

Notes of LGP Workshop
Monday 2nd July, 9am to 12.30pm
Ballroom, Duxton Hotel, Wellington
Facilitator: Clive Howard-Williams, Chair of LGP Science Steering Committee

1. Key Question 1

- Brian Sorrell:
 - Ponds Bratina Island, Dry Valleys, Cape Hallett and plans to begin further work at the Darwin Glacier area in 07-08. Pond metabolic processes, eco-physiology of benthic mat communities.
- Phil Novis:
 - What organism is most present along the latitudinal gradient? Nostoc. So looking at that.
 - Nostoc collected from soils and ponds leads to genetic variation between the two.
 - Also took samples from Paul Broady's collection to get more variation along the latitudinal gradient.
- Megan Balks:
 - K123 Landcare research. Jackie Aislabie Microbiology/Soil microbial work. Darwin glacier.
- Diana Wall:
 - Working with Phil and Megan. Gradient from Taylor Valley – streams with algae and mosses and away from streams. Sites at Cape Hallett and Luther Peak. Soil respiration – CO₂ flux. SVL local scale differences and saw higher response in NVL. Took nematodes and soil. One species is dominant in more salty areas.
- Tracey Jones:
 - Lichens over a latitudinal gradient with Allan Green = terrestrial biodiversity.
 - Molecular aspects.
 - Population structure, and photo bio choice over latitudinal gradient.
 - Photobiont aspects. Microsatellites.
- Pete Covey:
 - Look at patterns of diversity and diversity gradients. These do exist in the peninsula, but don't exist so obviously in VLC.
 - Diversity hotspots. Suggestive of ancient refugia.
 - Two areas where N-S gradients look good as a starting points. Peninsula and VLC.
 - See an environmental gradient, but doesn't simply match the increasing latitudes. So important to look at which gradient you're looking at.
 - Look at gradients across shorelines – intertidal to marine. Intertidal expected to be barren, but it is very rich, but not sure why.
 - So there are surprises in Antarctic research.
- Ken Ryan:
 - Sea ice: looks like a good latitudinal gradient, but not so clear.
- Vonda Cummings:
 - Structure and function of benthic communities along the latitudinal gradient.
 - Marine expect to be different to terrestrial due to influence of oceanographic factors – temp and light mediated by sea ice.
 - Quantify benthic community along latitudinal gradient and how this is linked to latitude. North is ship based so deeper than southern which is diving.
 - Isotope analysis to look at food web linkages, and information on physical variables – currents and sea ice.

2. Key Question 2

- Mark Stevens and Ian Hogg:
 - Springtails and mites through VL and QMM. Can go back through literature and get good idea of springtails and mites in the area.
 - Look at gradients and sites proposed - all have springtails and mites.
 - Each area is unique with no overlap between springtail populations. Can define barriers e.g. Drygalski ice tongue. Large areas of ice free land still to be explored.
 - Mites are non-overlapping too and can pick out barriers. But some overlap between species. NO information in some large areas around the region.
- Vonda Cummings:
 - Quantify differences in environmental variability to help us interpret community structure and function.
 - Big differences in ice along the coastline.
 - More macrophytes up around TNB.
 - Difference along coast in terms of disturbance and icebergs. In north lots of icebergs, but less in southern area.
 - Anchor ice sticks to sea floor and disturbs benthos to around 30 m. Thought to be a southern McMurdo Sound phenomenon, but also seen around TNB.

3. Key Question 3

- Ken Ryan:
 - Thermistors in the ice, temp profiles at depth in the ice.
 - Fluctuations in top of sea ice, temperature much more stable lower in the sea ice. Temperature profile shows a range of temperatures in the sea ice – 1.8 at the base and temp decreases as you go closer to the surface as get close to surface air temps.
 - Also took light levels in the ice. 0.5 % of light got through to the base of the sea ice. Can see immediate effect of snow cover on sea ice in letting the light through.

4. Key Question 4

- Berry Lyons:
 - Pond work: upland ponds in Taylor Valley. Nissbaum Riegel. Denton's work shows to be 1-2 million yrs old at elevations above valleys. Melt pond on these surfaces. Work on geochemistry and climate hydrology.
 - Effect of temp change on waxing and waning of ponds. Model using adiabatic lapse rate to generate a melt model. Validated using stream data taken in the valley floor. Take the model and run it for higher elevations in the valley to work out which years a couple of glaciers would generate melt and support occurrence of the ponds. Years when ponds lose water, and years when they gain water. When there is water, ponds grow and they get more productive. Get high carbon concentrations about the bath-tub rings of the ponds. As ponds grow, algal mass grows. As ponds gets smaller, algal mass gets smaller.
- Jenny Webster-Brown:
 - Water composition of meltwater ponds and how they vary over the season.
 - Interested because habitats are full of life. And have extremes that they have to put up with.
 - Trace elements. Computer models to predict chemistry of ponds. How well do these models work?
 - Link to question 1, 3 and 7.
 - Want to do work on soil geochemistry of salts on soil with latitude.
 - Contrasting work with Bratina Island. What are the differences as a function of distance from coast, and of elevation?

- Results show processes they are using. Find very high concentration brine at base of ponds. Could end up with highly toxic soup.
- Megan Balks:
 - Since 1999 with USDA – run series of AWS – monitoring ground parameters as well as soil moisture and temp.
 - 27 million data points and contributing to AWS at Hallett and Darwin.
 - Student to spend time going through the data. Importance of availability of moisture to the soil.
- Pete Convey:
 - Freshwater arthropods. Two environmental variables: temp and water.
 - Springtail/bacteria – very hard to measure water stress on the organism at that scale. Sensors are bigger than the organisms!! Springtails don't have a waxy layer so readily exchange water with external environment. So could be a good signal for moisture availability /content. See a cycling of water content through the annual cycle. Peaks and troughs in summer and winter.
 - Do see trends of decreasing water content and increasing water stress in environment. Can be used as biological indicators/proxies – get some trends of larger scale climate change.

5. Key Question 5

- Pete Convey:
 - Comparable monitoring between BAS and LGP.
 - Marine monitoring at BAS. Signy in South Orkney Island North of the Antarctic Peninsula. Holds longest climate record in any Antarctic location. Monitor sea ice extent and duration.
 - Mid 1990s marine work moved to Rothera. Have 10 years of data. Rats data, monitoring environmental variables that may or may not be linked to local environment, and biological measurements. See some inter annual variability.

6. Key Question 6

- Ken Ryan:
 - Algae and bacteria function in sea ice. Number of different communities in sea ice. Near surface with low temps and high salinity and a distinct population. At bottom, temp is more stable and warmer.
 - Salinity and nutrient content environment higher. Very different mixture of organisms growing here.
 - Look at effect of environmental variables on algae in the sea ice. Use PAM fluorometry. Photosynthesis going slowly at -10deg C.
- Vonda Cummings:
 - Functional aspects different food available for benthos and how related to sea ice conditions.
 - Different things important at different areas along the coastline due to sea ice cover.
 - Used stable isotope analysis to look at trophic links of species. Taken 7 species to look at. The closer the dots are, the more similar they are. See a good link between latitude and food sources.
 - Big gap between Southern McMurdo sites and Northern sites. So need to sample locations in between.

7. Key Question 7

- Megan Balks
 - Soil characterisation.

8. Key Question 8

- Tracey:
 - Refugia, or long distance dispersal? Maybe a bit of both. Looking at a few species. Microsatellites. Relationship between photobiont dispersal and microbial dispersal.
- Mark Stevens:
 - Use DNA work to see if we can find refuges of the animals. Centres of diversity?
 - Not much connection among the areas but good connection within them. Within an area can look at different invertebrates and see if they are showing similar patterns.
 - Use as a proxy for glacial history.
 - Finding the species and working out where they came from. Have they been in Antarctica since it was a temperate climate? Some have been here at least since Antarctica was glaciated. Looked at locations around Antarctica to see what was endemic. Data self-calibrates itself. Patterns correlate to genetic molecular clock. Some are very young within 2myrs.
 - Take a multi-disciplinary approach to see what is real in the scenario. Phylogeography – spatial distribution of genealogy in any particular area. Need to sample the entire species range. Also fine scale phylogeography in glacial lakes. And co-phylogeography.
 - Looking at links between areas. Seeing same or different patterns.
- Pete Convey:
 - Nematodes in Peninsula. No species overlap between Peninsula and VLC. Not as diverse as we thought, don't overlap. Symptoms of refugial area and hot spots, so not overrun with ice in last glacial maximum.
 - Lots more examples like this where terrestrial biology doesn't fit with the present dogma on last glacial maxima. Flies were around on these plates for 40myrs.
 - Lichen – 1/2 lichen endemic to Antarctic continent – so was the Antarctic continent a source of propagules? Some lake environments have been continuous through glacial maximums.
- Nancy Bertler:
 - Use ice cores to reconstruct climate of the ecosystems that we are working in.
 - Graph comparing temp in DV with ice cores. Fairly close comparisons = good proxy. Use ENSO to explain large part of temp variability. But need to shift variables a bit to get exact match – decadal variability. Also maybe sea ice extent. Warmer summers = more sea ice – El Niño summer oscillation. Colder oceans but warmer atmosphere.

9. Feedback on recent relevant International Meetings

- Dean Peterson:
 - Follonica – Italy:
 - Research that Italy is doing on Biology topics.
 - Talk about IPY.
 - Italy having problems with funding for LGP at present.
 - Lots of talk on genetics.
 - And some LGP work that Italians have done. Stefano and Mariachiara with Vonda and Simon, on benthic marine work – on the Tangaroa too.
 - Marino Vacchi – silverfish work in TNB area – where are the larvae in the platelet ice.
 - CAML workshop in Poland:
 - New Zealand has a dedicated voyage to the CAML project.

- Connected to CoML = very important because of big network of marine researchers.
 - Need to ensure we connect our work with the other partners.
- Allan Green:
 - Conference in Spain:
 - Livingston Island – 25 summer only scientists 2 boats down there. Supporting Antarctic research.
 - Leo Sancho – biocomplexity of Antarctic and Subantarctic ecosystems for global change – written around the LGP work.
 - Glacial retreat and colonisation processes.....etc
 - Carmen Escaza??
 - Jack Beuthos? Specialise on microscopy endolithic organisms.
 - Spanish are not big but are consistent.
 - Antonio Quesada – Bryant Peninsula IPY project under MERGE
- Simon Thrush:
 - Follonica – Italy:
 - Italians been all over northern part of Ross Sea – NZ hasn't really studied much of this area – good potential for collaboration.
 - Workshop about Italian biology programme.
 - Organising principles like LGP very useful – molecular work.
 - Terrestrial and molecular ecologists. Molecular happy to have samples taken in field and brought back to study on.
 - Focus on climate change.
- Jenny Webster-Brown:
 - Action group for environmental contamination in Antarctica.
 - Predominantly Italians scientists and geochemists.
 - Also France, Australia, Korea and China (collaborations with Italians).
 - Recommend priorities for environmental research in Ant. (see Jenny).
 - 1st report of that action group at SCAR meeting in St Petersburg.
 - Italian programme: very few of the scientists get down to Ant. So collection of specimens has been very important – so set up a specimen bank – frozen specimens stored and available for anyone to have access to. Mostly for marine organisms.
 - Developing reference samples for the Ant. – soil and fish – fully validated and available. Third one for shellfish is being worked on.
 - Linkages on LGP – specifically at latitudes near TNB. Need to fill in the gaps around TNB.
- Diana Wall:
 - Book on terrestrial biodiversity – had a very broad scope – where is this work going and opportunities?
 - SCOPE project. Looking for upcoming areas that aren't getting enough attention and how can science address these by synthesising what we know already – and make a new research agenda. Biogeochemists and taxonomists – looking at soils in sediment, from soils, freshwater and marine. What do we know and what do the organisms do here and what are the feedbacks and what are the changes?
 - SCOPE project ended with synthesis book.
 - Next project is where are long term experiments and how do we work around these with other disciplines to understand the feedbacks.
 - No formal project yet, looking for someone to lead it.

10. Looking at the Key Questions

Fundamental issues to address: the following comments came from the general discussion involving all participants:

- Are they so broad that you can do work anywhere? Are they too focused? Still valid?
- Very impressed on challenging the glaciologists on thinking about the last glacial maximum – shows we need to re-look at our thinking about endemism and re-distribution of organisms. Over last 5 years – what we thought was ice covered land 10-20 thousand years ago – were not covered by ice when previously thought they were – e.g. Amery Ice Shelf. = whole new concepts to think about.
- Challenging the glaciologists – getting them more involved with biology and ecosystem science?
- Presentations – show how focused we are on our little areas. Pro or con? Should we be doing ecosystem studies or just focus on our small areas?
- Also issue about carbon cycling – is it different in different areas? Is it the same? We've chosen weird areas in Antarctica because they are ice free. But is altitude a more discriminate variable than latitude? Is it more important?
- Temp and water driving the ecosystem. Does temp drive ecosystem – or is it liquid water that does the driving?
- Obviously looking at many different ecosystems. No single one. How do we cope with that?!
- Are we figuring out the latitudinal variation, or are we working together? Could work together better.
- Jenny trying to deal with this problem by looking at altitude and distance from the coast for her work.

So – any comments on these questions? Do we still want to operate on this framework?

- Key questions help, so don't need to keep going through them.
- Packaging exercise on how you deal with them. All 8 of questions are very relevant to BAS work.
- Questions 2 and 3 could go under question 1.
- But in general they are good questions. 1 is a very well worded question.
- Keep questions as they are: good figure that relates diff time scales and physical scales of biological processes (refer to Andy Clark diagram). Would not like to see every little detail integrated into other groups. At some point good to have integration – but building blocks of small groups doing the work still need to be there.
- Do you want to stimulate research in a certain area?
- EBA keen to tie together disparate research communities. Form of the question is important in attracting the discipline that you are wanting.
- Could say that questions on marine are different to land – so could split marine and terrestrial.
- Don't divide up questions because you want to encourage cross- disciplinary work.
- Q3 and 4 including ice dynamics and climate – don't want to remove these because they include ice dynamics!!
- Ice dynamics – were not thinking of Holocene changes but just annual and decadal. But may need to include a time scale for the ice dynamics – long and short time scales.
- Diana and Berry invited to Antarctic Integrated System Science workshop by NSF – contemplating setting up another programme besides their disciplines – 40 US scientists spanning range of Antarctic science. LGP Question 3 now seen as one of the most important questions facing global society today. Not just past but also

future ice dynamics – on ecosystems and sea level – impact on global climate and on the biology as well.

- Last Glacial maximum only affects coastal fringe and borders of glaciers. But if you go past that limit you can step in the past even further. Need to understand what is happening there. Little distinction between soils of Hallett area and to 86°S – won't see much difference – so think there is not much going on. But good to find older surfaces – need to take into account the age of the landscape.
- Age of surfaces at DV and Larsemman Hills?
- Age boundaries may be hard to look at.
- Timescales important - need to re look at those.
- Looking at Question 3 – only says ice, but snow may be important to put in there. Snow cover is bad for the terrestrial communities. See the importance of snow cover on sea ice from Ken Ryan's slides. Snow important for marine as well as terrestrial.
- INTIMATE: integration of ice- core, marine and terrestrial records – NZ group shows last 3000 yrs – shows all these records to make super record to see what the diff environments look like over last 30000yrs – good for LGP to do this. For all the areas to show what the different areas are characterised by. Individual research projects but all interconnected. Put into one paper and poster – each person contributed.
- Want to address questions in near future and not too far in future.
- Want to include more International collaborations.
- LTER – what are the timeframes you are thinking of in terms of hypotheses? Haven't got to this point yet!
- LTER benchmark in the middle of the Victoria Land Coast.
- Is the next step to be more integrative and synthetic? Better questions rather than tweaking questions.
- Worried about emphasis on latitude. Do we need to integrate what we have now in the areas – to bring in coastal and inland stuff too? Integration at certain sites?
- Trying to bring in integration at Darwin and Hallett – this is the idea we are trying to undertake.
- Steering committee of OSC – outline proposal sessions targeted and trying to encourage cross disciplines – will be inviting submissions to these topics. Potential for synthesis volumes.
- Don't want everyone to be interdisciplinary scientists. Want to devote some people to bring that interdisciplinarity to link the groups. Need to feed data through to make things more successful.
- So what are data sets that we can get to help us more? AWS? Maps?

11. New areas of science not yet incorporated in the LGP?

- Carbon cycling in the Ross Sea region?
- Microbes in ice?
- Beardmore Glacier?
- B15 – predictability of large ice bergs? Yes – this was envisaged to be included in the key questions. Just one event had huge impacts on the ecosystems.
- Benthic communities can be very stable but then change rapidly. Linked to anticyclonic changes. Radical changes in primary production – but no link back to sea floor? Dearth in work in this area. Not much data to show this. Episodic events – could be modelled? Important to find out about these sporadic phenomenon – and future for the ecologists.
- Carbon – biodiversity evolutionary angle – how to explain what we have. Or function side of ecosystems and explain how they work e.g. using carbon dynamics. So don't want to only focus on carbon – biodiversity, evolutionary refuge stuff also imp.
- Dynamics issue – how fast are systems changing? Are we covering this?

12. General

- Need to graphically show what EBA does and how other projects work under it/contribute to it. EBA is NOT doing the work – sub projects are doing them. EBA brings it together.
- Peter talked about Antarctic Wallace line – bottom of Peninsula flora and fauna changes dramatically. Compare Victoria Land and Trans-Antarctic Mountains further south.
- Climate models are a bit ambivalent – Ross Sea area more stable than Peninsula.
- Antarctic Environmental Gradient (AEG): used for RiSCC – to show environmental gradient in Ant are not linear necessarily – can look at gradients as a spiral – different gradients within each spiral. All spirals come to AEG. Can expand out to Andes too if you want. But could have linearity between Peninsula and Victoria Land Coast (VLC).
- Compare systems studies between rapid changes of Antarctic (Peninsula) and slower changes in (VLC).
- Use SCAR as a link between EBA and AGCS.
- Also link between VLC and Peninsula.
- Is there anything in IPY making these links? See if there are any IPY programmes to link these together.
- AGCS – link – LGP is already bridging that gap. What are specific questions we are trying to answer and how best to answer this? Only have people work together if they need to.
- S. Chile – relating work at altitude with what is seen in the Peninsula.
- Want to give NZ scientists a chance to look at rapidly changing environments too.