NFSA

PATRICIA KELLY / PROFESSOR IAN LOWE

STUDYGUIDE

Muddy Waters

Life and Death on the Great Barrier Reef

THIS PAGE: DICK CAMILLERI, SUGARCANE FARMER ((PHOTO: SALLY INGLETON); COVER PAGE: REEF ECOLOGIST DR KATHARINA FABRICIUS AND BLEACHED CORAL (PHOTO: RORY McGUINNESS) © NFSA

THE STORY

THERE IS TROUBLE IN PARADISE. By 2010, forty per cent of the world's coral reefs may be dead. By 2030, half of the Great Barrier Reef may be gone. Parts of it are already dying, but the reasons have not always been clear. Global warming and outbreaks of crown-of-thorns starfish have put extraordinary pressure on the reef. Now scientists have identified another threat—sediments, fertilisers and pesticides from agricultural run-off. The reefs most at risk lie along Australia's north eastern coast between Cairns and Townsville.

Muddy Waters journeys to the plantations of north Queensland and into an underwater world to find out what's killing the reef and what can be done to save it. It's also the story of a small community facing the challenges of responsibility and change. This time, what's at stake is one of the world's greatest natural treasures.

Sugarcane farmers, suffering bad seasons and low prices, are reeling at the prospect that their land management practices may be part of the problem. This is the heart of the wet tropics where high rainfall regularly causes rivers like the Tully to flood, sending huge plumes of mud and chemicals into the sea. In their natural state, native wetlands filter the water and silt but more than sixty per cent has been cleared and drained for sugarcane. Some locals are trying to bring all the parties together to develop a workable solution, but, as the documentary reveals, leading the way can be hard work.

CURRICULUM LINKS

At secondary school levels, *Muddy Waters* can be used to support learning in Science, Studies of Society and the Environment (SOSE), English, Media Studies, Politics and Legal Studies.

SOSE

One of the four key values of SOSE is **Ecological and Economic Sustainability**. The documentary offers a good case study for this area, with links to the key values of **Democratic Process** and **Social Justice**. Relevant key learning outcomes in these areas are:

- understand past ideas, events and actions to:
  - explain the causes and effects of changes and continuities
  - use various sources of evidence
  - value the contribution of people and the importance of diverse heritages.
- understand social, natural and built environments to:
  - evaluate human and environmental relationships
  - recognize processes linked to environments and the spatial patterns inherent in environments

DR KATHARINA FABRICIUS, (RIGHT) WITH RESEARCH ASSISTANT LINDSAY HARRINGTON (PHOTO: SALLY INGLETON) © NFSA

- value and promote stewardship and the significance of places.

SOSE STRANDS AND CONCEPTS

The documentary relates directly to:

- Time, Continuity and Change
- Place and Space
- Systems, Resources and Power

SCIENCE

In the Science syllabus, the issues raised in *Muddy Waters* relate to the **Science and Society** strand, especially the following learning outcomes and levels:

Level 2, Core: Students identify some ways scientists think and work
Level 3, Core: Students recognize the need for quantitative data when describing natural phenomena
Level 3, Discretionary: Students consider the meaning and implications of information collected when differences of opinion occur
Level 4, Core: Students present analyses of the short and long-term effects of some of the ways in which science is used
Level 5, Core: Students analyse the relationship between social attitudes and decisions about the application of science
Level 5, Discretionary: Students present data in a variety of ways to support different interpretations
Level 6, Core: Students make presentations supporting the different sides in debates about controversial applications of science
Beyond Level 6, Discretionary: Students evaluate the reliability and validity of scientific information from different sources

ABOUT THIS GUIDE

The suggested activities could be part of Science or SOSE or integrated between the two. The people profiles and other resources provided at the end of the guide would suit work on viewpoints in English as well as values clarification, feelings, retelling a story and media analysis.

BEFORE WATCHING

- Ask students to discuss the possible meanings of the title, *Muddy Waters*. After watching the film, have their thoughts changed or expanded to include metaphorical as well as literal meanings for this title?
- Brainstorm what students already know about the Great Barrier Reef (GBR). Put all suggestions on the board without comment. After watching, compare the facts. Which are correct and which need extra information or changes in light of what students have learned from watching *Muddy Waters*?

KEY WORDS AND TERMS

On the next page is a vocabulary list which can be used to draw out student knowledge and understandings before watching the video.

MUDDY WATERS WORD BINGO

marine snow	biodiversity	tariff	organism	run-off	barnacle	visibility	nutrients	stress
sediment	algal blooms	globalisation	murky	organics	fertiliser	polyp	sediment	erosion
barramundi	phosphorus	habitat	groundwater	nutrients	larvae	flood plume	silt trap	bleaching
nutrients	terracotta	outcrops	global warming	cycle	sustainability	algae	lagoon	fossil fuels
future generations	introduced species	environment	wetlands	habitat	natural cycle	topsoil	coral recruit	pests

- Try this as a form of bingo. Add your own key terms. Ask students to do this individually, in pairs or small groups or as a class. Harder terms may be worth more points.
- Turn the best explanations into a wall chart.

AFTER WATCHING: DISCUSSION AND ACTIVITIES

THEMES

1. THE GREAT BARRIER REEF

Here are some questions to begin discussion:

- What makes the Great Barrier Reef a unique world treasure?
- At the end of the program we see the text: 'By 2030 50% of the Great Barrier Reef will be dead'. What is the basis of this prediction and how seriously should we take it? Who and what would be affected if that happened? Can anything be done to stop that from happening or to lessen the destruction? Relevant materials listed under Other Resources can be used as handouts to inform discussion.
- Whose job is it to manage the Great Barrier Reef? Which governments have a role?
- Tropical waters will always carry some sediment, so how do we know that the run-off from farms causes particular problems?

ACTIVITIES

- Ask students to research and depict the life cycle of coral in a healthy reef in any way they choose. This could be dramatic, pictorial, or in any written form.
- Some of the science is still uncertain. Read an article published in *New Scientist* early in 2003[1] and the response by some reef scientists. [2]
- Organize a debate between two teams, one arguing that the reef is quite healthy and the other arguing that it is in serious trouble. Is this a good way to clarify the issues—or does it muddy the water?
- Use the facts from the video and other sources to produce a poster or an oral presentation demonstrating why the GBR is a unique world treasure.
- Use the facts to produce a health report on the GBR as if it was a human patient.
- Draw up a plan to keep the GBR for future generations. Who would you have to convince in order for this plan to succeed?
- What can students do to support campaigns to save the GBR?

REEF THREATS

Overall, how would you assess the health of the Great Barrier Reef? What are the most important threats to it? How serious are the threats?

Scientist Katharina Fabricius says, 'crown-of-thorns are incredibly fertile animals—one female produces a hundred million eggs at a time'.

- Identify from the video the possible connections between river run-off and the crown-of-thorns starfish.
- Research pollution events such as oil spills.
  'Even small oil spills can pollute the Great Barrier Reef for months: between 1985 and 2000 there were 31 collisions and groundings on the Great Barrier Reef, a far higher proportion than in any other Australian shipping passage.' [3] (See also Resource No. 7)
- Discuss what you've learnt about sediment and chemicals from farm-



L-R: SUGAR CANE HARVEST (PHOTO: IAN COURTNEY); DR KATHARINA FABRICIUS (REEF ECOLOGIST WITH THE AUSTRALIAN INSTITUTE OF MARINE SCIENCE STUDY) AND SHERIDEN MORRIS (GREAT BARRIER REEF MARINE PARK AUTHORITY); RORY MCGUINNESS AND SALLY INGLETON (PHOTO: DR KATHARINA FABRICIUS)

DICK CAMILLERI WITH UNIDENTIFIED FARM WORKERS ON SUGAR CANE PLANTATION (PHOTO: SALLY INGLETON)

ing and read additional material. You will find a summary of the longer government scientific panel report in the *Courier-Mail*, 29 January 2003 'Report confirms run-off wrecks Reef' at www.couriermail.news.com.au/common/story_page/0,5936,5904580%255E3102,00.html. The Canegrowers' media releases criticizing the report of this scientific panel are also available from www.canegrowers.com.au. (See also Other Resources)

RIVERS

Sugar cane cultivation ideally needs warm sunny weather, freedom from frost, well-drained soil and at least 1500 mm of rain or irrigation per year. Fine, relatively cool weather immediately before harvesting retards plant growth and increases the sugar content of the cane. With the high rainfall of the wet tropics, farmers have drained the natural wetlands in order to get the water off their crops quickly. The wetlands traditionally filtered the rain and sediment and slowed down the flood flows. Now with more than 60% of the Great Barrier Reef's coastal wetlands cleared, heavy loads of sediment, nutrient and pesticides are being washed down the river and out onto the near shore reefs, covering the coral with a layer of thick sticky mud.

DISCUSSION

- What did you notice about the colour of the water in the rivers? The water was not clear because it carries soil particles. The tropical rivers have always carried sediment to the sea, because a lot of the rain falls in heavy storms. Clearing land for farming removes the trees that hold the soil together, so rain carries away more soil.
- Tropical waters will always carry some sediment, so how do we know that the run-off from farms causes particular problems?
- Who controls or regulates the activities that produce run-off? Is there a general problem when one arm of government promotes an economically desirable activity, but a different government body is responsible for regulating environmental effects? If so, how could such problems be avoided?
- What evidence does the film present to show that farming is damaging the reef? Try to find other scientific studies. Do they reach the same conclusion?
- What components of farm run-off affect reef systems? How is the run-off affected by farming practice?
- What can farmers do to improve the situation? How have some farmers responded? What is the evidence that they are making a difference?
- The film also says that the rivers carry nutrients from the land into the sea. Farmers use chemicals to promote plant growth, but when the soil is washed away, some of the chemicals go with it. Scientists are worried that the levels of two chemicals, nitrogen and phosphorus, are damaging the Reef.

TALKING POINT

It takes 1600 litres of water to produce a

dollar's worth of cotton and 7500 litres to produce a dollar's worth of rice.

- Encourage students to think about the resource cost of wearing a cotton shirt or eating rice as specific examples of the general link between our lifestyle and pressures on the environment.
- Discuss the differences between growing rice in Thailand and growing it in an Australian arid zone.

THE WETLANDS

The farmers cleared what they said was 'useless swamp country'. Was it? What are the wetlands here and what are their functions in the natural cycle? In late 2002, the Wentworth Group of Concerned Scientists called for an end to large-scale land clearing because of the effects on water quality, soil loss and loss of biodiversity.

DISCUSSION

LAND CLEARING

- Why do farmers want to clear more land? What reasons were given in the film?
- What was the government's role in creating this problem?
- What are farmers like Ross Digman doing to try to solve this problem?

ACTIVITIES

- You have to present an argument to a group of your neighbouring farmers against land clearing. You have five minutes to present your case. What are your five most important points?
- Draw a model of the effects of digging drains on the environment.

GREENHOUSE GASES AND GLOBAL WARMING

- What are the links between greenhouse gases, human activity and global warming?

For accurate and current information see the full CSIRO report on climate change at www.dar.csiro.au/impacts/future. A short and attractive pictorial version of this report is available as an A2 poster. (See also Resource No. 6)

The Australian Greenhouse Office (AGO) has released a booklet that explores the complex issues surrounding the greenhouse effect and climate change such as:

- What is the greenhouse effect?
- Is the Earth's climate really hotting up?
- How do scientists project future climate?
- How reliable are climate models?
- What are the potential impacts of climate change?

You can obtain a copy via www.greenhouse.gov.au/science or contact the AGO Infoline on 1300 130 606.

DISCUSSION

- What are the alternatives currently available to people who want to reduce their contribution to global warming?

Organize a class survey to establish answers to the following questions and discuss the responses:

(see chart below)

ACTIVITIES

- Ask students to compare the facts about global warming with some current advertisements in print or on television or at the movies, for vehicles such as four wheel drives or domestic air conditioners.
  - Compare the messages that the public is being given about each. Report your findings.
- Use the Internet to research the fuel consumption of a variety of vehicles and then calculate their costs for an average week of driving.

BIODIVERSITY

While the focus of *Muddy Waters* is on the Great Barrier Reef, declining biodiversity is a global issue.

DISCUSSION

- What is biodiversity? Why is loss of biodiversity a global problem? Why is it a problem for the Reef?
- What does the term 'introduced species' mean? Research some other introduced species of flora or fauna. Remind students to look for less obvious examples, such as pasture grasses, exotic trees, shrubs or vines and sea creatures introduced from ship ballast water. For information about Australian biodiversity and links to many other resources, go to www.ea.gov.au/biodiversity/index.html.

2. THE SUGAR INDUSTRY

There are over 6000 cane farmers and many north Queensland towns have been built around the sugar dollar. Most farmers have been running family farms for three or more generations.

DISCUSSION

- How important is sugar to our way of life?
- How is the Australian sugar industry being affected by globalization? If the price of sugar is falling, does this affect the ability of farmers to change their practices? One old

QUESTION	RESPONSE
What causes global warming?	
How does it affect the Great Barrier Reef?	
Name one thing you can do to not contribute to global warming.	
What is the international community doing about the problem?	

strategy was to impose tariffs on imported produce to help local farmers. This approach has become unpopular with economists.

ACTIVITIES

- Find statistics on how much sugar an average Australian consumes. Compare the amount with the recommended daily intake. What are the impacts of sugar on health, both positive and negative?
- How should governments respond if a product is economically important but also a potential health problem? What products do you think fall into this category?
- Research the arguments for and against a tariff on imported sugar.

TALKING POINT

Queensland produces 95% of Australia's raw sugar and it's one of the country's largest export crops. Film-maker Sally Ingleton says:

World prices had plummeted due to a glut on the market and farmers were lamenting that they were getting less for their crop than the cost of production. The government has offered a rescue package to encourage farmers to diversify or leave the industry altogether. There is also increasing pressure on farmers to be seen to be changing their land management practices to incorporate environmental codes of practice. As the industry ages it is likely that many will sell their farms. It will be interesting to see what the future of the Australian sugar industry holds over the next decade.

The sugar cane industry has developed environmental codes of practice, but encouraging farmers to implement them takes time and resources. Many farmers want to see the scientific evidence and can get confused when opinions differ.

Muddy Waters has helped contribute to the debate. In November 2002 a meeting was held between the Tully Sugar Mill and scientists from the Australian Institute of Marine Science (AIMS). The result was more understanding and farmer Dick Camilleri offered an open invitation to Dr Katharina Fabricius (senior scientist at AIMS) to come and visit his farm to witness his land management practices.

3. THE PEOPLE

This documentary is not only about the Great Barrier Reef. It is the story of how people interact with each other and the environment. Here are some profiles that may be useful for telling this story from varying points of view.

TALKING POINT

Sally Ingleton:

This topic is currently polarising several communities in far north Queensland who are experiencing a clash of philosophies as to what is most important—the survival of old family industries such as sugar cane or the growth of twenty-first century industries such as tourism.

- Are these the only two issues at stake here? What others can you identify?

3.1 THE FILM-MAKER

What inspires film-makers to spend the huge amount of time and effort involved in making a documentary like *Muddy Waters?* Sally Ingleton explains:

Four years ago I learnt to scuba dive on the Great Barrier Reef. At the time I was working on a project far out in the Coral Sea and was fortunate enough to dive in some of the world's most pristine and untouched coral gardens. Later I went diving in Indonesia and was shocked by the contrast. Many of the reefs close to shore were bleached, covered in algae and in a general state of poor health. Whilst some of this was due to global warming, the majority was due to human impact.

I found myself wondering if parts of Australia's Great Barrier Reef were also showing signs of ill health. And if so, who was taking its pulse? I began doing some preliminary research towards the end of 2000. I travelled to Townsville and met with several key players who are involved in studying and protecting the marine environment of the 2000 kilometre-long Great Barrier Reef Marine Park.

I was in search of a story that would show the challenges involved in looking after such a pristine piece of the environment that is subjected to commercial pressures such as tourism.

To my surprise all stakeholders identified that one of the biggest threats to the reef lay on the land, not in the sea. Scientists are convinced that water pollution from the excessive chemical and pesticide use in agriculture—primarily sugar cane and bananas, is severely damaging the in-shore reefs. The sugar cane industry has made many efforts to improve the land management practice of their members but, as the average age of a cane farmer is 60 years, change may be too late.

ACTIVITIES

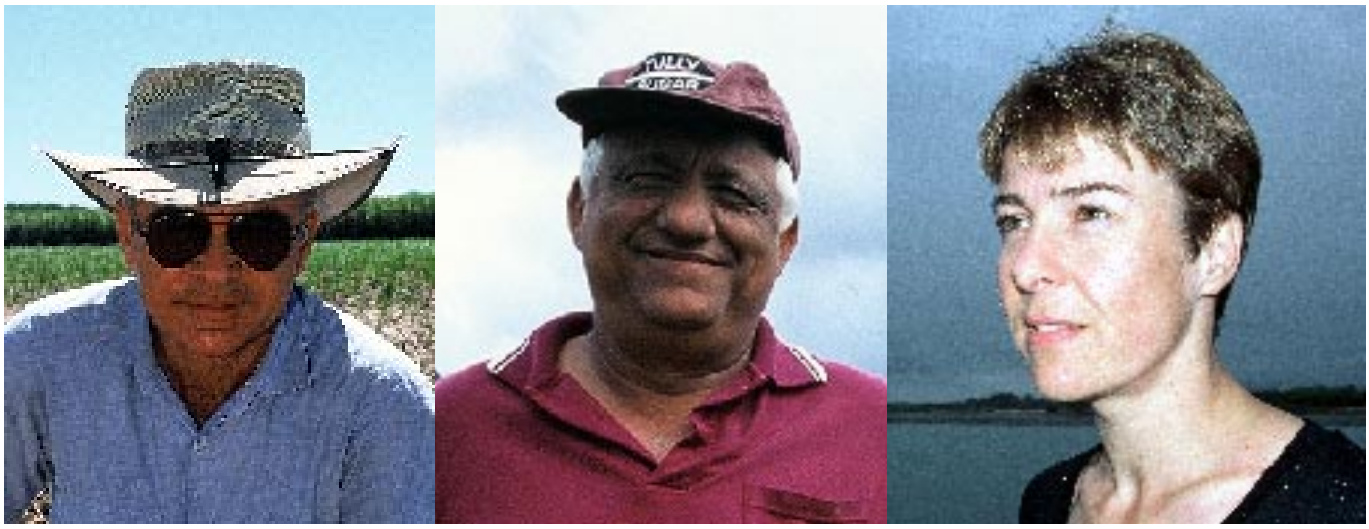
- Use this information to write an interview with Sally, formulating questions to which her words fit as answers.
- Ask students to research and report on an environmental topic that is close to their hearts in the way that the GBR is to this film-maker. It can be local, national or global. The report must include:
  - the issues
  - how they become interested in it
  - one action they are able to take and intend to take to make a positive difference to their issue OR they can write a personal response to it, similar to Sally's.

3.2. THE SUGAR INDUSTRY WORKERS

Research the history of cane cutters and other workers in the sugar industry. How has this affected the social structure of north Queensland?

- Who are the cane growers? What do you notice about them as a group?
- What are some of their points of view as we hear them in this video? The following profiles may help.

L-R: **ROSS DIGMAN**, Sugar Cane Farmer (photo: Ian Courtney); **DICK CAMILLERI,** Sugar Cane Farmer (photo: Sally Ingleton); **DR KATHARINA FABRICIUS**, Reef Ecologist (photo: Sally Ingleton)



ROSS DIGMAN

Ross's great-grandfather grew sugar cane along the Tully River and is credited with being one of the founding fathers of the Tully sugar industry. Ross bought his parents' farm and up until the late 1980s farmed in much the same manner as his parents had. A keen fisherman, Ross noticed how the fish stocks were running low and realized that the years of draining the natural wetland habitat had affected the fish breeding grounds. He decided to build an artificial lagoon on his property. Ross now has three such lagoons and to the locals is known as a 'greenie'. After years of derogatory comments, local farmers are finally taking notice of Ross's environmental techniques and he's now in demand up and down the coast as a speaker.

In 2002, Ross Digman and Margaret Digman won the first Mangrove Jack award for their commitment to sustainable farming.[4]

DICK CAMILLERI

Dick is deputy chairman of the Tully sugar mill and one of its most successful cane growers. He has been a farmer all his life. His father emigrated from Malta in 1927, moved to the north Queensland cane fields where he stayed and had a family. By 14 years of age Dick was clearing land by hand and by 18 he was running the farm. In those days when farmers cleared the wetlands, or 'swamps' as they were known, they were applauded for turning what was seen as unproductive land into one of Australia's biggest export crops. Dick finds it hard to understand why farmers are being blamed for creating environmental ills. His view is that all their actions have been based on the advice of governments or industry bodies—from clearing the land to the amounts of chemicals they put on their crop. He questions the scientific community because he feels he hears so many different stories, he does not know who to believe. Dick was willing to be filmed for *Muddy Waters* as he felt it important to get the 'right message' across to the people in the cities.

DISCUSSION

- What message do you get from what Dick says? List the most significant things he says. Do you think that this is the 'right' message? Is there a 'right' message?
- Which of his concerns do you think are answered by the facts presented in the documentary?
- What can these farmers do to improve the situation? How have some farmers responded? Use evidence from the documentary to show that they are making a difference.

3.3 THE SCIENTISTS

How can scientists try to make farmers aware of the consequences of their practices? What lessons does the film have about the two groups working together?

DR KATHARINA FABRICIUS

German-born Dr Katharina Fabricius is a senior scientist at the AIMS. In a career spanning over 15 years, she has dived in almost every coral reef in the world. She has chosen Australia's Great Barrier Reef as her research base and has made six field trips between 2000-2002 in this location.

In the 15 years she has been diving on the Great Barrier Reef, Katharina has seen a marked difference in the health of various reefs and is keen to identify what has led to the demise of some of the reefs. One of her theories is that when sediment lands on the coral polyps they can manage to slough it off, but when sediment is mixed with nutrient and chemicals, relatively few baby corals settle and survive on the reefs, so reefs don't recover from events such as bleaching or cyclones. As a result, a large number of coral species are missing and coral cover is poor.

DISCUSSION

- How do scientists test their ideas? What evidence do we see of this in the video?

ACTIVITIES

- Use the evidence presented in the video of the marine scientists' work to write up one of their experiments. You can choose to write it as a brief scientific report or turn the facts into

a media release.

- Imagine you are one of the reef scientists. Write a short pamphlet explaining the main problems, as you see them, to a cane farmer.
- The Further Resources section gives an excerpt from a report by a panel of scientists and a response by Canegrowers to rumours of what the report would say.
  - What reasons can you suggest for their differing points of view?
  - Do you think that decision makers tend to listen more to scientists? What evidence of this can you find to support your opinion?

4. MISSING VIEWS

Points of view that aren't put forward in this video include those of:
Women on the land
Indigenous communities
All other species

- Discuss why you think these opinions weren't expressed.
- What are some of the special challenges that women on the land face in times of crisis?
- Who are the traditional owners in northern Queensland? What are their views? For detailed information on the Gulngay, Mamu and Jirru people and the traditional way of life of these Aboriginal people as recorded by Europeans, see *Background Cultural Heritage Study*, Gutteridge, Haskins & Davey Pty Ltd, 2001, 24 pp.
- Tell the Great Barrier Reef's story from the point of view of a barramundi, a piece of coral or a barnacle, in prose or verse or in a collage.

5. THE PUBLIC

Dick Camilleri complains that it just seems to be the cane farmers who are being blamed. He says, 'I don't believe there is … a man, woman or child on this continent who doesn't contribute to degradation of the environment'.

DISCUSSION

- How would students answer this challenge?

ACTIVITIES

- Identify a range of behaviours or activities that students and other members of the public do that contribute to degrading the environment. Choose one behaviour that you are going to change and persuade others to change, for example, at school, at home, locally, nationally, globally.

FISHING

How important is fishing associated with the reef, as a source of food or as an economic activity? How are reef fisheries affected by run-off? You will find several items of interest relating to changes to fishing on the GBR and its impact on fishermen in a Queensland government newsletter accessible at www.premiers.qld.gov.au/about/regionalcomm/pdf/fnq_newsletter_issue1.pdf

6. FUTURE GENERATIONS

'We've got to be able to conserve it [the GBR] for future generations…' Sheriden Morris, Great Barrier Reef Marine Park Authority

DISCUSSION

- What does Sheriden mean by future generations? Why should we care about them?
- What could previous generations of farmers have done differently to avoid the current situation?
- Ask your parents or grandparents or someone else much older than you what beautiful places they can remember from their childhood. What has happened to those places?
- What are some new ways to fix old problems?
- Write a letter to your great grandchild explaining why the GBR may not be available for them to enjoy.
- Write a letter to your great grandchild explaining what you did in your lifetime to help preserve the environment.

7. ECONOMIC ISSUES

TOURISM AND THE REEF

In the programme, project officer Andrew Morgan states that the local cane industry is worth half a billion dollars—and tourism is worth 2 billion dollars. How will it be affected if the Reef is damaged?

- Replay the segment showing a film of early reef tourism. Note activities that would not now be permitted and which would have contributed to damaging the reef.
- How have tourist numbers changed over time?
- Identify as many jobs as you can associated with reef tourism. What skills and qualifications do you need to do these jobs?
- Find a job you might like to apply for and prepare a one page résumé and a covering letter setting out why you are the most suitable candidate for this job.
- Hold an interview for this job.

OTHER RESOURCES

RESOURCE NO. 1

Fertiliser run-off threat to Reef
25 November 2002

A panel of researchers headed by Queensland's Chief Scientist, Joe Baker, has recommended that farmers in the Great Barrier Reef catchment be banned from buying fertiliser unless they control run-off from their properties. The panel's summary statement said that nutrients from farms and grazing land, as well as from cities, are already damaging inshore reefs.

The panel called for a wide range of measures to head off environmental disaster, including the crack-down on farmers' irresponsible fertiliser use. It recommended that all east coast intensively farmed river catchments be designated 'nutrient-sensitive zones', with farmers in these zones only being allowed to use fertiliser if they come up with management plans underscored by soil tests. The panel also recommended that farmers keep records of any ferti-

liser used for a minimum of five years.

Dr Baker said there's plenty of evidence of fertiliser overuse but this doesn't just apply to sugar cane farmers. Grazing occupies eighty-three per cent of the catchment and urban areas 1.6 per cent.

The proposal sparked anger from farm groups. Paul Ziebarth, chairman of Queensland Fruit & Vegetable Growers' Association, said that fertilisers cost between $400 and $500 a tonne, so members can't afford to waste it. And growers already test their soil, he said.

Concern about who would manage the control process also surfaced, with Queensland Farmers' Federation's executive director Brianna Casey saying growers could be 'lumbered with another layer of administration'.

Source: *Courier-Mail*, 25 November 2002, page 4.

RESOURCE NO. 2

QFF Calls for Release of Reef Science Panel Report

QFF is still waiting for the much-anticipated release of the final report from the GBR Protection Inter-Departmental Committee Science Panel, chaired by DPI Chief Scientist Dr Joe Baker. The Science Panel was commissioned to

- *review existing evidence for the decline in water quality of catchments draining to the Reef;*
- *evaluate the methodology and data used to set end-or-river targets contained in the GBRMPA Water Quality Action Plan; and*
- *advise on the most practical options for improving catchment water quality and reducing water quality impacts on the Reef.*

QFF understands the report was to have been released several months ago, to allow contribution to the drafting of the above-mentioned Reef Water Quality Protection Plan for the Great Barrier Reef World Heritage Area. *QFF is gravely concerned that the draft Plan is due to be released in December 2002, yet the Science Panel report has still not been released, and thus cannot be used in the draft Plan, which must have a credible scientific basis in order to be considered seriously.* ***QFF urges the signatories of the MOU to insist on the release of the Science Panel Report before the end of the year.***

It would appear that the report is close to completion judging by the very public comments by the Chair of the Panel in metropolitan media this week regarding fertiliser use in 'nutrient sensitive zones'. QFF is disappointed that the summary statement has been made available to the media without the supporting documentation to clarify broad-sweeping statements. It is also extremely inappropriate that the summary statement was 'released' to the media without any prior consultation with key stakeholders, in particular rural industry organizations, who actually instigated the report. QFF stresses the need for well-referenced, peer-reviewed documented science to underpin the report, as peer-reviewed, published science is imperative in the development of responsible natural resource management policy. Please contact Brianna Casey for additional information.

Source: *Weekly Bulletin*, Qld Farmers' Federation, 29 November 2002

(See Resource No. 5 for an excerpt from the Panel's report, released January 2003).

RESOURCE NO. 3: THE VIEW OF CANEGROWERS

CANEGROWERS
Harvesting the natural energy of life
190-194 Edward Street
Brisbane 4000
GPO Box 1032
Brisbane 4001
Phone (07) 3864 6444
Fax (07) 3864 6429
Attention News Editor

Media Release No.2002-61 for immediate release
28 November 2002

Chief Scientist's reef conclusions not backed by the science, say cane growers

Sugarcane growers were disturbed by recent unjustified suggestions from the Chief Scientist, Dr Joe Baker, that their farming practices might be harming the Reef, Ron Mullins, Acting General Manager of the CANEGROWERS organization, said today.

Mr Baker was quoted in the *Courier Mail* on 25 November as stating that all intensively farmed river catchments on the east coast should be designated 'nutrient sensitive zones' and farmers in these zones only allowed to buy fertiliser if they came up with a nutrient management plan backed by approved soil tests because of damage to inshore reefs.

Mr Mullins said that cane growers recognised the potential impact from cane growing on adjacent waterways in some catchments and were implementing codes of practice and best management practice to ensure we continually minimise any potential impact.

Adoption of minimum tillage within the industry now exceeds 70%. As a consequence of these and other industry initiatives we would expect that water quality in rivers and streams with sugarcane would be improving not deteriorating.

However, to suggest an impact on the inshore reefs is ridiculous and a position not backed by the published science. The recently released Productivity Commission report concluded that there was no evidence of water quality decline within the GBR lagoon or any resulting damage to ecosystems.

The Commission's report refers to circumstantial evidence of water quality decline, but as Professor Carter, a reef researcher with over 20 years experience on the GBR stated in an address to the Rural Press Club last Friday, there is also circumstantial evidence that, 'the Reef is thriving and blooming'.

Against this, cane growers are very concerned at published statements attributed to the Queensland Government's Chief Scientist calling for restrictions on the purchase and use of fertilisers by primary producers in intensively farmed river catchments adjacent to the GBR,

supposedly to 'head off an environmental disaster

We understand that Dr Baker's comments reflect the finding of a yet to be completed report commissioned by the Government early this year and scheduled for release in June this year. Why hasn't the report been completed and publicly released?

Assuming that the report will eventually be released will it be any different to the many reports released over the last 18 months that suggest an impact on the Reef without providing any evidence. It is time government started to develop public policy on the basis of the published science, rather than on media hype.

It is our view that the State Government is potentially undermining the international image and competitiveness of Queensland agriculture as a consequence of its approach to management issues associated with the Great Barrier Reef. That approach is not supported by the published scientific literature that indicates we have a healthy Great Barrier Reef, but instead seems based on the current global preoccupation with what Bjorn Lomborg in The Skeptical Environmentalist*, labels 'the Litany'—that the environment is in poor shape, resources are running out, the air and water are becoming more polluted, and industries must be heavily regulated. The litany is a pessimistic mindset that shuns science for doomsday scenarios and pays no regard to the sustainability of industry.*

Mr Mullins said the most recent, peer reviewed assessment of the *Status of Coral Reefs of Australasia: Australia and Papua New Guinea,* a book published by Clive Wilkinson, concluded that:

Australia's coral reefs are well described and monitored, and are generally in good condition. These reefs have exceptionally high biodiversity, favoured by the massive size and diversity of habitats. This biodiversity is, in general, well studied. They are well protected from the relatively low level of human pressures resulting from a small population that is not dependent on reefs for subsistence. An extensive system of marine protected areas is being implemented, the best known of these is the Great Barrier Reef Marine Park (which is also a World Heritage Area). This is the largest marine protected area in the world and serves as a model for the establishment of many other similar multi-user areas. The monitoring programmes on the Great Barrier Reef (GBR) are also probably the largest and most extensive in the world and are used as models for other projects. These are amongst the best studied coral reefs in the world with very high capacity in all areas of coral reef science, management and education.

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Source: http://www.canegrowers.com.au/share/Media_Releases/2002-061

RESOURCE NO. 4: THE SCIENTISTS AND THE JOURNALISTS

- Read *New Scientist*, 4 January, 2003: 'Great Barrier Bluff' by Dr Rachael Nowak.
- Then read the response from the coral reef researchers in *New Scientist*, 25 January 2003, which begins:

  > *We (coral reef researchers quoted in 'Great Barrier bluff', 4 January 2003, pp 8-10) are disturbed that readers of the article may come away with an impression that the Great Barrier Reef (GBR) is not under serious environmental threat … There is significant concern that coastal ecosystems in the GBR World Heritage Area are being adversely affected as a consequence of this increase.*

Last year, a review of data led to agreement that a number of near-shore sections of the GBR are under threat from enhanced land run-off of sediments and nutrients. All experts mentioned by Dr Nowak (and eleven others) signed the statement concluding: 'Run-off of sediment and nutrients to the GBR has increased several-fold as a result of past and current land-use practices. There is significant concern that coastal ecosystems in the GBR World Heritage Area are being adversely affected as a consequence of this increase' (http://www.reef.crc.org.au/aboutreef/coastal/waterquality_consensus.html).

Other credible threats to the GBR and reefs world-wide were highlighted in a second consensus statement by 16 recognised researchers drawn from a diversity of relevant disciplines in three continents ('Townsville Declaration', 18 October 2002, reported in *Australasian Science*, January 2003). Following an intensive forum, they concluded, for all coral reefs: 'Over-fishing and pollution have driven massive and accelerating decreases in abundance of coral reef species and have caused global changes in reef ecosystems over the last two centuries.' They further determined: 'If these trends continue, coral reefs will decline further, resulting in the loss of biodiversity and economic value.'

A significant proportion of the coral reefs in several parts of the world (particularly SE Asia, Caribbean) are now severely degraded from over-fishing and/or pollution. Importantly, the GBR has not been affected to the same degree and is probably going to be the last great refuge from these threats provided management addresses the same threats comprehensively.

Peer-reviewed evidence continues to build, showing that coastal ecosystems, including coral reefs, are under threat in almost all parts of the world. As for the GBR, human-enhanced global climate change has added yet another convincing threat.

The December 2002 report of the Global Coral Reef Monitoring Network, referred in passing by Dr Nowak, states firmly: 'The GBR was fortunate to escape with only a few reefs suffering extensive coral mortality in the 1998 and 2002 bleaching events. However, the extent of bleaching throughout the GBR in 2002 indicates that few reefs are immune

from increased sea surface temperatures.' Projections of future temperature increases have scientists very worried about the health of coral reefs like the GBR under future climate change.

The fact that the GBR is currently among the least degraded of coral reef ecosystems should spur us to address the serious challenges that this critically important and beautiful treasure now faces. We must do so while it is relatively easy to make changes or prevent greater degradation.

RESOURCE NO. 5: EXCERPT FROM THE SCIENTIFIC PANEL REPORT

The evidence that we now have for the GBR is as follows:

a. *Land-sourced pollutants such as chemicals used by humans in current urban and rural activities are reaching the GBR. These include chemicals used in agricultural and veterinary applications (AgVet Chemicals)*
b. *Excess nutrients that are transported by rivers in peak floods reach the GBR*
c. *Some areas of the coastal GBR, most affected by river run-off, appear to be degraded and/or slow to recover from natural events, such as cyclones. In this regard, we note the experiences documented overseas that the first major signs (that is, hard proof of adverse impact) appear when the coral reef system fails to recover from other disturbance (including natural events such as cyclonic level events).*

There has been recent media debate claiming that turbidity in the waters of the GBR has not increased, and therefore, that adverse impact on the reef cannot have increased. Such claims overlook the facets of river run-off, other than turbidity alone and fail to recognize the importance of some components of the sediments; sediments, which cause turbidity, may today include very different adsorbed and absorbed chemicals from those present in previous decades, and the dissolved substances in the sediment-carrying waters may also modify the characteristics of the sediments. The evidence is clear that the levels of some chemicals (notably in nutrients containing nitrogen and phosphorous), in some rivers discharging to the GBR are increasing, and have increased over several years.

The Panel is of the view that the current declines in river water quality in several catchments that drain to the GBR, should not be allowed to worsen, and that, as soon as is practicable, the trends in worsening water quality should be reversed, to allow the GBR and its catchments the best possible opportunities to recover from disturbances. This view includes the consideration that other disturbances, such as the predicted 'global warming', are likely to adversely affect corals and coral reefs.

The evidence that we possess is admittedly incomplete, and some will say that the situation is "circumstantial", from the most rigid scientific approach. We agree that the scientific evidence is incomplete, but we also believe that the measures we are suggesting to be put in place, to improve the quality of water entering the GBR, are fully justified on the scientific evidence to hand.

The Panel is also of the view that the changes necessary to achieve improvement in water quality can be best achieved by close collaboration among all sectors of the community, and that corrections should be sought at the source of the problem, not "at the end of the river" entering GBR waters.

The report of the GBR Reef Protection Inter-departmental Committee Scientific Panel was released in January 2003. The panel members were:

Dr Joe Baker, Queensland Chief Scientist, Department of Primary Industries, Dr Miles Furnas, Principal Research Scientist, Australian Institute of Marine Science, Dr Andrew Johnson, Program Leader, CSIRO Sustainable Ecosystems, Dr Andrew Moss, Principal Environmental Scientist, Environmental Protection Agency, Professor Richard Pearson, Director, Australian Centre for Tropical Freshwater Research, Dr George Rayment, Department of Natural Resources and Mines and Sugar Cooperative Research Centre, Professor Russell Reichelt, Director of the Reef Research Centre, Dr Christian Roth, Program Leader, CSIRO Land and Water, Dr Roger Shaw, Chief Executive Officer, Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management

The full report is available at www.premiers.qld.gov.au/about/reefwater.pdf

RESOURCE NO. 6: CSIRO POSTER - FUTURE CLIMATE CHANGE IN AUSTRALIA

Greenhouse gas concentrations have increased over the past 200 years due to human activities such as burning coal and oil, land clearing and agriculture. This has led to global warming and other changes in climate.

Further climate change is likely despite efforts to reduce greenhouse gas emissions. The Inter-governmental Panel on Climate Change [IPCC] has concluded that by the year 2010:

- The Earth is projected to warm by 1.4 to 5.8^{0}C
- The sea level is projected to rise by 9 to 88 cm

relative to 1990. The projected rate of warming is much larger than observed warming of 0.6^0 during the 20th century and is very likely to be without precedent during at least the last 10,000 years, based on paleoclimatic data (temperatures derived from air bubbles trapped in polar ice cores).

Changes expected in Australia are shown for ten regions for the years 2030 and 2070. The range of values depicting likely changes is due to an allowance for uncertainty in future emissions of greenhouse gases and the response of the climate system. Most of Australia may warm 0.4 to 2.0^{0}C by 2030, and 1 to 6^{0}C by 2070, with slightly less warming near the coast.

This would likely result in:

- more evaporation, more hot days and fewer cold days
- rainfall decreasing in the south and east (mainly winter/spring)
- some inland and coastal areas experiencing wetter summers
- some inland areas becoming wetter in autumn

- extreme rainfall and tropical cyclones becoming more intense.

The tendency for less rainfall and more evaporation means less water will be available, as measured by the annual moisture balance (rainfall minus potential evaporation). Potential evaporation measures the ability of the atmosphere to remove water from soil, vegetation and water bodies.

NORTHERN COASTAL QUEENSLAND

- Warmer ocean temperatures will increase bleaching of coral on the Great Barrier Reef.
- Stronger cyclones will increase coastal inundation, coral damage, property damage and beach erosion.
- Less water for cities (e.g. Cairns), agriculture (e.g. sugar) and natural ecosystems (e.g. rainforests)
- Reduced bio-diversity (e.g. decreased rainforest habitat for frogs, skinks, tree kangaroos and possums).

(see chart below)

Source: www.dar.csiro.au/publications/Cechet_2002a.pdf

RESOURCE NO. 7

Passing ships heap grief on the reef

Even small oil spills can pollute the Great Barrier Reef for months, Amanda Hodge reports.

In two short years the World Heritage-listed Great Barrier Reef has weathered three oil spills, two serious ship groundings and a push to test for oil just outside its eastern boundaries. Little wonder the region is again the centre of an environmental debate.

On Christmas Day, exactly one month after an unknown ship passing through the Great Barrier Reef's inner channel released 800 litres of thick oil into a pristine coastal region and onto Townsville's white sandy beaches, it happened again.

A slick up to 100 km long was reported 12 nautical miles east of Whitehaven Beach whose pearly sands are frequently featured on Whitsunday holiday brochures.

Ten years after the massive Exxon Valdez spill in Alaska, scientific reports confirm commercial fish spawn are deformed, reproduction rates in fish and mammals continue to decline and lingering vestiges of toxic hydrocarbons remain from the slick.

The Australian government reviewed shipping arrangements through the Great Barrier Reef after the disastrous grounding in late 2000 of the Bunga Terai Satu Malaysian container ship on the Sudbury Reef southwest of Cairns.

The Great Barrier Reef Review Report made many recommendations, including the extension of compulsory pilotage through the Torres Strait and increased surveillance measures. But it ruled out rerouting ships not using Queensland ports to the outer channel despite the fact that between 1985 and 2000 there were 31 collisions and groundings on the Great Barrier Reef—a far higher proportion than in any other Australian shipping passage…

Source: Amanda Hodge, *The Australian*, 29 January, 2003.

CAIRNS	NOW	2030	2070
Annual average max. temperature (°C)	28.9	29.2 – 30.6	29.7 – 34.1
Dec-Feb days over 35°C	3	3 – 8	6 – 76
Annual rainfall (mm)	2028	1785 – 2105	1300 – 2270
Annual moisture balance (mm)	-200	-215 to -275	-620 to -430

Muddy Waters A Film Australia National Interest Program in association with December Films. Developed with the assistance of the Australian Film Commission and Film Victoria. Produced in association with SBS Independent.

Writer/Director/Co-producer: Sally Ingleton
Producers: Tony Wright, Stuart Menzies
Executive Producer: Franco Di Chiera
Year: 2003
Duration: 55 minutes

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ENDNOTES

1 Rachael Nowak, New Scientist, 'Great Barrier Bluff', 4 January 2003, pp. 8-10.
2 Letter to the editor, New Scientist, 1 February 2003.
3 Amanda Hodge, 'Passing ships heap grief on the reef', The Australian, 29 January, 2003.
4 http://www.qff.org.au/Bulletin/26%20July%202002.htm