Australian Institute of Alpine Studies

Newsletter No. 11 July 2001

Meeting of the AIAS in Hobart December 5th-7th

This year the annual meeting of the AIAS will be held in Hobart from 5th-7th December, at the University of Tasmania. Because of the longer than normal distances required for most to attend we will be extending the meeting to three days. The first day will be taken up with talks on current and completed mountain research. This will be followed by drinks then dinner –location to be arranged. For the two field trips we will be hiring a mini-bus. On Thursday 6th the field trip will be to Mt Field National Park (1-1.5 hour drive from Hobart) to look at a ski village, track works Tasmanian style and alpine vegetation. On Friday 7th there will be a field trip to the eastern Central Plateau (2 hour drive from Hobart) to examine recovery of vegetation and soil after burning and grazing (stock, rabbits and native herbivores). We will also look at revegetation works on closed tracks and other degraded sites. Staff from DPIWE (also not now known as the Parks & Wildlife Service) will come along and tell us about their research. It will be a great opportunity for people north and south of the moat that separates our two large alpine areas, to put faces to names and just to find out that we are all doing the same things (albeit slightly differently).

On the Wednesday, as usual, talks will be 15 minutes duration - 12 minutes for the speaker and 3 minutes question time. We plan to start at 9am with a 'welcome' and an introduction on Tasmanian alpine environments from Jamie Kirkpatrick and then follow on from 9.30 am with the 15 min talks. Morning tea will be from 10.30-11, lunch 12.30 - 1.30, afternoon tea 3-3.30, finishing with a wrap up 4.30-5.00. This leaves space for 22 talks so another busy day. Again we will try and group the talks into themes for the sessions which will be set once we now who is coming and talking.

Transport to/from the airport will be organised if masses of people turn up on the same day at the same time. There is also an airport bus that will take you into town and drop you at your accommodation. There is a caravan park in Sandy Bay (where the University is also conveniently located) and there are hotels, motels and backpackers all within 30 minutes walking distance of the university (or on the bus route). Kerry Bridle will track them down - prices too if people wish.

I know it's a long way to go but the value of seeing the quite different Tasmanian alpine flora, fauna and landforms, methods etc will be worth it. Could all people intending to attend please contact Kerry Bridle on 03 62 262837 (kerry@utas.edu.au) so that we can get some idea of how many to cater for. Titles of talks and abstracts would be welcome for the next newsletter.

STOP PRESS

The Australian Alps Liaison Committee will be running an event for the International Year of Mountains, probably in Jindabyne, in the third week of November 2002. Within that will be a science conference examining 'Conservation and Restoration of Mountain Ecosystems'.

Earlier in the year the AIAS will be running a biodiversity blitz based at Thredbo. Like similar events in Europe we will attempt to take a snapshot of the biodiversity in a given area (Thredbo Valley to summit of Mt. Kosciuszko)in one day. The weekend of January 19/20 is earmarked for this event.

Canadian ice core to yield clues on global warming

Canadian scientists are attempting to extract a tube of ice measuring 225 meters deep from the summit glacier of Mount Logan, Canada's highest peak. They hope to obtain a 10,000- year record of climate change, the first long-term record for a geographical feature located so near the Pacific Ocean.

PlanetArk news story at: http:// www.planetark.org/dailynewsstory.cfm?newsid=10644

Mountain Filming

AIAS members Karen Watson and Chris Holly are madly working to complete a documentary on the Young Australian Antarctic Expedition of January 1999. The documentary is going to be screened at the Talluride Film Festival on the 25th/26th of May. The Film Festival's theme this year is the Antarctic. The documentary is about a crew of mostly ACT-based climbers/scientists who decided to travel to Antarctica to climb an unclimbed peak on the Antarctic Peninsula. Chris Holly not only managed to capture the pretrip preparations in Australia, but over 5 weeks, shot some absolutely breathtaking footage including life on board the tiny yacht in which they sailed to Antarctica. The documentary filmed whales, wildlife, amazing mountains, snow trekking and mountainclimbing, and documented rain in Antarctica. Post - Talluride they are looking to hold a screening in Canberra. Karen also managed to get the mountain pygmy possum documentary cut to 17 minutes but with the extra footage shot on the survey of 2000 (and thanks to the BBC!*) and time willing, should be able to spread it out to a commercial half hour. Chris and Karen would like to extend to the Institute the opportunity for anyone with a project with subject interesting or controversial enough to make a video about for their next possible project.

Contact Karen at *karenwatson@bigpond.com* or Chris Holly at *Holly@atrax.net.au*

*The BBC Natural History Unit are currently making another David Attenborough series 'Life of Mammals' to complement his 'Life of Birds'. Filming of wombats in the snow was conducted in the Snowy Mountains in July and of mountain pygmy possums in December.

Mountain Forum News

The Mountain Forum has a current version of Mountain Networks posted on their webpage at the address listed below: *http://www.mtnforum.org/resources/library/netwo00a.htm*

The Mountain Forum also has available many printed and bound documents for members to purchase. These documents include printed proceedings of mountain-related e-conferences, summaries of international meetings, as well as issues of the Mountain Forum Bulletin.

You may browse the entire inventory of publications available at the website address listed below, as well as find complete instructions for how to order. Please note that many of these documents are also available on the website in electronic format. However, for those members who wish to have a hard copy for their office, a library, or to share with colleagues, contact the Mountain Forum with your request.*http://www.mtnforum.org/resources/orders/publications.htm*

Documents Newly Available in the Mountain Forum's On-line Library and Reference Database

Thanks to generous contributions from our Mountain Forum participants, a number of documents of interest to the mountain community are newly available through the Mountain Forum's on-line library at *http://www.mtnforum.org*

GENERAL: ORGANIZATIONS

International Geographical Union, Study Group on Diversity in Mountain Systems. *http://www.mtnforum.org/resources/library/igusg01a.htm*

EPSI. *http://www.mtnforum.org/resources/library/epsi99a.htm*

WATER, EARTH AND ATMOSPHERE: GLACIOLOGY

Valdivia H., R. 2001. Economía de Recuparción en Glaciares Andinos. *http://www.mtnforum.org/resources/library/valdr01a.htm*

WATER, EARTH AND ATMOSPHERE: NATURAL HAZARDS

Fletcher, T. 1999. Lahar on Casita Volcano: The Inevitability of a Natural Disaster. Mountain Forum On-Line Library. *http://www.mtnforum.org/resources/library/flett99a.htm*

AGRICULTURE: AGRICULTURE GENERAL

Paradis, D.L. 1996. An Agroecosystems Approach to Local Resettlement and 'In Situ' Development in Upland Areas: Case Studies in Central Sulawesi, Indonesia. University of Guelph. *http://www.mtnforum.org/resources/library/parad96a.htm*

EDUCATION: ELEMENTARY AND SECONDARY EDUCATION

Murray, P. 1996. Mountains: Biomes of Nature Series. Childs World. *http://www.mtnforum.org/resources/library/murrp96a.htm*

O'Mara, A. 1996. Mountains. Capstone Press. 24pp. *http://www.mtnforum.org/resources/library/omara96a.htm*

Abstracts

Late Pleistocene glaciation of the Kosciuszko Massif, Snowy Mountains, Australia

Timothy T. Barrows,[1] John O. Stone, L. Keith Fifield and Richard G. Cresswell [1]Research School of Earth Sciences, Australian National University, ACT, 0200, Canberra, Australia

Late Pleistocene glaciation of the Australian mainland was restricted to a small area of the southeastern highlands. Geomorphic mapping of the area and exposure dating using the in situ-produced cosmogenic isotope 10Be provides evidence for at least two distinct glaciations. The Early Kosciuszko glaciation consisted of a single glacier advance before 59,300 ± 5400 years ago (Snowy River Advance). The Late Kosciuszko glaciation comprised three glacier advances 32,000 ± 2500 (Headley Tarn Advance), 19,100 ± 1600 (Blue Lake Advance), and 16,800 ± 1400 years ago (Mt. Twynam Advance). The Early Kosciuszko glaciation was the most extensive and the Late Kosciuszko advances were progressively less extensive. These periods of glaciation in the highlands correspond to episodes of periglacial activity, and peaks in lake levels and river discharge at lower elevations in southeastern Australia. Glacier advances on the Kosciuszko Massif correlate with advances in Tasmania, South America and New Zealand, and are broadly representative of hemispheric climate changes during the last glacial cycle.

Litter and Soil Dynamics at an Inverted Treeline

D. Little, J. Banks and J. Field, A NSW NPWS funded ANU Forestry Honours Project

Frost hollows in the Eucalypt forest are largely confined to the subalpine zone in South East Australia. The forest boundary surrounding these frost hollows, the inverted treeline, is strongly defined and this provides the opportunity to study the soil and litter chemistry on either side of this boundary. Previous work by Hedenstroem (1993) and Banks (1997), have already shown marked differences in soil chemistry across this ecological boundary. A study site has been selected on Long Plain in the northern section of Kosciuszko National Park to quantify and expand upon these findings.

Preliminary results show that there are distinct changes in surface pH and litterfall across the woodland-grassland boundary. The final results will help to identify frost hollow margins where the have been lost during the grazing era. In addition, where these soil signatures have persisted inverted treeline boundaries under past warmer climates may be identified.

Relationship between road induced disturbance, soil properties and weed occurrence in Kosciuszko National Park

Frances Mary Johnston [(1)] and Stuart William Johnston [(2)], ([1] Griffith University, School of Environmental and Applied Sciences, PMB 50 GCMC Qld 9726; [2] Johnston Environmental Consultancy Pty Ltd., 5 Nightingale Lane Berridale NSW 2628)

The construction and maintenance of roads in Kosciuszko National Park has seen profound disturbance to existing vegetation and soil, as well as the introduction and proliferation of alien plant species. Changes in chemical and physical soil properties were found to occur along roadside verge compared to the natural state. Soils from natural areas had higher humus levels, less gravel and sand, and higher levels of nitrogen and phosphorus. Roadside disturbance caused an increase in soil pH and EC, with significant changes in nutrient concentrations. A relationship was also found between soil properties and the occurrence of different weed species along roadsides. The introduced weed *Achillea millefolium*, (yarrow) was found predominantly along high wash off areas with significantly higher soil pH and exchangeable levels of calcium and potassium than natural areas and disturbed areas without yarrow. Yarrow also changed the soil in these areas with an increase in organic matter compared to disturbed areas with no yarrow.

The Kosciuszko National Park Plan of Management is to be reviewed

Monica McDonald

The NSW Minister for Environment, Bob Debus, announced on 20 February 2001 that the Kosciuszko National Park (KNP) Plan of Management is to be reviewed over the next two years. This will be an important step in setting future management directions for the Park, so I thought I would provide Institute members with some preliminary information.

Plans of management are statutory documents under the NSW National Parks and Wildlife Act 1974. They are prepared by the National Parks and Wildlife Service (NPWS), in consultation with the public, and approved by the relevant Minister. Such plans establish the framework and principles for the way in which a particular park will be protected and used.

The current Plan of Management for KNP was initially published in 1982 and its approach to the complex interactions between conservation values, ecological impacts and public uses created a landmark in the development of protected area planning in Australia. The management framework established by the 1982 Plan has contributed significantly to the protection of many of the unique features of the Park.

However, the Plan has remained essentially unchanged since 1982. Those amendments which have been made related primarily to the detail of ski resort management and accommodation. Thus, the review of the Plan is an opportunity to look at Kosciuszko in the light of recent developments – including changes in the Park's ecological condition and visitor usage; recent scientific research in the area; and general developments in ecological concepts and approaches to park management.

The review of the Plan of Management is part of a package of measures announced by the NSW Government to "overhaul" planning in KNP in response to the recommendations of the Walker Report. This inquiry (conducted by Bret Walker SC) was established to investigate issues arising out of the Coroner's report into the Thredbo landslide.

One significant change resulting from this package will be the development of a separate planning regime for the ski resorts in KNP. This is intended to introduce planning and development approval mechanisms more suited to the built environment of the resorts and more in line with mechanisms applying to settled areas throughout NSW. While they will remain part of KNP and under NPWS management, the ski resorts will be subject to a Regional Environmental Plan (REP) operating under Part 3 of the NSW Environmental Planning and Assessment Act 1976 (the EP&A Act). That REP will be developed by the Department of Urban Affairs and Planning, in conjunction with NPWS. Development consents within the ski resorts will be subject to the provisions of Part 4 of the EP&A Act. The consent authority for major development proposals (approximately $2 million) will be the Minister for Urban Affairs and Planning, while NPWS will remain the consent authority for all other development work in the resorts.

It is intended that the REP for the ski resorts and the revised Plan of Management for the rest of the Park will be developed in parallel in order to maintain consistency between the two planning regimes. At this stage, the processes for producing the ski resort REP and revising the Plan of Management are still being developed.

Alpine Ecology Course

A review by Hazel Rath (P/T teacher)

The Alpine Ecology course is held in the Bogong High Plains, near Falls Creek Victoria for a week in January each year and is organised by Latrobe University. The aim of the course is to provide participants with an understanding of the alpine ecosystem and its significance for conservation and land use. Although prior knowledge of botany, zoology or soils is not assumed, some understanding and practical experience in any of these areas does help to make the course more enjoyable!

There were 48 participants in the course, each with very different skills and knowledge in alpine ecosystems. This led to some very interesting discussions on how the alpine areas should be managed, particularly in the ski resorts, and what restrictions should be placed in order to best conserve the alpine flora and fauna. Pre-conceived ideas were often dispelled as the week progressed and we could all see the importance of finding balanced management decisions.

In the first session we were given a brief introduction to alpine flora, vegetation and soils which provided some background material for the excursions and field projects held during the week. A seminar in the evening on vertebrate and invertebrate fauna completed our introductory knowledge. A set of course notes helped fill in the gaps although there was little time to actually study them in detail during the course, but they were helpful in putting it all in perspective when I returned home.

Each day was spent from 8:00 am to 6:00pm in the field. After the first day, we were allowed to choose whole day projects or a morning and an afternoon session in a subject area which interested us. It was difficult to decide whether to 'specialise' in one area and get a more in-depth understanding or to choose as many topics as possible to provide a broad overview. In the end, I opted for two areas of interest – spatial patterns and management of vegetation and the geomorphology of mountains. Dick Williams, Keith McDougall and Neville Walsh provided some very interesting field sessions, both in the resort of Falls Creek and on the Plains. Neville Rosengren captured my interest with his descriptions of the landscape and how it evolved into its current forms. I had one data collection day where we measured and described pools in an area of alpine bog. There were several groups working on different aspects of the bog so we were able to collect a range of data. This was analysed the next day and the results presented in a seminar. Some of these seminars were well planned and provided light relief as well as significant findings after a very hard week of work.

A highlight of the course was the seminar given by David Ashton, a very esteemed plant ecologist with many years of experience working in the high country of Victoria. He had some great stories of his former research years and it was only as you talked with him that you came to realise how tough his initial work had been.

The course costs $825 or $975 if paid by your employer. It was certainly value for money as it gave me a fresh insight into management and land use issues and how these need to be approached within the ski resorts and on the High Plains. I feel I would benefit by attending another course so that I could participate in all the sessions that I missed out on!

Climate change - trees and toads

Victorian treelines

Rhonda Dredge, Science Writer, La Trobe University

Global warming could see the end of Australia's alpine communities. An international scientific program involving La Trobe University is keeping watch

La Trobe University research has shown that the treeline near Mount Hotham has moved thirty to forty metres in the past twenty-five years - confirming fears that global warming may already be affecting plant communities at high altitudes. The work was carried out by Botany PhD student Lynise Wearne. Many of the oldest snow gums in the subalpine forest near Mount Hotham are estimated to be between 300 and 500 years old, suggesting the forest has been stable for a long time.

'We are now starting to see movement in the trees,' says Dr John Morgan, who supervised the student's research in the School of Botany. 'They are now establishing and growing thirty to forty metres from the existing tree line.' All of the trees growing in this previously non-treed region germinated after 1975, he says. Some are several metres high while others are small seedlings. 'There is clearly a change going on. Every year since 1975 new snow gums have established where they were previously absent.'

The research supports evidence that global warming is changing the pattern of vegetation in the world's alpine regions, allowing trees to move further up the mountains where they replace more restricted alpine species. A survey of mountains in Germany in the mid-1990s showed that some alpine species that were prevalent in 1901 are now found on only the highest peaks. The research was one of the first pieces of evidence that showed a biological response to global warming and made the front cover of the international science journal Nature.

Since then, 65 countries have joined a research program called the Global Observation Research Initiative in Alpine Environments (GLORIA) to establish a long-term observation network in all of the major mountain systems on earth. La Trobe University will monitor the Victorian Alps with a team headed by Dr Morgan. GLORIA is among the first research programs that studies the impact of global warming using field observations. Most previous work has concentrated on predictions based on models, and short-term manipulative experiments.

Australia's mountains are low by world standards, with only one to two hundred metres separating the tree line from some mountain tops. Yet more than 250 species of alpine plants grow in this restricted habitat, distributed in communities that have evolved to live in snow patches, heathlands, grasslands or bogs.

'Australia's mountains are just at the limit of alpine. So changes could happen very dramatically here. We may be an early warning system for the rest of the world.' Some of the more pessimistic scenarios predict that temperatures could rise by up to five degrees Celsius by 2070. The pattern and distribution of rainfall will also change significantly. 'This is critical because the amount and duration of snow is crucial. Some of the highest plant communities depend on the banks of snow that lie around for an extra two or three months relative to early melting areas,' Dr Morgan says.

Students from La Trobe will survey the biodiversity of species within alpine communities on the summits of Mount Feathertop and Mt Hotham and feed the information into a central European data base. Scientists want to know at what altitude and longitude the effects of global warming are occurring. How high do mountains have to be before you see change?

'Perhaps we are seeing an increase in the rate of change as a result of human activity; a rise in temperature that in the past occurred over 1,000 years instead of 50 to 70 years. How do alpine plants cope with such a change? In Australia, we could have the complete loss of the alpine ecosystems within the next seventy years.'

For more information contact Dr John Morgan *j.morgan@latrobe.edu.au*

SYDNEY - In an early warning to the rest of the world, Australia's snowy alpine regions are shrinking and could disappear in 70 years because of global warming, Australian scientists say.

"In Australia we could have the complete loss of the alpine ecosystems within the next 70 years," said botanist John Morgan in La Trobe University's latest campus magazine.

A La Trobe study found that sub-alpine trees in the Snowy Mountains have started growing 40 metres (130 feet) higher than they had in the past 25 years as a result of global warming.

"Australia's mountains are just at the limit of alpine, so changes could happen very dramatically here. We may be any early warning system for the rest of the world," said Morgan.

Australia's mountains are low by world standards, with only 100 to 200 metres (328-656 feet) separating the tree-line from the top of some mountains. Yet there are more than 250 species of alpine plants growing in the restricted habitat.

Morgan said the amount and duration of snow was crucial for the survival of alpine vegetation, with some plants dependent on banks of snow not melting until late in the spring.

La Trobe scientists say Australia's Snowy Mountains sub-alpine forest are 300 to 500 years old, suggesting the forest had been stable for centuries.

"We are now starting to see movement in the trees. They are now establishing and growing 30 and 40 metres from the existing tree-line. Every year since 1975 new snow gums have established where they were previously absent," Morgan said.

Morgan said the movement of sub-alpine trees higher up the mountains supported evidence that global warming was changing the pattern of vegetation in the world's alpine regions.

The demise of Australia's alpine ecosystem would mean the end of a small but thriving ski industry worth hundreds of millions of dollars a year.

Australia's highest peak is the 2,228-metre (7,310 feet) Mount Kosciuszko.

Climate, UV-B, pathogens and frogs.

Ken Green

People interested in the above and their interaction in mountains would benefit from taking a look at the 5 April edition of Nature. In that, a paper by Kiesecher et al. looks at the complex causes of amphibian population declines and postulates pathogen outbreaks due to increased UV-B exposure, not from depletion of the ozone layer, but due to lowered water levels in ponds as a result of reduced precipitation linked to El Nino. They found a link between water depth in ponds and winter precipitation as snow, which was in turn a function of the Southern Oscillation Index. They then measured the decline in UV-B flux with increasing water depth (at 50 cm there was 43.5% less UV-B than at 10cm). In a field experiment where water levels were manipulated they found >50% of tadpoles developing infections by the fungus Saprolegnia ferax with at water depth $\leq$ 20cm whereas in water >45cm deep infections never exceeded 19%. There is also a useful summary of the debate in the same journal (Pounds 2001) which points out that chytrid fungi (blamed for so much of the frog declines in Australia) are not the only fungi killing amphibians in unprecedented numbers. Pounds (2001) points out that climate only loads the dice for disease outbreaks whether they occur or not depend upon a host of other factors. In Costa Rica, rain frogs lay eggs underground where (like corroboree frog eggs in sphagnum) they are shielded from UV-B yet their numbers have also decreased.

Kiesecher, J.M., Blaustein, A.R and Belden, L.K. 2001 Complex causes of amphibian population declines. Nature 410, 681-684

Pounds, J.A. 2001 Climate and amphibian declines. Nature 410, 639-640.

Climate change wipes out US toads

Source: AFP|Published: Thursday April 5

Climate change is wiping out toads in the northwestern United States, according to a study which warns that global warming can have an effect that can ripple down the ecological chain.

Biologists are fretting over the western toad, a creature that once thrived across the foothills of the Cascade mountains but like many amphibian species around the world is now in dramatic decline.

There are plenty of shallow lakes and ponds where western toads can hole up and reproduce and there is no pollution threat, so in theory they should be thriving rather than imperilled by extinction.

Researchers led by Joseph Kiesecker of Pennsylvania State University fanned out across the region on a mission to figure out why toad embryos were dying in their tens of thousands.

They discovered that the likely culprit is El Nino, the occasional weather pattern, caused by a buildup of warm water in the western Pacific, which can disrupt local climates around much of the world.

These phenomena have become more frequent since the mid-1970s, coinciding with a recorded increase in the atmospheric temperature.

A succession of El Ninos reduced winter snowfall on the Cascades, which in turn meant there was less water runoff in springtime, when the snow melted, and so lakes and nursery ponds were only partially filled, the team found.

That meant the toads often had to spawn in water that was shallower than normal, which exposed their eggs to higher levels of ultra-violet (UV) light from the Sun.

In turn, this damaged the embryos and made them highly vulnerable to a lethal white fungus, *Saprolegnia ferax*, they found.

Armed with a measuring stick and a UV meter, the toad detectives found that when the water was less than 20 centimetres deep, 80 percent of the embryos were wiped out by the fungus.

But the mortality was only 12 percent when the water was more than 50 cms deep.

The team said the finding dramatically shows how climate change can reverberate down the ecological chain.

“It has become increasingly clear that to predict how climate change may translate into species losses, we must link global and local processes,” they said.

Amphibians living in high altitudes may be especially at threat. The UV factor is higher in the mountains because the atmospheric layer which filters out ultra-violet rays is thinner, they said.

Challenges of a Changing Earth

The Open Science Conference (OSC) "Challenges of a Changing Earth" will take place from 10-13 July 2001 in Amsterdam. This conference is a joint effort of the three Global Environmental Programmes IGBP, IHDP and WCRP.

A session on "Global Change and Mountain Regions" at the OSC will be chaired by Dennis Lettenmaier, P.S. Ramakrishnan and Harald Bugmann. The Mountains session will be held on 12 July. If you are interested in further details of the conference and the sessions, check the conference homepage at *http://www.sciconf.igbp.kva.se/fr.html.*

Global Change and Mountain Regions

Mountain regions are particularly sensitive to global environmental change and provide unique and sometimes the best opportunities to detect and analyse global change processes and phenomena. This is mainly due to the often steep altitudinal gradients in nearly all environmental features (meteorological, hydrological, cryospheric and ecological), which change substantially over relatively short distances. Accordingly, biodiversity tends to be high, and characteristic sequences of ecosystems and cryospheric systems are found along mountain slopes. The boundaries between these systems (e.g. ecotones, snowline, glacier boundaries, etc.) may experience shifts due to environmental change and thus can be used as indicators. Some of them can even be observed at the global scale by remote sensing.

Related to the changing environmental conditions along mountain slopes, changes also occur in socio-economic conditions, land-use and land-management practices, their attraction for tourists, etc. Unsustainable management practices may lead to the deterioration of the living conditions to the point where migration processes are intensified; some mountain areas become depopulated, whereas others become overpopulated. Such processes have a number of strong and mostly negative side-effects. Research on all these issues should increasingly include stakeholders.

A further characteristic feature is that many mountain ranges, particularly their higher zones, are not affected by direct human activities. These areas include many national parks and other protected, "near-natural" environments, including biosphere reserves. They may serve as locations where the environmental impacts of climate change alone, including changes in atmospheric chemistry, can be studied directly.

Finally, mountain regions are distributed all over the globe, from the Equator almost to the poles and from oceanic to highly continental climates. This global distribution allows us to perform comparative regional studies and to analyse regional differences in environmental change processes.

This session will provide (1) an overview of mountain research across different mountain ranges of the Earth and (2) information for stakeholders on possible development paths over the next few decades, taking into account globalisation processes and related cumulative and systemic environmental changes which may significantly threaten the ability of mountain regions to provide goods and services.

The ultimate aim of this kind of research is to contribute to sustainable land, water and resource management in mountain regions all over the globe.

Contact: Sabine Luetkemeier, luetkemeier@pik-potsdam.de, website: www.sciconf.igbp.kva.se/fr.html

Herpetofauna surveys of the alpine bioregion of Victoria

Nick Clemann, Arthur Rylah Institute for Environmental Research, DNRE. Heidelberg 3084Victoria

Between January and March 2001 I conducted surveys for herpetofauna (reptiles and frogs) in the alpine bioregion of Victoria. This work was supplemented by targeted frog surveys by Graeme Gillespie and Michael Scroggie, as well as capable and enthusiastic field assistance from John Silins, Cassie Wright and Simon Scott. As fieldwork has only recently been completed, we have not yet had a chance to evaluate (or even file!) our data, however this article summarises the background to the surveys, and reports some preliminary findings from the fieldwork.

Background to the surveys

The alpine bioregion of Victoria is home to several endemic species of herpetofauna listed as threatened in Victoria by NRE (2000). These include: Alpine Tree Frog *Litoria verreauxii alpina*, Alpine Water Skink *Eulamprus kosciuskoi*, Alpine She-oak Skink *Cyclodomorphus praealtus*, Alpine Bog Skink *Pseudemoia cryodroma* (believed to be endemic to this state) and Glossy Grass Skink *Pseudemoia rawlinsoni* (not endemic to the alps). In addition to these species, two as yet undescribed species of the scincid genus *Egernia* occur in this region. The biology and ecology of most of these species are poorly known, as are the processes that threaten them.

Plausibly, these threats may include trampling of habitat by cattle and feral horses, predation by introduced carnivores, habitat modification or destruction due to development, recreational activities or the invasion of weeds, and global warming due to the enhanced greenhouse effect.

One of these species, the Alpine Tree Frog, has suffered major declines throughout much of its range. The current status of the alpine reptiles is poorly known, but these species may also have declined due to these threats.

This region also contains other threatened alpine vertebrate species including, the Baw Baw Frog *Philoria frosti* and the Mountain Pygmy Possum *Burramys parvus*. Several vegetation communities, the Alpine Bog Community, Alpine Snowpatch Community and Fen (Bog pool) Community, are listed on Schedule 2 of the Victorian Flora and Fauna Guarantee Act 1988 (FFG). The region is experiencing soil erosion and vegetation damage and disturbance caused by cattle grazing, listed on the FFG as a potentially threatening process.

Victorian Department of Natural Resources and Environment Draft Action Statements have been prepared for the Alpine Water Skink, Alpine She-oak Skink and the Alpine Bog Community.

Surveys

Our surveys extended from Davies Plain in the far northeast of the state, to Lake Mountain near Marysville in the southwest of the Victorian High Country. In between these localities we surveyed areas such as Mt Buffalo, Mt Bogong, Mt Buller/Stirling, the Bogong High Plains, and Howitt, Bennison, Dinner and Dargo Plains. Due to logistic constraints, localities surveyed were not exhaustive, but chosen to reflect areas likely to be subject to considerable disturbances.

Logistic constraints also meant that the time spent in each area was relatively brief, and we conducted simple timed (20 minute) “active searches” for animals at randomly-

chosen sites. Actual sites surveyed were chosen to reflect obvious, readily-identified, broad habitat types such as snow gum woodland, heathland, bogs, grassland, rocky grassland and areas that had been cleared or grossly disturbed. Where possible, two sites in each habitat type were surveyed at each locality.

Preliminary findings

As mentioned earlier, full results are not yet available, however some interesting preliminary records are evident from this work. Disappointingly, we did not record the Alpine She-oak Skink, despite searches in the vicinity of known localities. Detection of this species using the techniques we employed is notoriously fickle (P. Robertson pers. comm.), and later searches by another herpetologist in one of these areas near Falls Creek confirmed this lizard's continued existence in this area (M. Swan pers. comm.). Similarly, the Glossy Grass Skink was not detected during these surveys.

The Alpine Water Skink (Figure 1) was detected at several sites on the Bogong and Davies Plains. The Alpine Bog Skink was also recorded at several localities throughout the bioregion, including Davies Plain. This latter site, where I had previously recorded the Alpine Bog Skink in 1998, is tantalisingly close to the New South Wales border, suggesting that this species might eventually prove not to be endemic to Victoria.

Alarmingly, the Alpine Tree Frog (Figure 2) was not recorded from at least five localities from which it was historically known to be abundant, including Lake Mountain, the Howitt Plains and Mt Hotham, although it continues to survive in areas such as the Dargo Plains and Mt Bogong.

Several specimens of undescribed *Egernia* skinks (Figure 3) were collected from Davies Plain, Mt Bogong, Mt Buffalo and near Falls Creek. These lizards appear to be most closely aligned to *Egernia whitii*, and material from these specimens will be examined by staff from the South Australian museum as part of a study examining the taxonomy of members of this genus that occur in the alpine areas of southeastern Australia (M. Hutchinson pers. comm.).

We hope to use the data from these surveys to design a more focused future study to examine the processes that threaten herpetofauna in the alps, with a view to investigating strategies to ameliorate these threats.

References

NRE (2000). Threatened Vertebrate Fauna in Victoria 2000 – a systematic list of vertebrate fauna considered extinct, at risk of extinction or in major decline in Victoria. Department of Natural Resources and Environment, East Melbourne.

Figure 1. Alpine Water Skink from Davies Plain

Figure 2. Alpine Tree Frog from Dargo Plains

Figure 3. Egernia sp. from Davies Plain

Snow Ecology: an Interdisciplinary Examination of Snow-Covered Ecosystems. edited by H.G. Jones, J.W.Pomeroy, D.A.Walker and RW Hoham, Cambridge University Press 2001 pp 378 US$80.00

Book review by Harvey J. Marchant, Australian Antarctic Division

While the title is a bit of a mouthful and sounds somewhat daunting, this is a volume that should be on the bookshelf of anyone who works on environments on which snow falls. The book grew out of a need by physical and biological scientists working on snow to develop a more interdisclipinary approach to their research. Snow scientists from Europe and North America formed a Snow Ecology Working Group with the goal of compiling basic information to enable the study of snow from an ecosystem perspective. I believe with this book the Working Group achieved its goal.

The book consists of 7 chapters plus a preface, epilogue, glossary and a comprehensive index. It is a text aimed at graduate students and researchers. The 15 authors and coauthors of the chapters come from Canada, France, the Netherlands, Russia, UK and USA. All are authorities in their respective disciplines. Hardly surprisingly the book has a heavy Northern Hemisphere focus but the principles discussed are obviously common to all snow-covered ecosystems. Also the emphasis is on seasonally snow covered environments rather than areas of permanent snow and ice.

The first chapter deals with snow cover and the climate system and provides an introduction to the next three chapters which deal with the physical properties of snow, its chemistry and role in nutrient cycling, and its microbial ecology The final three chapters are concerned with the effects of snow cover on small animals, snow-vegetation interactions in tundra environments, and tree ring dating of past snow regimes.

The book is structured so it can be read from cover to cover. However having initially read it this way, I found it much more satisfying to delve into individual chapters for details on specific topics. The contents of each chapter is well "signposted" with the use of headings and subheadings and the chapters are well referenced making this an excellent resource volume from which to access original research literature. The preface provides a useful synopsis of the chapters and the individual chapters more or less follow the same format of providing an historical perspective before reviewing the contemporary knowledge and concluding with an indication of directions for future research.

I have only a few quibbles with the book. The reproduction of the black and white photos and some of the diagrams is of disappointingly poor quality and hard to make out the detail being illustrated. I expected much better from this eminent publishing house and at a price tag of around 160 Australian Dollars. Figures 1.3 and 1.4 and 4.33, 4.34 and 4.35 are shown twice, once in black and white and again in colour between pages 204 and 205. While most chapters have adequate figures and tables, some do not. For example, only illustrating 4 of the 32 shapes of snow crystals in Chapter 2 is a pity. A few of the references are inconsistently formatted and a few spelling errors mar the overall presentation. The single greatest omission in my view is the absence of a short section in the opening chapter on those parts of our planet where snow covered ecosystems occur. While most are pretty obvious, some, such as the equatorial glaciers, are not. Some general introductory comments would have also been useful - I felt the editors rather threw the reader in the deep end!. Another omission, in my view, was a discussion of the geomorphological role of snow. Glacial, periglacial and nivation processes are touched on in a couple of the chapters but not tied together in a way to indicate the major role snow has in shaping landscapes. Despite these reservations the book is a mine of detailed information, a resource that those working on snow covered ecosystems will keep close at hand.

Hills and Mountains

An e-discussion on "Hills vs. Mountains", sparked off by Masi's posting to the Mountain Forum's-Asia list, lasted from March 27 to April 10, 2001. In the posting, Masi asked if there was much difference between hills and mountains in terms of cultures and geographies in a holistic sense. The ensuing e-discussion was, however, tilted more toward a search for the definitions of hills and mountains, with most participants towing the geographical line.

No clear consensus emerged on the definition of the "mountain," or of the "hill," however. The following capture the salient points raised directly or obliquely by the participants during the course of the e- discussion.

Some comments about the e- discussion.

*The search for THE definition of mountains either doesn't matter or is an exercise in futility. No matter how useful it would be to lawmakers to have a definition for "pornography," none has ever proved workable. That's a damned good thing. And the same goes for "mountain."

*Geologists, soil scientists, hydrologists and other physical and biological sciences need to adopt naming conventions that facilitate research and scholarly discourse. Others have definitions as per the requirements of their disciplines. Rather than we define what a mountain or hill is, let us ask the local people

*People's perception of the differences between hills and mountains are locality-specific or context-specific. In Nepal the general distinction is "hills" are green and mountain are "snow-covered." This distinction based on color, however, is not universally applicable.

*Let us not give a new definition but accept the existing names and describe the specific features according to the purpose let us not tie ourselves down to a rule that goes beyond what we have been following for years and years;

*How do we define hills and mountains from the human point of view (not just cold scientific point of view)? Can we define hills from mountains by the cultures that live on them? I feel that defining hills and mountains without considering the human cultures that live on them as a vital parameter, is a gross under-definition. The human network in hills and mountains combined, is not as static an element as elevation and vegetation-type and geological make-up, but is rather a very dynamic and unavoidable part of what mountains and hills are.

Some definitions arising from the e-discussion.

*Hills may go as high up as 3,000 feet (about 1,000 m), with grassy, scrub and broad-leaf vegetation, while a mountain may be higher than that with pine forests and snow-covered peaks.

*Han Hunni in "Sustainable Management of Natural Resources in African and Asia Mountains" (Royal Swedish Academy of Science 1999, Ambio, Vol 28, No 5, August 1999) gives altitude and slope as the two major criteria for the physical definition of a mountain eco-region. As these two factors influence the climate, vegetation, soil formation and hydrological processes, the most significant difference between mountain area and lowland is the abrupt changes in vegetation. At any latitude, the hill area is not high enough to show a significant change in vegetation, whereas mountain area is high enough to demonstrate various vegetation belts.

*From the kind of analysis that Mr. Hurni carried out, I believe relief maps of the terrain (characteristics) are important, not the names of the terrain (not the terms).

*To my understanding hills and mountains are elevated features of the earth's surface the standard measure of which is 'altitude'. There is an indirect relationship between altitude and vegetation, but a direct relationship between climatic conditions (temperature and humidity) and vegetation. The climatic conditions change with altitude at the same grid location (higher the altitude lower the temperature), thus influencing the vegetation. The climatic conditions also change with 'latitude' at the same altitude (generally temperature decreases from equator to poles), thus influencing the vegetation. (From Hurni's definition it appears as if there will be similar vegetation at 500 m altitude all over the world, but this is not so.)

*One definition I read in a geomorphology text years ago was that a mountain is a landform that rises 3000 feet vertically over a distance of 1 mile.

*Grade-6 teacher's definition of how people in his village in Pakistan differentiated the two: "Hills are those landforms having more sand/soft texture of soil irrespective of height and with good vegetation; whereas the mountains contain more hard rocks irrespective of height."

*Grade-6 teacher's definition based on texture doesn't cut it either. There are plenty of "hard hills" and bountiful vegetation in the Himalaya can extend quite a bit higher than the highest Swiss Alps. In any case, hills are often parts of mountains. Are we going to say a feature is a hill up to a certain point and then becomes a mountain? Or perhaps that the front of a lump is, according to the anthrocentric definition, a hill, while the backside is a mountain? And what do we do about the fact that hills may be growing into or ground down from mountains?

*Platforms and hills correspond to the 200-500 m mean elevation class and have a greater degree of roughness (RR>20%). Plateaus (16.8 M km^2), with mean elevations between 500 and 6000 m, have a medium degree of roughness (RR from 5 to 40%). Mountains (33.3 M km^2) are differentiated from hills by their higher mean elevation, (>500 m), and from plateaus by their greater roughness (>20% then >40%) in each elevation class. Accordingly, Tibet and the Altiplano are very high plateaus, not mountains. (Source: Meybeck M., Green P., Vorosmart C. A New Typology for Mountains and Other Relief Classes: An Application to Global Continental Water Resources and Population Distribution, MRD Journal, Vol.21.1, pp 34-45)

Participants were: Masi Latianara, Seth Sicroff, Rana Riaz Saeed, Shah Nawaz, Assefa Kuru, Mervin Stevens, Chan Jin Hooi, Muhammad Ayaz Khan, Muhammad Akhlas, Alejandro Camino, Margaret Percy, Megh Ranjani Rai, Bakht Jehan, Dr. Jane Pratt, B. K. Joshi, Martin Curd, Elizabeth Byers.

Martin Price [Director, Centre for Mountain Studies Perth College UHI Millennium Institute Crieff Road Perth, Scotland] responded with: This is a very interesting discussion. You mention the work done by Meybeck et al., but I would like to draw your attention to recent work done by the World Conservation Monitoring Centre (WCMC: see http://www.wcmc.org.uk/habitats/mountains/background.htm). This uses the same global database, which records the average altitude of every square kilometre of the Earth's land surface, but actually at this resolution, not the coarser resolution used by Meybeck et al.

The criteria for defining mountains are:

* > 2,500 m; * between 1500 and 2499 m if slope is >2 degrees; * between 1000 and 1499 m if slope is >5 degrees and local elevation range (radius 7 km) > 300m; * between 300 and 999 m if local elevation range (radius 7 km) > 300m. While altitude and slope have commonly been used, the local elevation range (relief) criterion is also critical, as those of us who live in and near low-altitude mountains know. The slope criteria of 2 and 5 degrees were essential to remove high-elevation plains and plateaux. The resulting digital map is beginning to be a standard reference, and is already being used as the basis for a number of other studies, both regional and global, of mountain regions.

See: V. Kapos, J. Rhind, M. Edwards, M.F. Price and C. Ravilious (2000) Developing a map of the world's mountain forests. In M.F. Price and N. Butt (eds.) Forests in sustainable mountain development: A state-of-knowledge report for 2000. CAB International, Wallingford: 4-9. Copies of the printed map are available from the World Conservation Monitoring Centre; you can see regional maps starting from http://www.wcmc.org.uk/habitats/mountains/region.html

Your comments on the content or contributions for future issues are most welcome.

Please contact
Dr Ken Green
PO Box 2228
Jindabyne NSW 2627
tel: 02 64505538
fax: 02 64562240
email: ken.green @npws.nsw.gov.au.

Editor Ken Green
Layout Jo Hooper