ASEAN FAW ACTION PLAN
Supporting IPM Across Southeast Asia

Drones and Digital IPM

Webinar Series
Part 3: 5 December2024

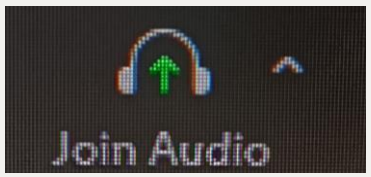
Supported by
Australian Government
Department of Foreign Affairs and Trade

The session will be recorded.
A copy will be shared 1 week after this session.

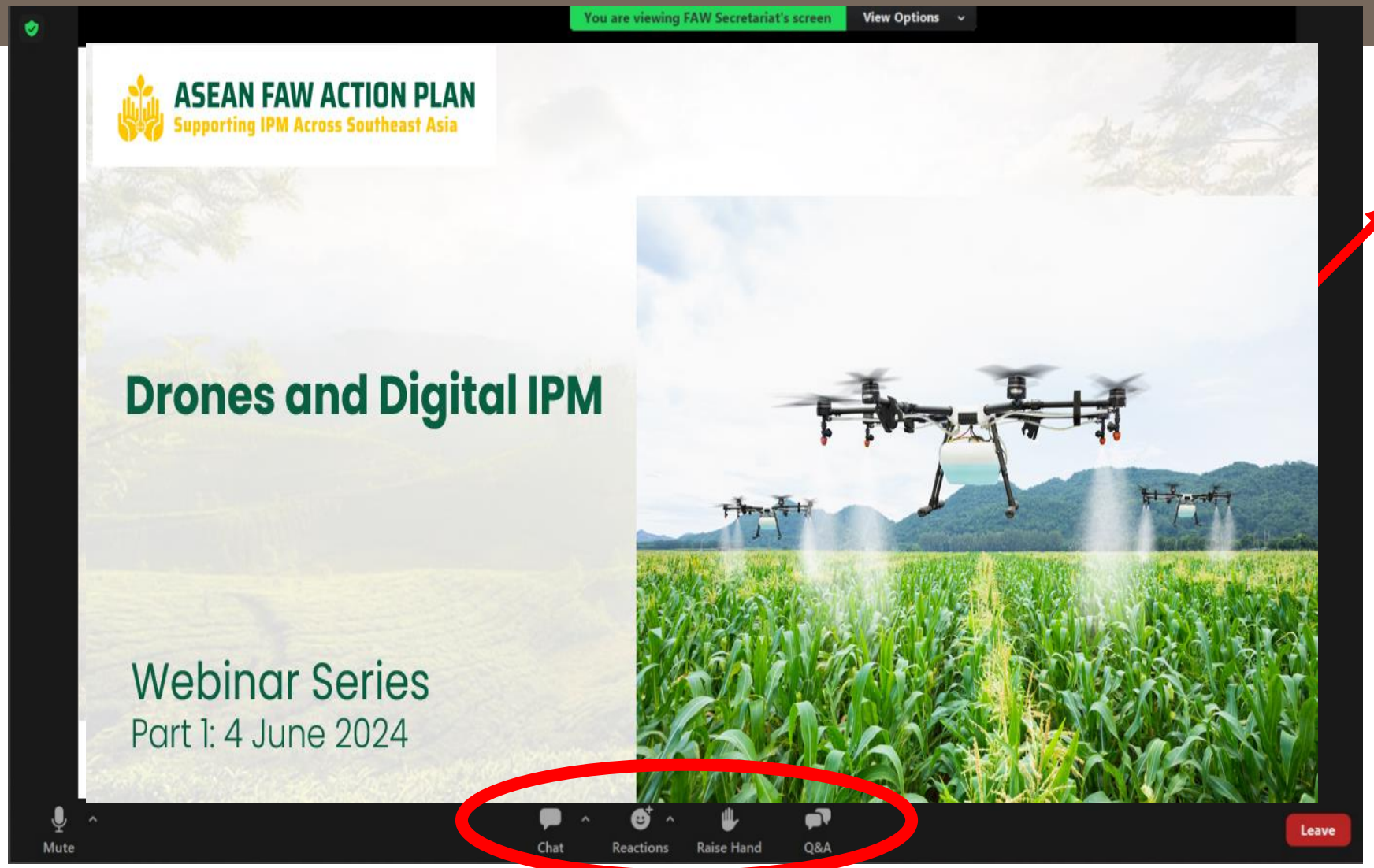
Technical issues?

- **Audio**
  - Click "Join Audio" and check the volume
  - Click the speaker icon
    (if using a mobile phone) and make sure it is on
  - Check connection to speaker
    (if using a desktop/laptop)
- **Try logging off and on**
- Send a message to us in the chat box

"Join Audio"



A recording of the webinar will be made and be distributed
See www.aseanfawaction.org/drones-and-digital-ipm



1. Use the Q&A box to ask questions to the speakers

2. Use Chat to make a comment to everyone (e.g. thank a speaker, share a link, highlight an important point)

3. Use Reactions if you want to share a reaction quickly – thumbs up, congratulations, etc.

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Agenda

Time (SGT)	Agenda	Speaker
10:00	**Welcome & Remarks**	ASEAN Action Plan – Dr Alison Watson
10:10	**Next-Generation Pest Management Tools: Drones + Sensors + Artificial Intelligence + Natural Enemies**	**Professor Yong-Lak Park** | West Virginia University, USA
10:30	**Q & A Session**	
10:45	**The Drones for Agriculture Project in Thailand**	**Preesan Rakwatin |** Executive Vice President, Digital Economy Promotion Agency (depa), Thailand
11:05	**Q & A Session**	
11:25	**Closing**	ASEAN Action Plan – Dr Alison Watson
11:30	**End**	

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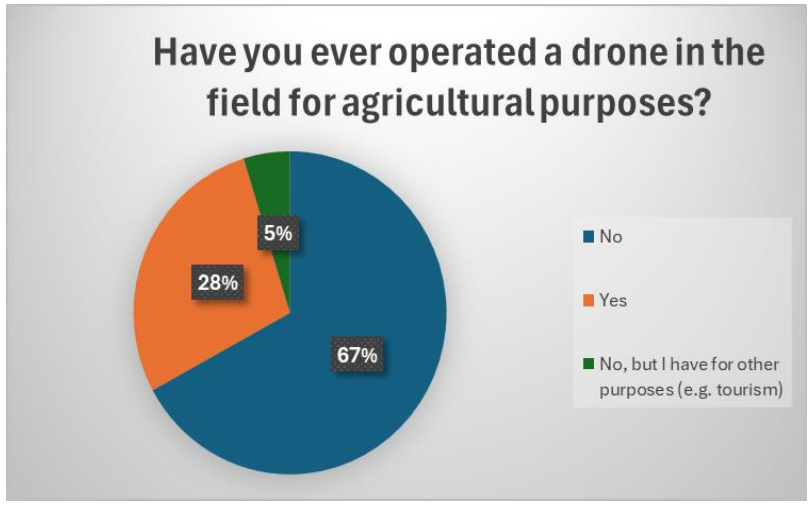
Poll

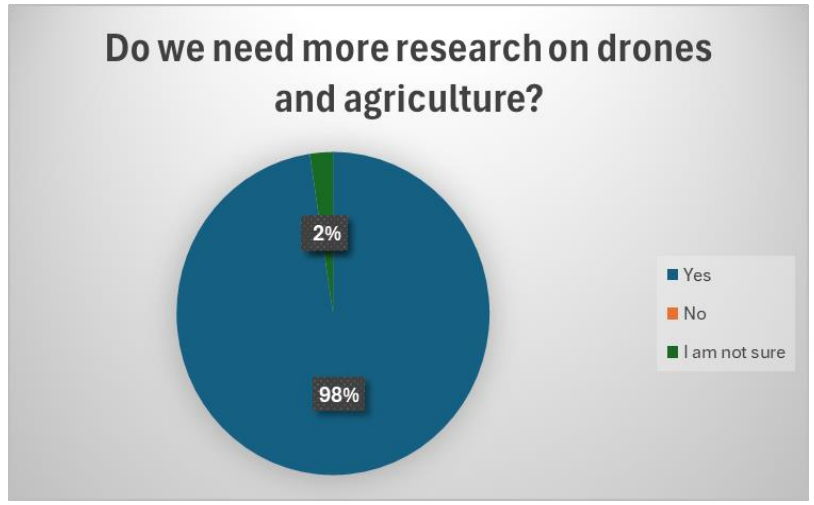
1. Who has operated a drone in the field for agricultural purposes?

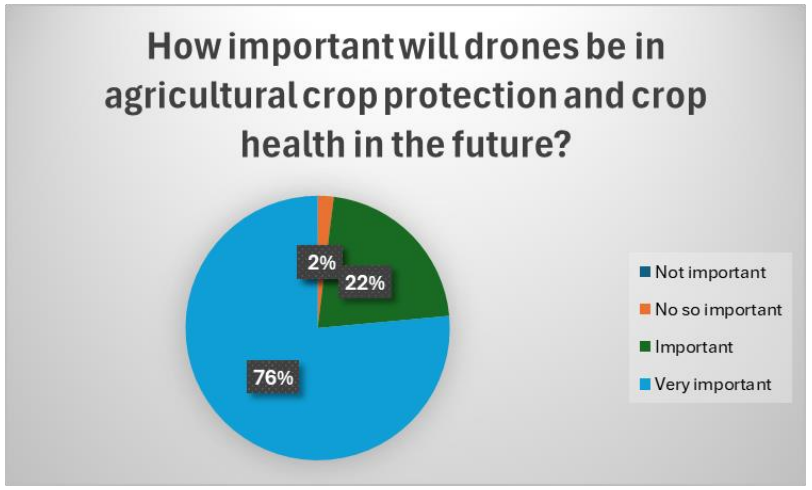
2. How important will drones **be** in agricultural crop protection and crop health in the future?

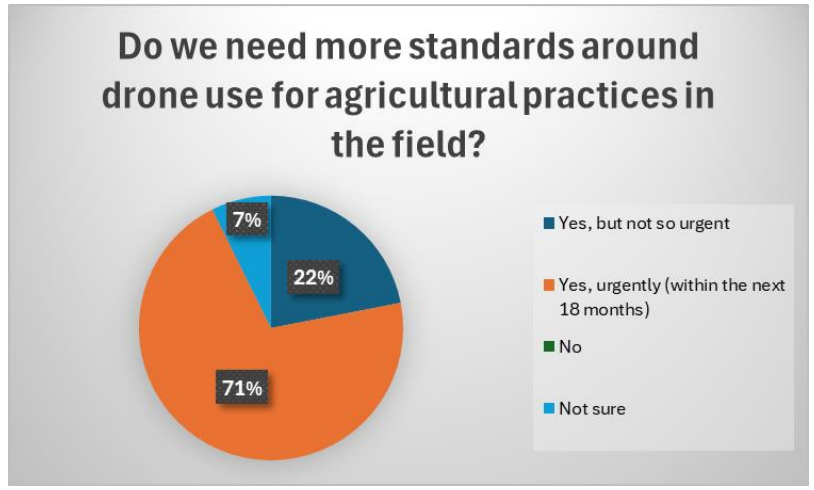
3. Do we need more research on drones and agriculture?

4. Do we need more standards around drone use for agricultural practices in the field?









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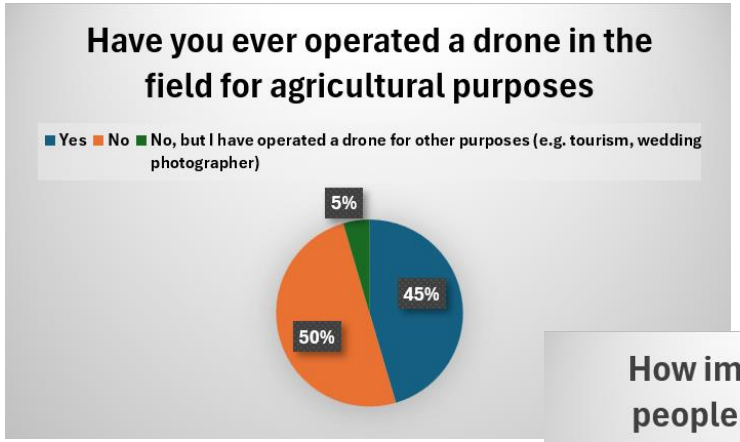
Poll

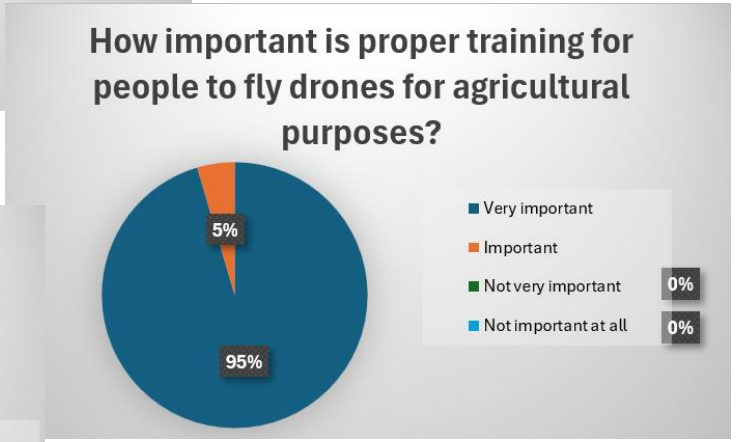
1. Who has operated a drone in the field for agricultural purposes?

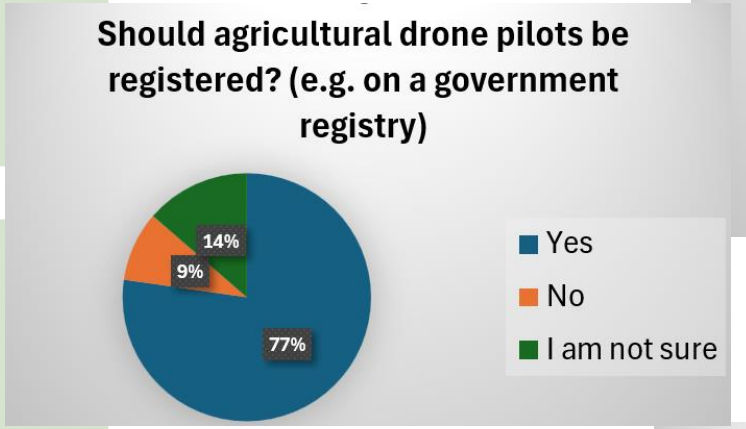
2. How important do you think proper training is for people to fly drones for agricultural purposes?

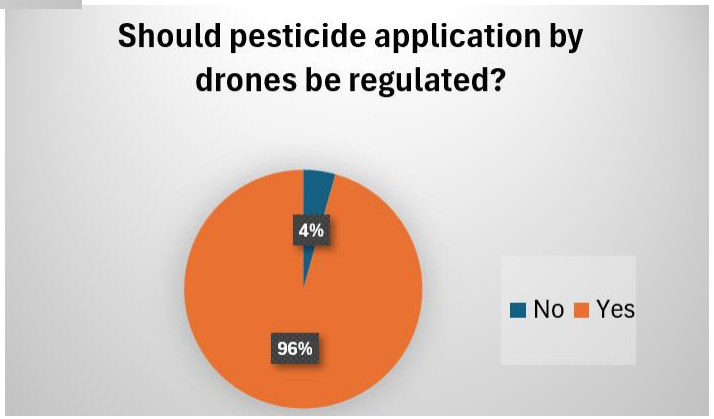
3. Should agricultural drone pilots be registered?

4. Should pesticide application by drones be regulated? (e.g. rules around who can apply pesticides by drones, standards that must be applied and safety rules that have to be followed)









Poll

1. Who has operated a drone in the field for agricultural purposes?

2. Would you be interested in attending a special training and skills course on drones in agriculture and next generation pest management tools?

3. Have you seen drones used in agriculture for:

seeding; delivery of beneficial insects; pesticide application; fungicide application; fertiliser application; crop health monitoring; other

4. would you be interested in being part of a network supporting the development of a regional Drones and Integrated Data Centre of Excellence on Climate-Resilient Food Systems?

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Next-Generation Pest Management Tools: Drones + Sensors + Artificial Intelligence + Natural Enemies

Our Speaker:

Professor Yong-Lak Park | West Virginia University, USA

The Drones for Agriculture Project in Thailand

Our speaker

Preesan Rakwatin | Executive Vice President, Digital Economy Promotion Agency (depa), Thailand

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Next-Generation Pest Management Tools

Drones, Sensors, AI, and Natural Enemies

Yong-Lak Park, Professor of Entomology
West Virginia University, U.S.A.

Drones (UAV, UAS, or sUAS)

- UAV: Unmanned Aerial Vehicle
- UAS: Unmanned Aerial System
- sUAS: small Unmanned Aircraft System (official term by the US FAA)

Rotary wing

Fixed wing

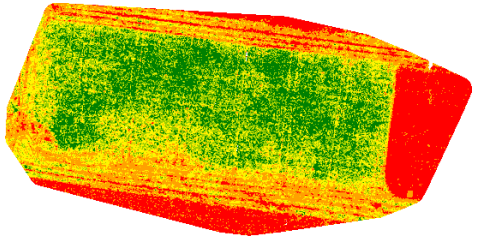
Drones and Sensors

Drone

Sensor

Natural color

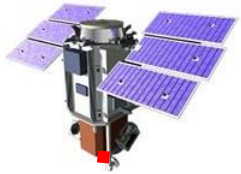
Thermal sensor



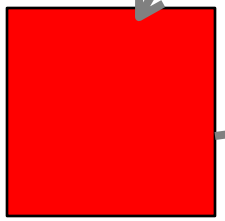
Spectral sensors

Autonomous Drone

Satellite-guided



Take picture



Spray pesticide

Autopilot

Invasive Plants to Eastern USA

Mile a minute

Japanese knotweed

Invasive Plants to Eastern USA

Weevil

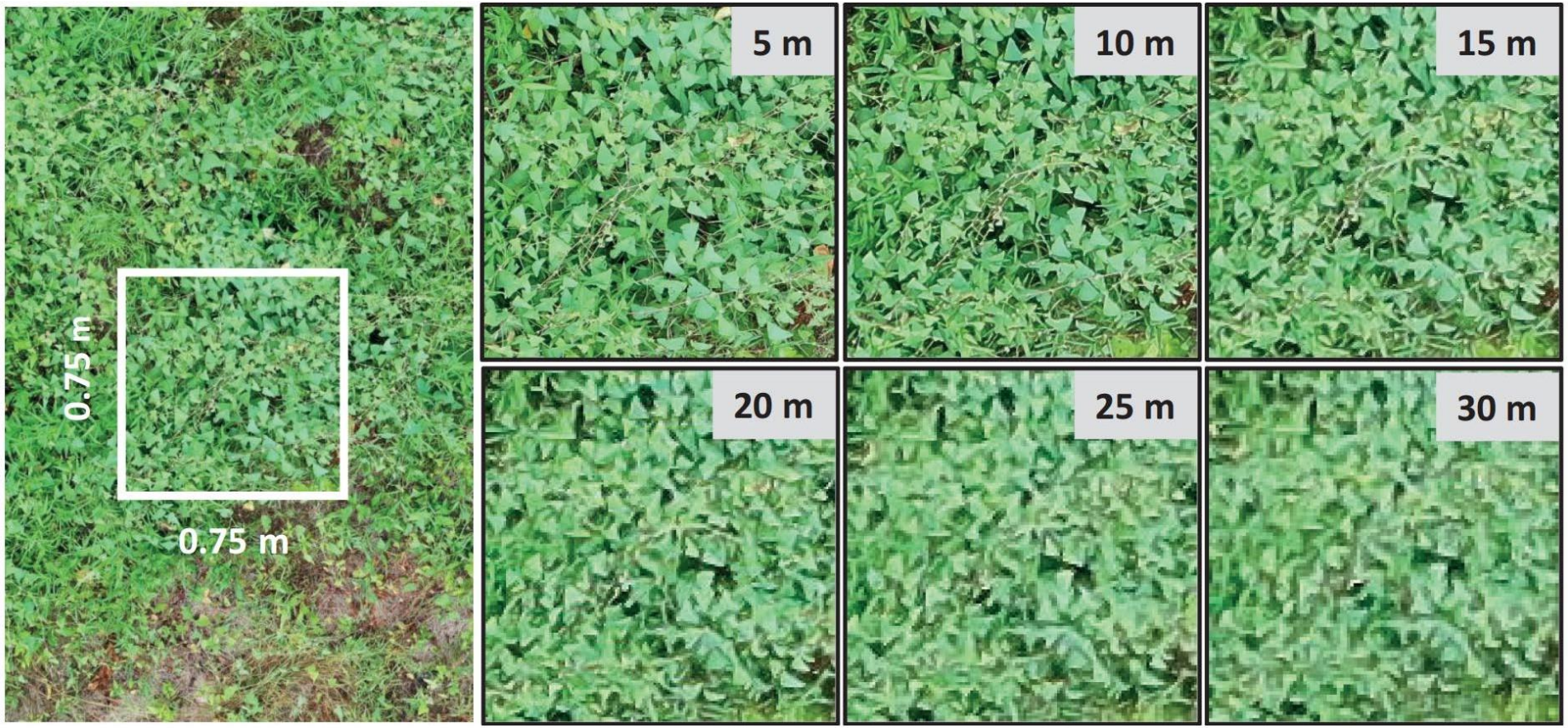
Psyllid

Mile-A-Minute Weed

Persicaria perfoliata **(Polygonaceae)**

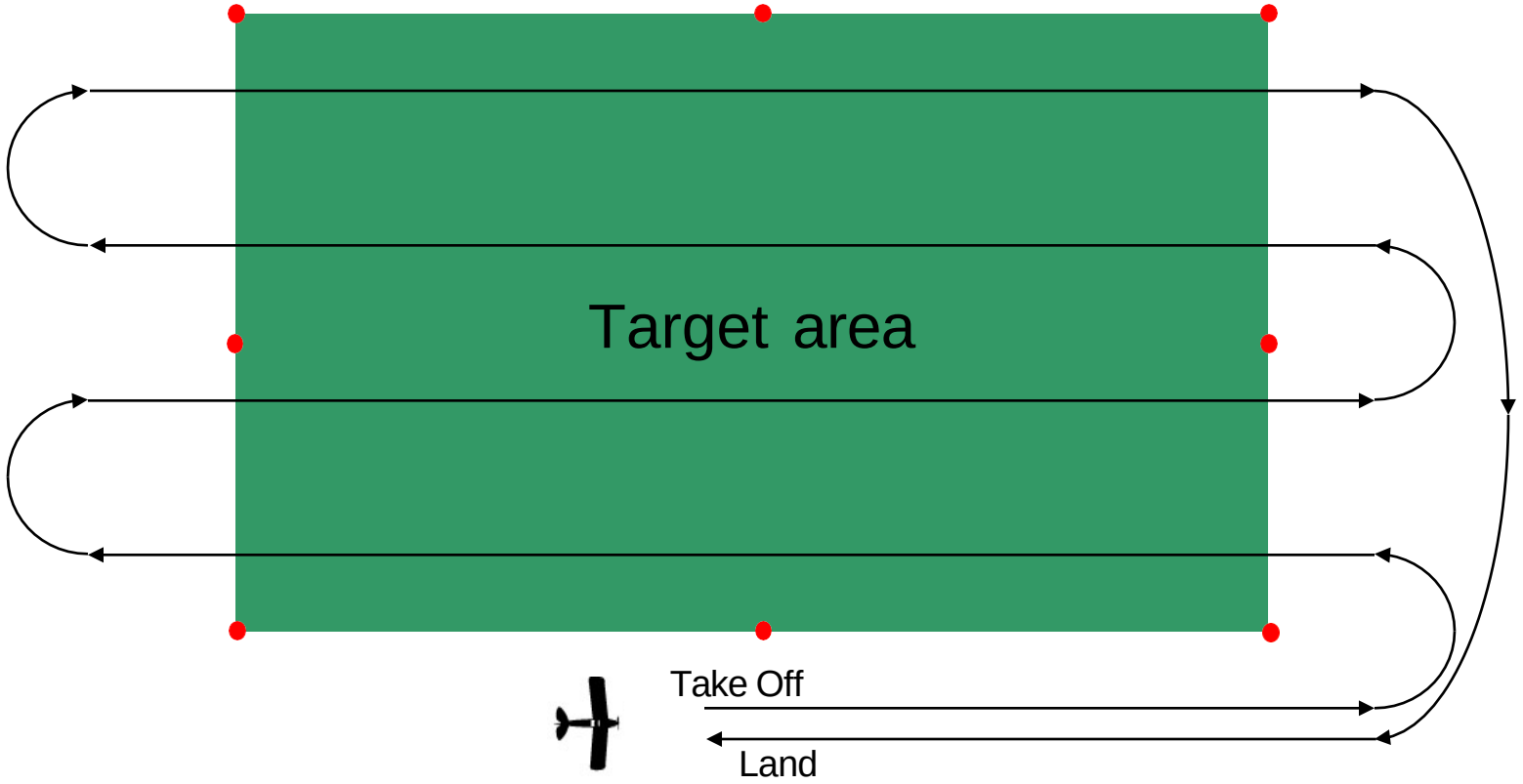
Mile-A-Minute Weed

Detection of Mile a Minute Using Drones

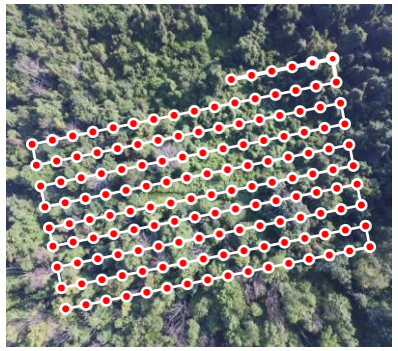


Aerial images taken < 25 m above the ground
can detect mile a minute

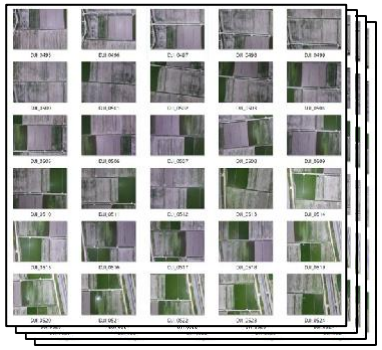
Autonomous Drone Operations



Automated Drone Survey in Large Area



Aerial survey with autopiloted drone



Download aerial images

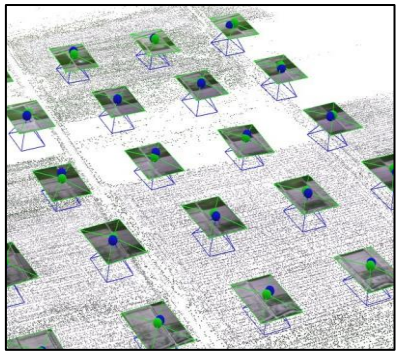
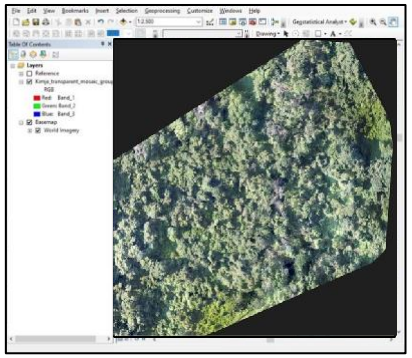
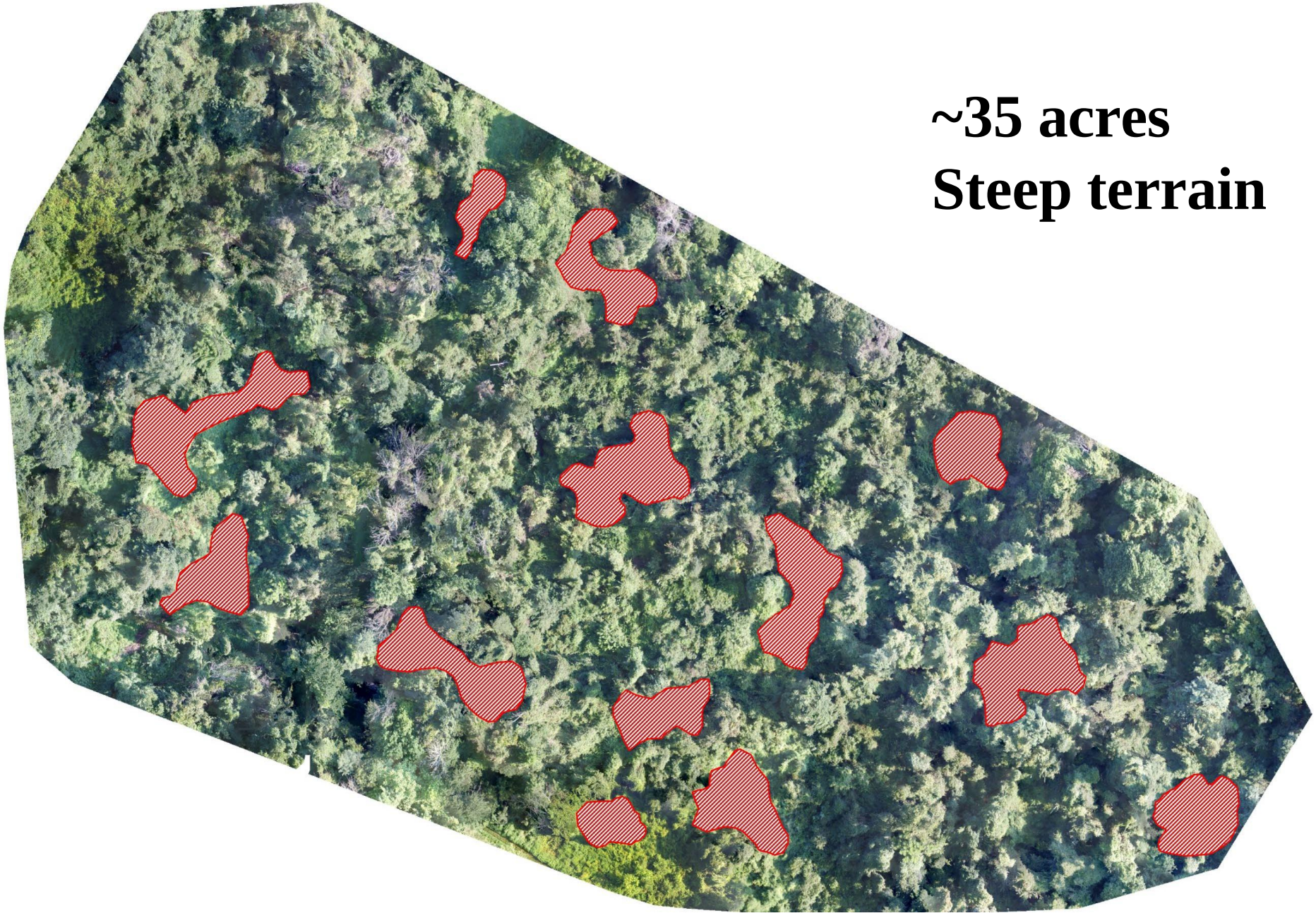


Image alignment and stitching



Georeferenced finalized aerial map

Detection of Mile-a-Minute Patches



~35 acres

Steep terrain

Mile-A-Minute Weed

Mile-A-Minute Weevil

Releasing natural enemies in

- large areas
- hard-to-reach areas

Mile-A-Minute Weevil

Shortage of weevils

$1.00

Rhinoncomimus latipes - Foliage feeding weevil
Mile-a-minute, ***Persicaria perfoliata***

- **Adults = $500.00/500 + shipping**

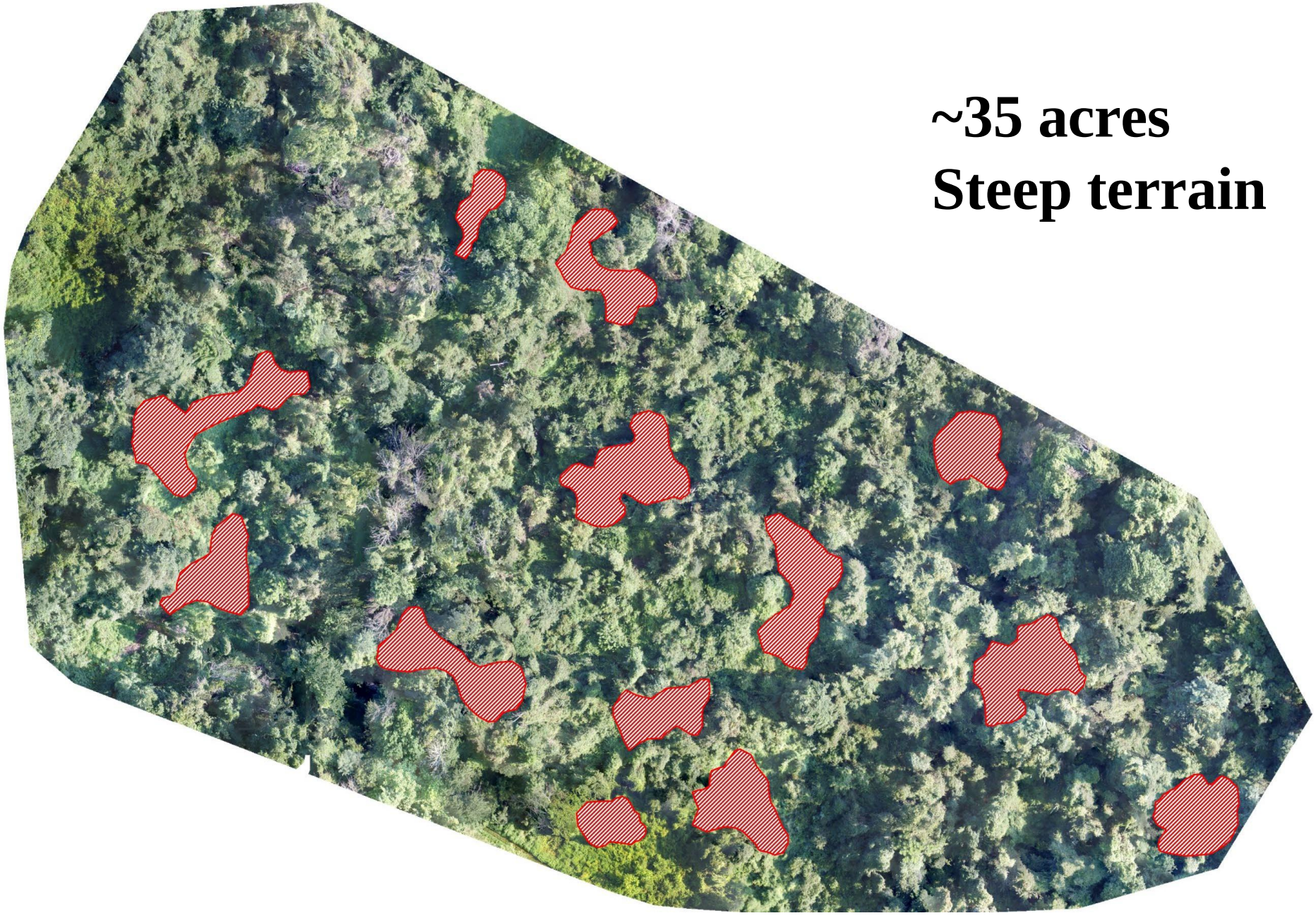
[USDA 526 Permit Required]

Only one lab produces the weevils in the USA

Current release method

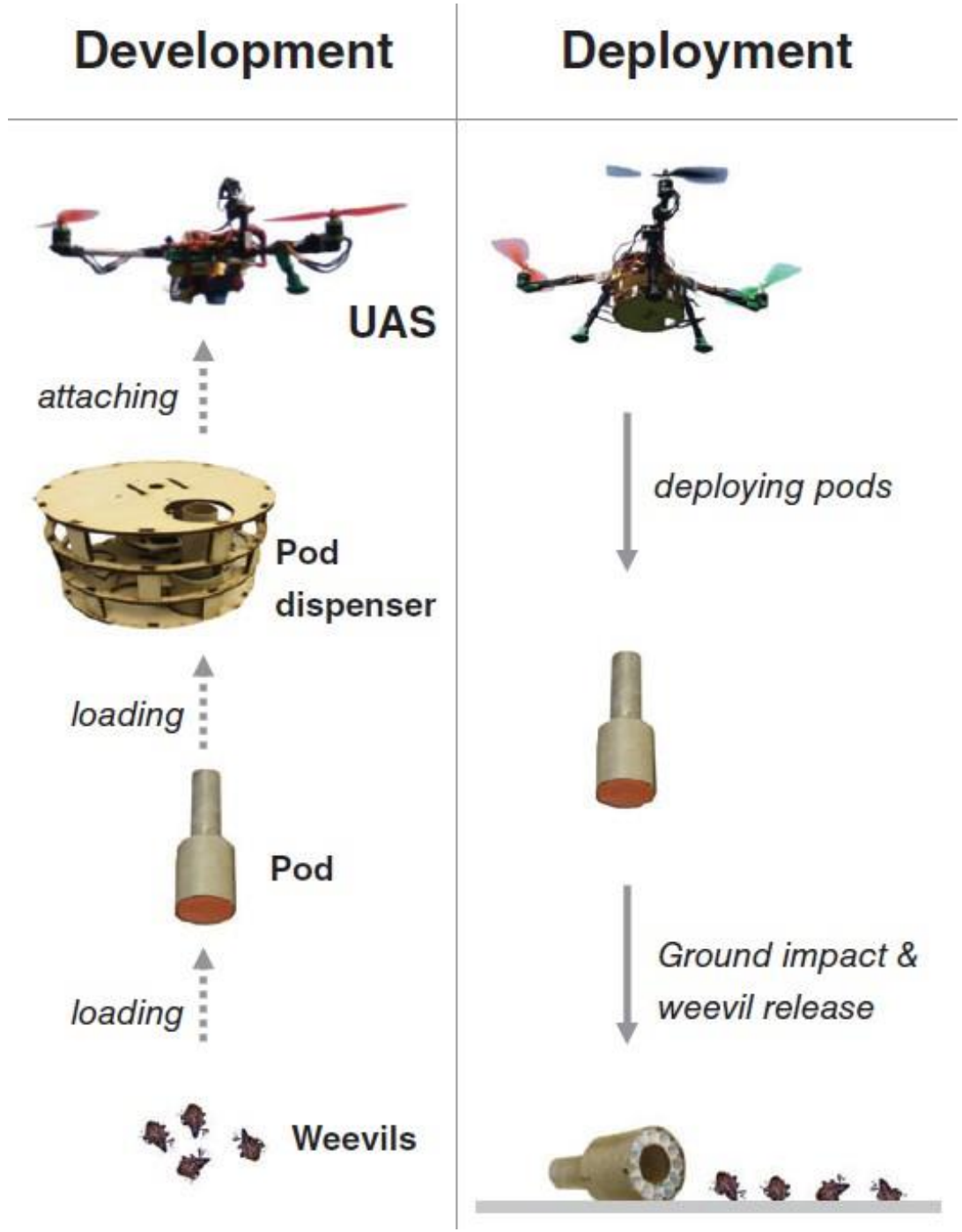
Locate weed patches and hand-release weevils

Detection of Mile-a-Minute Patches



~35 acres

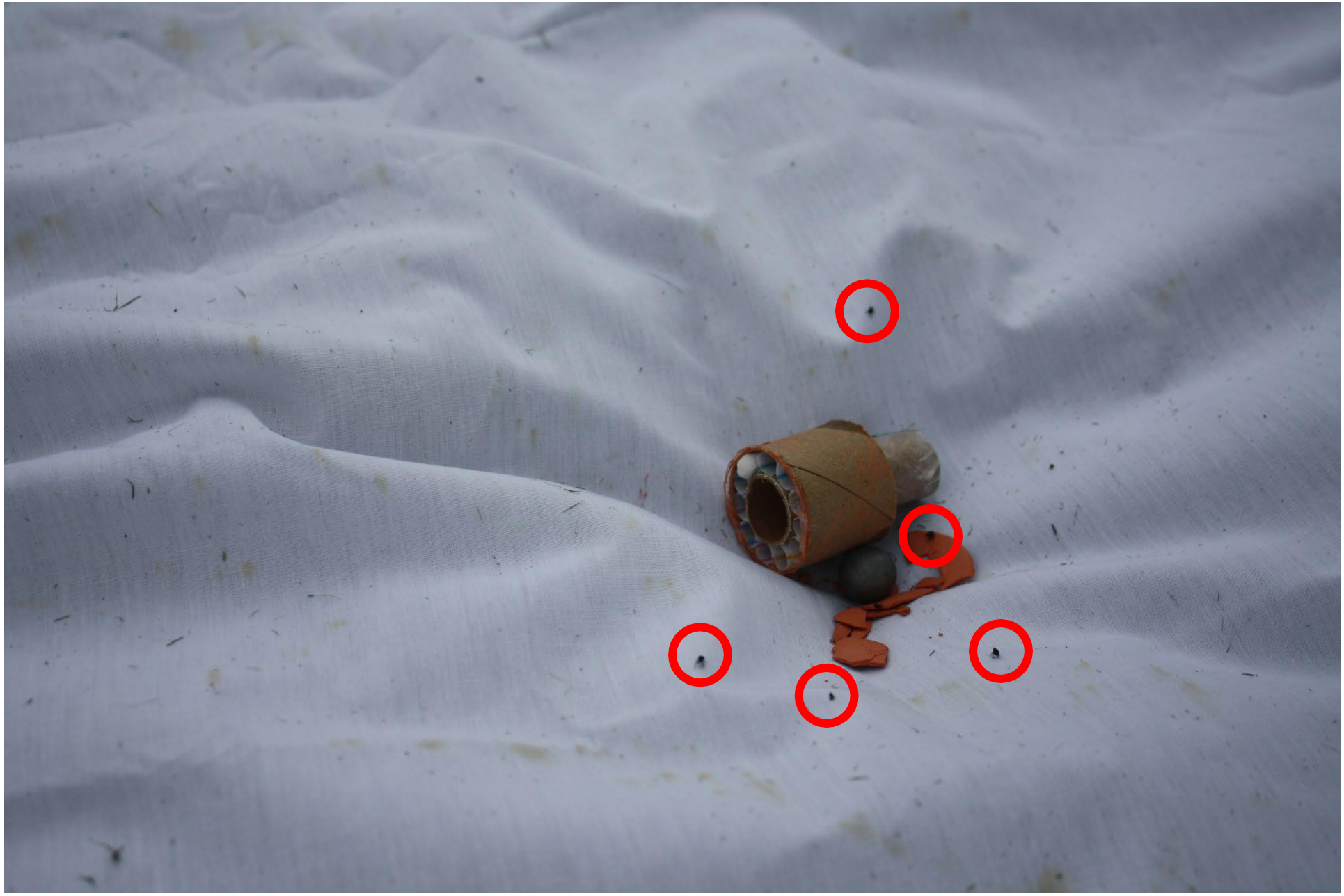
Steep terrain


Development
Deployment
UAS
attaching
Pod dispenser
loading
Pod
loading
Weevils
deploying pods
Ground impact &
weevil release

Development of Bug Bomb

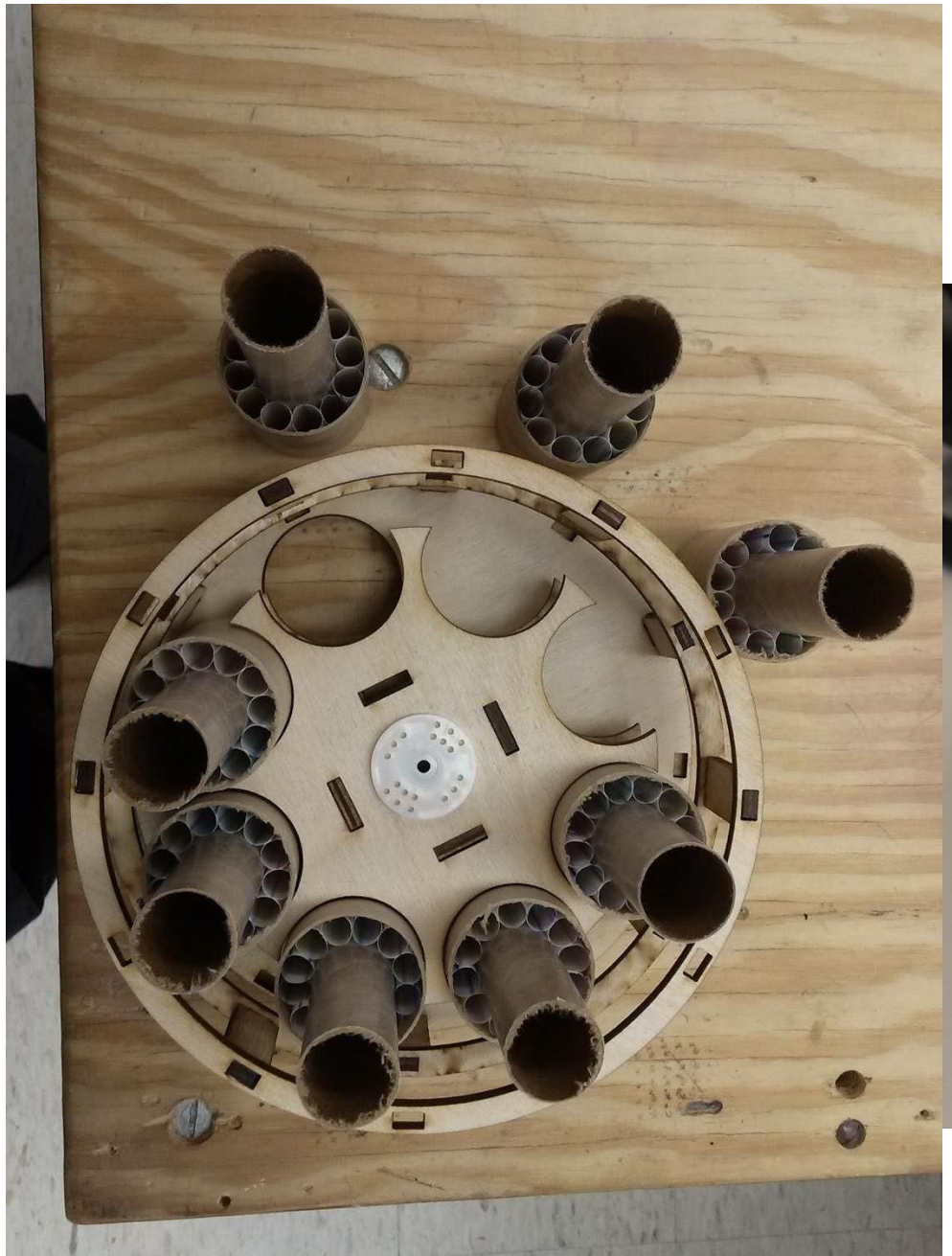
Development of Bug Bomb

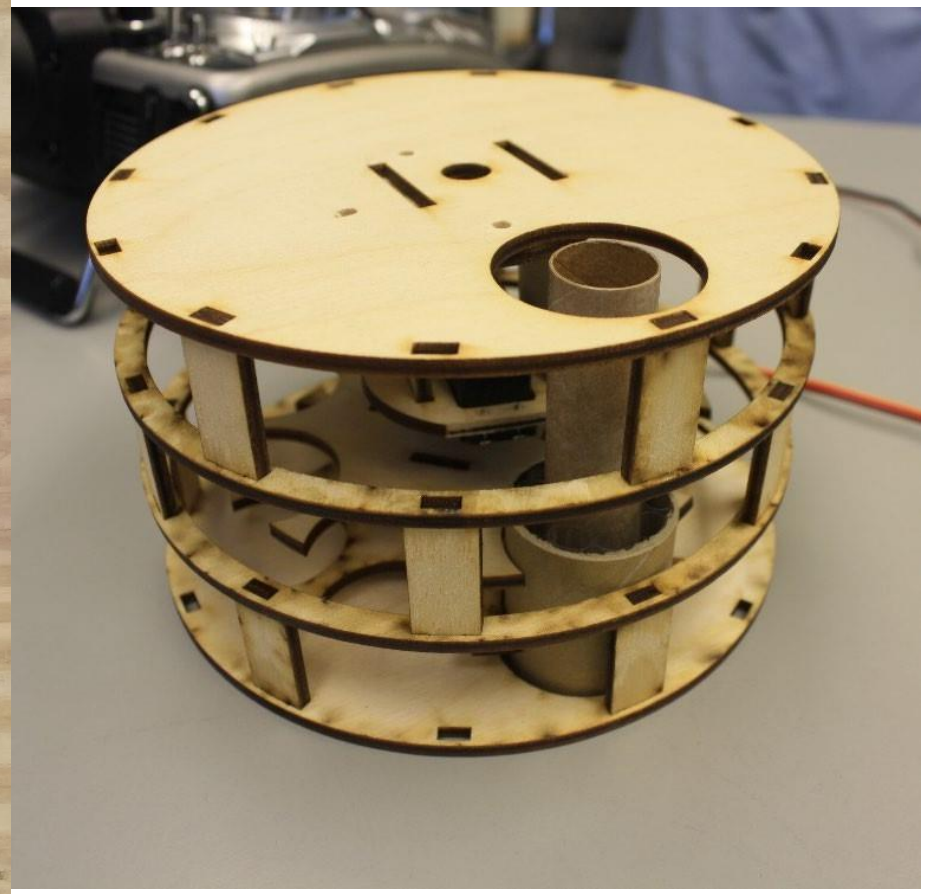
UAS Equipped with Bug-Bomb Dispenser



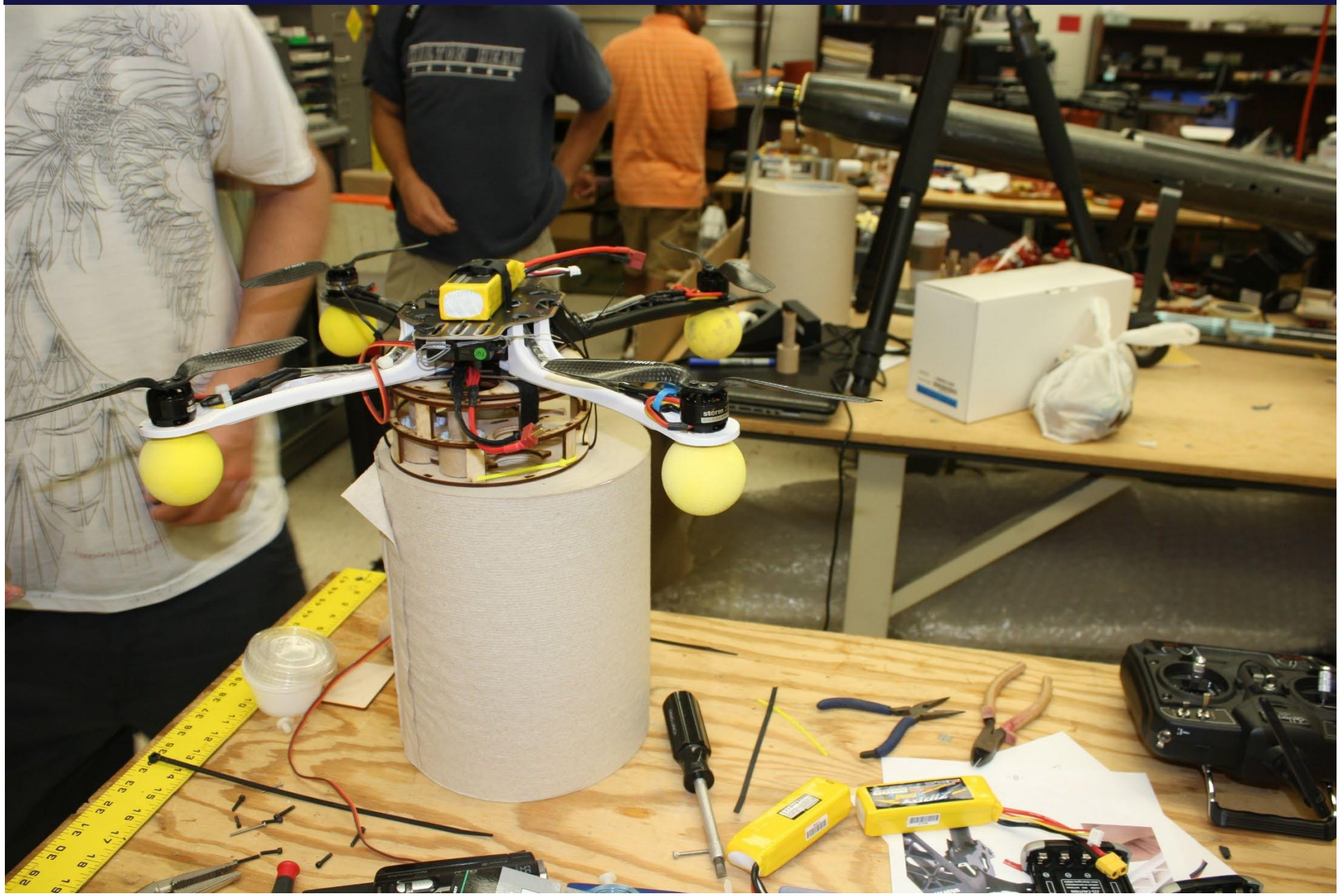
Development of Bug-Bomb

Bug-Bomb Dispenser





UAS Equipped with Bug-Bomb Dispenser



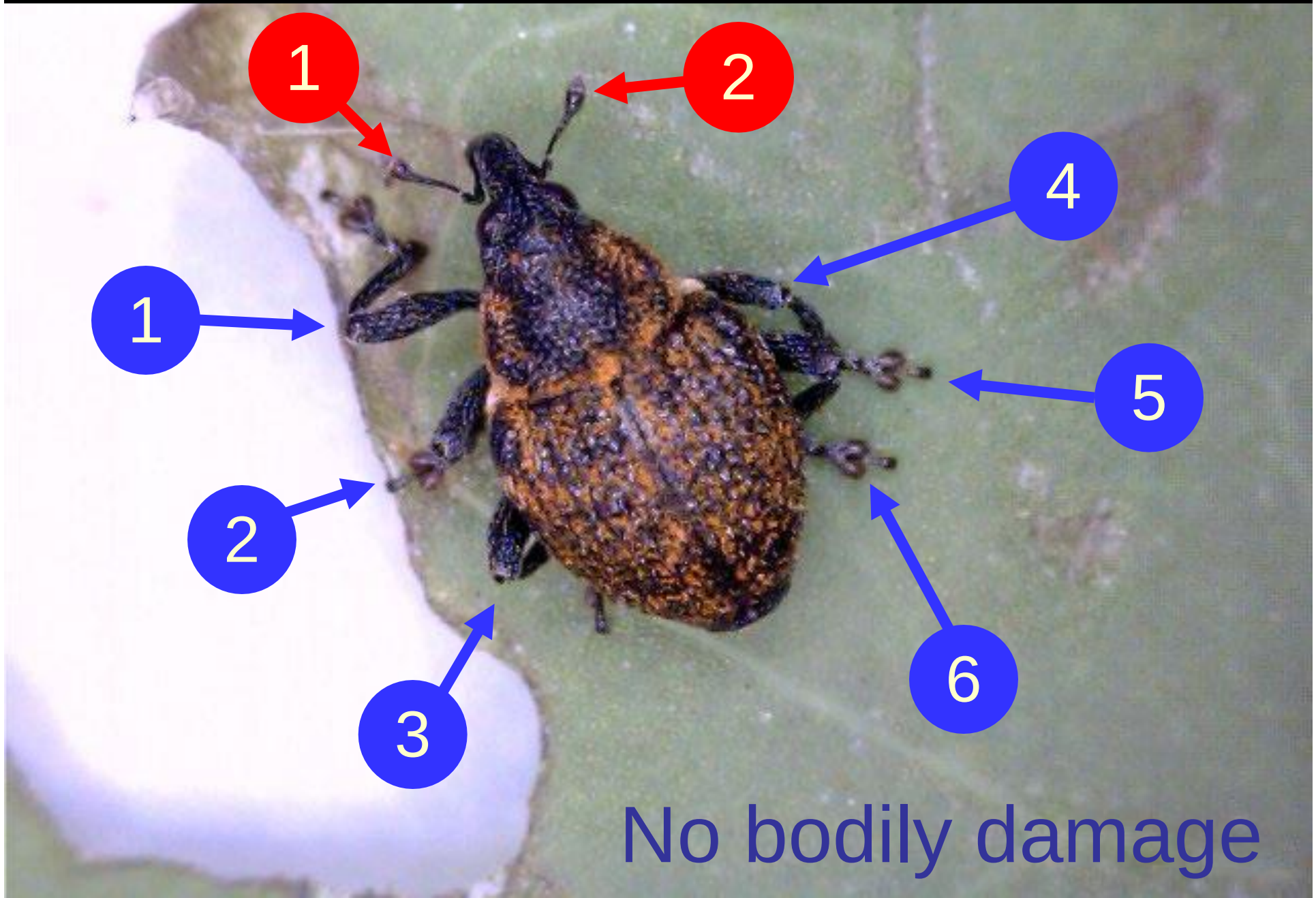
Large-Scale Test

UAS Equipped with Bug-Bomb Dispenser

Drone Equipped with Bug-Bomb Dispenser

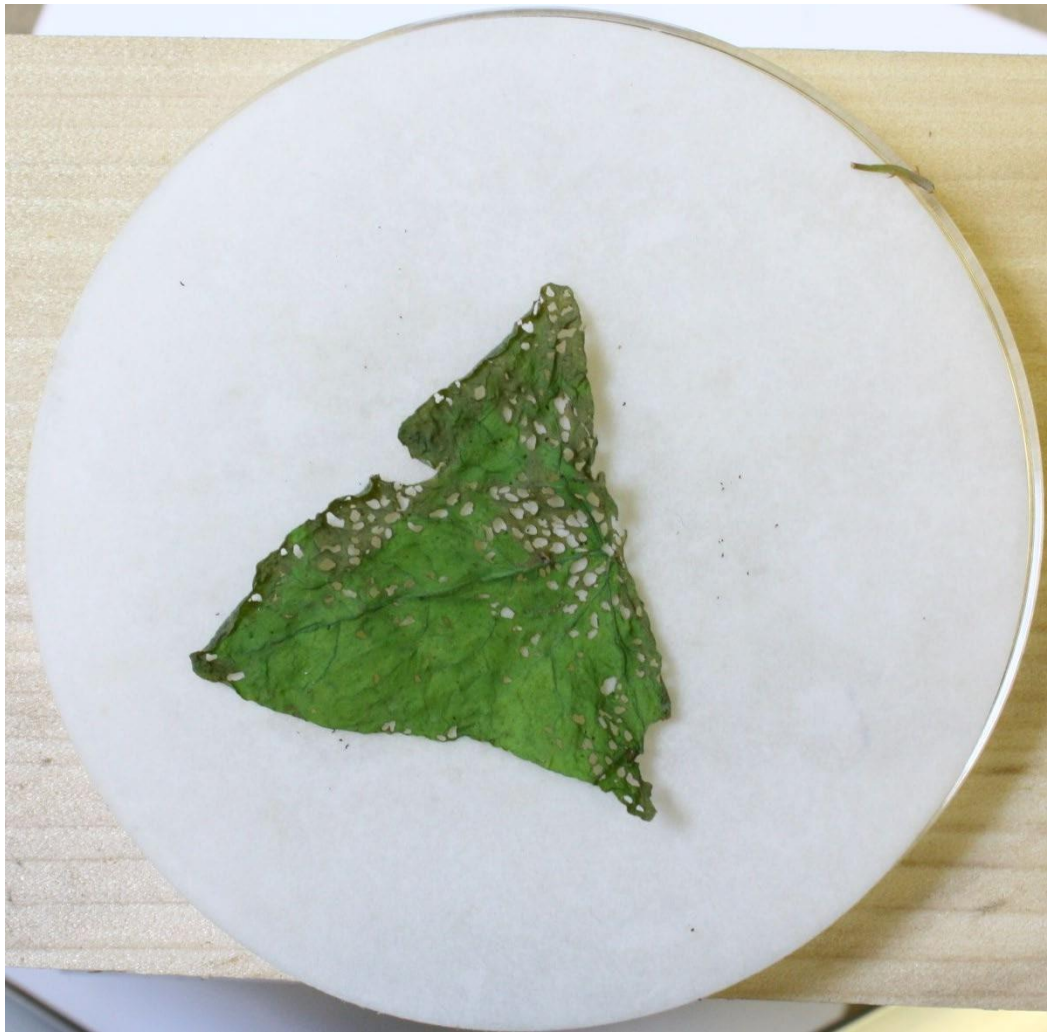
Aerial Release of Bug Bomb

Effect of Aerial Release on Weevils



Effect of Aerial Release on Weevils

Effect of Aerial Release on Weevils



Feeding:
No
effect

Effect of Aerial Delivery on Weevil Feeding

Effect of aerial release of *R. latipes* on post-release survivorship and feeding ability

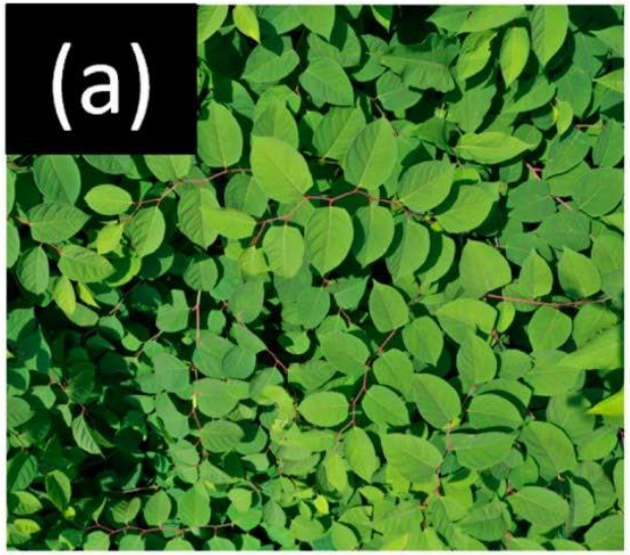
Study year and treatments[a]	Survivorship (%)[b]	Feeding amount in 15 days (cm^2 per weevil)
Trial 1 (2014)		
Release at 15 m	93.0 ± 5.13	4.5 ± 0.53
Release at 30 m	88.2 ± 7.07	4.9 ± 1.44
Control 1	91.3 ± 4.79	4.8 ± 1.16
Control 2	90.0 ± 4.08	4.2 ± 1.48
Trial 2 (2015)		
Release at 15 m	91.7 ± 7.77	4.6 ± 1.35
Release at 30 m	89.9 ± 8.31	4.1 ± 1.78
Control 1	87.5 ± 6.45	4.4 ± 1.01
Control 2	88.8 ± 8.54	4.2 ± 1.74

***No significant differences at* 5% error rate**

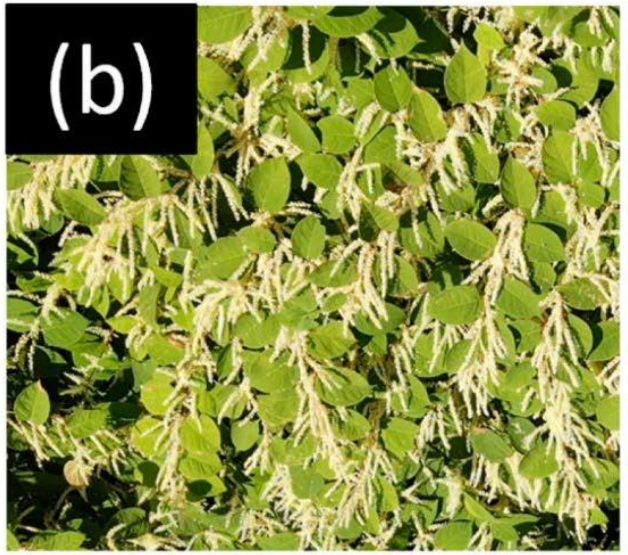
Park et al. 2018. Pest Management Science

Japanese Knotweed & Giant Knotweed

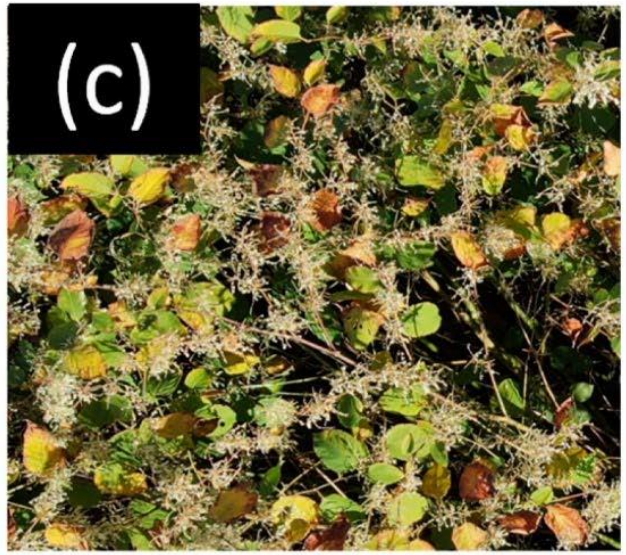
Japanese Knotweed Phenology



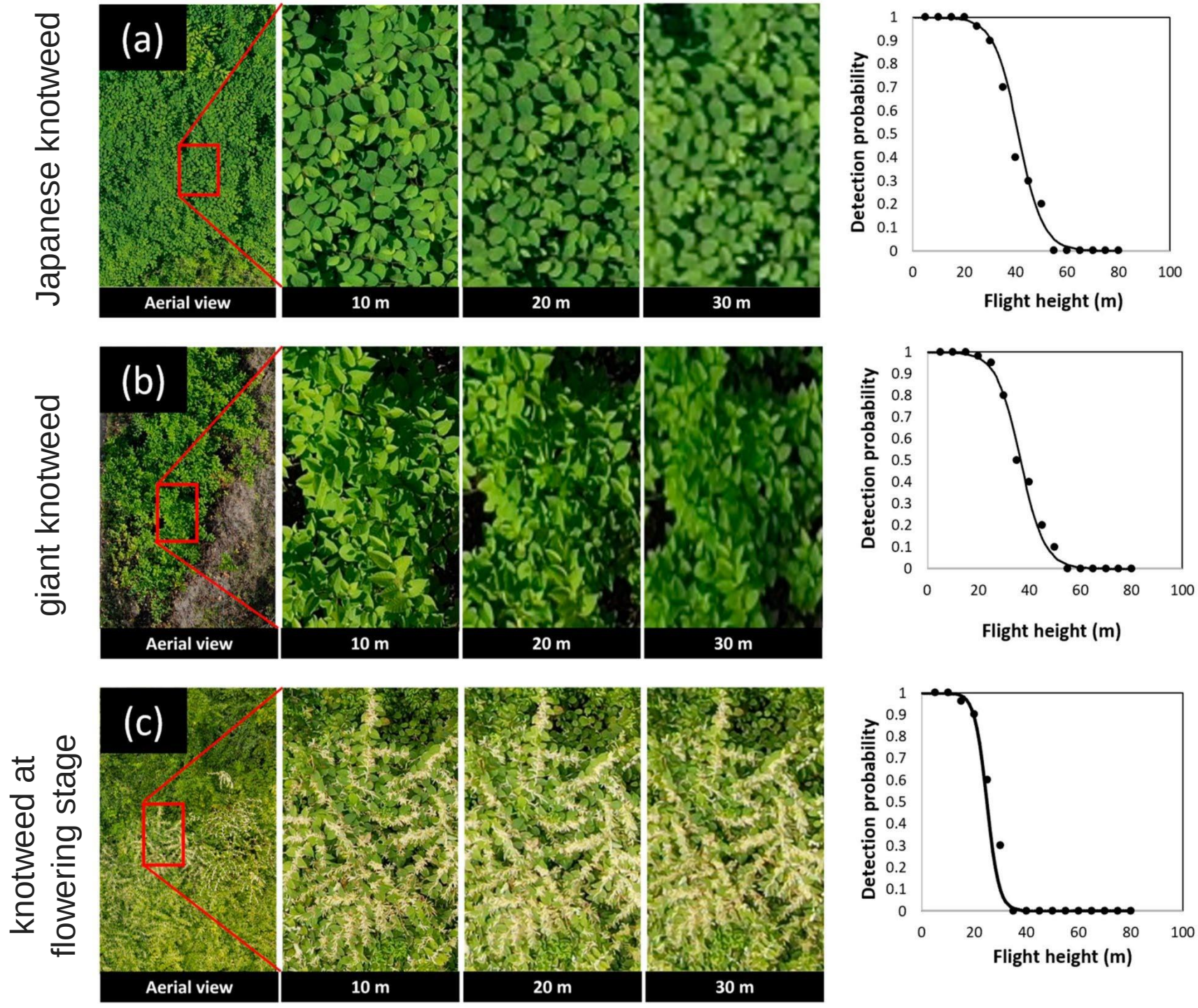
Vegetative stage



Flowering stage

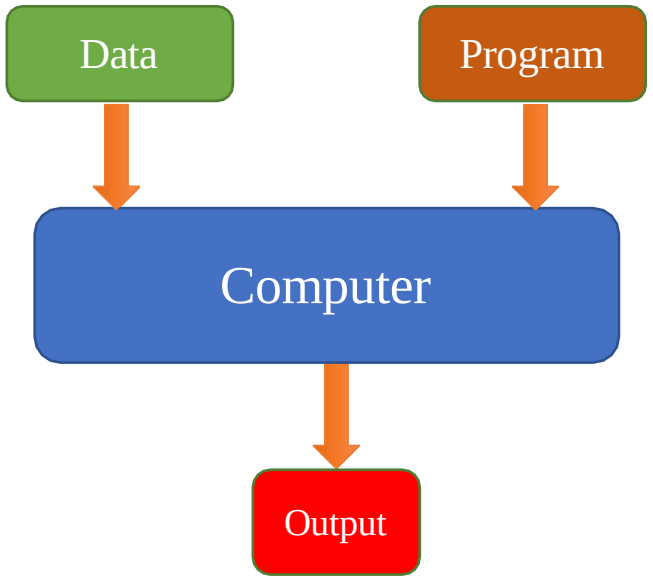


Seed cluster

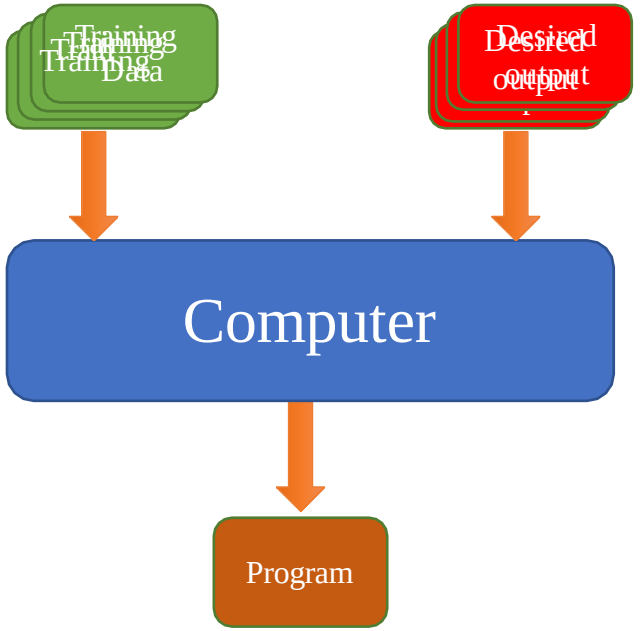

Japanese knotweed
(a)
Aerial view
10 m
20 m
30 m
Detection probability
Flight height (m)
giant knotweed
(b)
Aerial view
10 m
20 m
30 m
Detection probability
Flight height (m)
knotweed at flowering stage
(c)
Aerial view
10 m
20 m
30 m
Detection probability
Flight height (m)

Machine Learning Advantages

Algorithmic Solution



Machine Learning



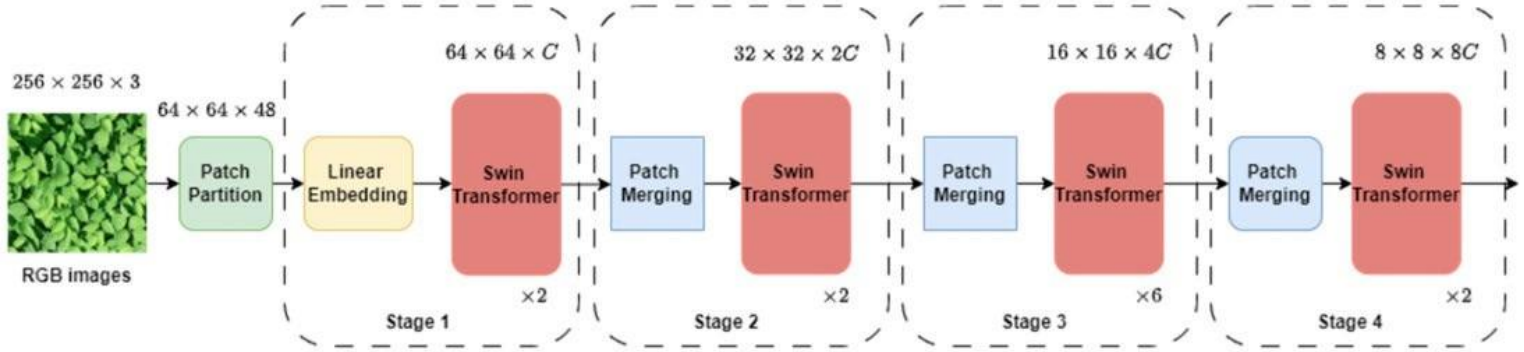
Aerial Images for Deep Learning

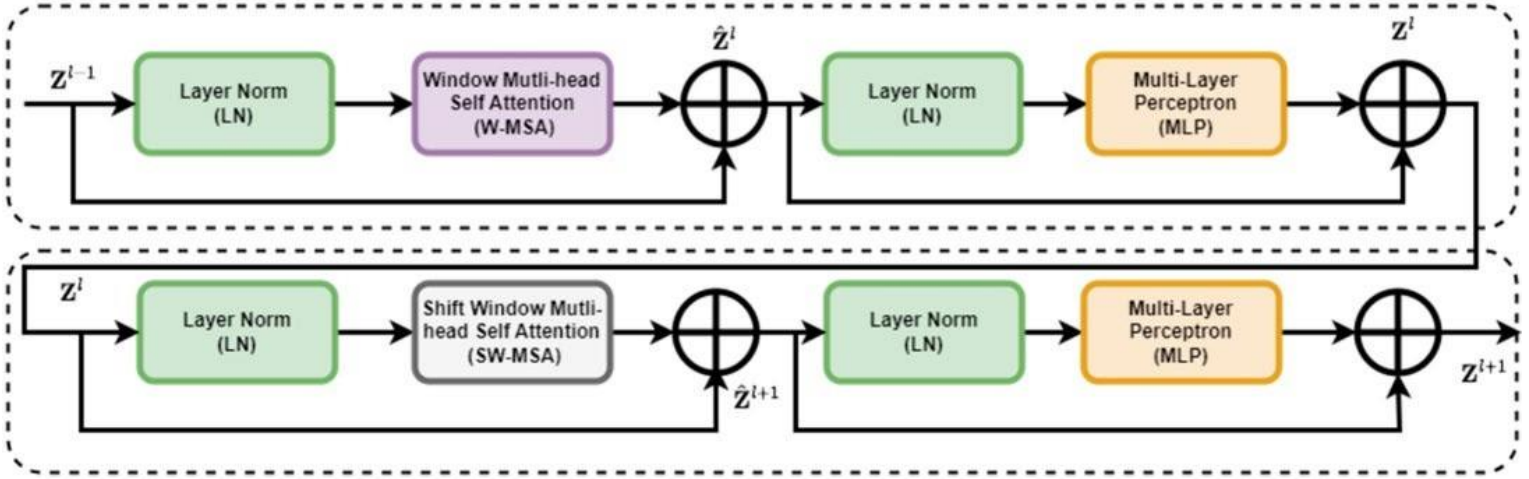
Number of aerial images used to train and validate deep learning capability

Category	Training Images	Validation Images	Testing Images	Total Images
Giant knotweed at the vegetative stage	5351	1528	764	7643
Japanese knotweed at the vegetative stage	7538	2154	1075	10,767
Knotweeds at the flowering stage	5827	1665	833	8325

SWIN Transformer

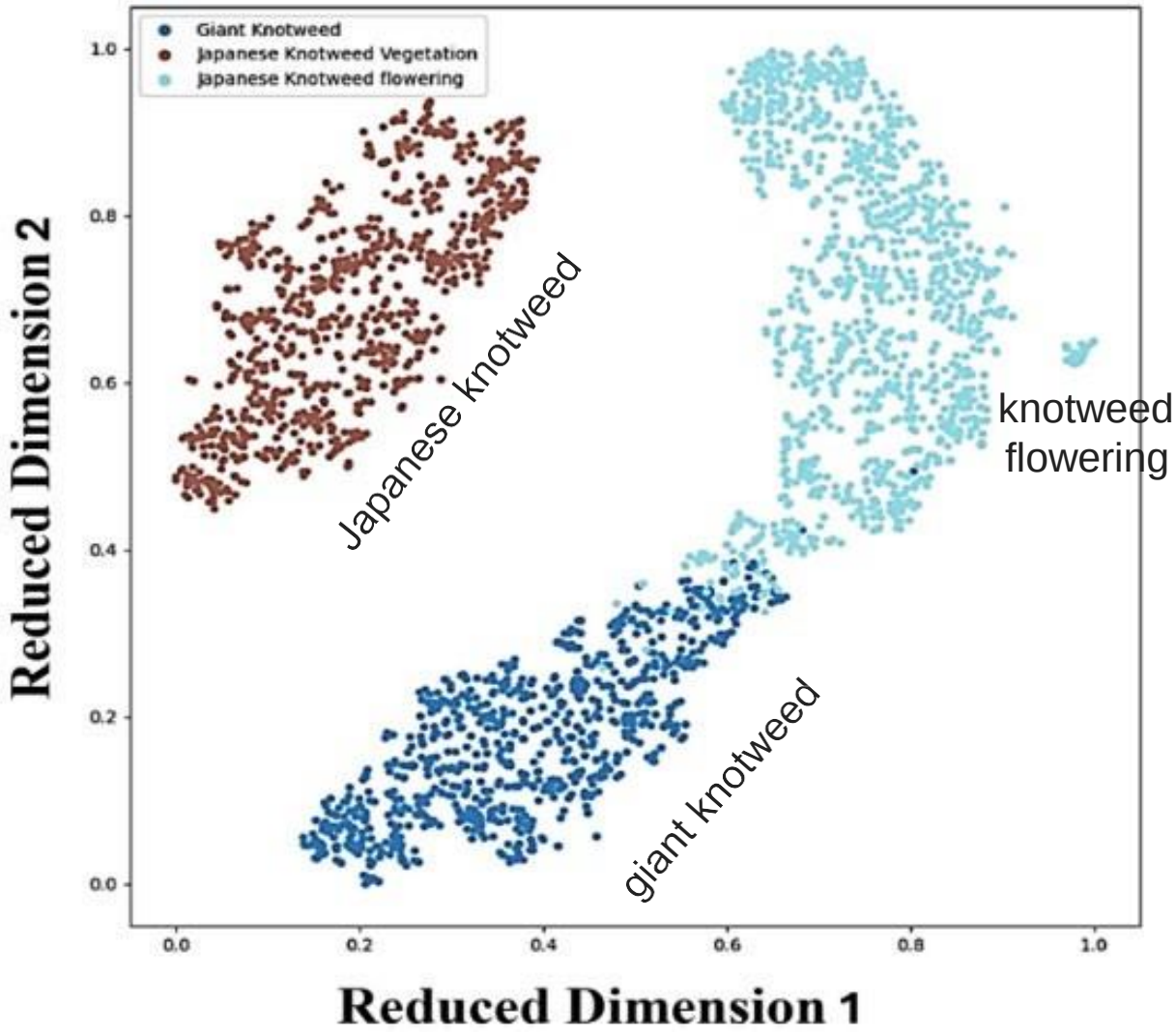
Swin Transformer network architecture





Enhanced feature extraction with two successive Swin Transformer blocks

t-SNE Plot for Feature Extraction

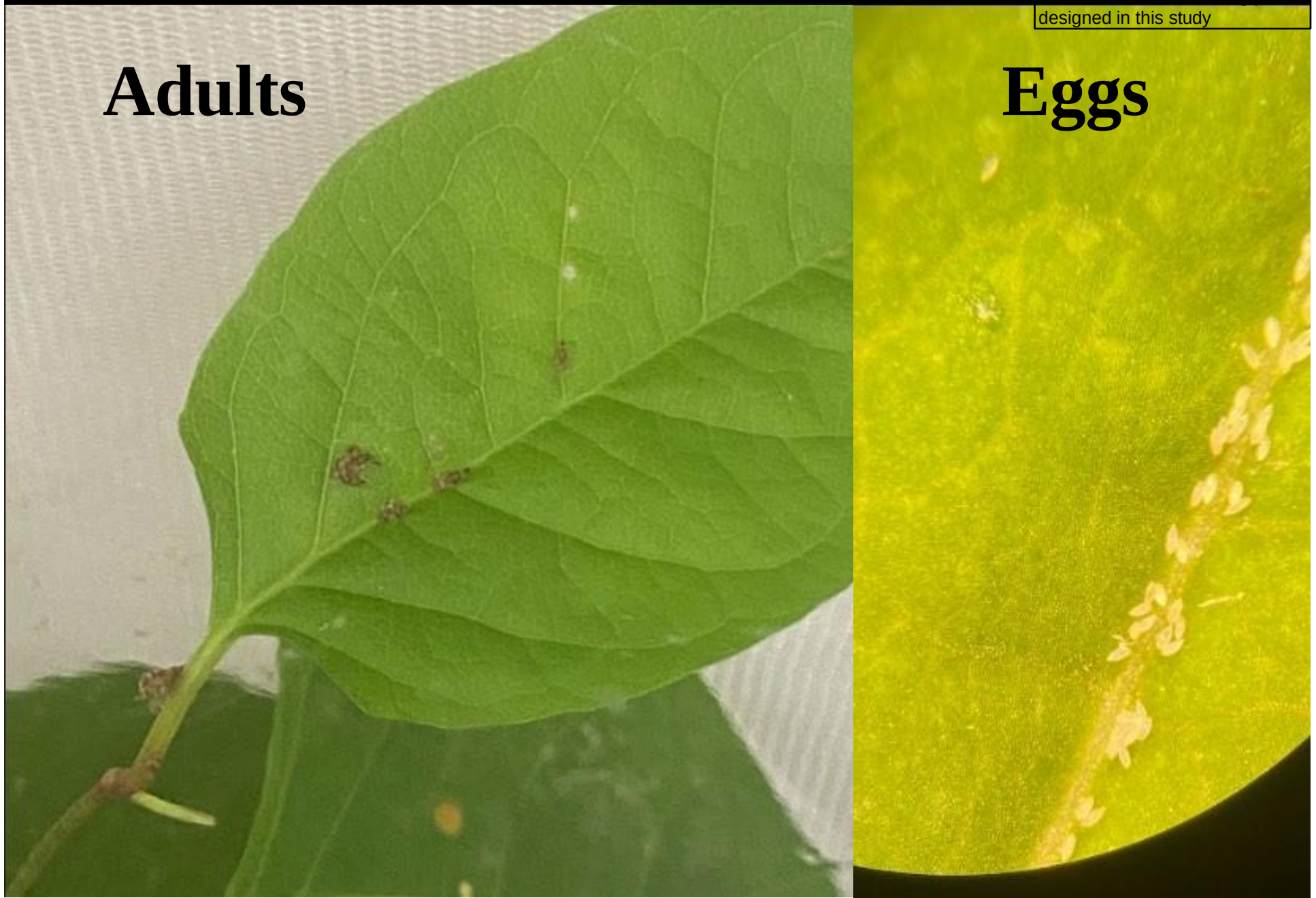


Valicharla et al. 2024. Drones

Knotweed Psyllid

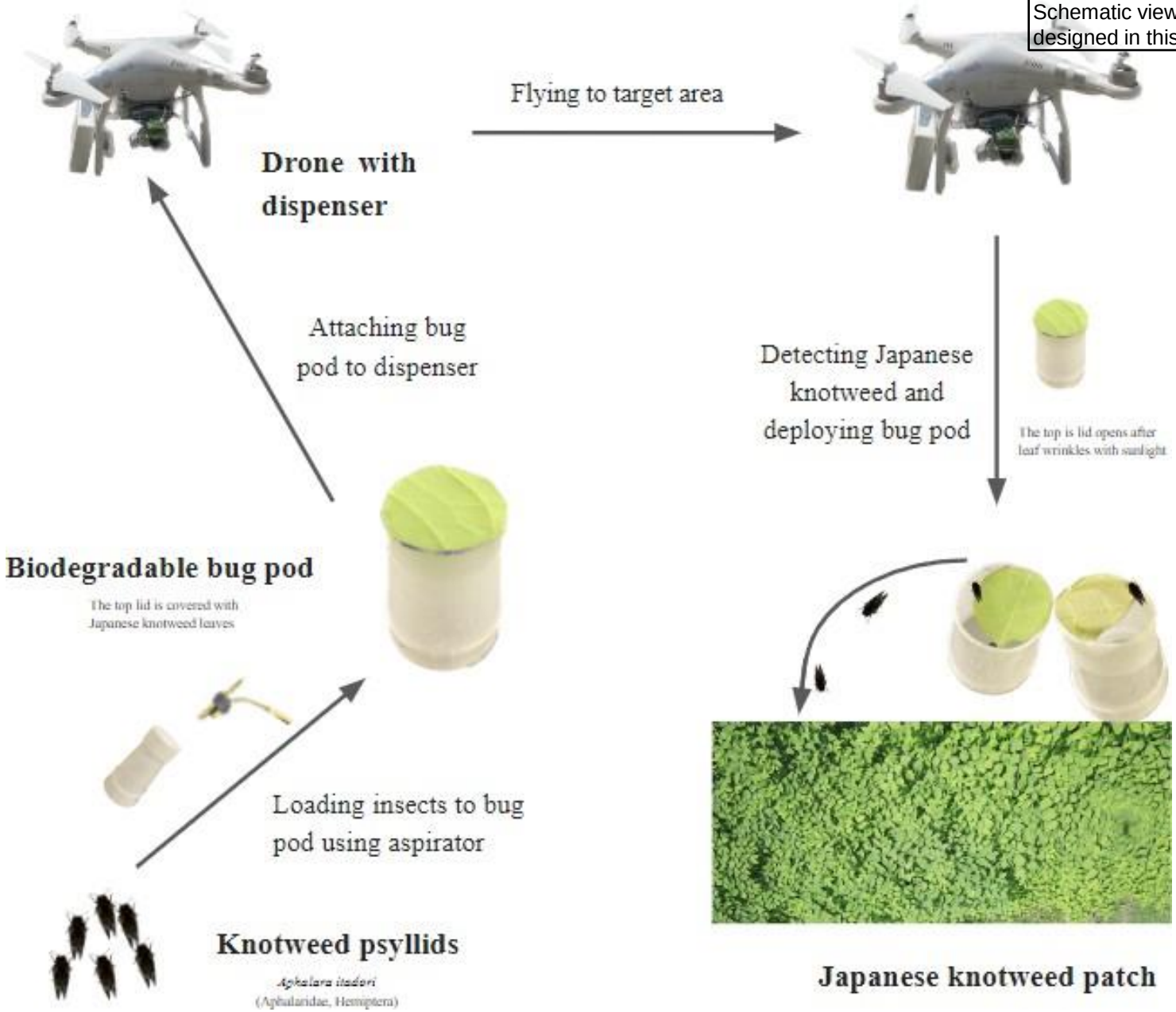
designed in this study

Knotweed Psyllid



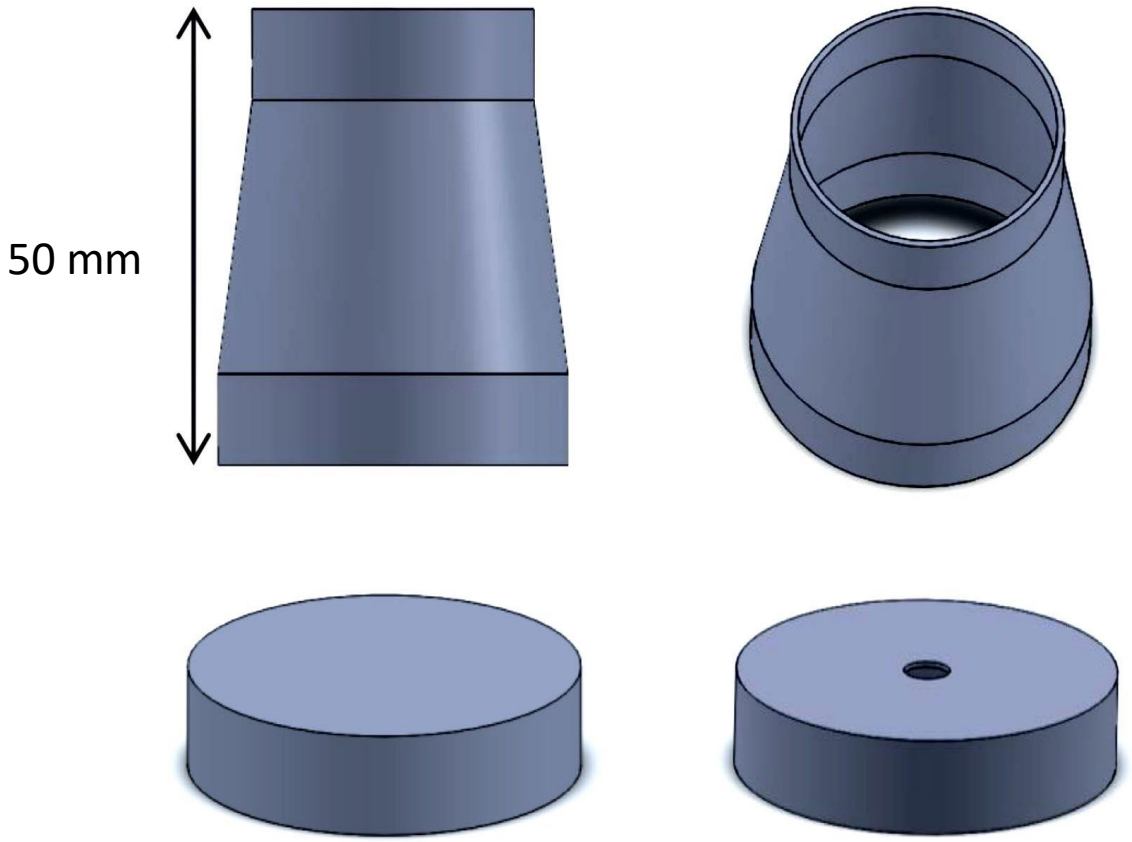
Presenter Notes
2024-12-03 16:57:37

Schematic view of the bug pod designed in this study

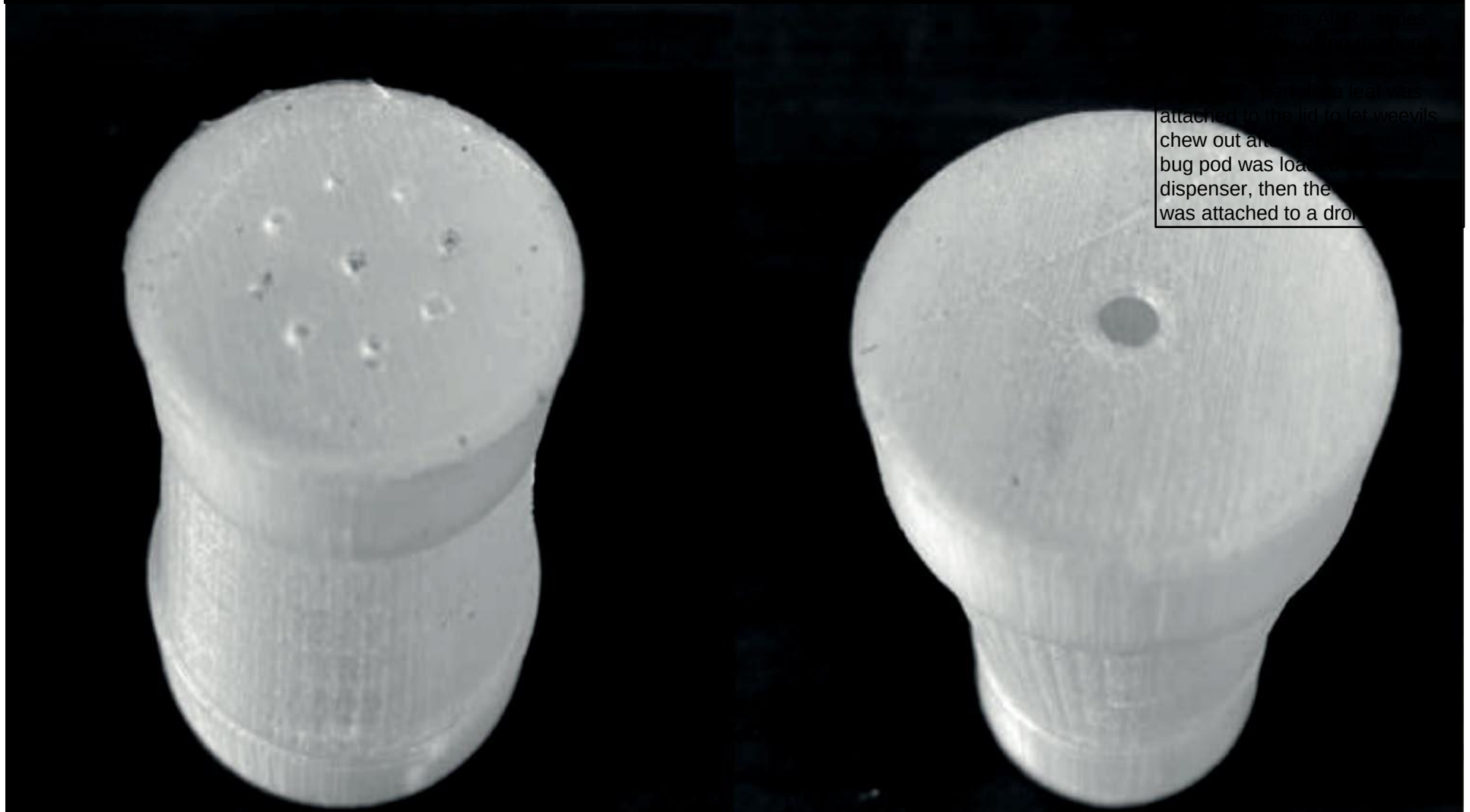


Bug Pod Design

designed in this study



Environmentally Friendly Bug Pods



Polyvinyl alcohol (PVA)

Presenter Notes
2024-12-03 16:57:37

Schematic view of the bug pod designed in this study

Presenter Notes
2024-12-03 16:57:37

Schematic view of the bug pod designed in this study

Checking Mortality after Aerial Release

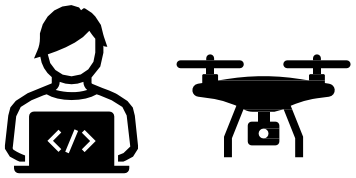
designed in this study

Successful for 3 weeks until storms hit

Next Generation Workforce Development

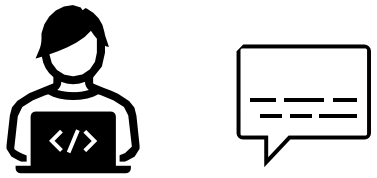
Operation → **Data Analysis** → **Interpretation**

Pilot Drone



Analyst Software

Expert Knowledge



Autopilot
Field protocols

Auto detection
Machine Learning

Generate experts
New workforce

Funding Agencies & Collaborators

West Virginia Univ.
Kushal Naharki
Roghy Karimzadeh
Nellie Heitzman
Erica Edigner
Jaewon Kim
Rakesh Chandran
Xin Li
Sruthi Valicharla
Srik Gururajan

U.S. Forest Service
Chris Hayes
Cindy Huebner
Rick Turcotte
Heather Smith

USDA APHIS
Colin Park
Joel Price

The Drones for Agriculture Project in Thailand

Preesan Rakwatin
Executive Vice President
Digital Economy Promotion Agency (depa), Thailand

Established under the Digital Economy Development for Economy and Society Act B.E. 2560 (2017)

- VISION
  - **“We work smart every day to build a world-class digital economy and help people perform better, think faster, and live better.”**

E EQUALITY

Q QUALITY

S SMART

S SERVICE-MINDED

S SIMPLIFIED

MISSION

Promote
investment and business operation on digital industry and innovation

Develop
national policies and plans on digital development

Co-operate
with other entities in digital industry and innovation development

Support
digital manpower development

Propose
law, regulation, measure, and sandbox recommendations

Upper Northern
Provincial Cluster Office

Center Northeastern
Provincial Cluster Office

Lower Northern Provincial
Cluster Office

Lower Northeastern
Provincial Cluster Office

HQ

Eastern Provincial
Cluster Office

Upper Southern Provincial
Cluster Office

Lower Southern
Provincial Cluster Office

Head Quarter & 8 Cluster Offices

Reinforcement

Promote Digital Industry & Innovation

Transform

Transform Businesses and Create New Growth Engines

Ecosystem

Enabling Digital Ecosystem

- HealthTech
- GovTech
- AgTech
- EdTech
- FinTech
- TravelTech

Digital Startups

Standard

Transform

- Agriculture
- SMEs
- Industry
- Community

Smart City

Digital Manpower

Basic → Intermediate → Advance/Expert

Digital Thailand

- Employment Rate
- Purchasing Power
- Quality of Life
- Strong Community
- Civil Society
- Sustainable Economic Growth

Thailand Digital Catalog

Product/ service	Hardware and Embedded Software	Software
Standard	dSURE dSURE dSURE	ISO 27001 ISO 20000 ISO 29110 CMMI
Privilege	❶ Access to **public procurement** both national and local levels; **Additional scores** in public procurement; BOI privileges in **smart city areas**; Access to **gov. Supporting measures**	❷ Registered as "Tax 200% entrepreneurs"

Thai digital providers
Supply

Demand
clients in industries

Public Sector	❶ Digital Providers **registered on Thailand Digital Catalog** → **Qualified** Products/service + **Procurement Standard Price** → Access to digital products and services **certified by the Comptroller General's Department**	
Private Sector	Hardware and Embedded Software **300% of tax deduction at the budget of 300,000 THB** (proposed as policy recommendation)	❷ Software **200% of tax deduction at the budget of 100,000 THB** (existing privilege per the 200% tax reduction program)
Individual	Access to qualified products and services **Certified with standards on safety and quality at reasonable price**	


depa




depa



DIGITIZED 2019
ดิป้า

ณได้ไปต่อ"

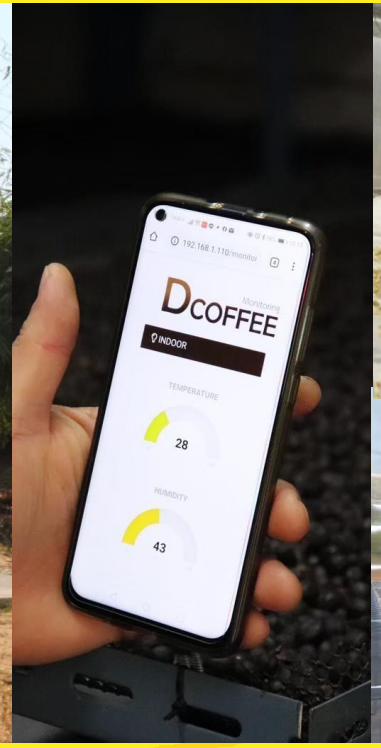


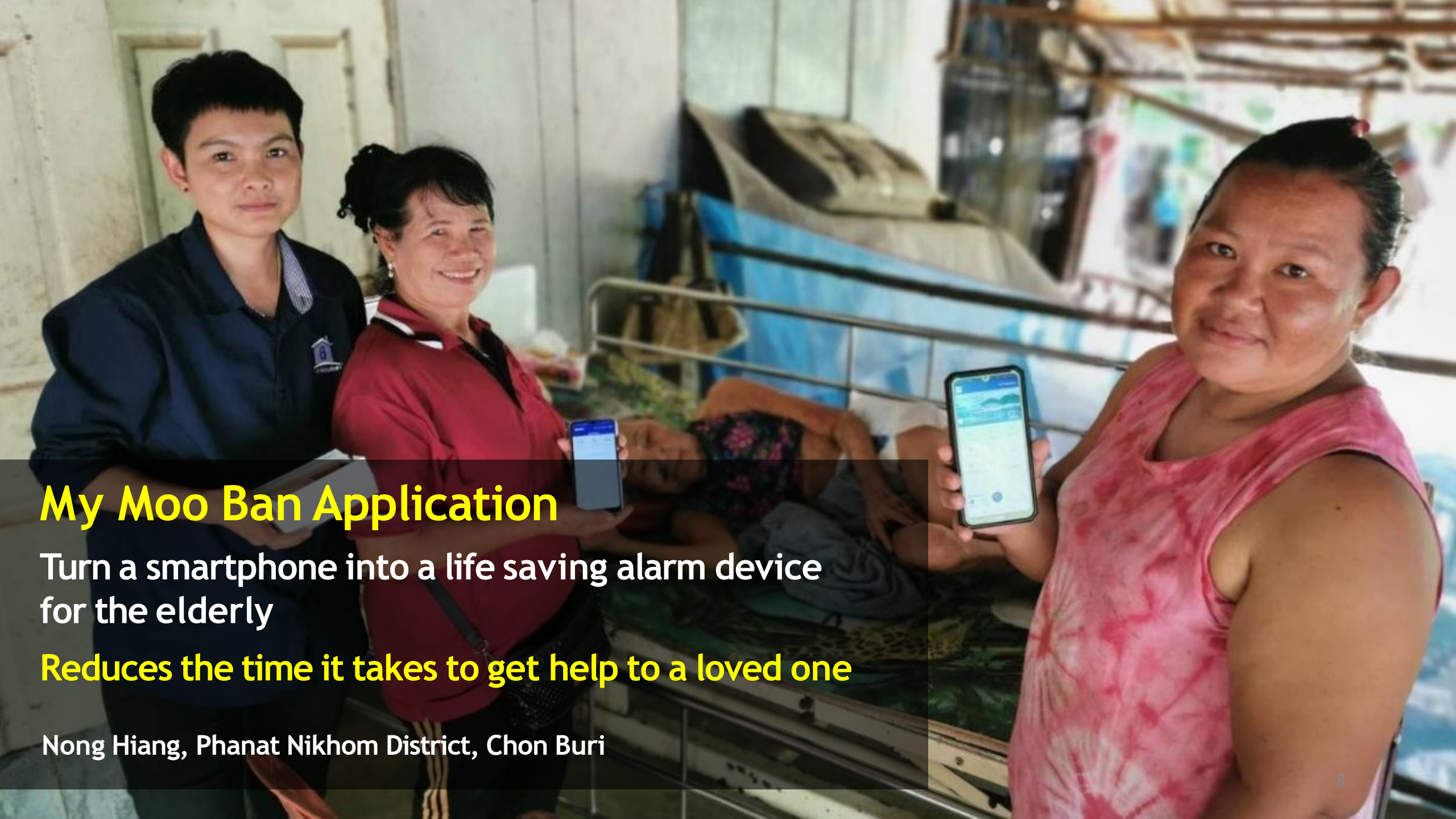





The Internet of things (IoT)

Smart Farms and Smart Communities





My Moo Ban Application

Turn a smartphone into a life saving alarm device for the elderly

Reduces the time it takes to get help to a loved one

Nong Hiang, Phanat Nikhom District, Chon Buri

New way of storytelling

Organizing tourism information by local communities in Tha Chalom Subdistrict, Samut Sakhon Province, in a digital format.

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Winner in the category United Nations Public Service Awards 2022

Fostering innovation to deliver inclusive and equitable services

Koh Libong Community: Digital Transformation for Smart Environment

Community enterprises, Tourism and career development Koh Libong, Kantang, Trang




Illegal fishing has led to the destruction of natural resources.

Manatees died in accidents on community tour boats.

Manatees die from manatee poaching

High cost of fuel for tourist boat service

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Answer and Solve 4 issues

Technology “Drone”

Impact

Reduced illegal fishing has resulted in the restoration of dugongs and marine animals.

Tourism has increased as housing and manatee sightings have improved

From the increase in tourism. The local economy has also improved. The increased revenue made it possible to provide more public services on the island.

Related SDGs:

8 DECENT WORK AND ECONOMIC GROWTH

11 SUSTAINABLE CITIES AND COMMUNITIES

14 LIFE BELOW WATER

15 LIFE ON LAND

17 PARTNERSHIPS FOR THE GOALS

The only one

In Thailand to receive this year’s award.

In the world to receive such award.

Total Agricultural Land Area

153,184,527 ไร่

Cultivated area

77,743,698 ไร่

50.75%

Forest, Non-cultivated, and Perennial Area

72,810,928 ไร่

47.53%

Conserved Area

2,629,901 ไร่

1.72%

กลุ่มเกษตรกร

8,037,932 ครัวเรือน | **9,202,664** ราย

Drone use in agriculture

โดรนเพื่อการเกษตร **9,063** ลำ

Annual growth rate **88%**

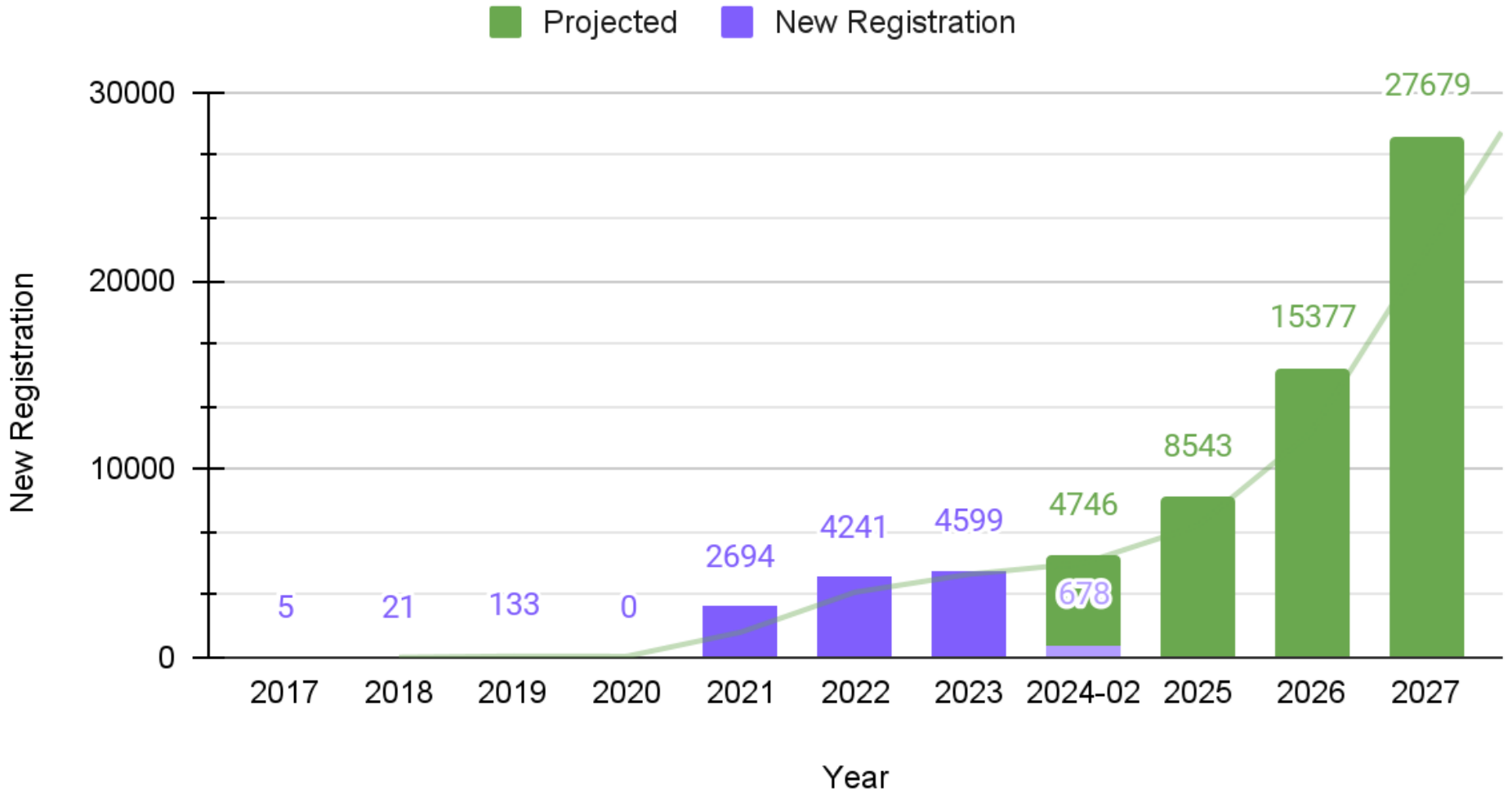
คาดจะมีโดรนเกษตรไม่น้อยกว่า **80,000** ลำ

Challenges in Thai agriculture sector

- High cost of cultivation
- Shortage of Labor and skills
- Limited access to digital technology
- Insufficient government support allied with farmers needs conservation

แหล่งที่มาข้อมูล :สำนักงานเศรษฐกิจการเกษตร กระทรวงเกษตรและสหกรณ์ ปี 2566

Agricultural Drone Registration as of Feb 15, 2024 (NBTC)



กระทรวงดิจิทัล เพื่อเศรษฐกิจและสังคม
depa
กองทุนดิจิทัล

Project Overview
One Tambon One Digital (Chumchon Drone Jai)

Establish drone repair centers

50

centers

Promote the use of agricultural drones in

500 **Communities**

covering an area of **4** **Million Rai**

Collaborate with the private sector to establish licensing examination centers

50

nationwide

Phitsanulok
Khon Kaen
Ubon Ratchathani
Chonburi
Songkhla

Develop the skills of

1,000

drone pilots

100

repair technicians

Elevate the standards of digital technology products through

dSURE

Qualifications for Communities Joining the Project

Communities Prepared for Investment

At least **40%**

The community must be officially established and recognized by the government.

Must own an area of at least 4 rai for training purposes.

Must consist of at least 20 households.

community economic groups, village funds, cooperatives, or associations representing large agricultural communities.

Located near at least one support service center.

Must have two representatives trained as drone pilots.

Communities Prepared for Investment

For drones up to 11 liters: Communities must contribute **50,000 Baht**.

For drones larger than 11 liters but not exceeding 17 liters: Communities must contribute **90,000 Baht**.

เงื่อนไขการชำระเงิน

Activity: Upgrading Existing Repair Centers into New Business Change Agents

1 Repair Centers

10 Communities

Each community must have at least 20 households

\+

Agricultural Area

4 rai

Target group

- Technicians specializing in electrical, mechanical, or digital services
- Community-based repair technicians

50 ศูนย์ซ่อม

Repair and maintenance services

Sale channels

Coordinating communication

Qualifications for Community Technicians Joining the Project

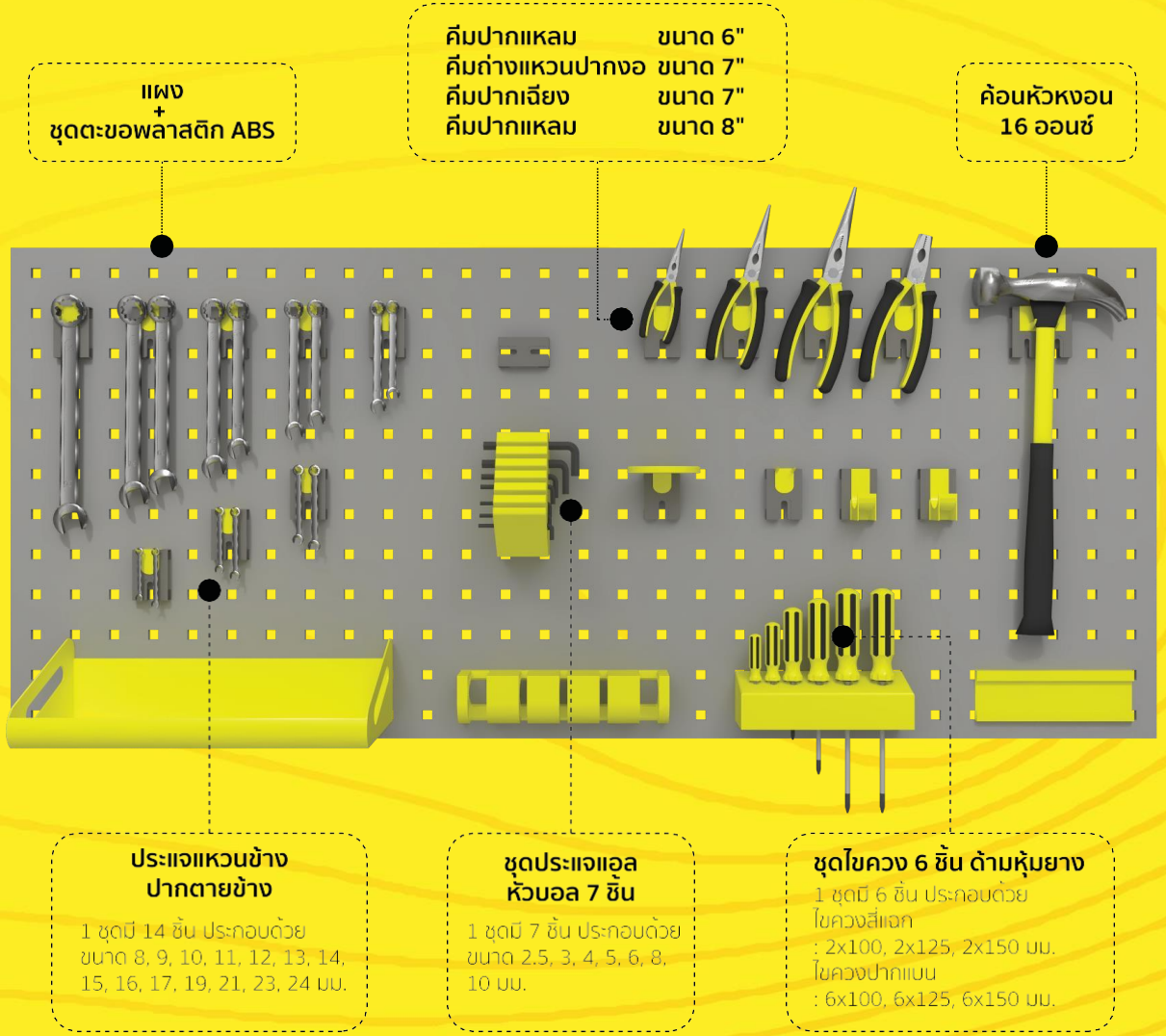
Must participate in training programs specified by the authorities.

Operate a repair service shop serving the local community

Own a service area of at least **40 square meters** for repairs.

Have at least **two technicians** designated as representatives

Be part of a community network capable of providing repair and maintenance services



Conditions for Transferring Drone Usage Rights for Agriculture

Provide drone services for agricultural spraying to members and other farmers.

The services must cover a total area of at least

2,500 rai

within **1 year**.

Participate in the cost-sharing for adapting drone technology in agriculture.

Contribution rate:

At least **40%.**

Group Representative

2 persons

Must complete training and obtain official certification from the authorities.

Economic and Social Impact

Project Partners

Value exceeding

20,000

million Baht

Reduce work time

Generate income and create jobs

Reduce costs and save expenses for farmers

Enhance quality of life by lowering injury and mortality rates from chemical usage

Improve productivity and cultivation efficiency

Promote the use of agricultural drones




Establish drone repair centers

THAILAND AGRICULTURE DRONE COMPETITON 2024

THANK YOU

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ASEAN FAW ACTION PLAN
Supporting IPM Across Southeast Asia

Closing thoughts

Supported by
Australian Government
Department of Foreign Affairs and Trade

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Thank you to our speakers today:

Next-Generation Pest Management Tools: Drones + Sensors + Artificial Intelligence + Natural Enemies

Professor Yong-Lak Park, West Virginia University, USA.

The Drones for Agriculture Project in Thailand

Preesan Rakwatin, Executive Vice President, Digital Economy Promotion Agency (depa), Thailand

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Drones and Digital IPM

A recording of the webinar will be made and be distributed

See www.aseanfawaction.org/drones-and-digital-ipm

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