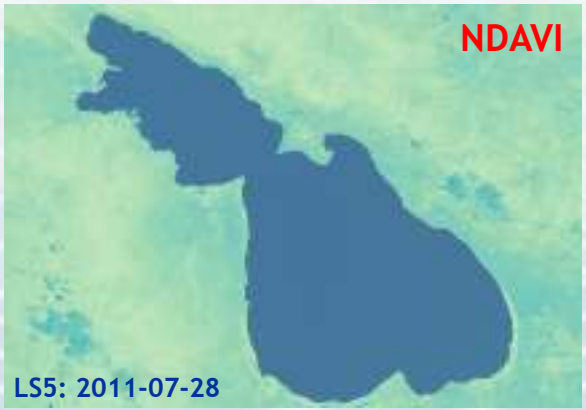
LandSat: PONTOS-AM

Floating vegetation identification







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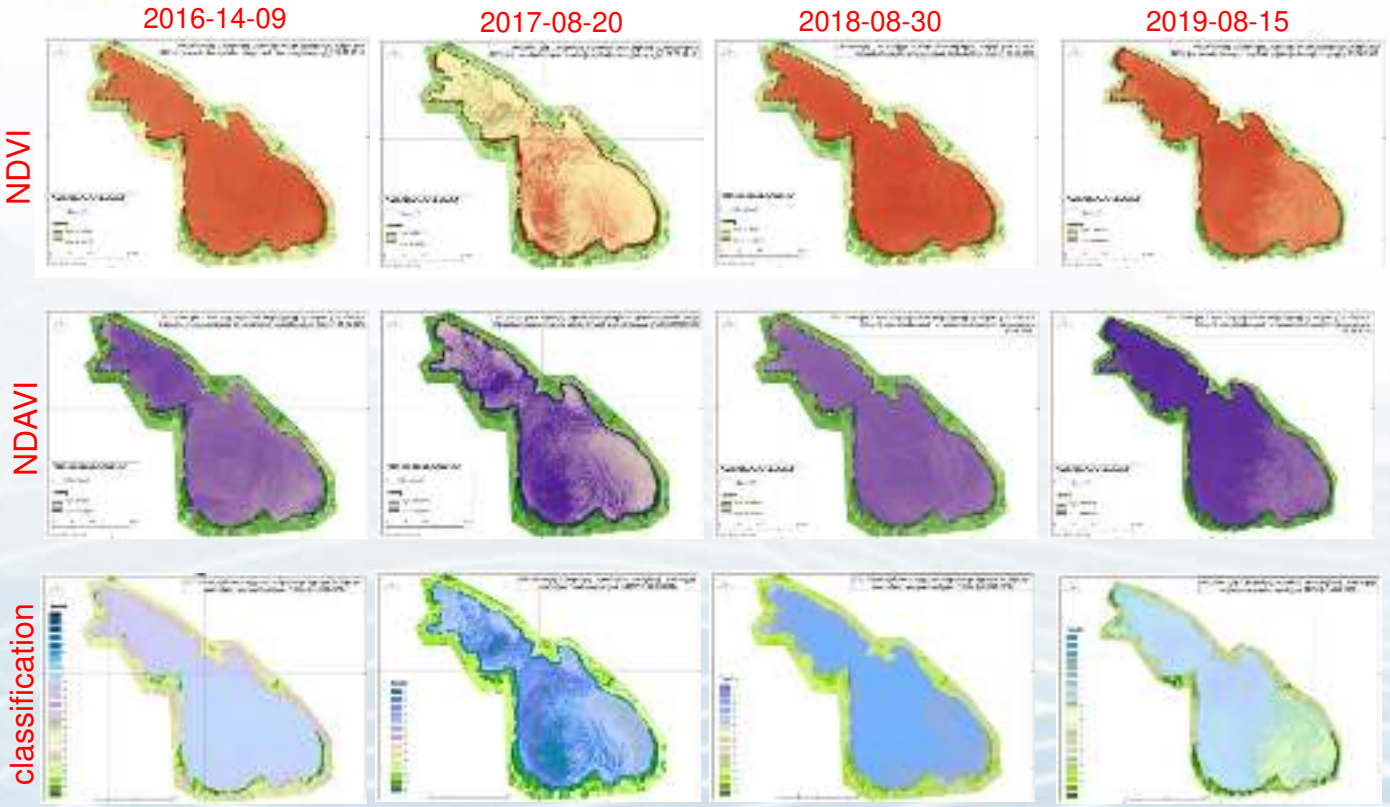
Sentinel-2: PONTOS-AM

Floating vegetation identification



Floating vegetation cover variation over 2016-2019

Year	Area, ha
2016	174
2017	179
2018	154
2019	189.6

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Дякуємо за увагу!
Շնորհակալություն ուշադրության համար!
მადლობთ ყურადღებისთვის!
Σας ευχαριστώ για την προσοχή σας!

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