West Virginia Watershed Assessment Pilot Project
EXPERT WORKSHOP 1
October 25 & 26, 2011
Bridgeport Conference Center, Bridgeport, WV

In attendance:

Keith Fisher, TNC – WV
Ruth Thornton, TNC – WV
Amy Cimarolli, TNC – WV
Misty Downing, TNC-WV
Diane Packett, TNC-WV
Beth Wheatley, TNC-WV (10/25 only)
Braven Beaty, TNC-VA
Mike Strager, WVU (10/25 only)
Todd Petty, WVU (10/26 only)
Abby McQueen, Canaan Valley Institute (10/25 only)
Mitch Blake, WVGES
Ashley Petraglia, USACE (10/25 only)
Jennifer Skaggs, WV Conservation Agency
Terry Messinger, USGS (10/25 only)
Greg Gies, EPA (EPA project manager) (10/25 only)
Greg Pond, EPA (10/25 only)
Danny Bennett, WVDNR
Karri Rogers, Potesta & Associates
Rick Buckley, USDOI, OSM
Mike Whitman, WVDEP, WAB
Dennis Stottlemyer, WVDEP (DEP project manager)
John Wirts, WVDEP, WAB

Could not attend, but will provide written comments:

Stuart Welsh, USGS
Mike Owen, USFS
Michael Hatten, USACE
Tim Craddock, WVDEP
Michael Schwartz, The Conservation Fund
James Anderson, WVU
George Bell, Elk Headwaters Watershed Association
Evan Hansen, Downstream Strategies
Christine Mazzarella, EPA
Tom Demoss, EPA

Recommendation that Nathaniel ("Than") Hitt, Research Fish Biologist with USGS would be a good person to invite to participate

OVERVIEW PRESENTATION (Ruth Thornton, TNC)

CONDITION / FUNCTION

- Should Function be separate out from Condition? (Mike Strager)
- Need to define function (Greg Pond). This project defines function as ecological services.
- Metric - Impaired Streams – using both all impaired streams and individual impairments pulled out.
- Questions whether Thresholds should be consistent across state? (Abby) Since we are setting methodology for watershed assessments for the entire state are assuming that they are, however, for some metrics may need to adjust for different areas of the state.
- Metric – GLIMPSS index, very good condition (Braven), why 125% Ref Condition very good – wouldn't all of them be considered very good? Discussion with Greg Pond that 100% threshold is dividing line between Fair and Good categories (less than 100% is considered impaired, more than 100% not impaired). 125% of threshold approximates 25th percentile.
- Barriers to fish movement (Strager), yes using dams under threat: *Could it be used as measure of streamflow condition*?
- In WV, not sure would keep waterfalls as impeding stream
- Unimpeded stream= condition; Culvert=threat to system. Keep both?
- Mike Strager-culvert stream data layer available
- Wetland hydrologic connectivity (need WV thresholds, NC coastal plain paper may be a good source)-distance to nearest headwater streams & surface water, farther = poorer)
- Metric: Forest Block Size; largest intersecting, and mean- to get idea of how unfragmented upland habitat is
- Metric : Local Integrity-how fragmented is the area, ease of movement
- Lacking in Geology metrics (Mitch WVGS); could this inform our erosion metric better?
- Metric- change in vegetation Using Land fire now…other ideas?
- Metric-Rare species potential, need thresholds.
- Wetlands study, EPA funded to WVU: biodiversity metric that isn't rare spp focused
- Bird IBI, amphibian IBI, hasn't seen it published – Anderson's students, 40-50 sites, Diane has seen (TNC has copies of thesis and publications in literature folder)
- Need to assess wetland functions, not there yet. May be difficult with current state of data in WV.
- Wetlands group discussed further (see below)

GENERAL COMMENTS, post-presentation

- Marcellus gas wells will likely be reused indefinitely to go deeper to other 'plays'. So will likely be refracked, roads and landings kept open, collection and transmission lines, indefinitely. Assume will continue to be used into future. (D Stottelmeyer). Our current metric as "new Marcellus wells" as estimator of water use will not work with this scenario, need to change.
- Can we know how many wells are permitted per pad? Yes, from permits. *This is the tip of the iceberg. Ruth 'good to know'; Amy 'actually, ignorance is bliss'*
- Company index. Joke! (impact will depend on company)
- WVDA models for loss to pests, so WVDA must have a baseline forest layer of dominant species

BREAK TO GROUPS

BREAKOUT SESSION NOTES: DISCUSSION OF METRICS AND THRESHOLDS

Streams Condition/Function

- Water quality metric: chloride is also an important metric to include, indicates fracking activity in watershed, consider putting under Threat – Resource extraction instead of condition
- Include Specific conductivity as its own metric, check lit for threshold values. Recent EPA study found that 300 would be a good threshold instead of the 500 that is often cited. That is what EPA is going with and they're getting sued for it now.
- Check out chloride as 303(d) impairment and include as metric
- Sulfate as indicator for mining activity – remove from condition/function and put in threats – resource extraction
- "Stressed" category also in GLIMPSS paper. Instead of current if one of the metrics is not attaining, consider changing to 2+ need to be not attaining to make it into a stressed category to avoid false positives
- WQ – look back at both max values and most recent values for each station. Max values would give you a screening tool, where most recent is what you're dealing with currently. Depends on objective.
- Use medians instead of means for WQ metrics
- Caution with low flow impaired streams
- Imperviousness could be used as indicator for multiple indices, not just WQ – also water quantity (flash floods)
- Some modeling has been done in WV in some areas for flow
- 7Q10 flow is the lowest flow during 7 consecutive days in a 10-year period. Drought statistic
- WCMS – not publicly available, state agencies are using it, from DEP to the agencies directly
- IHA software better and easier to use than the USGS software (according to Terry Messinger) – consider using it to analyze flow. Either one can only be used for gauges with daily values over a long time period. USGS gauges are the only ones in WV that satisfy that. DEP take flow readings on some sites, but no daily values.
- Hydrologic connectivity – NHD 24K
- RBP – use sedimentation & embeddedness as a summed metric (on a scale of 40). One gives values for sedimentation in riffle areas, the other for pool areas. Greg Pond sums them to analyze a site's characteristics. Also view Bank stability as a separate metric.
- Soil infiltration rate – check if SSURGO for WV includes a sanitation metric - could use that as a surrogate
- Biodiversity – Number of native aquatic species, including historical ones. Add original native spp (that are now extinct) as a metric – contact Dan Cincotta, he knows which fish were originally in which watershed
- Include forest block metric in streams as well
- extract Bank Stability Score or other possible measures of physical integrity from the RBP data
- weights/thresholds should vary based on type of stream impairment
- Tier III streams? (should they be included? –I believe I explained why they weren't and it was satisfactory)
- WARSSS (Watershed Assessment of River Stability & Sediment Supply)- sediment assessment technical procedure

- consult with watershed groups such as Deckers Creek Watershed Organization (very active); Save Our Streams
- priority on tribs that drain to a public water supply reservoir (such as Cobun Cr near Morgantown); could also emphasize the importance of wetlands in such catchments to reduce cost of water treatment
- high weight on riparian area with forested cover (most important metric); also, headwaters within forest blocks; 78% forested = good WQ?
- NPDES should be split by attributes (outlet type) and weighted differently (ie CSO weighted more heavily than industrial general SW permits

Streams Threats

- Coal vs non-coal discharges
- DEP only has non-coal NPDES permits
- Contact DEP's DMR for coal NPDES – Nick Schaer best person to approach for this. Put under mining.
- Brownfield/superfund sites, volunteer remediation cleanup status
- Septic systems: Where TMDLs are done James Summers with WAB (DEP) has done a lot of work on getting the # of septic systems. Current method we're doing not reliable, many areas outside of town boundaries are actually on public water systems. Contact him for his data. Currently done on Mon, in Elk from Sutton down
    - Or: There's a field in census data, on a census block data - use that!!!
- Large feedlots – again, James Summers compiled this for TMDL. Upper Mon done 2009, Dunkard 2005/6, Elk (Sutton dam and down) 2007
- Population – may tell % urban
- Include # bridges again, many have a center pier that impedes flow. Use road crossings over small streams as one metric to estimate culverts, and over larger streams to estimate # bridges.
- Todd Petty & Mike Strager might be able to supply surface mining thresholds from their studies. (5-10% mining showing effects on WVSCI) Work in press: 26% watershed surface mined, stream conductivity increases to 500-600
- Check out Emily Bernhardt's study for thresholds of mining in watershed
- % of coal not mined from GES as way of assessing future threat
- Include plugged wells in addition to active – indicator for roads, sedimentation issues
- Future impacts – look at thickness of Marcellus shale, also Utica below it
- Include aquatic species under invasive spp – DEP data on Corbicula (invasive mussel), Zebra mussel (2 places in WAB db: Wildlife observations (more opportunistic), and under: Benthic – family – WVSCI – Corbiculidae (is the only one that occurs here in that family) – Benthic taxa – code)
    - DNR invasives data – carp
    - DNR – data on Didymo, golden algae occurrences
- Include voluntary remediation, Brownfield/superfund sites
- Acid rain
- Snowmaking (large quantity user)
- EPA-funded study on developing IBI's for wetlands
- # landfills: discussion if should consider distance to landfill, since its effect decreases over distance, but we decided for catchments simply to have a Good/Fair for absence/presence. Also active vs. inactive
- Add: # open dumps (from DEP) under dev & Ag. Also: # superfund sites

- Include a metric for miles road/RR in entire planning unit, not just riparian area. Roads farther from the stream still have a sedimentation effect
- # dams/Max Storage – consider using median instead of mean to get rid of large effect of the Summersville impoundment on the Elk. Or look at log-transforming it.
- Separate out transmission lines from pipelines – pipelines should have heavier weighting. Capture effects of roads for Marcellus gas wells
- Move # buildings in riparian area from habitat frag to Dev & Ag
- Change name of "Ecological Threats" index to "Biological Threats"
- Be careful with the GES Marcellus well shapefile – many are actually conventional wells
- Marcellus wells have much larger footprint than conventional wells
- We need to change our "new Marcellus wells" as estimate of water quantity – many wells are refracked, we have no idea from attribute table. However, current legislation in the works that companies have to report water use from fracking, so this may be a metric we can realistically use soon to pinpoint large quantity users. With the intent that DEP will only permit taking water out of a stream if it will not stress the stream.
- From Rick Buckley: every acre of underground mine produces ½ gal water/day (check with him to make sure this statistic is correct, this is what he remembered off the top of his head)

Wetlands Condition/Function

- wetlands are primarily a priority based on presence (particularly for restoration), quality not really a consideration (presence itself is a priority)
- wetlands research by DNR (re-registering of NWI should be complete, not sure if we can get data, currently in the process of conducting functional analysis of wetlands, though seems to be at beginning stages?)- WRAP Wetland Rapid Assessment Procedure conducted by WVU (field samples to "quantify wetland condition in terms of functional capacity and biological integrity")
- need hydrogeomorphic (HGM) classes of wetlands (ACE classification system)
- DNR wetland priorities value forested over shrub/scrub over emergent
- should be considered by their functional values:
  - Flood attenuation
  - Pollutant filtration/assimilation
  - Sediment retention
  - Wildlife habitat
  - Recreation
- Penn State wetlands center has possibly useful studies
- Possible Metrics:
  - width of floodplain; elevation of floodplain versus stream elevation (bank/height ratio)
  - geology composition (limestone base encourages biodiversity)
  - adjacency or proximity to existing public lands
- highwall mining, old mine benches (strip bench data) as potential places for development of new wetlands of various water quality; created by gaps in undergrounding mining; "punch-out"
- bad water quality in surrounding streams may increase the functional value of a wetland; water quality should not be a wetlands index since it varies by type of wetland and function of wetland; WQ in wetlands based on surrounding land use types

- ratio of existing wetlands to potential wetlands
- flow accumulation grid; wetland shape metrics (depth x width); depth to bedrock
- existence of a natural corridor between wetlands or wetlands and streams
- biodiversity should be weighted low for restoration priorities
- wetland size may not be an issue as ALL wetlands are valuable in WV; wetland area very good would be even 10% or less

Wetlands Group Data Suggestions

- lose current NWI data (useless); may be able to get updated NWI from the Google Earth application, or try to get DNR data
- LIDAR being processed for all WV south of 60/64; best contact Nick Schaer, DEP
- DNR priority areas (desired acquisition areas like Meadow River complex)
- CAFOs, chicken houses, # head cattle (or other livestock) by county then distributed through watershed, from Dept of Ag
- Farmland Protection Act data; information about tiled or any previously converted wetlands (would be very valuable because it is easiest to restore previously existing wetlands; also true for potential wetlands analysis results) – maybe NRCS drainage maps, by county
- trend stations data
- soils roughness coefficient; slope
- paper maps of coal seams with their elevation data (time intensive to get to a digital format?)
- below drainage deep mine areas
- precipitation data

Wetlands Threats

- threat should be called stress or stressor with “threat” referring only to future potential threats
- use coal type as a metric, including whether seam is “hot or not hot” (related to acidity?)
- may be worthwhile to try and footprint Marcellus wells (or copy methodology for this?); wells may be re-fracked or drilled deeper into the Utica formation
- the idea that was is on the ground now should be considered a condition and potential future threats are the actual threats
- impervious cover should be a threat metric
- we should weight the land use types differently (be good to know types of agricultural use, but is more significant than pasture lands)
- landfills not a threat if managed properly (Landfill Closure Assistance Program), should have a low weight
- consider also proximity of rail/roads to wetlands, which may affect its functional value; consider that wetlands may be created by abandoned roads or rail; also, in restoration projects some roads nearby is a good thing since it prevents them having to be constructed for project

- buildings should have a low weight or be removed (redundant, not a threat); also, remove wind turbines? (should only be on ridges, where wetlands are unlikely)
- wetlands should not be separated between conditions and threats for prioritization, especially for protection (there is potential for increased threat to make a wetland more valuable)
- some mining outfalls are pumped to a different area
- create an inverse metric of buffering capacity by identifying areas with poor capacity (sandstone); also get acid rain (deposition) data if possible
- interbasin transfer data would be useful
- snow-making activities
- consider dam release rates to evaluate downstream threats
- would be good to know type of timber harvesting

Uplands Condition/Function

- Common, or all, species diversity
- WVU land cover/forest type dataset: forested locations derived from NAIP photo 1:10000 dataset
- Number of soil types, support native vegetation types?
- Many areas not sampled for species. Use 2003 ELUs 1:48000 as surrogate for species diversity – Mike Strager's dataset
- Density of rare species vs number or presence/absence: measure of watershed condition
- Important to identify species that are restricted to patches (rare snail) vs matrix forest species?

Uplands Protected Lands and Priority Interest Areas

- Move from condition to prioritization indices
- What percent of a watershed is needed intact for it to be functional?
- How much protected land results in good condition? Mark Strager: studies show that good water quality results if 78% forest cover is maintained. Also depends on land use.
- Add farmland protection group interest areas, NPS proclamation boundaries
- Check GAP status of secured lands - & within protected lands GAP 1-3
- Challenge: Severed mineral rights can alter surface that is "protected"; check farmland protection program for lands that cannot be mined
- Need to consider lands that are adjacent or upstream, which could be across the watershed boundary
- Buffer watershed boundary to capture conditions in the neighboring watershed.

Uplands Habitat Connectivity

- If any data could be added, what would it be?
  - Large forest blocks > 15000 acres

- Integrity
- Connectors of forest blocks (corridors etc): valuable, need info on how much they are really being used.
- Special features such as migratory routes, stopover sites and last populations of species.

Uplands Physical Integrity

- Soil buffering capacity: Experts are Jeff Skousen at WVU, Lee Daniels at Virginia Tech
- Geology can influence the ability of soils to buffer acid deposition and AMD. Add % limestone per planning unit as metric under Physical Integrity
- Percent "native" or unaltered soils to support vegetation, as opposed to mined, farmed areas and drained wetlands, altered elevators, filled valleys

Uplands Resource Extraction

- Timber harvest – move to condition for those acres; leave for likely impact to streams from loggers (sometimes no or minimal best management practices, unmanaged forest jobs)
- Add Utica Shale wells to Marcellus wells
- Add coal footprint. The presence of any coal is a threat because new technologies allow it to be mined
- Oil wells are likely to remain. They have similar infrastructure to gas, but "spills are uglier"
- Oil and gas wells' greatest impact is at the surface: roads and pads. (Number of wells) X (avg area disturbed)
- Add "serviced areas": septic and water
- For quarries, use acres of disturbance

Uplands Ecological Threats

- Add WVU's "Suitability for Invasives" dataset, and prioritize areas with lower suitability. 30-m raster grid
- Add some measure of deer overpopulation, which results in poor forest health. Use DNR data (number of deer by county) and compare with forest ecologist recommendations for deer herd size. Elk also?

DAY 2 Prep for Exercise to prioritize indices for protection and restoration models

Todd Petty idea-objectives will determine how you weight indices to seek priorities, because objective will drive best places for those

Ruth conclusion: We need to have models be flexible enough so end user can manipulate for answer that will meet their objective

Breakout Session: Priorities for Streams Restoration

- Weighting varies with objectives – weight index values
- We assign weights to metrics
- Idea: The end-use application could have menu of options for users with appropriate embedded mini-models according to their objectives
- Objectives likely for model users:
  - Restoration of certain size streams for In Lieu Fee
  - Restoration of 303D streams
  - Restoration to increase aquatic diversity, increase species richness/population viability
  - Restoration for recreational use (swimming/fishing/boating)
  - Restoration to reduce sediment/nutrient input/soil erosion/downstream wq improvement
  - Default option: find general stream/watershed condition

Stream Restoration Model Weighting Indices and Metrics

- Trout Conservation Success Index (Trout Unlimited): Web application similar to what we're doing, for trout streams. Users can see results and drill down to reasons for the index values. Available online.
- Weight each index based on how it affects objective; most significant = full weight
- Use regression analysis to inform which measures/factors to put in the tool, then use experts and resources to identify weights, which will depend on the factor
- Dennis: Could the tool also provide response predictions such as whether specific work would improve the score for the stream?
- Priorities: Improve stream condition and biodiversity
- First priority given to streams with some threats, otherwise wouldn't need protection
- Type of work will depend on budget
- Past threat data is actually a "condition", and future threat data is a "threat"

REVIEW OF ANALYSIS RESULTS FOR WATERSHEDS

- Consider keeping RED as always most high, now it's relative within a watershed. For objective measure could designate across the board and can get picture across wetlands.

Monongahela watershed comments on first assessment

- Todd Petty: Made a lot of maps, concerned about the Threat map, likes Condition map. It makes sense. White Day is still one of few high condition areas in watershed.
- Western part of watershed-rural, deep mining area; far East coal mining. Along I-79 a limestone/coal free zone. WAP-old plateau, ridges are leftover plain among incised rivers
- The lack of threat is contributing to its current condition (all trees, no mines). SE corner (White Day) is threatened by development not showing. Far E section shows as high threat but it's open wetlands and maybe not under such great development. (Future Trends - Threats are not yet included.)
- Call Threats=> Stressors (Todd, Danny)
- Todd-% impervious (Condition);
- Braven: Nutrient loading N P loading responses (want more or less)
- Consider extending Monongahela (and other borderland watershed asst's) across line into PA re: Dunkard and Robinson Creek
- Reach out to Dunkards' Creek Watershed Association-high profile
- Robinson Creek – another interstate creek that along with Dunkard could lead to collaboration with PA
- -head start on creek that are coming from PA and entering WV with PA's inputs
- As move to eastern panhandle these will become more complex.
- WMAs are not all Public lands—make sure ID those that are leased and remove them from the Public Lands layer
- Cannot assume removing water from any certain river for gas wells in a watershed…e.g., they are removing from Ohio River, piping to distribution center ponds, and then taking to well sites
- Basin exchange, water discharge into flood control ponds, pumping from three places.
- Underground mining has likely messed up flow of water/availability based on rainfall. Coalmine pumping also impacts flow in a stream , pump during wet seasons so it's diluted, not pumped during dry (solved problem) Water pumped is no longer in circulation, put in deep injection wells.
- White Day unmined, rivers in good condition (no 303d listed), but now gas is starting and this is likely to change.
- DEP has monitoring hourly records on streams to try to track Marcellus well changes
- Suggestion (Mitch) Run same model without coal and see if the same areas of good water quality still pop out
- At the thickest, Marcellus will continue to be threat. Where it is thin, rocks breaking up (e.g. Erbacon) poor production
- Use DEP map and ID places most likely to continue to operate
- Shale not gas producer where silty, Utica under entire state but not good producer in all places (Mitch)
- Mitch's opinion - potential for geothermal energy is slim in WV (WVGES can't reproduce the data/model, can't show any likelihood of the high potential). Researcher has graduated and WVGES

can't find data, can't reproduce would think it'd be obvious if such high potential.) Heat flow not showing itself on surface.

- DESCRIBE WHAT DO WITH NULL POINTS (insure users it wasn't set at 0)
- Mine pools—where there is mining there is water pooling underground

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ELK Comments on watershed first assessment

- Expect more of a headwater to Charleston gradient with Condition/Threats, especially given all the public lands
- (Mitch) Northern high acid producers/ soils/geology, on Elk there are low buffered soils that are not impacting acid deposition that falls in watershed—Add Geology as layer for Condition or as Stressor?
- (Mitch) Deep mines above drainage have different impact than deep mines below drainage
- Type of mining and whether it's above or below drainage affects impact. Even though deep, below drainage mines have 'artesianing'…it may not discharge for 100 yrs but will come out somewhere. May not know location of a threat (mine drainage).
- Todd Petty has mapped coal layers and outcrops (know depth of coal, & DEM, then ID outcrops, then can draw cross sections, throw on side, and can see locations of mines and where streams are.) Maps are there but cannot just import and show.
- Separate from mine maps are water flow maps, assume water moving through Pittsburgh coal seam, not sure where…coal barriers to keep blowing out, but still seeps, and it's pumped. Can't map something being artificially controlled by coal company.
- On HUC 12 layer, ID below drainage deep mine areas (Pittsburgh Coal, Fairmont Coal). By HUC- 12 mined out and not pumped, some artesian water, some water loss, some will be mined in future.
- ADD mapped outlets (not just permits) of mine discharge HPU dataset
- Once a well is punched and operational, is there any difference in the type as far as impact? Yes, fracked horizontal wells will be refracked (can expect) maybe every 5 years so that re-ups water use, surface disturbances, road use
- Injection wells significance? Years of use, potential for spills, two classes-coal (slurry injection in mined out areas; injected above drainage and impacts surface water), deep (gas energy uses, truck traffic and footprint-don't appear to be issue unless cause earthquakes
- CSO-Combined Sewer Overflows. Old systems during storm events overflow into streams—ADD to list, all polluting with untreated sewage. *ADD as new point source.*
- Contaminants related to CSOs? Would require data search/lit review
- NOTE: Stream and wetland threats map appears off, seems tribs' threats should decrease as move east
- Middle west area-appears less threatened except for over mine, lots of oil and gas (older field)
- Streams should be less threatened as move east, mining and gas/oil drop out as key activities
- Gas wells-check if modern or old well (split out wells permitted after 2006-2009-completed. And horizontal. These are just active wells.

- Weighting super important…getting high threat where have 4 factors show up, and invasive spp for stream quality may not be that significant relatively
- In headwaters, deep coal above drainage. Low acid producing section.
- "Above drainage" – whether coal mining is above the main river level, oxygenated water running through and dumping into creek. Pennsylvania Coal is all below drainage. But can back up underground, and will come up at an outcrop.
- Pump from new mines into old mines into treatment plants so don't need to build new plant.
- Paddling Trail planned for Elk River
- Lump all wells? Have one oil and gas layer, plus others? Lump together (for analysis)? From interactive web server, may be pre-32 wells, '67, really old, if leaking gas someone making money on them
- Old wells, not an issue unless a bit of erosion. If plugged will be pipe with number on side. If not plugged, could be returned to.
- Active wells are much more of concern-surface disturbance, lack of road maintenance same. Oil, roads used a little more to collect from tank if not pipeline. In fields likely all piped to one place.
- Current shale well different from Coal bed methane well. Some CBM wells discharging to surface, maybe more issue than Marcellus that cant discharge anything.
- Scale of surface disturbance greater on Marcellus, but mgt issues/concerns similar? Brine water discharge from CBM can be very saline and polluting.
- Take all active as one layer-active oil, gas, CBM
- GES Marcellus gas wells pulled out?
- New rules could help with our flow data needs…from time when Regulations to register water withdrawal start…will know where going to withdraw water—start & ending dates, amount and from where.
- Energy assessment work…utilize footprint of Marcellus wells * # wells.

NEXT STEPS, FUTURE ANALYSES

- Data layers needed:
  - DOH planned projects: bridges and roads. May have plans for expansion in their EIS
  - Better info on value of forest connectors (current and potential); CVI may have something, and TNC CAP work
  - Energy development patterns: wind potential, power line corridors (PATH, TRAIL), coal & gas prioritization to estimate mining development.
    - USGS has data on location of "metcoal"
  - Dam purposing and operation
  - Power plants
  - Timber harvest activity – salvage work due to pests and pathogens
- Other datasets:
  - From DEP: HPU – coal NPDES outlets (with emphasis on the outlet, not the permit)
  - From DEP: Self-reported violations (of NPDES permits)
  - From GES: oil & gas wells – contact Mary Behling with GES

- From USGS – coal reserves left and their estimates of desirability
- Powerplants – hydrologic connectivity issue (temperature)

- any other major development projects that may be planned (like the Boy Scouts venue in New River Gorge)
- unmined coal seams (existence of any coal is a potential future threat)
- gas shale coverage (gas plays)
- perhaps the Dam Safety department, for future dam removal projects or High Hazard dams as an indicator of possible future failing infrastructure as a potential threat
- certain invasive species are often correlated with major roads projects; data on invasives spread and trends
- Division of Forestry should have some kind of trend analysis, or perhaps a private industry coalition like Society of American Foresters, may have some future projections data (good contact: Randy Dye, state forester)
- air pollution data (considering things like power plants or waste incinerators that may deposit pollutants on land or water)
- West Virginia Watershed Network webpage (http://www.wvca.us/wvwn/) has information about Watershed Celebration Day event, as well as useful documents such as past meeting minutes, including information about 2009 Statewide Water Sampling Programs Forum, which gathered all entities involved in water quality sampling in the state together- good source of contacts and to find out what's happening in watersheds in the state; also has document describing Stream Disturbance Permitting Requirements (which describes permits for stream remediation projects)
- population growth/development projections from census or city/county government- does WV have extraterritorial jurisdictions?
- include information on funding sources; recreation
- Check with National Mining Reclamation Center
- Check with WV Water Research Institute (WRI) – Paul Ziemkiewicz – good contact who's been working on many of these issues (he was invited to this workshop, try engaging him again!)
- Include FAA cell phone towers as fragmenting feature
- Geothermal potential as something to be aware of
- Climate change concern- additions? We're capturing heterogeneity, elevation gradients already…can we add more? Will it change our decisions of where to work?
- Can we prioritize best & easiest to get of what's left in coal and gas reserves? That is where imminent threat is. See WVGES (steam coal vs. metallurgical coal) locations has 80% of coal mapped. Will be done in two years. New technologies make predictions difficult. Mitch can help us with this.
- Power plants-AEP said no new coal fired plants, but new gas plants. Changes water temperatures (hydro connectivity-temp and dams) new ones? New transmission lines, rivers-have projected in
- Hydro power on existing dams…hazards. All dams in now, do we need to separate them by use?
- Population change into future? USFS projections for development and impact on forest resources in East (value of these projections at HUC12 level?)

- focus primarily on population growth/urban development and energy development/resource extraction
- be able to weight some indices and metrics individually, possibly with certain data such as water quality sampling, remaining constant
- cumulative impacts assessment makes more sense at the HUC12 or HUC8 level, not at NHD Plus catchments
- create scenarios of energy development (low-medium-high) similar to PA office

ARE WE ON TRACK? ARE WE MISSING ANYTHING?

- Growth estimates for state? (e.g. Development authority? demographic projections out 10-yrs, but they're not always correct)
- Will timber harvesting activities increase with invasion by new pests and pathogens-markets changing; longer travel to market

WHAT ARE THE MOST IMPORTANT QUESTIONS?

- Places to conserve.
- Places to fix.
- Make applicable to broad number of stakeholders (beyond TNC and DEP) with diverse priorities.
- Priorities
  - Large forest blocks
  - Water quality
  - Unique land forms/communities/species
- SOME DATA LAYERS WON'T BE USED IN OUR PRIORITIZATION, BUT THEY MAY BE USEFUL FOR OTHER USERS/DECISIONMAKERS-special features, cultural/historical resources (e.g. Blair Mountain, Indian burial grounds, campsites and trails, old growth stands, karst/caves-mapped by Nick Schear and George Dasher of DEP), Susan Pierce, Cultural and Historical office
- Include caves as biodiversity feature, as special habitat, in condition/function – biodiversity, as one of the communities. Caves/springs useful for mitigation work possibly, a mitigation bank? (Can't show rare cave species, location of caves published, can show.)
- Include springs as unique feature? Or simply include as additional layer in final web application, without including in any of the rankings
- Karst occurrence-boost the weight of it for conservation if it's on karst. Include karst as separate biodiversity feature? Not the same as % calcareous, which is currently included

IS METHODOLOGY SUFFICIENT?

- We have to start, build on it…this doesn't cover it all but this start will allow us to determine what is correlated, important.
- Where are cumulative impacts assessments most appropriate?