

WHITE PAPER

# The Future of Drone Surveillance

SAVING TIME, MONEY, AND LIVES.



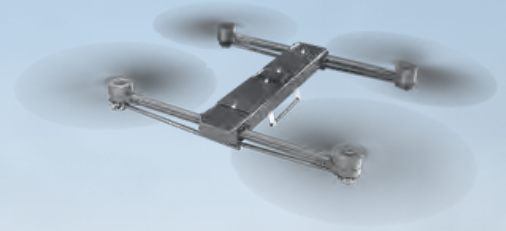
**WHITE PAPER**  
→ **DRONE APPLICATIONS**  
NEXT-GEN SURVEILLANCE

**draganFLY**<sup>™</sup>  
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# BACKGROUND

## THE FUTURE OF DRONE MONITORING

Short-range drone surveillance has experienced significant attention thanks to its low cost and efficiency. Long-range drone surveillance beyond visual line of sight (BVLOS) is now on the horizon and is set to amplify cost savings regarding resources and time spent on data collection.

**"AS DRONES IMPACT BUSINESS MODELS AND CONSUMERS, IT FOLLOWS THAT DRONES CAN HAVE FAR-REACHING IMPLICATIONS FOR SOCIAL, ENVIRONMENTAL, AND ECONOMIC ASPECTS OF LIFE...." — M. LETT**

## Critical Surveillance Applications

- Oil & Gas
- Infrastructure
- Agriculture
- Forestry

## Global Monitoring Challenges

- High cost of satellite and airplane data
- Resource-heavy analysis and management
- Limited accuracy of optical satellite imagery

## Monitoring Solutions

- Increased data precision
- Greater operational efficiency
- Increased safety
- Cost savings and fewer resources

Oil & Gas

Agriculture

Forestry

Infrastructure

# COMMANDER 3XL

**The Swiss Army Knife of drones.**



This weather-resistant, multi-rotor UAV is easy to assemble and transport — making it ideal for high-stress, high-risk applications due to its ease of use and rapid deployment.

The Commander 3 XL Drone supports automated and manual flight, making it an ideal choice across diverse applications like public safety and agriculture.

This 'Swiss Army Knife' of drones is capable of drop and winch-down systems to transport payloads as heavy as 22 pounds. It performs extremely well in light rain and snow.

## KEY TECHNOLOGY



Frame can pack down into a transportable case



High-endurance, electric multi-rotor



Simple, rectangular tube fuselage



Patented carbon-fibre airframe with folding landing gear and interchangeable payloads

## XL SPECS

**24-mile**

flight range

**45-mph**

max airspeed

**50-min**

flight time



# OIL & GAS



## Components

### Landing Gear

Folds below each motor along arm length

### Propellers

Quick-release or folding

### Battery Attachment

Semi-permanent attachment to carrier plates for quick attachment

### Arm Assembly

Two quick release arm assemblies

## Key Features

### Payload Capacity

Carries 22 pounds for ~20 minutes

### Timely Deliveries

Drop or winch-down systems deliver payloads

### Weather-Resistance

Strong performance in light rain and snow

### Secure

**Communications**  
North American-built flight controllers, sensors, and radios

### Extendable Range

Multiple configurations for radio equipment, including point-to-point and cellular link

## EFFICIENCY WORTH MILLIONS

The importance of the oil and gas sector (O&G) to global peoples and economies is undeniable. As global events place greater pressure on O&G usage, pipelines remain incredibly important to our way of life across the globe. With more than 1.9 million kilometres of international pipelines, the risks are high, making efficient management critical to our communities, society, and ecosystems.

## Key Challenges

### Regulatory Pressure

The O&G industry has a responsibility to reduce GHG emissions and drones can play a critical role in tracking, reducing, and managing regulatory compliance.

### High Risk

With large areas to monitor, the associated costs can be immense; leaks and spills cause immense financial and reputational damage.

### Monitor Safety

In-person inspections can be unsafe in remote areas

### High Costs

Monitoring costs, from satellites and in person on-site, can be extremely high.

## Key Solutions

### Inventory Tracking

- Volumetric measurements tracked

### Leak & Spill Detection

- Preventative anomaly detection

### Infrastructure Safety

- Structure tracking
- Soil and foliage encroachment
- Detect damage and degradation

### Resources

- In-person detection hours reduced
- Fewer maintenance hours

### Environmental Impact

- Regulatory and sustainability reporting becomes more efficient

"DRONES, AS A SUBSET OF FOURTH INDUSTRIAL REVOLUTION TECHNOLOGIES, ARE POISED TO PLAY A TRANSFORMATIONAL ROLE IN THIS SECTOR." — WEF



## → OIL & GAS



# DRAGANFLY SOLUTIONS



→ LONG-RANGE SURVEILLANCE & RECONNAISSANCE DRONE (LSR)

## Components

This versatile, vertical take-off and landing multi-rotor drone is designed for ease of use and sustained flights.

Its quick-assembly design allows for rapid setup and launch. Made from composite materials, the frame is light and challenging and can withstand high winds. This will enable it to perform aerial tasks in complex situations and environments.

The LSR supports robotic missions and semi-automated flight operations and is compatible with various payloads.

### A READY-TO-FLY SOLUTION IDEAL FOR:

- Agricultural monitoring and research
- Border control and surveillance
- Mapping, Surveying
- Environmental monitoring
- Search and rescue

## Capabilities

- Real-time telemetry and video links
- Situation awareness with actionable data
- Multiple communications and data links
- Range capabilities matched with operational requirements like point-to-point and cellular radios
- AES256 encryption supported via data link for secure data and video feedback

## Key Applications

- Site selection
- Leak and spill detection
- Refinery monitoring
- Risk assessment
- Safety audits
- Reclamation management
- Construction monitoring
- Optical and thermal imaging
- Pitch enhancement for investor briefs
- Incidence management and containment
- Real-time video and imagery monitoring
- Insurance claims
- Emergency supply delivery
- Inventory management with RF tags

OIL AND GAS COMPANIES CAN USE DRAGANFLY DRONES TO INSPECT INFRASTRUCTURE, LOCATE DAMAGED OR FATIGUED COMPONENTS, CONDUCT ENVIRONMENTAL IMPACT STUDIES, AND LEVERAGE MULTISPECTRAL SENSORS TO MEASURE FOLIAGE ENCROACHMENTS NEAR INFRASTRUCTURE.

"THE OVERALL LENGTH OF OIL AND GAS TRUNK PIPELINES GLOBALLY IS EXPECTED TO REACH 2.03 MILLION KILOMETRES IN 2024." — [WEF](#)

SOURCES: [WEF](#)



## Specs

130 km

flight range

108 km/hr

cruise speed

120-min

flight time



# AMISK CREEK

- Environmental Footprint Analysis
- Drill Pad Footprint Analysis

## The Challenge

- Environmental footprint analysis for reclamation planning
- Water offloading concerns
- Assessing water flow characteristics between pits and nearby river system
- GIS data required to prove usage cases

## The Solution



**High-res images**  
Neighbouring river systems and pit lake



**ArcGIS Water-flow Analysis**  
Freshwater offloading area



**Reclamation Report**  
Volumes recorded for AEP (Alberta Environment and Parks)



**A PPP-RTK Survey**  
Stationed from an existing ASM (Alberta Survey Marker) pin 1.5km offsite; collected 10 RTK control points for the site imagery and confirmed areas of interest

## THE DRAGANFLY EXPERIENCE

### A 'No Surprises' Platform

- Superior engineering of hardware and software is an important advantage in high-stress situations
- An intuitive platform with smooth workflows
- Geotagged data exported for processing

### Results: Crucial Datasets

The resulting datasets were vital to confirming: aggregate volumes, application permits, zoning issues, remediation planning, pit and quarry dewatering, and turnkey aggregate volumes.

"THIS HAS MADE MY LIFE EASIER. AS AN AGGREGATES AND MINING CONSULTANT, YOU WOULDN'T BELIEVE THE AMOUNT OF PITS IN ANY GIVEN AREA THAT REQUIRES PERMITS AND REGULATORY MONITORING. THESE DATASETS ALLOW ME TO VISUALIZE AND WORK WITH THE LANDSCAPES IN AN EXTRAORDINARY WAY FROM MY COMPUTER. THE DATA IS SHARED WITH REGULATORS AND MAKES MY REPORTING STAND OUT. THE GUYS AT STARSCREAM ARE AUTOMATIC. I REQUEST DATA, THEY PROVIDE IT."



**MEGHAN SOEHN P.AG., B.SC.**  
AMISK CREEK AGGREGATE

## Success Indicators

→ Precise identification of water flow to determine appropriate measures for water permitting.

## Return on Investment

	Traditional	Draganfly
Data Delivery	2-3 DAYS	1 DAY
Labour Cost	\$120 CAD	FLAT RATE
One-time cost	\$2,880 CAD	\$1,200 CAD
Frequency / Year	4	4
Annual Cost	\$11,520 CAD	\$4,800 CAD

Cost Savings Per Year → \$6,720 CAD and 3X Faster



# SURVEILLANCE

## BORDER PATROL, SURVEILLANCE & SECURITY

Combining drones, complementary technologies like AI, and data analysis, we can improve the monitoring efficiency of borders, infrastructure, and worksites, allowing for near-constant surveillance.

### Key Challenges

#### On-site Safety

- Military monitoring
- Detection awareness
- On-site security hazards

#### Resource Usage

- Inefficiencies: in-person, vehicles, cameras and ground sensors
- Cost of small-area coverage

### Key Solutions

#### Improved Safety

- High-tension areas and hazardous regions

#### Wider Coverage

- Remote monitoring of thousands of miles

#### Superior Site Monitoring

- Video Monitoring
- Tactical Overwatch

#### Realtime Monitoring

- Digital realtime tracking of dangerous personnel

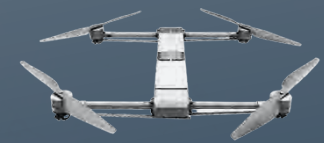
DRAGANFLY  
SOLUTIONS



## → LONG-RANGE SURVEILLANCE & RECONNAISSANCE

### Components

- Modular design for easy transport
- Navigation and strobe lighting
- Dual-sensor camera, thermal and RGB with 30x optical zoom
- Real time telemetry and video link
- Flight time up to 2 hours
- Optional communications and data links available, including point-to-point and cellular radios.



## → COMMANDER 3XL

### Key Features

#### Payload Capacity

Carries 22 pounds for approximately 20 minutes.

#### Weather-Resistant Design

Strong performance in light rain and snow.

#### Extendable Range

Multiple configurations for radio equipment, including point-to-point and cellular link.

#### Timely Deliveries

Utilizes drop or winch down systems to deliver payloads.

#### Secure Communications

North American-built flight controllers, sensors and radios.







## Draganfly Solutions in Focus

Military and government organizations and defence contractors partner with Draganfly to act as a force multiplier to operations, increasing the safety of personnel and enhancing intelligence and data infrastructure. We design and manufacture custom airframes, payloads, and robotic systems, as well as offer management services for complex flight operations.

Draganfly has a long history of supporting and working with public safety agencies worldwide. Our team has extensive experience working with several U.S. Department of Defense-approved entities.

## End-to-end Engineering Services

Draganfly is a contract engineering partner for federal, state, and municipal government agencies of all sizes. Our in-house team of hardware and software designers, engineers, project managers, and skilled technicians work together to build custom solutions for clients.

**"DRONES GIVE SECURITY A UNIQUE SITUATIONAL AWARENESS BENEFIT.... YOU'RE GATHERING VALUABLE SENSOR DATA THAT CAN BE IMMEDIATELY SHARED. IF YOU'RE SECURING A FACILITY AND THE PERIMETER, THERE IS NO BETTER VIEWPOINT THAN BEING IN THE SKY."**



**MARK MCCOURT**

CHAIR, SECURITY INDUSTRY ASSOCIATION'S  
ROBOTICS, DRONES & AI WORKING GROUP

SECURITY MAGAZINE

## CUSTOM PAYLOADS AND SENSORS CAN BE OPTIMIZED FOR MILITARY AND GOVERNMENT USES.

Draganfly's proprietary controller can be secured and encrypted as part of an end-to-end package that includes Draganfly drones or other drone systems. By combining our hardware and post-processing software solutions, data can be used to audit and improve responses to reduce exposure and aid in optimizing future high-pressure situations.



**THESE CRITICAL SYSTEMS CAN BE READY TO DEPLOY AT A MOMENT'S NOTICE**

## Draganflyer Video Network

Draganfly's **256bit** AES encrypted digital video down-link system delivers sharp, crystal clear video that can be networked and shared to multiple devices. This AES encryption ensures that your most valuable asset, your data, is fully secured in any high-pressure situation.





# COMMANDER 3XL

# AGRICULTURE

## ROOM FOR GROWTH

The agricultural sector — food production, in particular — is experiencing immense shifts. As a result, concerns about supply-chain efficiencies and the benefits of vertical integration are becoming top-of-mind. In turn, there is an increased need for high-tech hardware solutions, software integration, and precise data.

### Key Challenges

- Changing climate
- Geopolitical tensions that impact supply chains
- Shifting demographics
- Rapid technological innovation
- Shifting climate
- Geopolitical tensions that impact supply chains
- Shifting demographics
- Rapid innovation shifts
- Digital transformation
- Environmental shift placing new pressures on farmers
- Agriculture is a year-long process

### Key Solutions

With the proper hardware and sensor options, farmers can monitor and analyze systems to assess inventory, manage fields, monitor how environmental factors impact crop yields and maximize production. Drones make it possible to easily monetize agricultural data and improve production worldwide across the growing season.

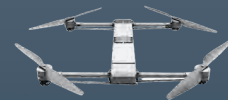
- Reduced costs of drone monitoring
- Improve yields with efficient data analysis
- Improved processing for efficient analysis
- Long-range coverage for large farms
- Irrigation and water management support

"THE ABILITY TO COLLECT AND ANALYZE THIS DATA IN REAL-TIME HAS TANGIBLE OUTCOMES FOR FARMERS SUCH AS BETTER CROP YIELD, FEWER RESOURCES EXPENDED ON WEEDS AND HERBICIDES, AND OVERALL IMPROVED MANAGEMENT DECISIONS." [BUSINESS INSIDER](#)

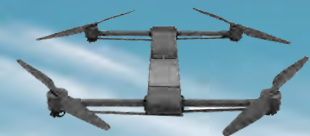
### Key Features

The Commander 3 XL Drone supports automated and manual flight operations, making it the ideal choice for industry leaders across various major markets, including public safety and agriculture.

The Commander 3 XL Drone's fuselage consists of a simple rectangular tube. Each component of the drone has been specifically designed to ensure the airframe can pack down into a portable case.



"THE IMPROVED FLIGHT TIMES OF THIS PLATFORM WILL LEAD TO BETTER PRODUCTION. THE PLATFORM'S VERSATILITY WILL ENABLE US TO MULTITASK BETWEEN OUR IMAGERY MAPPING AND HEAVIER PAYLOADS."  
— CURTIS PATE, OWNER, AGTEGRITY



## → AGRICULTURE

### Key Applications

- |                    |                    |
|--------------------|--------------------|
| Crop health        | Soil moisture      |
| Yields             | Field management   |
| Inventory          | Livestock          |
| Irrigation         | Infield assessment |
| Crop scouting      | Flood mapping      |
| Crop growth stages | Elevation models   |



#### For Commercial Growers

Analyze crop health, invasive species, drainage and irrigation issues



#### For Breeders

Livestock management, including inventory and field monitoring



#### For Researchers

Gain high degrees of detail in crop performance data

### Sensor Integration

Pairing UAV hardware with visual, thermal, LIDAR, hyperspectral, and other sensors can create an analytics system customized to suit any agricultural monitoring challenge.



## → COMMANDER 2

### Multi-rotor Commander

This high-endurance, electric, autonomous quadcopter drone is built on a patented carbon fiber folding airframe with interchangeable payloads, and is built for missions requiring high-res imagery.

Its dual-battery system powers 35-minute flight times, making it ideal for capturing high-res imagery from multiple sensors.

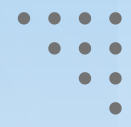


DEC. 13, 2022

The Commander 3 XL Drone is voted 'Best Enterprise Drone' at The Droning Company's Annual Droning Awards

[LEARN MORE →](#)





## ORCHARD GROWTH

→ Driving Higher Yields with Drones



### The Challenge

- Sand streak running through fields, impacting yields
- The extent of sand was unclear, affecting potential revenue

### The Solution



#### Monitoring Crop Health & Anomalies

Aerial surveys of fields using drone technology and data analytics via Draganfly and the AeroVironment Decision Support System™

The imagery was collected using true-colour and multispectral sensors and subsequently processed using AV DSS for deeper insights. The initial analytics from the 2016 season revealed that the northern half of the field had less-dense canopy coverage and appeared more stressed than the southern half of the field.

### The Results

Once the original irrigation system was altered to suit the orchard's needs, additional aerial imagery was collected to see if the new strategy improved canopy density.

- The outcomes are highly visible in side-by-side comparisons from before and after changes in irrigation were made.
- Compared to 2016, the 2017 analytics revealed trees with improved canopy and less stress throughout the field. With balanced water and nitrogen applications, the orchard achieved healthier trees and a larger canopy. Overall, Bill saw his yields increase by 21%, which resulted in a profit increase of \$51,960 across the 40-acre field.

**"WITHOUT THESE AERIAL IMAGES I PROBABLY WOULD HAVE NOT DONE ANYTHING TO THIS ORCHARD.... WHAT WE'RE DOING IS TAKING VALUABLE RESOURCES, WATER AND NITROGEN, AND USING THESE MORE EFFICIENTLY."**



**BILL BRUSH**

WALNUT GROWING

SOURCES: AEROVIRONMENT, DRAGANFLY

## FLOOD MAPPING

→ Assessing Drainage, Damage & Yield

### The Challenge

- Cornfield drainage and flooding
- Lack of visual insight into the field
- Flooding had reduced yield and nutrient-rich topsoil for years
- In-person research only allowed for small-area coverage, while satellite imagery proved expensive

### The Solution



#### Super Field Intelligence

AeroVironment helped to survey the corn field and process the aerial imagery data collected using the Draganfly Quantix™ Hybrid Drone and AeroVironment Decision Support System™ (AV DSS), an efficient drone and analytics system for superior field intelligence

### The Results

By combining innovative hardware with software, the project resulted in significant environmental and economic benefits.

- Drone data of the corn field showed evidence of water erosion when compared to pre-planting flight
- Impact magnitude was quickly identified and quantified, revealing thousands of feet of erosion damage
- Several erosion areas were identified beyond what was observed when walking the field
- The issue of a damaged drain tile was identified, as well as an ineffective terrace system

\*QUANTIX MAPPER DISCONTINUED IN 2022





# INFRASTRUCTURE

## BUILT FOR THE FUTURE

From urban planning and bridge maintenance to disaster monitoring and insurance, the cost of efficient infrastructure management is incredibly high — and even higher when the system fails. Thanks to the inherent flexibility and cost-friendliness of drone monitoring and related analytics, infrastructure managers have much to gain from the continual innovations associated with drone technology.

## Key Applications



### Drones for Construction

- Validation of blueprints and building results
- Measurement and storage of data for surveys
- Data for 'digital twin' creation allows for efficient operations and decision making



### Structural Maintenance

- **Safety Issues:** Maintenance data retrieval often involves workers and engineers climbing structures
- **Resources:** Traditional process is dangerous and inefficient.
- **Drone Solutions:** Detection and monitoring of infrastructure elements like roads, bridges, tunnels, dams, buildings, utility lines, and water storage.

"IN THE US, 1 IN 3 BRIDGES NEEDS REPAIR OR REPLACEMENT. IN JAPAN, THE NUMBER OF AGING BRIDGES THAT RESTRICT TRAFFIC TRIPLED BETWEEN 2008 AND 2019. IN THE UK, OVER 3,200 BRIDGES NEED REPAIRS." [IBM](#)

## Global Challenges

- Global climate shifts impact roads, bridges, buildings, etc.
- High cost of ongoing monitoring, remote and onsite
- High cost of natural disasters and structural damage

## Key Benefits

### Significant Cost Savings

Reduced maintenance costs, monitoring, and incidence response.

### Daily Monitoring

Track assets, work sites, and entire supply chains.

### Predictive Analytics

Precise time series information to improve insights for pricing, supply chains, and global issues.



## → INFRASTRUCTURE

### IN FOCUS: INSURANCE & DISASTERS

To improve outcomes from natural disasters and catastrophic events, drones can help develop pre-damage baselines and post-event damage assessments of property and infrastructure.

Property owners and insurers can leverage flight, data collection, and assessment services to increase accuracy and speed when inspecting sites. Drone data allows for improved insight, enabling accelerated decision-making while decreasing risk.

#### Key Sectors

- Agriculture
- Commercial infrastructure
- Utilities
- Property/asset owners

#### Key Application Areas

- Rate adjustments
- Preparation
- Assessment
- Claims

#### Key Applications

- Roof inspections
- Powerline inspection
- Identify damaged solar panels



### Commander 2 & Commander 3XL

The Commander series can be used by infrastructure owners and insurers looking to mitigate risk, assess damage, and inspect property following natural disasters like hurricanes, forest fires, or storms.

Multispectral sensors can be used in agricultural settings to assess crop damage following a hail or wind storm.

The Commander series is often used for low, slow, and “close” assessments like measuring flood and storm damage to houses and infrastructure. The drone systems also suitable for capturing larger sample sets with a macro-view assessment.

### Pix4D: Quantifying Disaster Impact

The Pix4D drone software suite is the premiere drone photogrammetry solution for UAV-based data collection.

- Transforms aerial photographic data collected into geo-referenced 2D orthomosaics, digital terrain models, 3D models, and vegetation indices
- Especially useful when comparing and overlaying pre and post-disaster drone data and maps to help insurers make accurate decisions.
- Insights can be integrated into the decision-making process to assess, analyze, and make informed decisions and take precise action.





# Smart Highways

→ Creating Safer, Smarter Cities

## The Challenge

As populations migrate to megacities and weather patterns shift, continually evolving road infrastructure will require increasingly efficient maintenance, inspection, and repair. The associated infrastructure management costs can be extreme and made all the more critical by road safety and traffic monitoring needs.



**"FOR NEXT-GENERATION SMART CITIES [DRONES] ARE VITAL TO INCORPORATE IN AIRSPACE FOR ADVANCING THE TRANSPORTATION SYSTEMS.**

— **OUTAY ET AL.**

## Solutions

Continuous drone technology innovations — when coupled with integrated technology like computer vision and analysis algorithms — can vastly improve traffic-flow analysis, risk assessments, accident investigations, bridge damage assessments, and more.

- Road Safety Monitoring
- Remote Bridge Inspection
- Remote Road Pavement Monitoring
- Accurate Accident Assessments
- Timely Risk Assessment
- Efficient Traffic Management
- Superior Traffic Flow Analysis

## Overall Benefits

Drones offer an efficient, safer, cost-effective, and environmentally friendly option compared to planes and in-person monitoring.

- Safety: reduced in-person management
- Cost: number of resources is limited
- Time: one remote data acquisition session in a fraction of the time

SOURCES: OUTAY ET AL.

# Construction Lifecycle

→ Supporting the Construction Lifecycle

## The Challenge

Our lives depend on efficient and safe construction of buildings, roads, buildings, tunnels, water structures, pipelines, and dams.

From planning and design to construction and maintenance, every phase of construction is critically important.

## Solutions

Integrating advanced drones with monitoring capabilities and advanced algorithms vastly improves construction efficiency and reduce associated costs across the construction lifecycle:

- **Smart City Urban Planning:** traffic flow analysis
- **Building Assessments:** landscape surveys and maps derived before construction
- **Asset Inspection:** Remote assets are monitored with HD cameras and other sensors
- **Construction Management:** Leading up to and through the lifespan of a project
- **Infrastructure Planning:** Building and road analysis with drone imagery

SOURCE: FAN & SAADEGHVAZIRI



# FORESTRY

## TRACKING THE FOREST FOR THE TREES

Drones have already proven to be formidable tools for nearly every aspect of forestry — from tracking invasive species to detecting fires — by delivering rapid data that is both high-quality and economical. With ongoing innovations in sensing and processing technologies, drone usage across forestry applications is anticipated to continue its rapid proliferation.

### Key Challenges

- **Climate Change & Conservation:** Forests are particularly affected by the longevity of the trees, and the primary objective is the conservation and protection of forests
- **Monitoring & Processing Costs Can be High:** Resources, human and plane-based, and software.
- **Delay of New Techniques:** Forestry and agriculture both involve the cultivation of renewable raw materials—the difference is that forestry is less tied to economic aspects, reflecting the delay in using new monitoring technologies.
- **Satellite Data:** Although powerful, satellite data can be extremely expensive, especially for small operators requiring time series data. The accuracy and precision of optical satellite data can also be of concern.

"IN COMPARISON WITH OTHER PERMANENT ECOSYSTEMS, FORESTS ARE PARTICULARLY AFFECTED BY CLIMATIC CHANGES DUE TO THE LONGEVITY OF THE TREES, AND THE PRIMARY OBJECTIVE IS THE CONSERVATION AND PROTECTION OF FORESTS." — [MATESE](#)



## → OVERVIEW

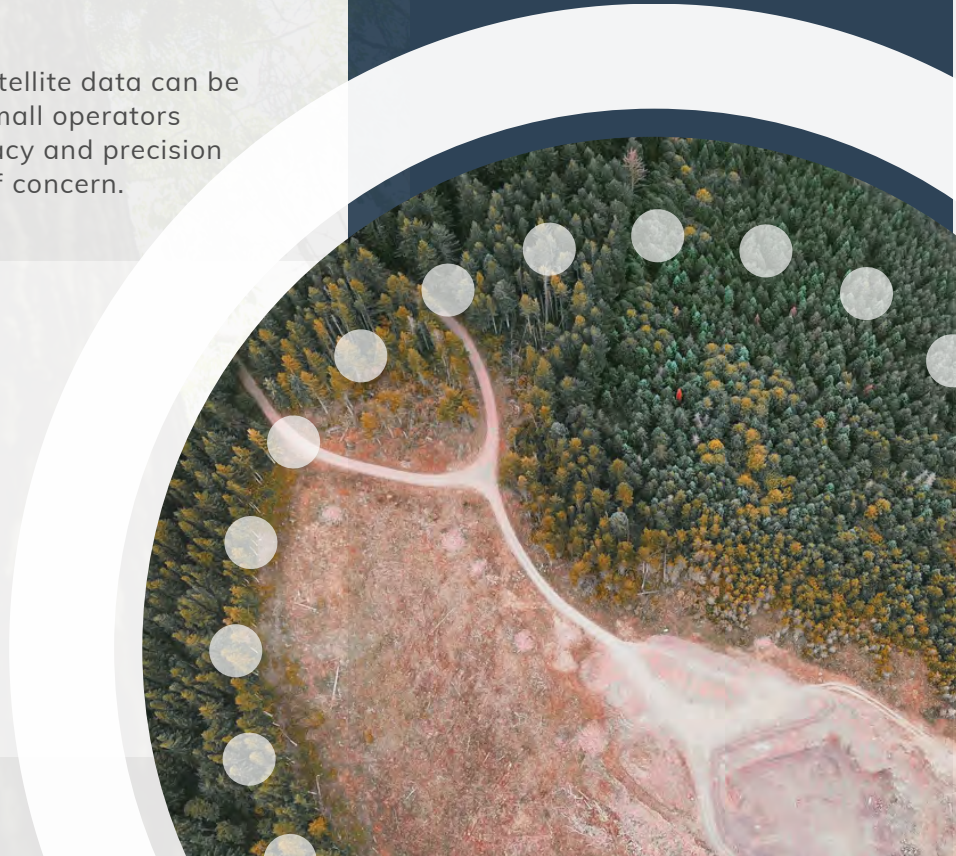
### Key Applications

- |                     |                        |
|---------------------|------------------------|
| Biomass analysis    | Timber evaluation      |
| 3D Mapping          | Pest Outbreaks         |
| Mapping diseases    | Large-area Seeding     |
| Classifying species | Forest governance      |
| Precision forestry  | Tracking deforestation |
| Fire Management     |                        |

### Forestry Drone Advantages

- Low energy consumption
- Reduced resources, lowered costs
- Preservation of human safety
- LiDAR sensors for biomass estimation
- Reduced costs for LiDAR and infrared
- Improved imagery precision
- Flexible usage, reliability, autonomy
- Timely high-resolution data
- Associated processing innovations
- Flight time capabilities increase regularly over time

SOURCES: BANU ET AL., MATESE







# Key Applications

## Disturbances: Mapping Canopy Gaps

More than satellite imagery or plane imagery, low-flying drones are adept at accurately detecting disturbances caused by wind, pests, and snow, which impact regrowth and reduce biodiversity.

## Biomass & Species Analysis

Drones equipped with multispectral sensors can provide high-res data down to the millimetre, allowing for precise analysis of biomass content, and invasive species mapping. From there, accurate carbon stock and biomass estimates can be made.

## Timber Evaluation

Timber management, at times similar to precision agriculture in its drone methods, can improve growth with regular drone-led inspections. With the steadily increasing demand for timber, these methods will be increasingly important.

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IN ADDITION TO THE EXTRAORDINARY SOCIOECONOMIC IMPACT IN TERMS OF LOSS OF HUMAN LIVES OF RESIDENTS AND FIRST RESPONDERS, HEALTH, INFRASTRUCTURES AND ECONOMIC ACTIVITY, EXTREME WILDFIRE EVENTS HAVE ALSO SERIOUS AND SOMETIMES IRREVERSIBLE ECOLOGICAL IMPACTS WHEN CONSIDERING SOIL AND WATER DEGRADATION AND BIODIVERSITY LOSS.' — EUROPEAN COMMISSION

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## Forest Fire Management

With autonomy and ease of access to remote locations, drones are well-suited for forest fire detection and prevention. Although drones are largely banned near forest fires across many regions, some emergency response teams use drones to fight forest fires. Specifically, drones are well suited to fire prevention, with the ability to monitor campfire violations and cigarette disposal.

## 3D Mapping & Time Series Data

3D maps derived from satellite data are high-quality but expensive for small, local operators. When data is required on a daily or weekly basis, costs increase considerably. Thus, drones provide an efficient and cost-friendly alternative, particularly when time series data is required.





# LAND MANAGEMENT

→ Balancing Human-Environmental Needs

## The Challenge

Balancing the needs of society, farmers, and the environment is a delicate and ongoing challenge. Although sustainability is now top-of-mind, established forestry practices evolve slowly, and innovation can be costly. That's where drones have a significant role to play, across several impact areas:

- Environmental impact
- Shifting climates
- Sustainability and compliance
- Invasive species mitigation

## Solutions

- Forest mapping: forest gaps, biomass type, forest structure, composition, volume, growth
- Precision forestry: sustainable forest planning management,
- Canopy height models
- Illegal harvesting detection



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**"REMOTE SENSING USING DRONES HAS A RANGE OF BENEFITS SUCH AS REDUCED COSTS, FLEXIBILITY IN TIME AND SPACE, HIGH-ACCURACY DATA AND THE ADVANTAGE OF NO HUMAN RISKS."**

— BANU ET AL.

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## Key Benefits

- **Safety:** fewer in-person assessments
- **Cost:** reduced resources and energy consumption
- **Time:** reduced data acquisition time
- **Accessibility:** lower costs and smaller sensor sizes required (LiDAR and infrared)

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SOURCE: BANU ET AL.

## MAPPING INVASIVE REDCEDAR, KANSAS

Shifting land management practices in Eastern Kansas led to the encroachment of an invasive species of Redcedar into farmland. Kansas State University researchers effectively used high-res drone imagery from low-flying drones to extract high-quality information at a fraction of the cost.

## MAPPING TROPICAL FORESTS, INDONESIA

Drone video footage was used to capture human activities, logging, wildlife and flora species. Using UAV remote sensing saved significant time, costs, and labor resources.

## 3D FOREST MODELLING, TURKEY

Nearly 70% of Kahramanmara, Turkey, is forested, limiting human access. As a low-cost mapping option, Istanbul University researchers used drones and phone software to conduct detailed contour mapping of the forested areas.





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SOURCES: COPTRZ, BANU ET AL.





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