Modern methods in cranes research

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Monitoring of cranes

- **Cranes population monitoring** is the process of collecting data on the abundance, distribution, and dynamics of bird populations in different habitats. Such studies can be conducted as part of global species monitoring programs, such as BirdLife International, or in local projects aimed at studying the status of populations in a specific region.

Objectives of cranes monitoring

Some goals of bird population monitoring:

Identifying changes in abundance. This helps assess the status of a species, determine conservation priorities, and evaluate whether populations are responding to management actions.

Studying species composition and changes in bird community composition over time. For example, monitoring may include a species inventory in the study area.

Identifying factors negatively impacting bird life. For example, monitoring may include analyzing the availability of food and nesting sites, assessing the impact of environmental pollution, and other factors.

Developing conservation measures for species with declining populations. For threatened species, at least five-year surveys are necessary to determine population trends.

Methods in cranes research

1. Counting cranes and their nests during the nesting season
2. Counting crane flocks during migration or wintering
3. Monitoring individual birds using GPS tracking (phenology and migration routes)
4. Studying cranes using color ringing
5. Monitoring chemical, microbiological, and other indicators using bioassays

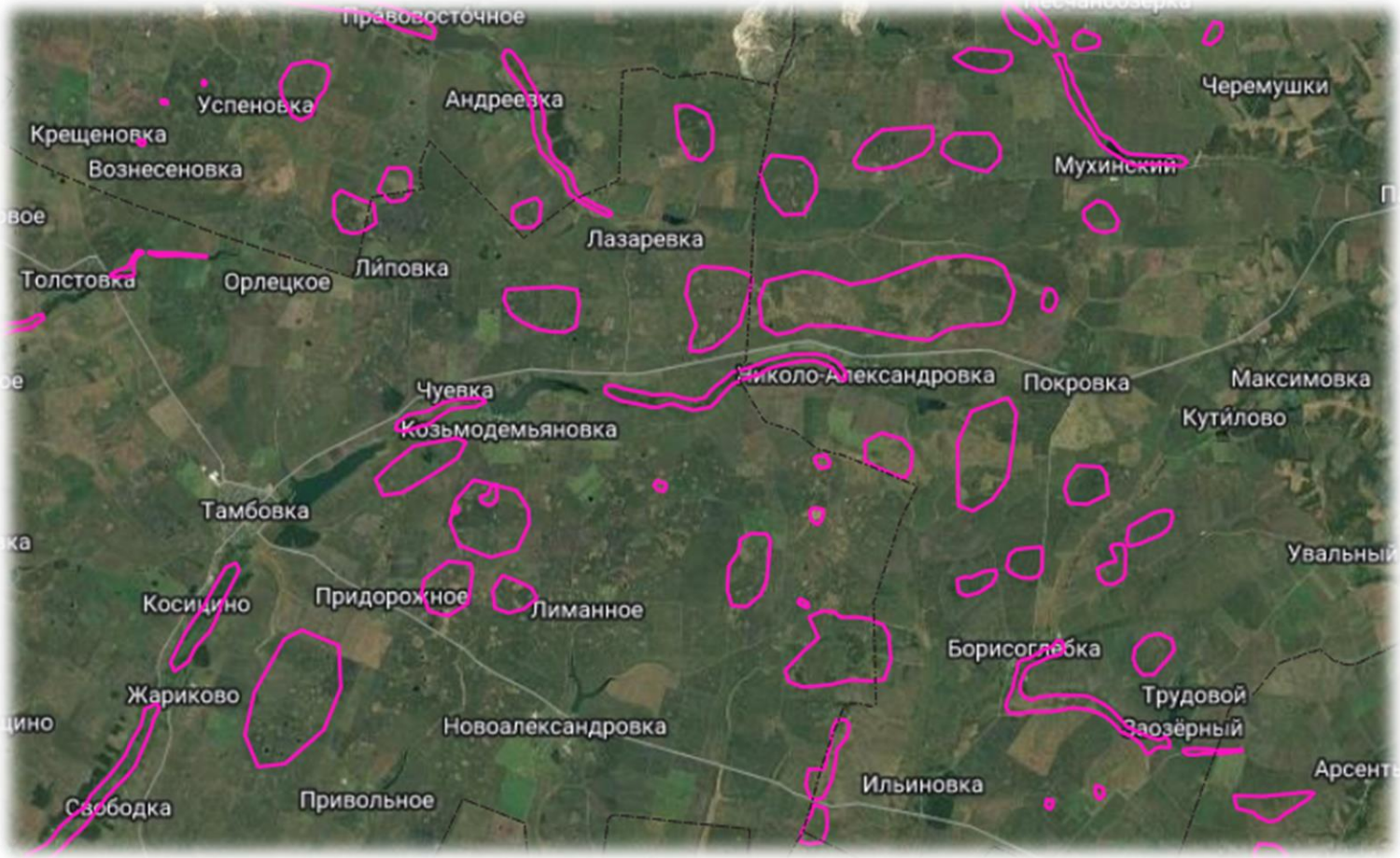
1. Counting cranes and their nests during the nesting season

- Crane nest counts and nesting (territorial) pairs are conducted during the breeding season: May-June.
- The primary method is aerial surveys of crane nesting sites, photographing and recording the coordinates of identified cranes and their nests.
- Required equipment: UAV.

Organization of nest surveys using UAVs

1. Selecting survey areas and routes:

- Data from previous surveys is taken into account,
- potential crane nesting sites are identified and mapped using satellite imagery in a GIS program. The mapped survey areas are transferred to the navigator.



Organization of nest surveys using UAVs

2. Equipment

- all-terrain vehicle,
- quadcopter with a large number of spare batteries

The most suitable quadcopter models for crane counting include the DJI Mavic 2, Mavic 3, Mavic 4, Air 2, and others. Specifications for one flight: flight time: 25-45 minutes, range: 5-15 km, distance: 10-20 km.

- battery recharging equipment,
- Binoculars, spotting scope.
- navigator with designated survey areas, maps

Organization of nest surveys using UAVs

3. Aerial survey of nesting sites

- A sequential overflight of the designated areas is conducted from an altitude of 50 ± 20 m. Upon detection of a nest or cranes, the quadcopter is lowered to 20 m (or Zoom is used) to photograph the nest or cranes and determine the number of eggs or chicks in the nest or per pair. The coordinates are automatically recorded in the photo metadata. After receiving the images, the quadcopter is immediately moved away from the nest and returned to its original altitude, continuing the aerial survey of other areas.

Organization of nest surveys using UAVs

- **Cranes' reaction to a quadcopter.**
- When a nest or nesting pair is detected, the quadcopter is lowered to a range of 15-20 meters for detailed aerial photography and counting the number of eggs or hatched chicks. Incubating cranes and pairs with chicks react relatively calmly to the approach of the quadcopter due to its small size and low noise. During close-up aerial photography, the incubating bird typically moves calmly away a few meters and then returns to the nest as soon as the quadcopter moves away. If the pair is with chicks, the adult cranes display a threatening posture, but calm down when the drone is more than 15-20 meters away. They do not show visible aggression toward the quadcopter. Non-breeding cranes usually fly to a new location when the drone approaches and continue feeding.

Organization of nest surveys using UAVs

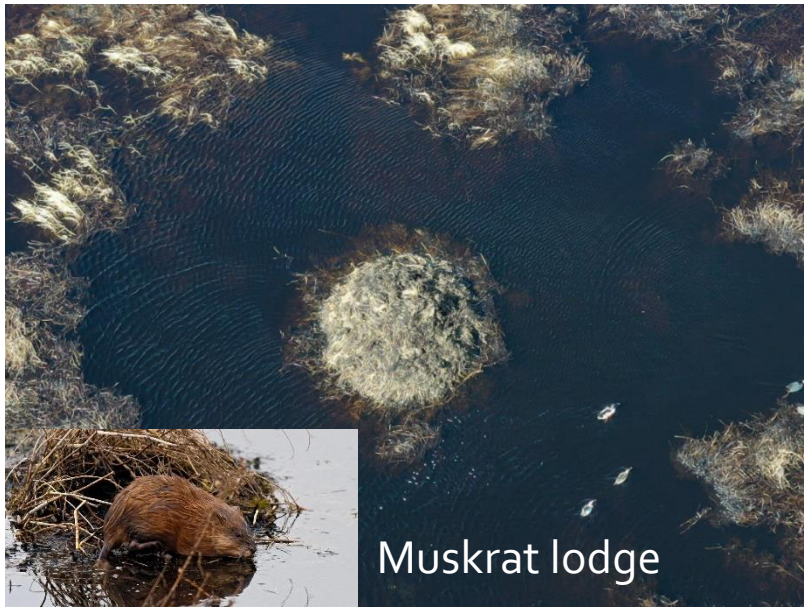
4. Nest search.

- From a height of 50 meters, inhabited nests are easily detected among the grassy vegetation of meadows and marshes at a distance of up to 500 meters downstream of the camera. This is because the crane's nest is a regularly rounded "island" of dry grass, approximately 1–1.5 meters in diameter, often surrounded by a ring of open water and trampled and plucked grass, giving it a distinctive, contrasting appearance when viewed from above. Occasionally, two or more nests can be found within a nesting area, spaced several dozen meters apart. Such nests belong to a single breeding pair and are therefore counted as a single nest.

Organization of nest surveys using UAVs

- 5. Identifying Empty Crane Nests

- Muskrat lodges are often found in crane nesting areas, and from the air, they resemble crane nests.
- The difference: Crane nests are flat, round, and located in shallow areas (up to 50-60 cm deep). For accurate identification, it's necessary to lower the viewing height and inspect the nest from the side. Muskrat lodges are usually tall and pyramid-shaped.



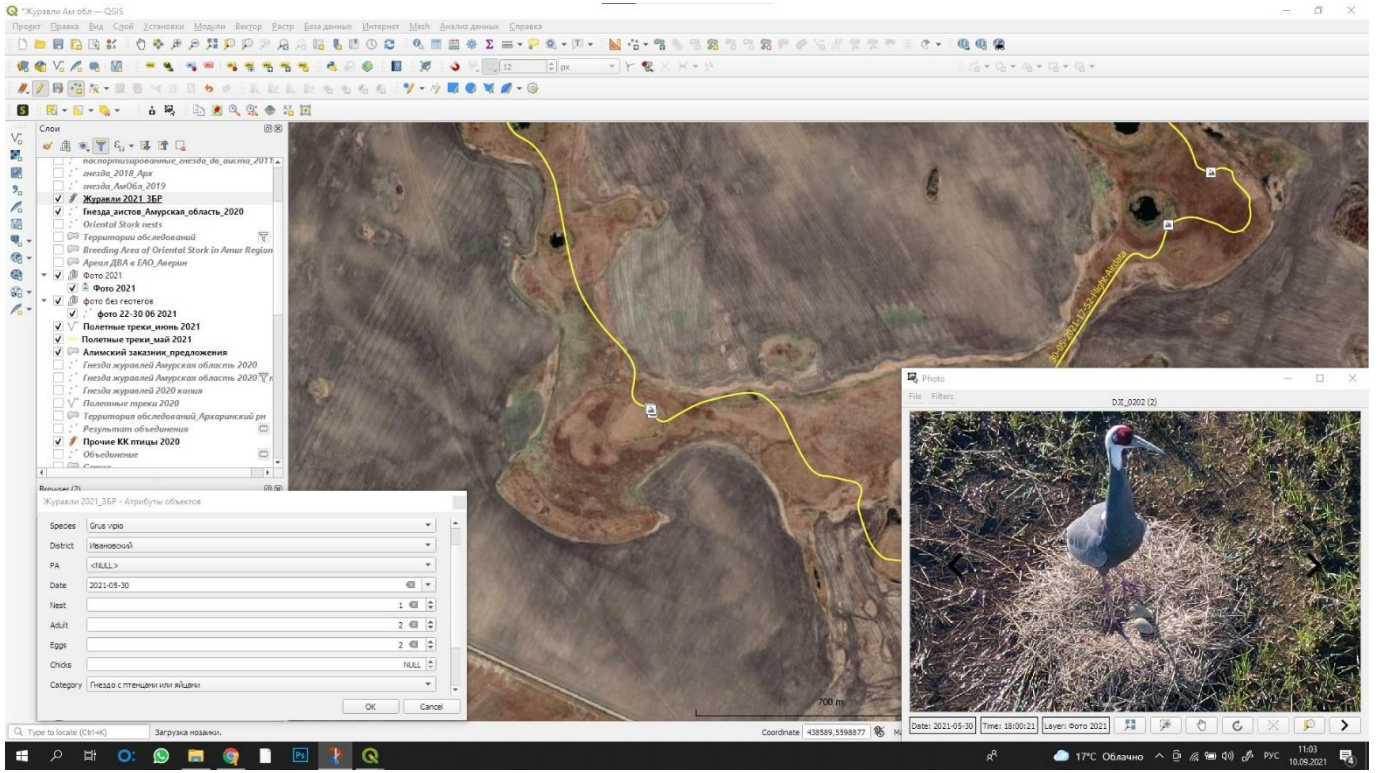
Organization of nest surveys using UAVs

Empty nests of white-naped cranes

Organization of nest surveys using UAVs

4. Processing the collected data.

- Photos collected from the drone are uploaded to a GIS program (QGIS, ArcGIS), and the locations of detected objects are automatically mapped using the coordinates in the files' metadata. Manual verification of the photo contents is required, after which the necessary information (crane species, nest condition, number of eggs or chicks, territory, date, etc.) is entered into an attribute table.
- After the initial data is entered, the survey results are statistically processed.

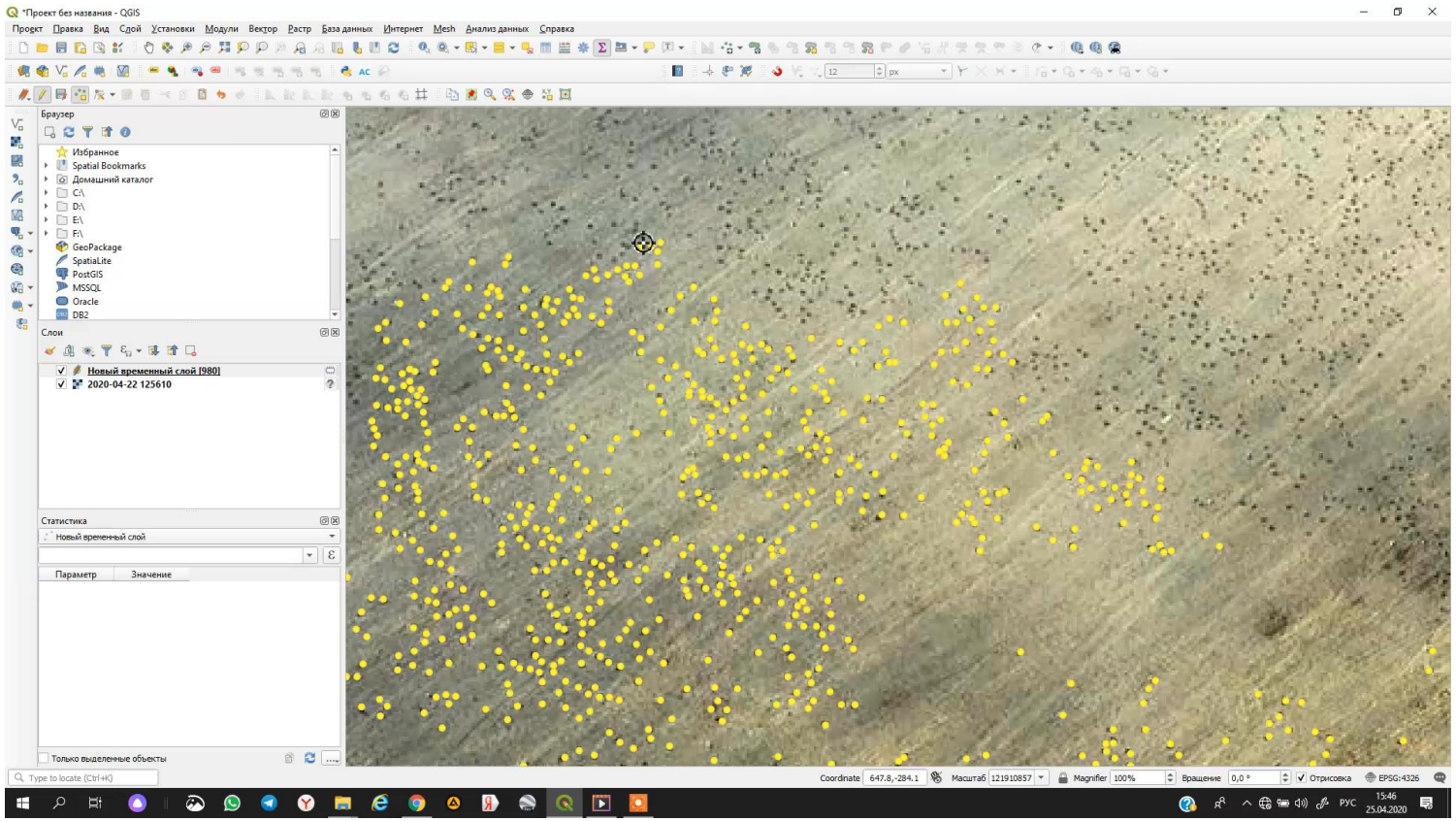


Counting cranes at gathering sites during migration or wintering

- Counting cranes from the ground in open landscapes (agricultural fields, meadows) using spotting scopes (or photo/video recording) and hand-held counters.
- Counts at winter aggregations allow us to obtain data on the total population size.

Counting cranes at gathering sites during migration or wintering

- Filming flocks from a high altitude using a quadcopter and then counting cranes in photos/videos (manually or using neural networks).



Monitoring of individual animals using GPS tracking

- Tagging cranes with GPS trackers allows us to obtain detailed data on migration routes, migration timing, nesting dates, selection of nesting and feeding areas, and other information that complements the general characteristics of the crane population.

Studying cranes using color ringing

- Color-ringing cranes has been used for decades to study migration, survival in the wild, and the spatial distribution of populations.
- In Eurasia, cranes are tagged both at their nesting sites (in Russia, Europe, Mongolia, and China) and at their wintering grounds.
- Color rings with alphanumeric codes, or combinations of color rings without codes, are used.

- The problem is the lack of a unified database of ringed cranes with standardized correlations between the returns and origins of ringed birds.

Studying cranes using color ringing

Monitoring chemical, microbiological, and other indicators using bioassays

- The collection and analysis of biomaterials (feathers, shells, excrement) allows us to monitor and identify factors affecting the crane population: diseases, chemical pollution, genetic abnormalities (mutations).

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