Australia's National
Science Agency

GISERA | Gas Industry Social and Environmental Research Alliance

Progress report

UAV–LiDAR and spaceborne remote sensing for site survey and habitat condition monitoring in the Beetaloo

Progress against project milestones

Progress against milestones/tasks are approved by the GISERA Director, acting with authority in accordance with the GISERA Alliance Agreement.

Progress against project milestones/tasks is indicated by two methods: Traffic light reports and descriptive Project schedule reports.

1. Traffic light reports in the Project Schedule Table below show progress using a simple colour code:

- **Green**:
  - Milestone fully met according to schedule.
  - Project is expected to continue to deliver according to plan.
  - Milestone payment is approved.
- **Amber**:
  - Milestone largely met according to schedule.
  - Project has experienced delays or difficulties that will be overcome by next milestone, enabling project to return to delivery according to plan by next milestone.
  - Milestone payment is withheld.
  - Milestone payment withheld for second of two successive amber lights; project review initiated and undertaken by GISERA Director.
- **Red**:
  - Milestone not met according to schedule.
  - Problems in meeting milestone are likely to impact subsequent project delivery, such that revisions to project timing, scope or budget must be considered.
  - Milestone payment is withheld.
  - Project review initiated by GISERA Director.

2. Progress Schedule Reports outline task objectives and outputs and describe, in the 'progress report' section, the means and extent to which progress towards tasks has been made.

Project schedule table

TASK NUMBER	TASK DESCRIPTION	SCHEDULED START	SCHEDULED FINISH	COMMENT
1	UAV-LiDAR data collection	1 Aug 2023	31 Oct 2024	1200 ha of high-quality UAV-LiDAR collected over different habitat types. Representation of wet and dry season conditions.
2	3D point cloud analysis and SAR calibration	1 Sept 2023	29 Nov 2024	Processing of UAV-LiDAR complete. Calibration of SAR backscatter signal for different months of the year completed.
3	Upscaling to larger areas with spaceborne SAR	1 Nov 2024	31 Mar 2025	On track.
4	Project reporting	1 Dec 2024	31 Mar 2025	On track.
5	Communicate findings to stakeholders	1 Aug 2023	20 Apr 2025	On track.

Project schedule report

TASK 1: UAV-LiDAR data collection

BACKGROUND

UAV-based LiDAR offers a tremendous opportunity to develop a high quality and quantity monitoring program for change in habitat structural conditions of any ecosystems in response to disturbance. There is a clear opportunity to harness this technology to improve the monitoring framework for the Beetaloo Sub-region once an unconventional gas industry is established. The main step in the use of UAV-LiDAR is to obtain the high-resolution point clouds that are required to provide a basis for assessing structural change and for calibrating spaceborne imagery. This task focuses on selecting suitable sites to meet the project objectives, obtaining flight plan permissions, and conducting the UAV surveys to collect the data.

TASK OBJECTIVES

i) Acquire high-resolution UAV-LiDAR data over select study sites at key times in the seasonal cycle; ii) Process IMU trajectory, GNSS base-station, and UAV-LiDAR flight data.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Analysis ready datasets in the form of geolocated point clouds (.las format version 1.4).

PROGRESS REPORT

UAV-LiDAR acquisition have been completed:

- The project team acquired 1200 ha of high-quality UAV-LiDAR over the course of two campaigns.
- Dry season (Oct 2023) and wet season (April 2024) conditions are represented in the dataset.
- Extensive flooding and major road works limited launch sites to the southern side of the Carpentaria highway, but diverse habitats are represented.
- Processing of the GNSS base-station data, the IMU trajectory, and the raw point cloud data through to geolocated point clouds is complete.

TASK 2: 3D point cloud analysis and SAR calibration

BACKGROUND

Changes in habitat structure for each study site will be assessed from voxelised versions of the time-series point cloud data collected in Task 1. Cloud-to-cloud distancing will be used to quantify the degree of change occurring in different components of the vegetation canopy through time. These voxelised representations of 3D structure and structural change will be used to test the sensitivity of Sentinel-1 C-band SAR for habitat structural condition monitoring. Time-series of Sentinel-1 backscatter intensity and coherence will be developed for each site for modelling against the voxel outputs.

TASK OBJECTIVES

i) Develop voxelised representations of structural change; ii) download and prepare Sentinel-1 data for analysis; iii) complete raw processing of Sentinel-1 data; and iv) define a suite of UAV-LiDAR metrics that have ecological relevance to key species of interest in the region.

TASK OUTPUTS AND SPECIFIC DELIVERABLES:

Classified and segmented LiDAR voxels (.ply format). Volumetric reconstructions of individual trees and branches (.ply format). Height and canopy cover structural metrics.

PROGRESS REPORT

UAV-LiDAR processing has been completed:

- Canopy height and cover rasters representing a broad range of vertical and horizontal structural metrics have been generated from the LiDAR point clouds collected in Task 1.
- Canopy metrics have been produced at 20 m resolution to match SAR pixel resolution, and stored as cloud optimised geotiffs (COGS).
- The processed LiDAR point clouds are available stored as .LAZ (v1.4) files.
- Individual tree segmentation was unsuccessful in some habitat types, but for areas where individual trees were separable the segmented trees and their volumetric reconstructions are available in .PLY format.
- Sentinel-1 scenes intersecting the region of interest have been downloaded and processed through to gamma naught backscatter intensity, and stored as COGS.

Variations to Project Order

Changes to research Project Orders are approved by the GISERA Director, acting with authority, in accordance with the GISERA Alliance Agreement. Any variations above the GISERA Director's delegation require the approval of the relevant GISERA Research Advisory Committee.

The table below details variations to research Project Order.

Register of changes to Research Project Order

DATE	ISSUE	ACTION	AUTHORISATION
26/06/24	Due to equipment issues and a big wet season which has prevented access to some sites, data collection is not complete therefore some UAV-LiDAR acquisitions have been pushed to later in the year. This delay has had a flow on effect for all other tasks.	Milestone 3 and 4 start dates extended by 4 months. Milestones 1, 3, 4 and 5 delivery dates extended by 4 months; milestone 2 delivery date extended by 5 months. The new	

DATE	ISSUE	ACTION	AUTHORISATION
		project delivery date will be April 2025.	
07/02/25	The project team acquired 1200 ha of high-quality UAV-LiDAR over the course of two campaigns with diverse habitats represented. Further surveys were constrained due to technical issues, road works and extensive wet season flooding.	Reduce number of planned repeat UAV-LiDAR surveys and use the data collected to date (2 surveys). A budget reduction of $50,304 which will bring overall budget down to $404,187.	

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GISERA is a collaboration between CSIRO, Commonwealth and state governments and industry established to undertake publicly-reported independent research. The purpose of GISERA is to provide quality assured scientific research and information to communities living in gas development regions focusing on social and environmental topics including: groundwater and surface water, greenhouse gas emissions, biodiversity, land management, the marine environment, and socio-economic impacts. The governance structure for GISERA is designed to provide for and protect research independence and transparency of research.