Teacher booklet

EEI – HUMANS IN THE ECOYSTEM

Year 9	Science

Students work in small groups to compare plant diversity in 3 different ecosystems within the Daintree Research Observatory grounds.

For this assignment, students will:

- ☐ develop a plan to measure abiotic and biotic factors in three different ecosystems
- ☐ make hypothesis about how the 3 different ecosystems will differ
- ☐ collect data
- ☐ collect plant specimens from each of the 3 ecosystems
- ☐ make inferences and conclusions
- ☐ present your findings.

Students will need to work in groups, but should be encouraged to complete their own individual report and collect their own plant specimens

DAINTREE RESEARCH OBSERVATORY - JCU

For this assessment students will be investigating how humans might impact the delicate Daintree rainforest ecosystems. Students will be collect data at the Daintree Research Observatory, which is run by James Cook University.

Location

The Daintree Rainforest Observatory is located at 40 m elevation in lowland tropical rainforest at Cape Tribulation, 140 kilometres north of Cairns in Queensland Australia (16º 06' 14.8" S, 145º 26' 58.0" E). The site is adjacent to the Daintree National Park. The Daintree rainforest has the highest biodiversity anywhere in Australia and has a unique Gondwanan flora.

In 1988 the rainforests among which the crane is situated were declared the Wet Tropics World Heritage Area. This is one of the few areas in the world where the reef meets the rainforest and the only place where two World Heritage Areas sit side by side. The site is flanked to the west by coastal ranges rising to more than 1400m and by the Coral Sea to the east.

Climate

Annual average rainfall is approximately 3500mm and is strongly seasonal with 70% falling during the wet season which runs from December to April. Summers are often hot and humid with the mean daily temperature in January around 28°C. However, temperatures up to 36°C are not unusual during the summer months. Winters are mild and dry with the mean daily temperature in July around 22°C.

Northern Australia is subject to tropical cyclones in the wet season and their occurrence is unpredictable. The impact of these severe tropical storm systems are regarded as a natural phenomenon and a key evolutionary factor in shaping the ecology of Queensland's tropical lowland rainforests.

History

The area in which this site is located was selectively logged in the late 1950's and early 1960's. There are however standing specimens of Toona ciliata (Red Cedar) in the area, which suggests that this logging was probably not intensive.

Extreme disturbance due to storm damage (tropical cyclones) is common in the area on a cycle of approximately 50 years. On the 11th of February 1999, tropical cyclone Rona (category 3) passed over the Cape Tribulation area causing widespread major damage. Wind gusts of up to 170 km/hr, local flooding and storm surges of up to 1.4m were recorded in the area. The canopy crane site was severely damaged, as approximately 10% of the trees were felled and 50% of the trees suffered complete crown loss on the research plot. The past 10 years has shown profound recovery of the forest.

http://www.jcu.edu.au/canopycrane/about/JCUPRD_046915.html

Australian Curriculum

Year 9 Achievement Standard

By the end of Year 9, students explain chemical processes and natural radioactivity in terms of atoms and energy transfers and describe examples of important chemical reactions. They describe models of energy transfer and apply these to explain phenomena. They explain global features and events in terms of geological processes and timescales. **They analyse how biological systems function and respond to external changes with reference to interdependencies, energy transfers and flows of matter.** They describe social and technological factors that have influenced scientific developments and predict how future applications of science and technology may affect people's lives.

Students design questions that can be investigated using a range of inquiry skills. They design methods that include the control and accurate measurement of variables and systematic collection of data and describe how they considered ethics and safety. They analyse trends in data, identify relationships between variables and reveal inconsistencies in results. They analyse their methods and the quality of their data, and explain specific actions to improve the quality of their evidence. They evaluate others' methods and explanations from a scientific perspective and use appropriate language and representations when communicating their findings and ideas to specific audiences.

Science Understanding	**Biological Sciences** Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems(ACSSU176)
Science Inquiry Skills	*Questioning and predicting* Formulate questions or hypotheses that can be investigated scientifically(ACSIS164) *Planning and conducting* Plan, select and use appropriate investigation methods, including field work and laboratory experimentation, to collect reliable data; assess risk and address ethical issues associated with these methods (ACSIS165) Select and use appropriate equipment, including digital technologies, to systematically and accurately collect and record data (ACSIS166) *Processing and analysing data and information* Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies(ACSIS169) Use knowledge of scientific concepts to draw conclusions that are consistent with evidence(ACSIS170)

	Evaluating Evaluate conclusions, including identifying sources of uncertainty and possible alternative explanations, and describe specific ways to improve the quality of the data(ACSIS171) Critically analyse the validity of information in secondary sources and evaluate the approaches used to solve problems(ACSIS172) *Communicating* Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations(ACSIS174)
General Capabilities	*Literacy* Comprehending texts through listening reading and viewing Word Knowledge Composing texts through speaking, writing and creating Text knowledge *Critical and creative thinking* Inquiring – identifying, exploring and organising information and ideas Reflecting on thinking and processes Generating ideas, possibilities and actions *Numeracy* Estimate and measure with metric units *Information and communication technology capability* Investigating with ICT Managing and operating ICT *Ethical understanding* Reasoning in decision making and actions

Learning Sequence

It is envisaged that this assessment task will form the final assessment for a standard 5-week unit for Year 9 Ecology. In accordance with the Australian Curriculum it is expected that students will have a satisfactory knowledge of standard ACSSU176: *Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems.*

Listed here are suggested **additional learning experiences** for students before attempting this assessment.

- Use qualitative and quantitative first-hand and second-hand data, and evaluate the contribution of the data sources. Construct arguments and draw conclusions supported by scientific evidence.
- Graph primary and secondary data to investigate the relationship between variables.
- Interpolate and extrapolate from graphical data to approximate values.
- Explore the experiment design concepts of:
  - scientific method
  - variables (independent and dependent)
  - formulating questions and hypotheses
  - controlling variables
  - conduct safety audits
  - fair tests
  - importance of repeating the experiment
  - designing appropriate tables.
- Discuss the reliability of information obtained by research.
- Locate and record details of sources for reference lists.
- Guided report writing practice.
- Practise using the Science report template to build understanding of scientific terminology and its use in report writing.
- Encourage familiarity with the internet and search engines to conduct research.
- Provide opportunities for ICT experiences, such as:
  - using learning objects
  - locating and organising data in scientific research
  - compiling and organising data using spreadsheets.

Sample Method

1. Select 3 distinctly different areas of grass / herb vegetation:

   - Heavily managed (e.g. lawn areas)

   - Rarely touched (e.g. forest)

   - re-vegetated (e.g. re-veg plots).

2. At each site, lay out a 5m transect line.

3. Carefully examine the plants along the transect, especially leaves and flowers, to determine the number of species present (diversity).

4. For each species, give it a designation (e.g. Grass A, Herb X), and:

   - Measure its height (greatest or average?)

5. Measure a variety of physical factors at each site:
   - air and soil temperature
   - soil moisture
   - soil pH
   - description of soil
   - amount of light reaching the ground/plants (estimate percentage of light reaching the ground, where 100% is full sun and 0% is no sunlight)
   - soil penetration (distance rod can be pushed into soil)

6. Collect **2 Specimens** from each quadrat. For each specimen:
   a. Press the specimen between paper to dry
   b. Mount the specimen on clean A4 paper
   c. Include the name of the specimen
   d. Include the area from which the specimen was collected
   e. Describe the adaptations of the specimen (e.g. runners to enable it to spread, light seeds to enable dispersal).

Teacher Resources

Wet Tropics Management Authority

- http://www.wettropics.gov.au/home

A relevant online unit is available from the ASTA website, Science Web Australia:

- http://scienceweb.asta.edu.au/years-9-10/unit1/overview/yr910-unit1-overview.html

Steps of the Scientific Method

- http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

Measuring Biodiversity – from Berkely.edu

- http://gk12calbio.berkeley.edu/lessons/less_measbiodiv.html

Techniques for measuring stand height

- http://www.epa.nsw.gov.au/resources/pnf/standheight07392.pdf

Understanding Soil pH

- http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/167187/soil-ph.pdf

Measuring Soil Quality

- http://wwf.panda.org/about_our_earth/teacher_resources/project_ideas/soil_quality/