FOREST LEARNING

SHE MAPS

DRONES IN FORESTRY

LESSON SEQUENCE

Years 5-6

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All units of work designed and created by She Maps are linked to the Australian Curriculum across multiple learning areas both inside and outside the STEM-identified subjects.

By using these programs you help to equip your students with the necessary STEM skills and knowledge that will enable them to engage with the careers of the future.

Working in collaboration with schools we set out to achieve the five strategies of action outlined in the Australian STEM education strategy.

This includes:

1. Increasing student STEM ability, engagement, participation, and aspiration
2. Increasing teacher capability and STEM teaching quality
3. Supporting STEM education opportunities within school systems
4. Facilitating effective partnerships with tertiary education providers, business and industry
5. Building a strong evidence base.

Digital Systems For Sustainable Forestry Years 5 & 6 Unit Overview

Sustainable forests are managed using a variety of digital systems including drone and satellite technologies. This unit has been designed in modules to cater for equipment access, time constraints and curriculum requirements. Over the entire unit, students will learn the different ways that digital systems assist Australian forestry workers, design and implement their own drone mission to solve a forestry problem and design and create a game-like app to reinforce understanding of drone mapping and STEM concepts.

LEARNING INTENTION

Learn about how digital systems are used in forestry and apply understanding to a simulated forestry problem.

SUCCESS CRITERIA

- Research ways that Australian forests were managed in the past.
- Research the ways digital systems assist Australian forestry workers manage the forest environments that provide sustainable resources for society.
- Conduct a case study of a forestry worker and create a biography to explain how she uses digital systems to assist in her work.
- Define, design and implement a flight path for a drone in a simulated forest environment.
- Define, design and implement a visually programmed drone app.
- Share apps with an authentic audience.

RESOURCES

Assessment rubric

Module 1:

Digital device with Internet access.

Classroom display screen.

StoryMap - Digital Systems for Sustainable Forestry

Early Forestry – Student response booklet

Module 2:

Digital device with Internet access.

Classroom display screen.

StoryMap - Digital Systems for Sustainable Forestry

Drones in Forestry poster

Digital Systems in Forestry – Student response booklet

Guess the word sets A and B

Module 3:

Digital device with Internet access.

Classroom display screen.

StoryMap – Case Study of Sarah Maddison

Sarah Maddison Case Study – Student response booklet

Module 4:

Class set of drones and digital devices (1 per 2-3 students)

Epicollect 5 app or pre-flight safety checklist

Drawing app/materials

Drone control app with visual programming e.g. Droneblocks, Tello Edu – App store Google Play store

Optional image mat

Module 5:

Class set of digital devices (1 per 2-3 students)

Drawing app/materials

Visual programming app/access e.g. Scratch

Student self reflection sheet

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KEY

HASS	TECHNOLOGIES	MATHEMATICS

See curriculum mapping document for details of Content descriptions and Achievement standards.

UNIT SEQUENCE			
STRANDS AND SUB-STRANDS	**KEY IDEAS AND CONCEPTS**	**LESSON SEQUENCE**	**ACTIVITIES AND ASSESSMENT OPPORTUNITIES**

Questioning
Researching
	• **Continuity and change**
	• **Place and space**
	• **Interconnections**
		Module 1. Early Forestry – Delving into Australia's past
		StoryMap research (2 x 50 mins)
		• Go through the StoryMap activity briefly with students and discuss how they will learn about colonial and early 20th century forestry practices.
		• Put students into pairs and have students record information either digitally in the provided Early Forestry – Student response booklet or in their notebooks as they work through the StoryMap activity.
		• The StoryMap activity could be conducted as a jigsaw activity where students research one aspect of forestry and report back to the whole class. Alternatively, students can conduct research on all sections in the StoryMap:
		  • Logging methods
		  • Haulage
		  • Milling methods
			Formative – students responses to prompts and booklet
			
			Resources
			Digital Systems for Sustainable Forestry StoryMap
			
			Early Forestry – Student response booklet

Questioning	• **Place and space**
	• **Interconnections**
		Module 2. Digital Systems in Forestry – Establishing Prior Knowledge
		Class discussion (10 mins)
		• Ask students:
		  • What do you think is meant by sustainable forestry?
		  • What digital systems do you think are used in modern forestry?
		• Write brainstormed ideas on whiteboard or record digitally on screen.
			Formative – student responses

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STRANDS AND SUB-STRANDS	KEY IDEAS AND CONCEPTS	LESSON SEQUENCE	ACTIVITIES AND ASSESSMENT OPPORTUNITIES

Researching
Statistics and probability
Knowledge and Understanding
• **Digital systems**
	• **Place and space**
	• **Interconnections**
	• **Understanding**
	• **Digital systems**
	• **Impact**
		Module 2. Digital Systems in Forestry – Getting the Facts
		StoryMap research (2 x 50 mins)
		• View the Drones in Forestry poster and go through the Digital Systems for Sustainable Forestry StoryMap activity briefly with students and discuss how they will learn about how digital systems are used in forestry.
		• Put students into pairs and have students record information either digitally in the provided Digital Systems in Forestry – Student response booklet or in their notebooks as they work through the StoryMap activity.
		• The StoryMap activity could be conducted as a jigsaw activity where students research one aspect of forestry and report back to the whole class. Alternatively, students can conduct research on all sections in the StoryMap:
		  • Digital systems in forestry (overview - This is an immersive 360° video that allows you to explore forests and machines within the 360° space using your mouse of magic window of an iPad/smart phone.)
		  • Barcodes for tracking timber
		  • Automated Optimisers
		  • GPS Tracking Systems
		  • Drones in Forestry
			Formative – students responses to prompts
			
			Resources
			Digital Systems for Sustainable Forestry StoryMap
			Digital Systems in Forestry – Student response booklet
			
			Drones in Forestry poster
			
			Note for teacher: How to use the Forest Learning VR synchronisation tool

Analysing **Evaluating and reflecting** **Knowledge and Understanding** • **Digital systems**	• **Place and space** • **Digital systems** • **Impact**	**Module 2. Digital Systems in Forestry – Revising the Vocabulary – Guess the Word** *Vocabulary game played - student pairs (20 mins)* • Students sit in pairs with a visual barrier between them so that each cannot see the other student's clue sheet. Give one student the 'Guess the Word Set A' sheet. Give the other student the 'Guess the Word Set B' sheet. Guess the word sets A and B • Taking it in turns, each student provides a definition of the word (concept) from their sheet without saying the actual word to the other student to guess and scores them for each word correctly chosen.	**Formative** – students responses to activity **Resources** Guess the word sets A and B

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STRANDS AND SUB-STRANDS	KEY IDEAS AND CONCEPTS	LESSON SEQUENCE	ACTIVITIES AND ASSESSMENT OPPORTUNITIES

Researching
Knowledge and Understanding
• **Digital systems**
	• **Place and space**
	• **Interconnections**
	• **Digital systems**
	• **Impact**
		Module 3. Case Study of Sarah Maddison
		StoryMap research (50 mins)
		• Go through the Case Study of Sarah Maddison StoryMap activity with students and discuss how they will learn about how Planning Forester Sarah Maddison uses digital systems to assist her with her work.
		• Play the video "An interview with Sarah Maddison" and make a concept map or table on the whiteboard to organise the information into the following categories:
		  • Geographic Information Systems (GIS)
		  • UAVs (drones)
		  • Data capture
		  • Hazards
		• Put students into pairs and have students record information either digitally in the provided Case Study – Student response booklet or in their notebooks as they work through the StoryMap activity.
		• Students create a biography of Sarah Maddison based on the answers from the video prompt and include geographical and technical data and information.
			Formative – students responses to prompts
			
			Resources
			Case Study of Sarah Maddison StoryMap
			
			Sarah Maddison Case Study – Student response booklet

Processes and Production Skills • **Collecting, managing and analysing data**	• **Data collection**	**Module 4. Design and Implement a Flight Path for a Drone Mission Simulation – Setting up the Drone Mission** *Complete drone safety checklist in student groups of 2 or 3 (5 mins)* • Explain to students that they are going to complete a drone mission. Provide context for the mission. For example, plan a mission to identify which trees are not healthy and need attention, or to check habitat trees for wildlife presence. • Using either Epicollect 5 (search for She Maps MINIDRONE PREFLIGHT CHECKLIST) or a (laminated) printout of the pre-flight safety checklist, lead students through their drone safety checklist.	**Summative** – completed pre-flight safety checklist **Resources** Video - Jack Carter ForestVR - wildlife surveillance pre-flight safety checklist Epicollect 5 (search for She Maps MINIDRONE PREFLIGHT CHECKLIST)
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Investigating and defining** • **Generating and designing**	• **Place and space** • **Understanding** • **Problem solving** • **Specification** • **Algorithms**	**Module 4. Design and Implement a Flight Path for a Drone Mission Simulation – Plan the Drone Mission** *Draw drone flight path and step out path in groups of 2 or 3 (15 mins)* • Using your chosen contextual mission with either an image mat or a simulated course with blocks and other objects, students will plan their drone mission. For example, plan a mission to identify which trees are not healthy and need attention. The ForestLearning video of Sarah Maddison in module 3 will provide guidance as to the types of missions students could complete.	**Formative** – drawn drone flight path **Resources** image mat or simulated course

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STRANDS AND SUB-STRANDS	KEY IDEAS AND CONCEPTS	LESSON SEQUENCE	ACTIVITIES AND ASSESSMENT OPPORTUNITIES
		• Students design their flight path using drawing tools and take it in turns to step out their mission to determine distance and types of turns required by their drone to complete the mission. Discuss with students which flight path would be most efficient to gather the data. For example, should they fly their drone in a spiral format, use backwards and forwards movements as a lawnmower would to mow a yard or use a zig-zag formation? Students can step out their planned path to see which is most efficient to cover most ground with shortest distance travelled (to save battery on the drone). • Remind students to add crosses in their mission path to indicate where they intend to photograph the forest or tree.	
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Generating and designing** • **Producing and implementing** • **Evaluating**	• **Place and space** • **Understanding** • **Problem solving** • **Algorithms** • **Implementation** • **Interactions**	**Module 4. Design and Implement a Flight Path for a Drone Mission Simulation – Code the Drone Mission** *Code and test (iteratively) drone flight path in groups of 2 or 3 (30 mins)* • Using your app of choice (for example, Tello Edu or Droneblocks), students visually program sections of their path and test the code iteratively until they have coded the whole mission. • Remind students to add code blocks in their mission code to photograph the forest.	**Formative** – coded drone flight path
Evaluating and reflecting Processes and Production Skills • Evaluating	• **Place and space** • **Impact**	**Module 4. Design and Implement a Flight Path for a Drone Mission Simulation – Complete the Drone Mission** *Demonstrate drone mission in groups of 2 or 3 (30 mins)* • Student groups take it in turns to demonstrate their successfully coded missions.	**Summative** – demonstration of successful drone mission
Evaluating and reflecting **Processes and Production Skills** • **Investigating and defining**	• **Place and space** • **Specification**	**Module 5. Design and Implement a Visually Programmed App – Setting the Scene** *Class and small group discussion (30 mins)* • Say to whole class: 'One of the reasons we use computers is to automate solutions and save time. We are going to create an app to help others plan their drone missions to survey a forest. The purpose of our app is for users to decide which will be the most suitable path or pattern for their drone to follow to survey the forest efficiently without hitting any trees. You are going to design three different paths for users to test. How will you design your app so it's challenging, yet easy to use?' • In groups of 2 or 3, students discuss what they will need to consider to make their app successful and create a list of all elements they consider important.	**Formative** – student responses

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STRANDS AND SUB-STRANDS	KEY IDEAS AND CONCEPTS	LESSON SEQUENCE	ACTIVITIES AND ASSESSMENT OPPORTUNITIES
		• Regroup the whole class and write a summary list on a whiteboard/digital screen capturing all the elements students considered important. Ensure students have listed the following (if not prompt them further to suggest them): • appealing interface with clear text and images including attention paid to size and space to limit clutter on screen. What icons and text will be needed? • user input controls – pop up box with question or button-activated actions for three options • algorithms to make the whole app work • coded instructions (algorithms) for three options • control structures, variables and operators required to control algorithms for each of the three options.	
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Investigating and defining** • **Generating and designing**	• **Place and space** • **Understanding** • **Problem solving** • **Specification** • **Interactions**	**Module 5. Design and Implement a Visually Programmed App – Designing the User Interface** *Use drawing tools (digital preferable) - student groups of 2 or 3 (30 mins)* • In their groups, students draw their user interface for the app, paying attention to clear text and images, size and space of icons and text.	**Summative** – group user interface designs
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Generating and designing**	• **Place and space** • **Understanding** • **Problem solving** • **Specification** • **Algorithms**	**Module 5. Design and Implement a Visually Programmed App – Designing the User Inputs and Algorithms** *Use drawing tools in student groups of 2 or 3 (30 mins)* • In their groups, students draw diagrams to represent the algorithm required for the whole app and each of the three options. Students can refer to the app maker program e.g Scratch, to see what code blocks are available. Students can work together to design algorithms for the whole app or work alone on a section and combine sections into a whole app algorithm once complete.	**Summative** – group algorithm plans
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Producing and implementing** • **Evaluating**	**Place and space** • **Understanding** • **Problem solving** • **Algorithms** • **Implementation** • **Impact** • **Interactions**	**Module 5. Design and Implement a Visually Programmed App – Implementing the algorithms** *Code the app with a visual program in student groups of 2 or 3 (60-120 mins)* • Using a visually programmed environment e.g. Scratch, students follow their algorithm and user interface designs to create the app using code blocks. Students can work together using pair-programming principles or work alone on a section and combine sections into a whole app once complete. • Students should be using control structures like repeat loops and variables and operators to automate calculations to make their code more efficient.	**Resource** Sample solution with control structures, variables, and a timer

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STRANDS AND SUB-STRANDS	KEY IDEAS AND CONCEPTS	LESSON SEQUENCE	ACTIVITIES AND ASSESSMENT OPPORTUNITIES
		• Students should test their code as they are working and debug problems as they arise to ensure things respond as intended.	
Evaluating and reflecting **Measurement and geometry** **Processes and Production Skills** • **Producing and implementing** • **Evaluating**	**Place and space** • **Understanding** • **Problem solving** • **Algorithms** • **Implementation** • **Impact** • **Interactions**	**Module 5. Design and Implement a Visually Programmed App – Testing and refining the algorithms** *Test and debug the app with a visual program in groups of 2 or (30 mins)* • Once complete, students should test the whole app to ensure everything works as intended and debug problems that arise	**Summative** – finished app
Communicating **Processes and Production Skills** • **Evaluating**	**Place and space** • **Impact**	**Module 5. Design and Implement a Visually Programmed App – Sharing the Apps with an Authentic Audience** *Whole class celebration – culminating activity (30-60 mins)* • Hold a showcase session either within the class or by inviting others (particularly other classes who are learning about drones) to try out the apps. Students should ask for feedback, note comments in their self reflection sheet and make changes to their apps as required.	**Summative** – students will learn from others whether their solutions are effective or not and record a self-reflection. **Resource** Student self reflection sheet

EXTENSION

If you would like to deepen the learning from of this lesson and/or provide extension for students, we recommend that:

- Students use variables to automate and streamline their code to make it more efficient considering sustainability factors.

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THANK YOU!

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WHAT DO YOU NEED?

We're always looking for recommendations for topics or themes for drone and geospatial teaching resources. If you've got something in mind, then please email

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