BBECA SCIENTIFIC ADVISORY PANEL WORKSHOP
Wednesday, April 20, 2016, 9:00am – 3:00pm
Arbutus Meeting Room, Metro Vancouver, Parks West Area Office
130-1200 West 73rd Avenue, Vancouver, BC
Thursday, April 21, 2016, 9 :30am – early afternoon
Burns Bog Ecological Conservancy Area

AGENDA

Attendees:
Markus Merkens (Chair), Metro Vancouver (MM)
Robyn Worcester, Metro Vancouver (RW)
Paul Whitfield, Scientific Advisory Panel (PW)
Dan Moore, Scientific Advisory Panel (DM)
John Jeglum, Scientific Advisory Panel (JJ)
Sarah Howie, Corporation of Delta (SH)
Jeff Fitzpatrick, Metro Vancouver (JF)
Richard Hebda, Scientific Advisory Panel (RH) – via conference call at 1pm

Guests:
Nick Lee, UBC-Dept. of Geography, Masters Student of Andreas Christen (NL)
Andreas Christen, UBC-Dept. of Geography (AC)
Johannes Exler, UBC-Dept. of Geography, PhD student of Dan Moore (JE)

Regrets:
Karen Golinski, Scientific Advisory Panel

1.0 Introductions

2.0 Review Agenda

3.0 Review of Scientific Research Strategy

4.0 Hydrological Monitoring and Research

Water level monitoring (see attached PowerPoint) SH

- Rainfall trends – higher than normal in winter, lower than normal in summer – as predicted by Environment Canada in 2006
- Last year's depth to water table measurement was the lowest measured since monitoring began in 2005, also declined earlier. Similar across different sites
  - PW - Probably good to look at spring and fall changes as they are changing more, as well as potentially hourly data
  - Generally - Fall is more stormy, spring is drier

- Summer moisture deficit – much larger in drier years, strongly related to plant community that is seen at the sites, this shows a potential for a threshold drying point.
  - Threshold is somewhere between healthy and transitional sites. Some healthy sites crossed the line in 2015.
  - How to create statistical validity:
  - analysis of variance – group the 3 types
  - Relate this to vegetation data as well
  - Action: Sarah send Dan raw data to help get stats done
  - Albedo measurements for sphagnum - to determine spectral signal to correlate with bog condition or health – possibility for research. Possible to do with digital camera. Also use for agricultural blueberry plants – to determine extent and area trends. Use targets and gimbal poles to get repeatable measurements

- Open water monitoring – measure difference between evapotranspiration in open water versus bog. Not exact; a proxy for comparison with piezometer data
  - Will help to set weir levels at southern sites for the purpose of flow monitoring.
  - Potential for creating models when combined with Johannes's more accurate evapotranspiration data.
  - In 3 ponds and 3 ditches, with plots in adjacent peat

  Action: JJ to send SH his water level monitoring info from his past research

- Outflow monitoring – in priority locations, the four outflow control structures built by SFPR are managed by Delta
  - Backwater at 80th – flap gate malfunction. Water came in through ditch during irrigation season. Flap gate was repaired and will be monitored in 2016.
  - Highway 91 – testing whether Cougar Creek overflow is influencing the bog. No hydrochemical influence detected at station south of 72 Ave during 2015. Station moved further north in 2016 to test if it is influencing there. The pH and electrical conductivity are too high for a bog – from road or surface water is unknown?
  - Northern boundary weir – water is 10cm higher on the western side of the weir relative to the esastern side. Water is moving eastwards not westwards as predicted. Probably eastwards due to peat harvest leaving a depression

- Measurement of Saturated Hydraulic Conductivity - done in wet season only to avoid influence of mire-breathing. Plant communities have a large range of Hydraulic Conductivity, so can't describe plant communities by this.
  - Could the peat relationship be used - weighted by bulk density?
  - GPR to see how much structure there is?
  - JJ – Measurements in summer would be significantly different than wet season measurements due to mire-breathing (peat compression)
  - JJ – regional scale may be important?
  - PW - mire breathing – good to look at this – compare healthy versus mined site

Action: Sarah and JJ to connect about help collecting data in summer

Action: Sarah to look into repeating measurements during dry season in healthy bog site and peat-harvested site to determine impact of mire-breathing.

- Ditch blocking – by Don DeMill (Delta's contractor). There are ~240 dams now across bog
  - Center of the bog is doing well. Focus now in drier sections to the south where forest is encroaching
  - Don has captured his ditch-blocking knowledge in a manual
- Updated watershed map – 2008 map has been changed.
  - There are 5 watersheds.
  - Flow patterns are documented

5.0 **Greenhouse Gas Flux Project – Nick Lee & Andreas Christen – Dept. of Geog. NL**

- Bogs are Methane sources and Carbon Dioxide sinks
- Main flux station at dominant habitat type. Pilot at 4 stations at areas at differing times since disturbance. Study in summer time, so far
- How does BB function at carbon exchange – keeps sequestering carbon in winter = sink
  - Carbon sequestering is due to limited respiration
  - Soil temperature has biggest effect on carbon sequestering and methane emission fluxes at this site.
  - Compare vegetation types – moss can store more carbon that grass or mix
- Discussion:
  - Doing the same study on drier site would be really interesting. Pilot stations that were studied showed a trend towards more methane in wettest site
  - water table will likely have a larger impact geographically
  - 80% of the data is high quality – can gap fill from Env Can. Weather station
  - Where should data go?
    - Global flux database for worldwide access
    - Metro Van will store here too
  - Use 80 year plan time scale to look at the global warming potential
  - Nick is writing up his thesis this summer
  - Important to specify that this is a study of this one habitat type 'not the whole bog'
  - How does a change in water level impact methane levels – a good question to answer for restoration purposes – does 5cm make a difference
- Flux Tower - Markus has budget for meteorological component but not carbon flux component yet. Should we do?
  - Meteorological data should continue – soil temp, etc.

- Infrared sensors will be removed by end of June – expensive and labour intensive
- EC1 (evapotranspiration) could be maintained if there is extra funding but requires labour and analysis time as well
- Don't take tower down this year
- Desire to do forests – very hard logistically – this is the ecotype that is an issue. Pine-sphagnum is 45% of bog
- Could do tall shrub phase (need 200 x 200 area)
- 30m tall tower can be driven in. The footprint goes many kilometers then
- If you keep the tower there, maybe the study can be replicated at some point

6.0 **Vegetation Monitoring Project Discussion** **MM**

- Vegetable monitoring – Thomas Munson collecting in 2016
  - What should we do moving forward?

Richard:

- Year 6 – paper was drafted – could be restructured to include longer term data
- Good news for open sites – good sphagnum species and abundance
- Rhynchospora alba has just appeared in zone B; indicates wetter?
- Rhynchospora seems to be associated with tenellum
- Seems like pine forest is opening up; means positive for lab tea and gaultheria
- More hummock / hollow topography is a good trend
- Removing hemlocks may be a good step; removing pine would help sunlight get to sphagnum in areas where it is not abundant
- Spread is not happening as much as would be desired

Discussion:

- Increasing sphagnum hummocks also increases Polytrichum strictum
- Changing water table is good idea
- Would be good to see how each plot has changed over the years
- Lawns versus hummocks - Hollows do not have full sphagnum coverage, because they are too wet. Part of normal process to have some of both
- Tree Cutting – not in research zone, but in fire breaks. Create fire break between middle to east of bog (at 96 St by Bremner Farm). Also, gently press surface down to encourage sphagnum (capillifolium will come first) – with rubber tired vehicle.
- 4 way experiment – tree removal and shrub removal, tree removal and no shrub removal, and then try pressing surface down on each type. Do parallel treatment zone to existing vegetation plot transect (to use as control)
- The machine for the job could possibly do both
- The vegetation data supports this route.
- 2 years of pre-treatment vegetation data and water level data. Tree removal in 2018

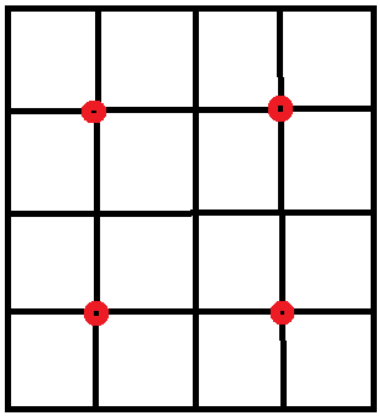
- Angela Danyluk's tree sapling removal experiment is being monitored; sphagnum is reestablishing under pine but not birch. Pteridium appeared to be the first plant species to emergeafter the 2005 fire, but pine and birch has taken over
- Options for birch – chemical, biological controls. Roundup could be tested. Too large to mow
- Action: PW to pass along names of 'just data' journals for possibility of publishing
- There is a potential for moving towards a longer-term strategy of sampling less often – use power analysis to see how often would be best
- This needs statistical analysis to strengthen Richard's opinion
- In year 1 they tested variance. These data use the mean
- Do analysis of variance on all
- Fixed effect model could be used as well
- The reindeer lichen have the same pattern as Polytrichum but reindeer lichen is preferring hollows, while Polytrichum is on hummocks
- Is there an opportunity to use the total cover of all species as a parameter to compare?
- Thomas saw that the trees were continuing to die in 2015 report; Labrador tea and salal respond positively
- Maybe shade is a really important factor that we need to be looking at here.
  - Can atmospheric photography to get a shade estimate
  - We have air photos for every 2-5 years, 10cm.
  - Good undergrad student project.
  - Atmospheric photography will give a better estimate of shade than air photos would.
  - Hyperspectral photos (compare 2008 and 2018) would be good for bog-scale

Summary from Markus:

- We will continue with vegetation monitoring for now
- Look into establishing a parallel pilot study
- Burn zone – continue to monitor and consider control options in the near future

7.0 **Bog Restoration Project** **RH/MM**

- Metro Vancouver grant $135,000 for 2 years (also includes help to install, support the work in addition).
- To look at cranberry field recovery and experimental recovery options with UVIC ecological restoration program
- Experiment with sphagnum propagules in depressions, no depressions
- Student is not 100% yet. She could still do the summer work.



- 3 replicates of a subreplicated design (16 areas) - 48 plots, 4 piezometers (see diagram below with piezometers in red)
- Size of treatment plots 5x5 or 10x10; 1x1 meter sample plots for mosses
- Spectral reflectants in association ($2500) for camera – compare restoration sites to the rest of the bog. Puts image into database of wavelengths to see how much sunlight hits / photosynthesis is occurring
- Also should measure soil moisture and soil water pressure (below a certain amount, peat won't grow) – uses tensiometer to measure.
- Soil surface temperature? Data loggers would help give more details
- Micro meteorological measurements – humidity and shade (only a couple hundred dollars)
- May need volunteers to support this work.
- Action: Sarah to purchase and install 4 piezometers (and/or wells??) after determining locations with research team.

8.0 Review Scientific Research Strategy

- Water balance model development - #1 priority – are we on track?
  - Do we have enough info yet? Seven items to achieve identified are being looked at. Sarah is doing lots of monitoring
  - By the end of 2017 we should have enough data.
  - What is being looked at by UBC:
    - Surface and Subsurface flux – made progress with 2 honour students and now Johannes, site scale water balance (need to do at other sites). Create shorter protocol for applying to multiple sites
    - 2-3 years was the idea (moving forward)
    - Interception loss is being looked at by Johannes as well
  - Conductivity study would be good master's project based on Sarah's data
  - Maybe by 2020 we could have the water balance finished?
  - Hydrology and Vegetation studies being done separately, but lots of power in combining them
- Other ideas: connectivity of the landscape (i.e. for wildlife movement)
- Other ideas: Peat forest ecology
- Other ideas: wildlife studies – populations, invertebrates; These other aspects would be good for the public buy in; Base survey was done on wildlife / inverts for the original ecological review
- Public access – research to determine. Possibly the southwest corner - where Burns Bog Conservation Society used to host tours. Low priority.
- Long-term monitoring study – 5km plots down to 0.25m2 plots, surveyed every 10 years by students. Complete inventory package provided. Provide framework on long-term changes.

9.0 Data Management/Sharing **MM**

- Asked for geo-referenced database tied to other database. No news yet.
- Bog data is stored digitally for now
- Everything is a CSV file – is a good way to keep it accessible.

10.0 Open Discussion:

- Moisture deficit research Laura Dilly's work –-should publish something?
- If moisture deficit could be correlated to climate information then perhaps you can hind cast
- Boardwalks – there are some benefits and good examples elsewhere. Delta Nature Reserve is likely the best place to invite the public.
- Also wildlife cams may be a good idea
- Action: All keep in mind retirees in fields of study that could potential be bog volunteers

11.0 Next Meeting: **April 21, 2016**
Field Tour – Meeting Place to be arranged during Workshop

Action Items:

- SH send DM raw data for moisture deficit to help get stats done
- JJ to send SH his water level monitoring info from his research station?
- SH and JJ to connect about help collecting data in summer?
- SH to look into repeating hydraulic conductivity measurements during dry season in healthy bog site and peat-harvested site to determine impact of mire-breathing
- PW to pass along names of 'just data' journals for possibility of publishing
- SH to purchase and install 4 piezometers (and/or wells?) at restoration study site.
- All keep in mind retirees in fields of study that could potential be bog volunteers