NutrientTransformations / Biogeochemistry

Breakout session,
MORNING Aug 21, 2007

M. Cohen /K. Reiss/C. Carton

Slides presented by Matt after the Breakout:

Slide 1

- What are the important unknowns?
    1. Metals
    2. Salinity
    3. Contributing areas – subset of spring shed most important – variability in different springs
    4. Hydrologics – change in residence time, change in flows
    5. flow dynamics / age dating
    6. storage of N in subsurface of springshed
    7. Higher trophic state feedbacks
    8. Relative importance of internal load built-up in sediments
    9. Dissolved oxygen (internal biogeochem and up trophic levels – why is DO lower? Is it lower? What is known about DOC out of vents? Changes in bio-film growth?)

Slide 2

- What are the most important management issues related to nutrients & springs?
    1. Linkages of N unclear, so what to manage?
    2. Effectiveness of BMPs
        a. need to differentiate between surface and ground water
        b. Look below vadose zone
    3. Land acquisition/protection – critical vs non-critical determination
    4. Land use change (planning) – ex. what density is allowed?
    5. Springshed delineation – ex. whole spring, sub-springs, etc. – differing spatial needs

Slide 3

- How might these management issues be addressed?
    1. Adaptive management – science based program with testable hypotheses
    2. Precautionary Principle?
    3. Variability in systems makes management difficult – no one size fits all approach possible, need site specific plans
    4. Better linkage of science with policy arena – political scientists should be included at the table (also concerning economics)

Slide 4

What are the most important future springs research initiatives ? (ranked)

- 10 votes
  - Time Lag – water age vs source contribution
  - Flow rates vs age of water relationship
- 8 votes
  - Are nutrients really the problem
  - Limiting nutrients: N vs other nutrients – P
  - Productivity decreases, nutrients increase – why?
- 4 votes
  - DO levels vs productivity (lower DO at night, lower DO over time)
- 3 votes
  - Saline indicators (water use/pumping)
  - Evaluation of capture zones (proximity, loading)
- 2 votes
  - Trophic level responses and interactions

Notes taken by Charlie and Kelly in the session

FGS study on Silver Glen and salinity

What about micronutrients? What about K? Thought not to be studied.

Known knowns → fertilizer vs other types of waster – created a narrative in state and regulations, but we should be looking at them do we have confidence in them? Concern on del15N from fertilizer (from Suwannee) are these universal? Do we have confidence? We can change these, so we should move forward with what we are sure of.

Higher loading at Silver and ? spring – why?

Keep time lag in mind for knowns as well – what water are we sampling?

Troy Springs – 5 yr period, 1998-2001 drought, flow cut >= 50%, age of water increased, nitrate concentrations decreased – seems counterintuitive (not a concentration/flow effect, but older water had less nutrients) – opposite relationship at Wakulla . . . . higher conc. At lower flows – smaller inflow from surface waters . .. shows complicated nature of systems . . . no blanket policy for any of them

What are some alternative narratives?

RN: BMP must be demonstrated to be effective – response – N not necessarily limiting in these systems – is there research on FL BMPs and their effectiveness – this is a major research need. Guy has paper (AR) showing 90% ag basin, no net change in N in water – perspective, the water keeps going downstream, so there are further complications (water in lakes, gulf, etc.)

Amount if N exported is less than what is applied (landscape perspective), how much N is stored in unsaturated (?) zone. Not accounting for this – would add to lag effect – J. Stevenson work – accumulation of N in sediments – see in Suwannee basin flushes in El Nino years, can have significant load increases

RN: What is the land area? Consensus that it is the near zones – could we pick one spring shed and study it – understand areas of that contribute water quickly that are not closed

GIS tool could be useful to distinguish springsheds – FL Aquifer Vulnerability Study also Alachua County layers – problems Fanning, Manatee, whole basins karst and unconfined- this would be a lot of work – have done some grid coverages for 3D loading in basin

LIDAR data for district (Jackson Co) – to refine springsheds, discern some subbasins for 2nd magnitude springs

RN: No a consensus that N is the factor – could be a chemical factor, but not N –
could be pumping and saline indicators and the natural response
could be low nighttime DO – why is the gw lower at night (high BOD), in spring run meets boil tension at night (Mill Pond)

Itchetucknee – algae highest where no tourist feet, NO3 levels lowest

RN: Rainbow River – USF – photoplankton biomass seems to be linked to metals, microcosm studies, next phase is to dissect metals (had been using a composite) – could be focusing on nutrients/BMPs/ and now we say it is something completely different – copper, iron, zinc, arsenic?

RN: Do we know if 1950's introduction of exotics, these would out compete natives . . . *Lyngbia wolfie* present in 1950s – was already there –

RN: Itchetucknee, gastropods density doubles down spring run – DO increase? Tissue analysis of nutrients in biota? A macroscale experiment – looking at N:P ratios in plant tissues – C related enzymes drastically different near boil and downstream, measured in algal community – response to H2O column nutrients, not sediments – should look at rates of dissimilatory processes – (questions is there enough carbon – answer 12% C in soils?)

RN: Whole ecosystem experiments – add dye to 1st order spring – couldn't move forward without broad support – had changed Wakulla green, could be possible – could do paired watershed approach (Alexander, Juniper, reference), background, geology, long term monitoring, low impact vs high impact – pair as opposed to manipulations

RN: More data needed – WQ coming in pulses, responses down gradient, design programs and sampling programs to further SI causes (ex FDEP sampled quarterly) – focus collections a bit better for integration - at Mill Pond (Itchetucknee), NO3 and PO4 sensors, hourly – have DO sensors been deployed in springs . . .some were included ask Russ Frydenbourg – Jon Manglin (TMDL) – 2yrs DO data on Suwannee, continuous in vent 2 unnamed springs below royal

Jon Martin has done some hydraulic studies – Santa Fe

UNKNOWN: Components of age flow coming out – not means but what about under different flow regimes – relative percents unknown – high flow has higher newer water %; see young water with color changes and pulses of N; some have short residence times – if 80% in one season (short residence time) what are the implications? Flow dynamics / age dating study suggested. If water was old wouldn't see DEET, other contaminates, (hormones, antidepressants) etc.

RN: water uses compared to (MFL vs TMDL) . . . salinity . . . how do you demonstrate impairment, are flow changes equally or more to blame for changes in these systems? Are there long term flow data sets? No – smattering of flow measurements available. Very little historical data available – do have gw levels, and can draw curves – USGS have synthesis of flow data . . . maybe how you pick your paired watersheds

UNKNOWN: Biofilms (ex Orange Springs) – coding on Hawthorne clays – S based films – moving deeper in Suwannee – ex Otter Springs – orange – Peacock Slough (?) – has been there for a long time – metal reducers and sulfur reducers (anoxic) unclear if they have changed or not, seem natural and have been there – but at Mill Creek Sink, new biofilms developing deeper than they have been before in the caves – are they an indicator (crust on walls, dissolve away and pile up on bottom, etc.), chemoautotrophs – Mn, Fe, slow growing – girthite (sp?) growth – catfish bring scat into cave – may be most effected by low DO