AN UNDERGRADUATE REGOLITH-LANDFORM EDUCATION AND TRAINING PROGRAM WITHIN THE SHOALHAVEN RIVER CATCHMENT, NSW

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INTRODUCTION

The Shoalhaven River catchment (Figure 1) provides an excellent arena for regolith and landform education and training. It contains a wide range of regolith materials and landform features that have evolved over very long geological timeframes and continue to evolve within the contemporary landscape. Much of the previous research within the catchment has been integral to the development of the foundations of regolith and landscape science in Australia, thereby providing a strong academic framework for students. The catchment has also hosted a wide range of landuse activities providing mineral exploration and land and environmental management case studies and issues for students to consider. Access to most parts of the catchment is good and it hosts a wide range of facilities to service most field trip needs.

From 1998-2002, 1st year undergraduate classes within the subject *Landscape Processes*, at the University of Canberra, included a series of field and associated practical-laboratory classes in this region. This short manuscript provides a brief outline of this teaching program, including an innovative, effective and simple teaching structure for field-based, regolith-landform teaching.

TEACHING STRUCTURE

Field classes were a valuable component of this course. They are an important part of education, for students' gain first-hand experience of landscape features that they can then immediately relate to and build their own experience with. The field classes also provide important links between undergraduate teaching and research activities both from within the teaching team but also previous research conducted through other institutions. Many university field classes have traditionally tended to focus on a theme within a broadly defined field area. During the course of these field trips there is usually a component where students are shunted in and out of vehicles to see ideal examples of sites that are consistent with the field trip theme. Such trips may be referred to

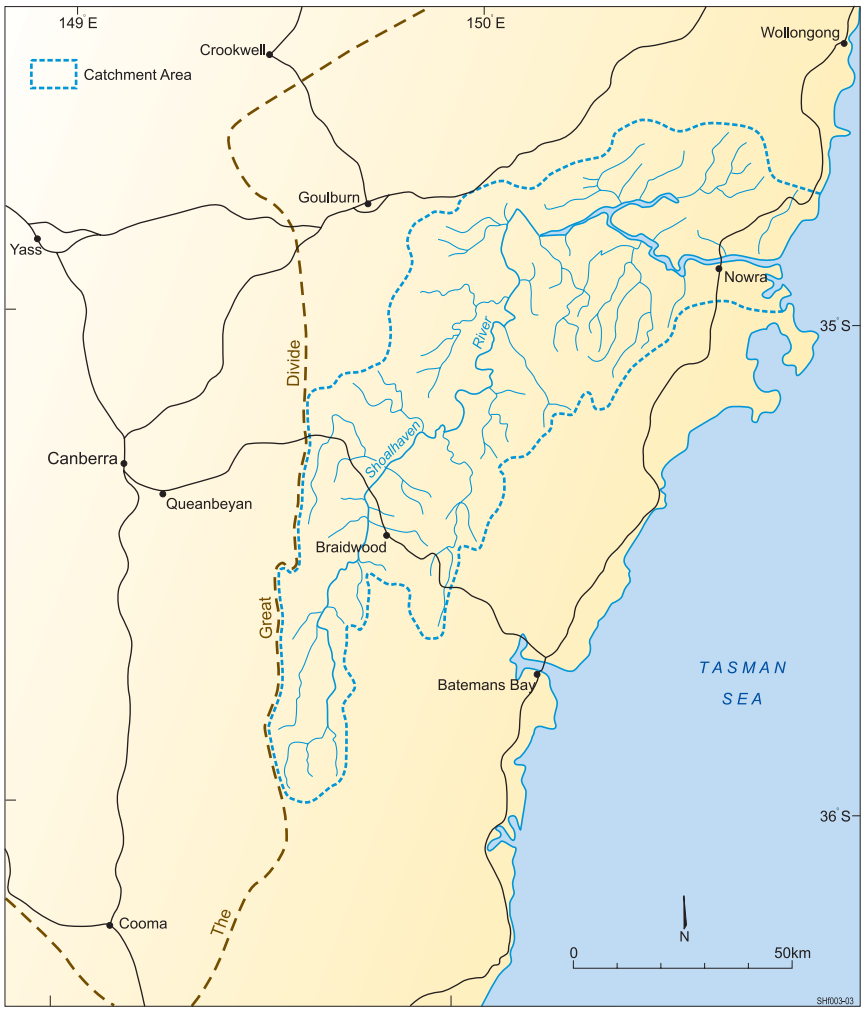

Figure 1: The location of the Shoalhaven River catchment

as “Cooks Tours” or “Fishing Trips” where field orientation soon leads to disorientation (at least in the students' mind) as the field journey weaves irregularly across the landscape. Although the staff leaders may have very good intentions and are putting a lot of time and effort into their teaching, most of the students are not really sure of: their location at any given site; the purpose of each field site; and, how sites relate to each other.

The field program initiated here for the Shoalhaven River catchment alleviates some of these problems by ordering visits to field sites in sequence from the catchment headwaters to the river mouth at the coast. As a result students automatically have at least some sense of place within the field area as each site is further downstream from the last. The advantage of this approach is also that in many cases the students are moving through the catchment in a path that is equivalent to how many of the landscape processes operate and many of the regolith materials are transported.

Field visits were organised over four days spread across second semester (July to November) and included:
- Day 1: Upper Shoalhaven River catchment:
- Day 2: Middle Shoalhaven River catchment; and,
- Days 3 & 4: Lower Shoalhaven River catchment.

As well as field visits, a series of practical-laboratory sessions were run each week during semester; each one contained at least one component that related to the Shoalhaven River catchment. These were also complemented by the lecture series that used numerous examples of field sites that students had visited within the catchment, as well as from elsewhere, both within the catchment and from around the world.

The assessment item for this program was a major report on *The Landscape of the Shoalhaven River Catchment*. This report was to outline the major landscape features and regolith materials of the catchment, and discussed the regolith and landscape evolution as well as the applications of this knowledge to human interaction with this landscape. The report was also to contain materials derived from field classes, practical-laboratory sessions and further reading by the students.

Class sizes ranged between approximately 40 and 50, most of which were in the first year of their undergraduate course. The author of this abstract was the subject convenor and primary lecturer for the subject, with assistance provided by a team of demonstrators (mostly including Honours and PhD students), and a technical officer. In all field classes “safety is no accident”, therefore all demonstrators are trained in first aid, and particular care is taken near cliffs, on river crossings and for oncoming traffic near roads. No injuries were reported on any of these trips. The environmental impact of the trips are also kept to a minimum, with limited field samples taken discretely from road cuttings or public land. No samples were taken from national parks nor conservation zones.

FIELD CLASS CONTENT

Field class transport was by a hired bus with a driver. Most field days commenced at 8 am and concluded at 6 pm. Field stops and key features examined are listed below.

Upper Shoalhaven River Catchment
- Lowden Forest (‘The Great Divide’, granite weathering, stone-lines, wet sclerophyll forest, pine plantations and timber harvesting practices);
- Harolds Cross (view over the upper Shoalhaven River catchment, tors, soil gullying);
- Jinden Creek road cutting (weathering profiles on granitic and basaltic bedrock, stone lines, Figure 2a);
- Krawarree Homestead (scotch-broom infestation along the Shoalhaven River alluvial plain);
- The Big Hole (‘big lunch’, Shoalhaven River crossing, geobotanical relationships, inverted tree lines, tree throw, termite mounds, cave collapse, Figure 2b);
- Ballalaba Bridge (Shoalhaven River, point bar, cut-bank undermining Majors Creek Road, weathered Palaeozoic metasediments); and,
- Braidwood-Cooma Road cutting (mottled saprolite derived from ignimbritic acid volcanics, Figure 2c).

This day served as the initial first-hand interaction with the landscape in the Shoalhaven River catchment. There was a major emphasis on making observations and descriptions and then constructing interpretations. Weathering profiles on a wide range of rock types were described and samples collected for later practical-laboratory sessions. Some land management implications for timber extraction and land clearing were considered. The walk to the Big Hole, immediately following lunch is a good chance to speak with many students one on one, as well as seeing a very exciting and unexpected landscape feature.

Middle Shoalhaven River Catchment

- Warri Bridge (Shoalhaven River and stream sediment composition, Figure 2d);
- Nerriga (remnant aeolian dunes with podsolic soil);
- Welcome Reef (proposed Welcome Reef Dam, pine plantations on shallow soils);
- Oallen Crossing (lunch, Shoalhaven River, high-level gravels and palaeo-Shoalhaven River, alluvial Au);
- Nadgigomar Trig (highly weathered bedrock, pallid zone, mottled zone, ferruginous induration, salinity, clay pit, palaeo-landscape reconstruction, Figure 2e);
- Windellema (Silicified palaeosediments, weathered Palaeozoic metasediments);
- Lumley Road (dryland salinity); and,
- Henley (bauxite developed on topographically inverted basalt).

A major theme considered on this day was the great antiquity and diversity of palaeo-landscape remnants and their regolith materials, and in particular how we live with these areas and manage some of the salinity problems and the proposed flooding associated with the Welcome Reef Dam. Soil testing and profile descriptions were extensively conducted during the day, as well as collection of indurated regolith samples for later investigation in practical-laboratory sessions.

Lower Shoalhaven River Catchment

On the first day:

- Badgery's Lookout (view into Shoalhaven Gorge, Tertiary basalt, Sydney Basin, regional landscape evolution models, view to limestone quarries). Caution is advised with a large bus due to the low railway overpass after leaving the Hume Highway to this site;
- Fitzroy Falls (Lunch, knick-point, Sydney Basin, geobotany associations, rockfalls);
- Cambewarra Mountain (cannot get a bus to the summit! Stop for views of the lower Shoalhaven catchment on the way down the mountain);
- Hanging Rock (Shoalhaven River, Nowra town siting, honeycomb weathering, colluvial processes);
- Broughtons Creek (acid sulphate soils, mangroves, bank erosion, Shoalhaven River);
- Shoalhaven Heads boatramp (anthropogenic influences on sedimentation);
- Shoalhaven Heads (river mouth, landscape changes, coastal dunes, beach processes and management, Figures 2f and 2g); and,
- Stay overnight at University of Canberra Field Station at Jervis Bay.

Then on the second day:

- Crookhaven Heads (Shoalhaven – Crookhaven rivers mouth, shore platforms, tsunami deposits);
- Seven Mile Beach (coastal dune and vegetation, beach processes);
- Black Head - Gerroa (shore platform, coastal cliffs, fractured rock aquifers, Permian fossils, beach spit and processes);
- Jaspers Brush (acid sulphate soils);
- Kiama (lunch, just out of the catchment);
- Minamurra Rainforest (just outside of the catchment, but an inspiring place to reflect on the trip and discuss where we have been over the course of the semester); and,
- Return to Canberra via Macquarie Pass and Robertson (marvel at the Big Potato!).

Quite a lot of sites were covered over these two days but they make a great finale to the Shoalhaven River catchment landscape story. The trip passes through some of the most beautiful landscapes in Australia and explores a wide range of landscape-related issues. Sediment samples are obtained from the Shoalhaven estuary, the beach and dunes at Shoalhaven Heads and the beach at Black Head for detailed examination during the following practical-laboratory class session. Arrangements must be made with the National Park rangers at Minnamurra before arriving with a large bus full of students.

PRACTICAL – LABORATORY SESSIONS

A series of practical exercises were run in close conjunction with the field trip visits. The results from the field and laboratory were therefore integrated and placed into the final student report. Some of the practical exercises relating to the Shoalhaven River catchment include:

- Map interpretation and base map production, using 1:250,000 topographic and geological maps (Canberra, Goulburn, Wollongong and Ulladulla). Stream longitudinal profiles and topographic sections were made across the catchment. This was done prior to the field trips and helped to initially familiarise students with the location and size of the catchment, and some its landscape features.

- Aerial photograph interpretation exercises for key sites such as, along the Shoalhaven Fault in the upper catchment, the Quilties Mountain area in the Budawangs, and the Shoalhaven Delta.
- Detailed description of regolith profiles developed on different rock types within the catchment. This largely followed on from the first field trip. This study utilises samples that were taken by the students from road cutting faces that they have previously mapped in detail.
- Detailed examination and description of sediments from the catchment, including stream sediment samples from Warri Bridge and Oallen Crossing, as well as coastal sediments from near the river mouth. Once again the samples that the students work with were collected on the field trips. Binocular microscopes were used to describe the composition and morphology of sediment clasts and to consider their transport and deposition history within the catchment.

EVALUATION

Student evaluation forms submitted each year very consistently endorsed this field program as one of the highlights of their university experience so far. As well as learning, the students mostly had fun, and got to know staff and other students a lot better for the experiences. It is very surprising how few students knew about the Shoalhaven River and its location at the start of the course (the river is less than 100 km from Canberra). From the perspective of students gaining a greater context and appreciation of their place in the landscape the course was successful.

The field trips were meant as an introduction to the area, although many student groups from the class planned trips to other sites within the catchment such as Bungonia Gorge, the Budawangs, Kangaroo Valley, and Marble Arch, to build upon their field experiences in their own time during the semester. Several students further pursued an interest in the regolith and landscape of the Shoalhaven River catchment introduced to them during this teaching program by completing Honours projects in the upper (Lewis 2000, Lewis *et al.* 2002) and lower (Christian 2002, Christian & Hill 2002) parts of the catchment.

CONCLUSIONS

Although this teaching program has not run since the University of Canberra withdrew from CRC LEME at the end of 2002, it is hoped that this short manuscript makes some documentation of part of the teaching program that took place. It is also hoped that these details may help others construct effective regolith and landform teaching programs at universities. There are many other river catchments that would be similarly appropriate as a basis for regolith and landscape undergraduate teaching.

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Acknowledgments: Demonstrators: Lea Hill and Kylie Foster (who kept coming back each year for more), it was great to work with their dedication, knowledge and experience. Melissa Spry, Darryl West, Steve Willis, Grant Jones, Ancret Lewis, Jaclyn Brachmanis, Simon Debenham, Ben Maly, Anthony Senior, Tessa Chamberlain, Rod Dann, Andrew McMahon, Andrew Christian, and Angela Ratchford were great teaching team members over the years.

Technical Officer: Glen Fisher, whose knowledge, assistance and friendship is greatly appreciated. You are an absolute champ Glen, and will be a sadly missed member of the CRC LEME team.

This teaching program was funded and supported by the University of Canberra, with the author of this abstract employed by a CRC LEME funded fixed-term contract.

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Figure 2: Field fun in the Shoalhaven River catchment. **a)** Jinden Creek road cutting weathering profiles; **b)** crossing the Shoalhaven River to the Big Hole; **c)** sampling mottled, weathered ignimbrite in the Braidwood-Cooma Road cutting; d) stream sediment sampling from the Shoalhaven River at Warri Bridge; **e)** highly weathered metasediments at Nadgigomar Trig; **f)** sampling dune sands at Shoalhaven Heads; **g)** examining beach processes at Seven Mile Beach.