Middle Potomac River Watershed Assessment: Sustainable Flow and Water Resource Analysis

First of a six-part webinar series
April 12, 2011

Please stand by, the webinar will start momentarily.

Speakers

Stephanie Flack, Potomac River Project Director, MD/DC Chapter of The Nature Conservancy

Carlton Haywood, Director for Program Operations, ICPRB

PURPOSE

To develop information and tools that enable the Potomac watershed jurisdictions to protect **environmental flows**,

which are defined as the seasonally variable flows of water that sustain healthy river ecosystems and the goods and services that people derive from them.

Benefits of basin-wide environmental flows assessment

Each of the Potomac basin jurisdictions is developing or planning for some sort of environmental flows assessment. Shared drivers are:

- Ensure water supply adequate for population growth
- Protecting ecological resources and promoting environmental sustainability
- Improved preparedness for periodic droughts
- Respond to water quality and quantity issues arising from Marcellus shale gas

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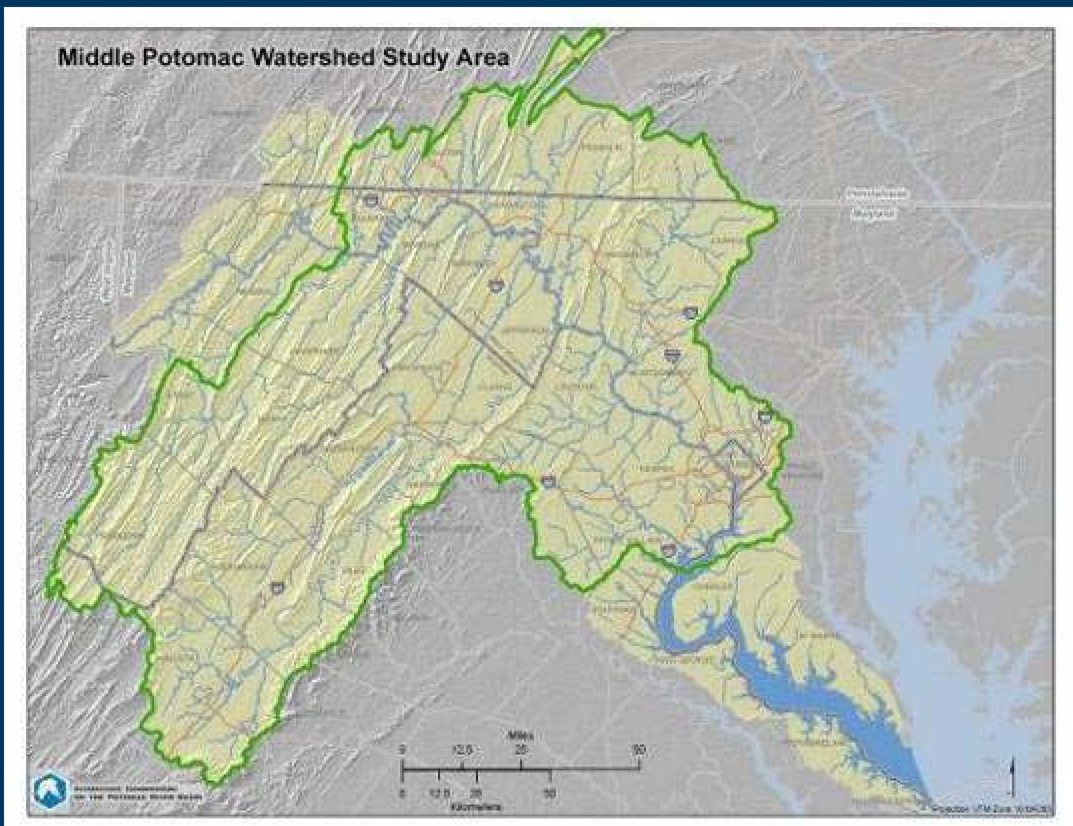
Benefits of basin-wide environmental flows assessment

- Watershed approach
- Consistent methodology basinwide: tools and information for all jurisdictions
- Fill historic gap in considering inter-jurisdictional impacts of water use

Middle Potomac River Watershed Assessment: Sustainable Flow and Water Resource Analysis



Cost-shared project:

- 75% Federal (USACE) funding through Energy and Water Act
- 25% funding from non-Federal funding sponsor = TNC
- Technical partner = ICPRB
- Additional support from NPS, other agencies

Total project cost $1.2M

Project timeline:

Start	May 09
Complete	Jun 12

Two methodologies

1) Small streams

- An adaptation of the Ecological Limits of Hydrologic Alteration (ELOHA) approach (Poff et al, 2010)
- Estimate current and future human water uses and watershed impacts on flows
- Quantify relationships between flow alteration and aquatic ecosystem health
- Provide baseline information and analyses to support water use decision making

2) Large rivers

- Flow-ecology hypotheses developed for key species from literature review and expert judgment
- Hypotheses translated into flow component needs
- Flow statistics identified for flow components, and calculated
- Review with stakeholders

Project Timeline

2009

- May – Project start
- Sep – Project Overview Webinar (recording on project website)

2010

- Sep – Large River Flow Needs Workshop

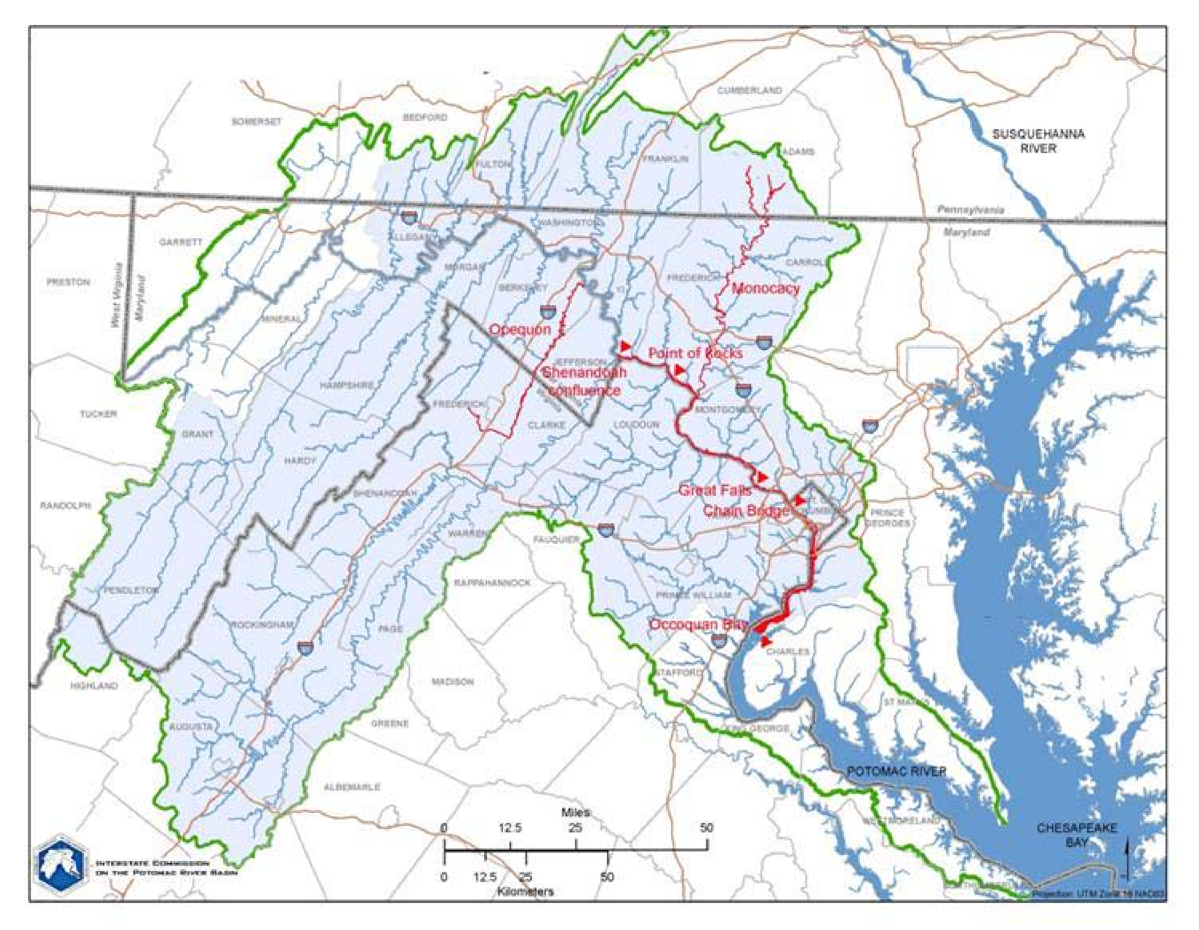
2011

- Apr – (anticipated) Large River Flow Needs Final Report
- Apr-Oct – Webinar series to explain project to stakeholders and get input
- Nov - Final project workshop: potential policy & mgmt. applications

2012

- Feb – Final report delivered to COE

Large River Flow Needs Study



- Literature review / expert assessment of ecological needs
- Flows analysis
- Stakeholder workshop
- Final Report

Outcomes

- High inter- and intra-annual variability in flows
- No documented negative ecological impacts from flow regime
- ID Information gaps
- Pending more info, current flows be maintained
- Workgroup to follow-up

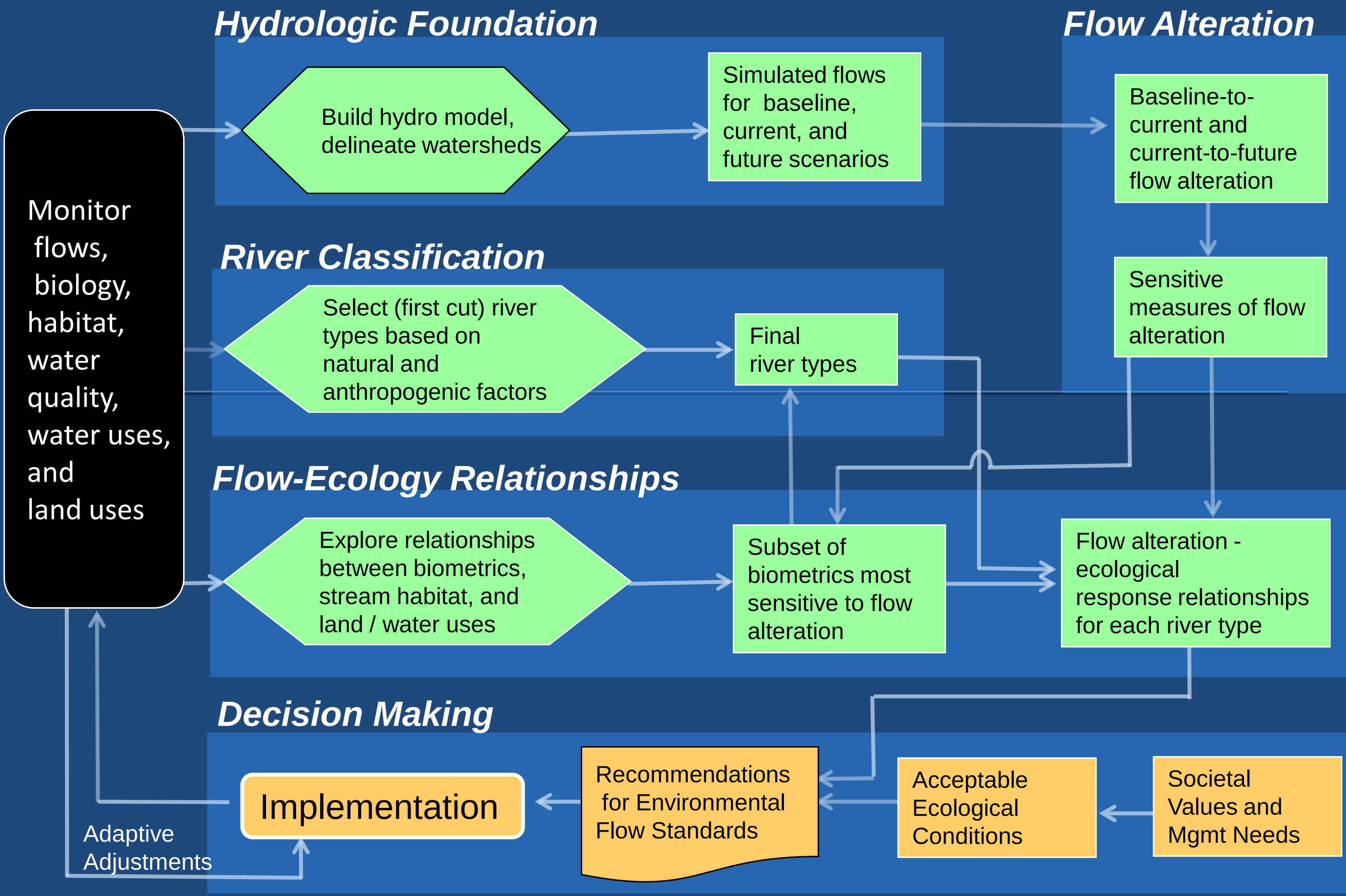
Webinar Series

- Technical details on methodology for small streams
- Obtain feedback from stakeholders
- Prepare for concluding workshop: focus on management applications

Date	Webinar Topic
Apr 12	Technical overview of project
May 10	Current and future demands and impacts on flow
Jun 16	Modeling streamflow
Jul 14	Quantitative flow-ecology relationships Part 1: Data, variables and methodology
Sep 8	Quantitative flow-ecology relationships Part 2: ELOHA curves, uncertainty, and interpretation
Oct 27	From Science to Management Applications

→ Nov 29-Dec1 Flow Ecological Response Workshop at NCTC

Determining Potomac Basin Quantitative Flow-Ecology Relationships / Implementation



Flow chart adapted from Poff, et al (2010) Freshwater Biology 55: 147–170.

Monitoring: Necessary data sets

Project is built on an existing foundation of data

- Gaged stream flows
- Benthic macroinvertebrate samples
- Stream habitat data
- Water withdrawals locations and amounts
- Land use/land cover
- Impoundments

Hydrologic Foundation – Flow Model

- HSPF (Bay Watershed Model)
- Additional segments to accommodate significant impoundments
- Calibrated at 56 gaged locations
- Flows simulated for 713 delineated watersheds using WOOOMM model
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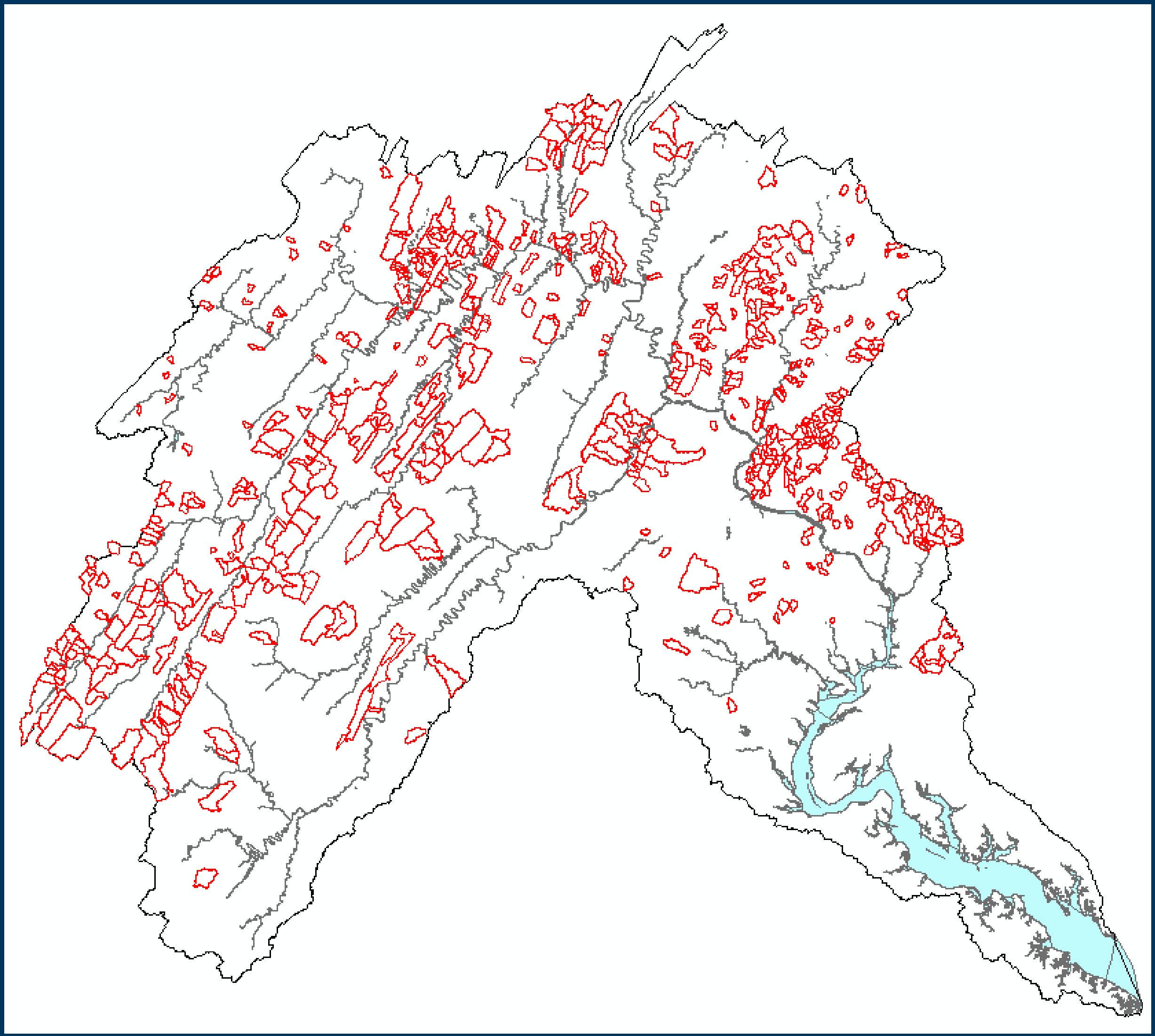
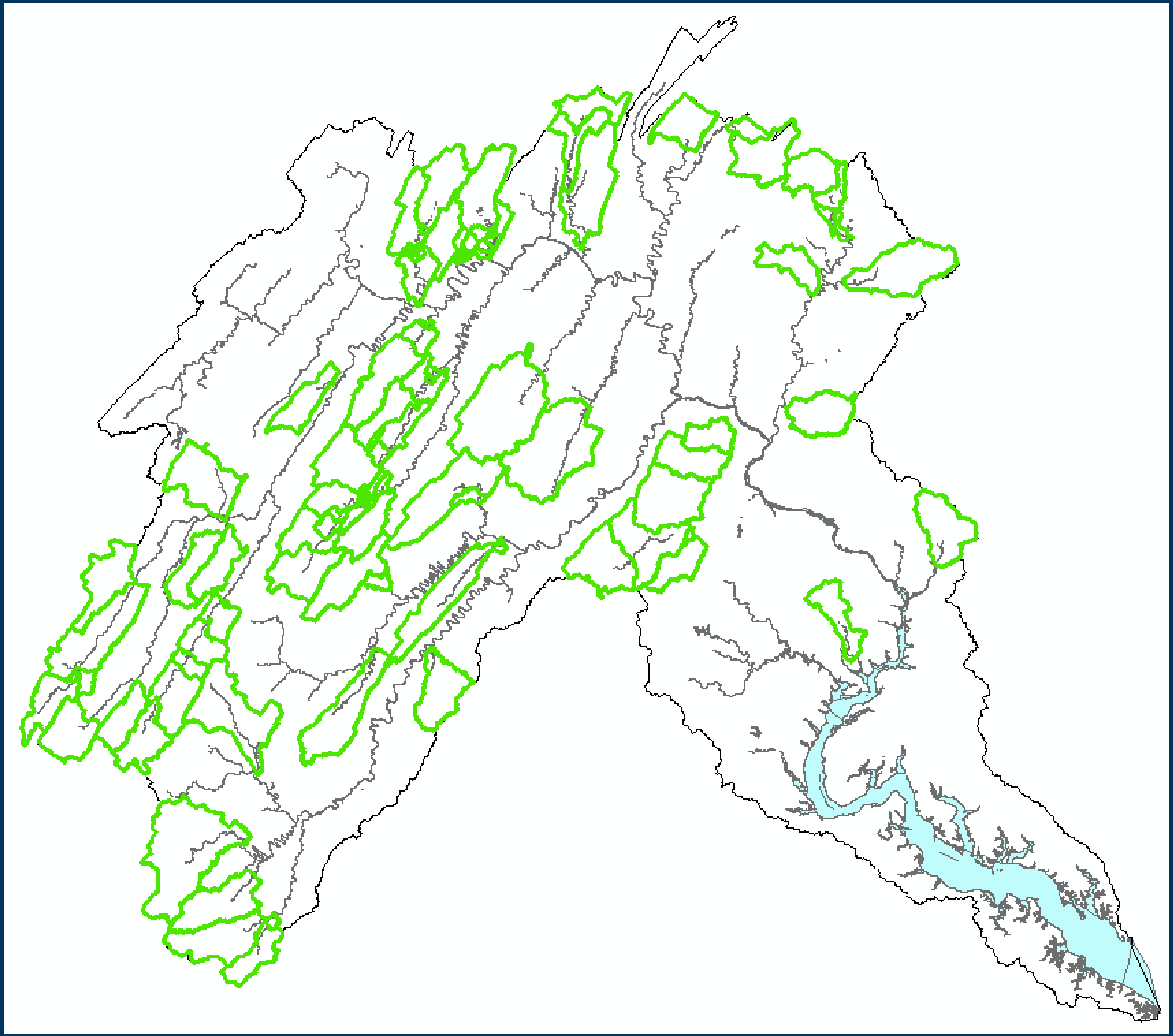
Jun 16 webinar: about modeling and the hydrologic foundation.

Watersheds with biological sample points selected for flow simulation



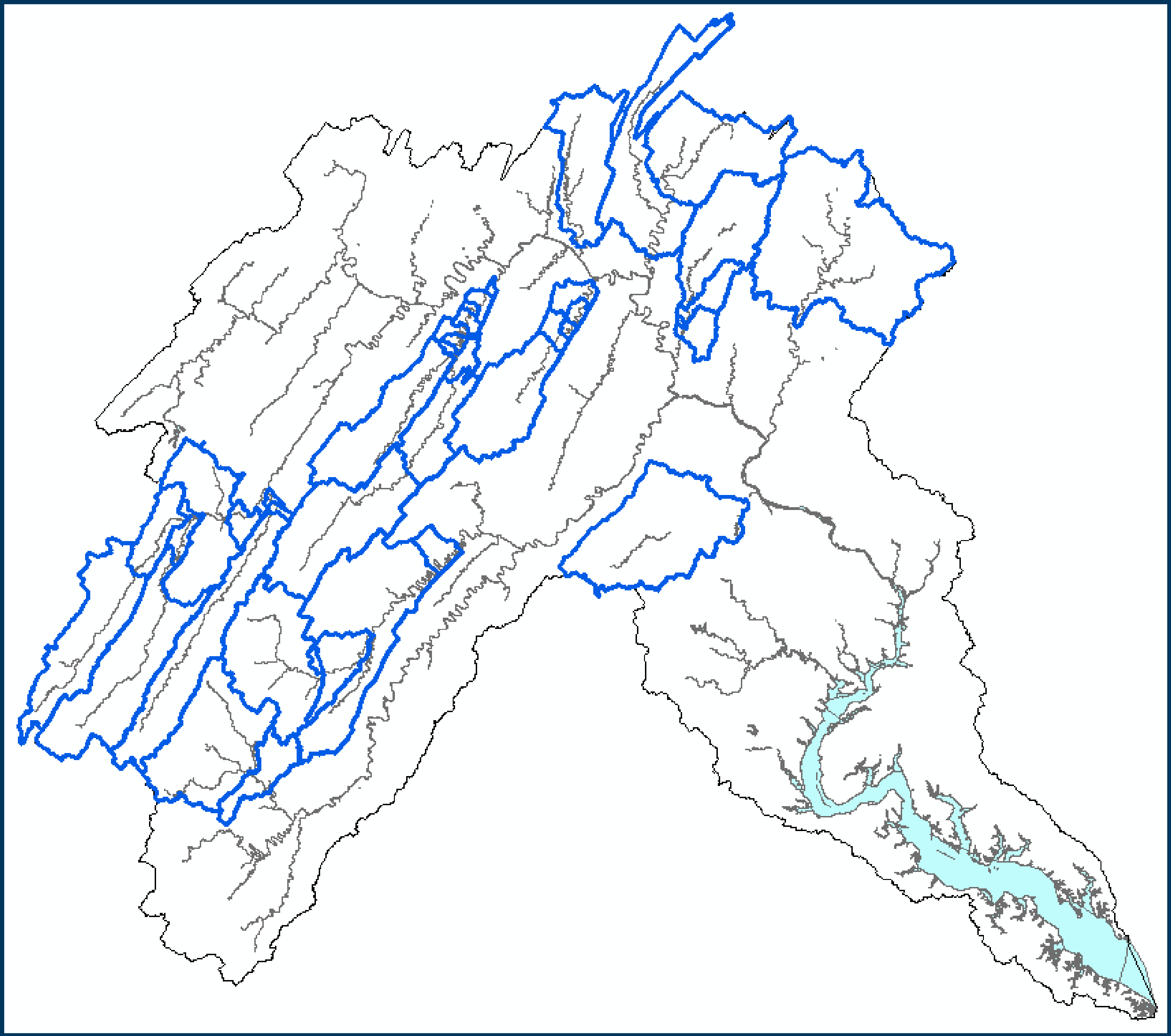
574 watersheds < 38.6 sq. mi.

Watersheds with biological sample points selected for flow simulation



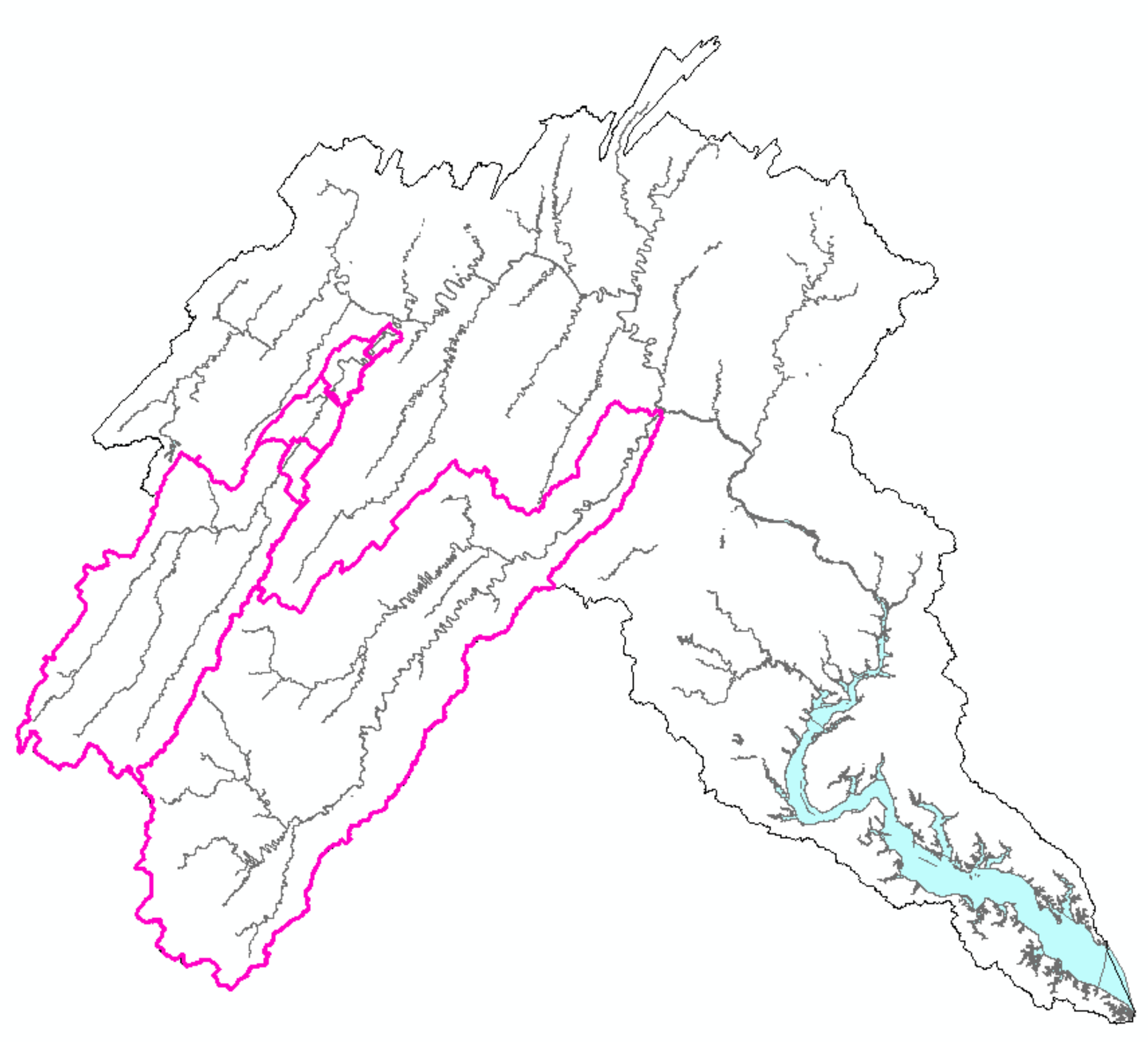
92 watersheds between 38.6 and 200 sq. mi.

Watersheds with biological sample points selected for flow simulation



40 watersheds between 200 and 1,000 sq. mi.

Watersheds with biological sample points selected for flow simulation



7 watersheds > 1,000 sq. mi.

Hydrologic Foundation - Scenarios

Current conditions scenario

1984-2005 meteorology, 2000 land cover; 2001-05 withdrawals (CBP, but spatially disaggregated); current state impoundments databases (**16** large impoundments simulated)

Baseline

Forest >= 78%, impervious cover <= 0.35%, no withdrawals, no discharges, no impoundments

Hydrologic Foundation – Future Scenarios

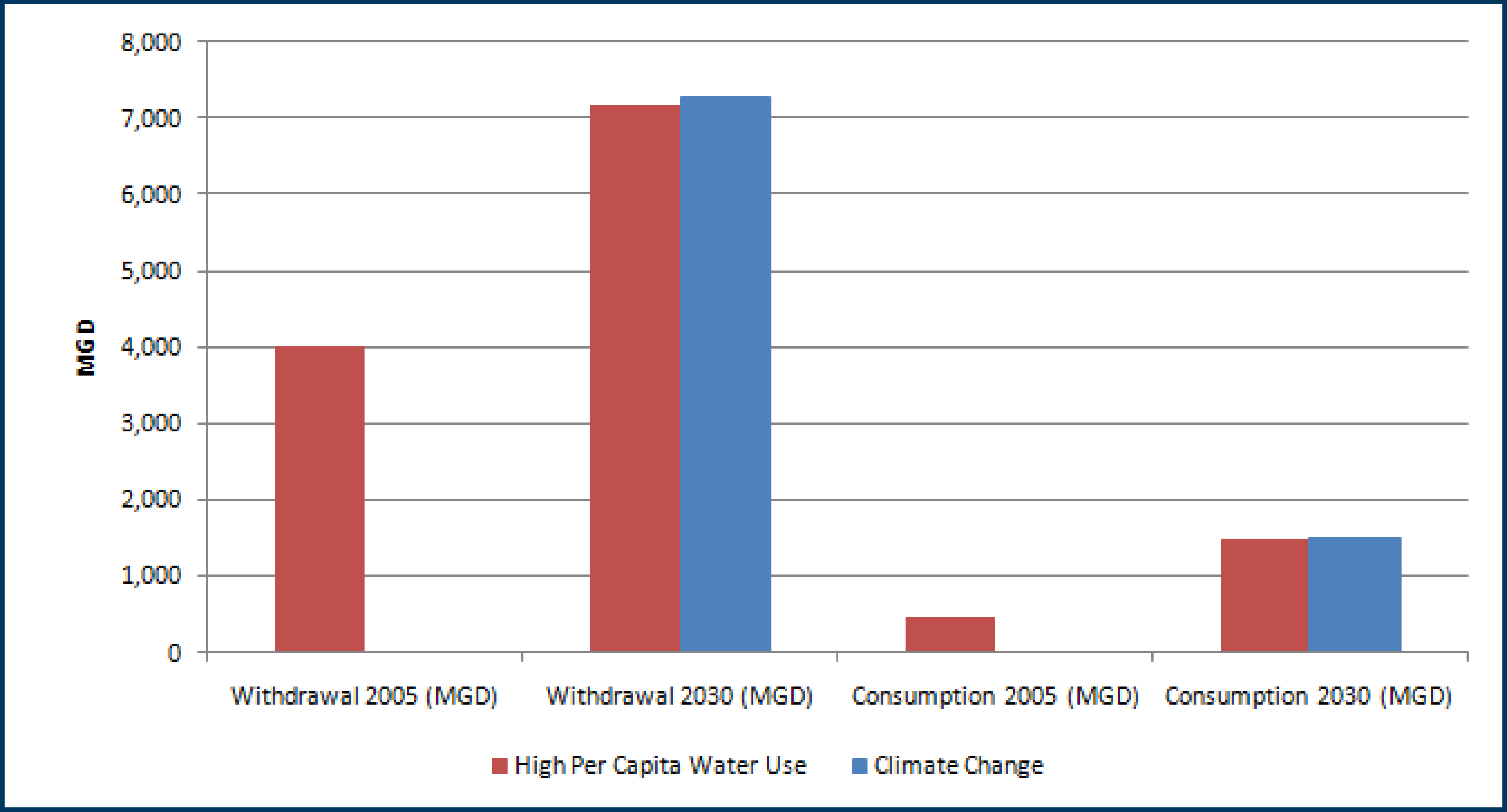
Future conditions scenarios

1) Water use by sector: domestic, agriculture (animal), agriculture (irrigation), power, industrial.
2) CBP pop. and land use change projections to 2030, withdrawal per person is constant.
3) Same as (1) except withdrawal per person increases at 1.8% annual rate.
4) Same as (1) except withdrawal per person increases at 4.0% annual rate.
5) Simulate a dry year – 2002 – but with higher temperatures.
6) Climate change: 0.4 deg. C increase in temp., no change in annual precip. amount, but increased precip. uncertainty.
7) Increased Power Production Capacity

May 10 webinar about future water demands and "future" scenarios.

Water use analysis informs scenarios

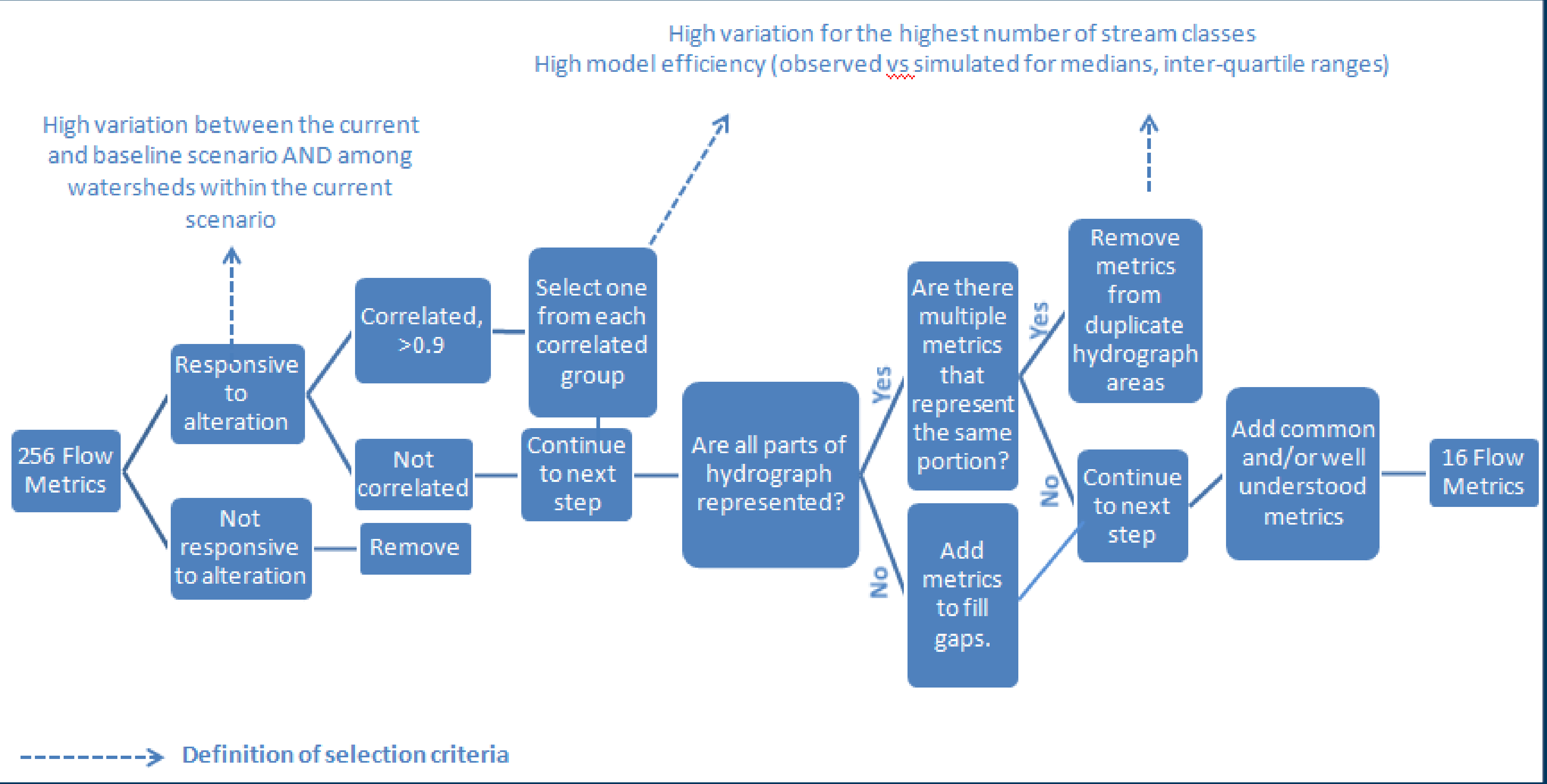
Example: current and future water use for high growth and climate change scenarios



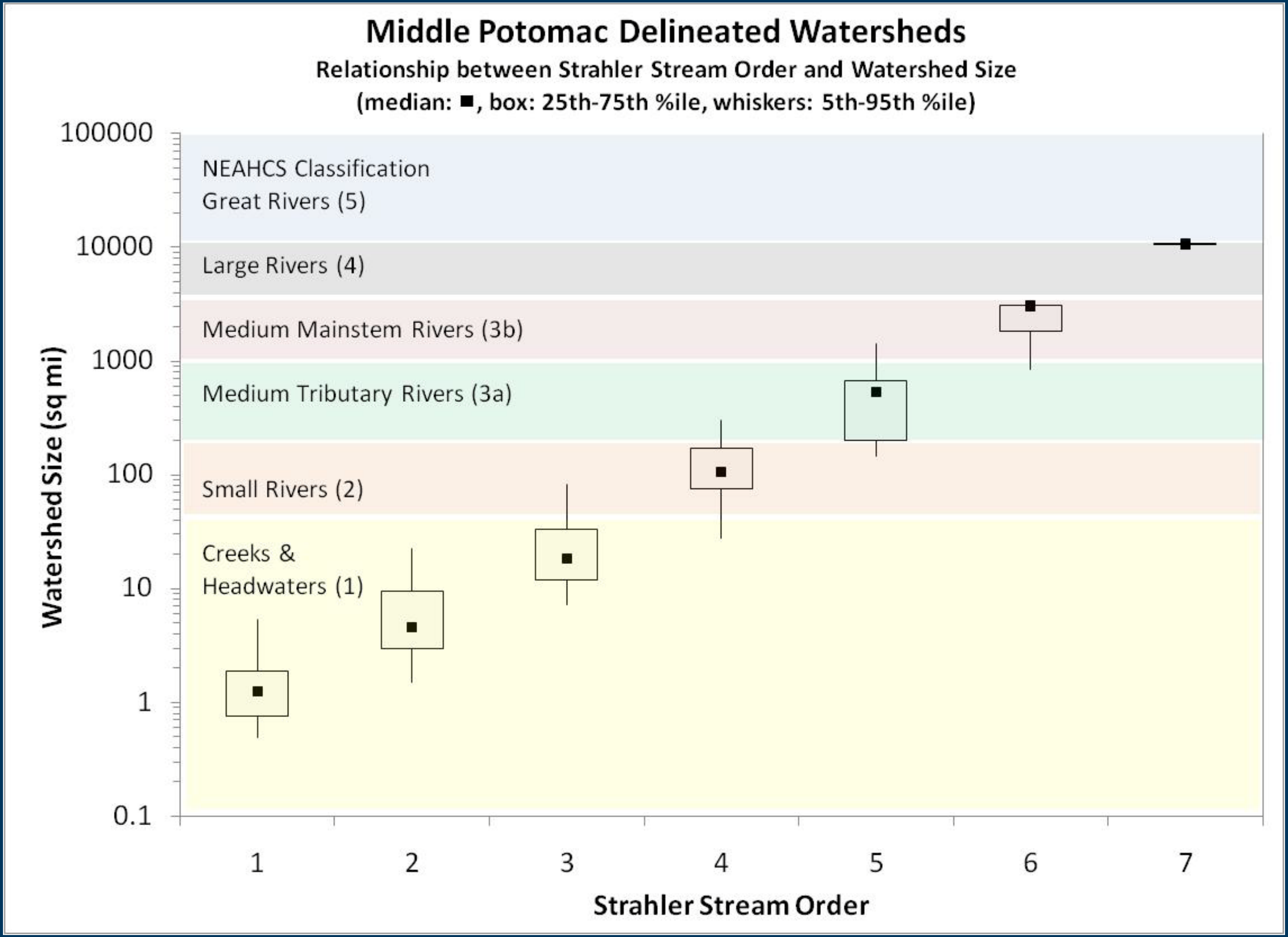
Flow Alteration

1) Compute 250+ flow statistics (IHA + HIT + others) for each scenario, each location
2) Flow alteration measured as difference between Baseline and Current; Baseline and Future; Current and Future
3) Select a refined list of flow metrics

Flow Metric Selection



River Classification (First Cut)



Natural & anthropogenic factors

- •Watershed size
- •% karst
- •% forest
- •% impervious
- •Withdrawals
- •impoundments

Flow-Ecology Relationships

1) Initial hypotheses:. Bio community shows influence of river continuum, bioregions, anthropogenic impacts on water quality and on flow.
2) Objective is to separate natural from anthropogenic factors, and isolate flow impacts from water quality impacts.
3) Multiple exploratory analyses to inform selection of biometrics, river types, and flow metrics.
4) Initial suite of biometrics: 52 commonly used benthic macroinvertebrate metrics
5) How subset of biometrics selected
   a) Most responsive to anthropogenic stress, habitat degradation
   b) High variability among locations

Subset of sensitive biometrics (not final)

Chessie BIBI
BECK_R
EPHEMEROPTERA_TAXA_CNT_R
EPT_TAXA_ABUND_R
EPT_TAXA_COUNT_R
FBI_R
NON_INSECT_TAXA_CNT_R
PCT_PLECOPTERA_R
PCT_SCRAPER_R
PCT_SENSITIVE_R
PCT_SHREDDER_R
PCT_SWIMMER_R
PCT_TOLERANT_R
PLECOPTERA_TAXA_CNT_R
SCRAPER_TAXA_CNT_R
SENSITIVE_TAXA_COUNT_R
SW_R
TAXA_RICH_R
TOLERANT_TAXA_COUNT_R

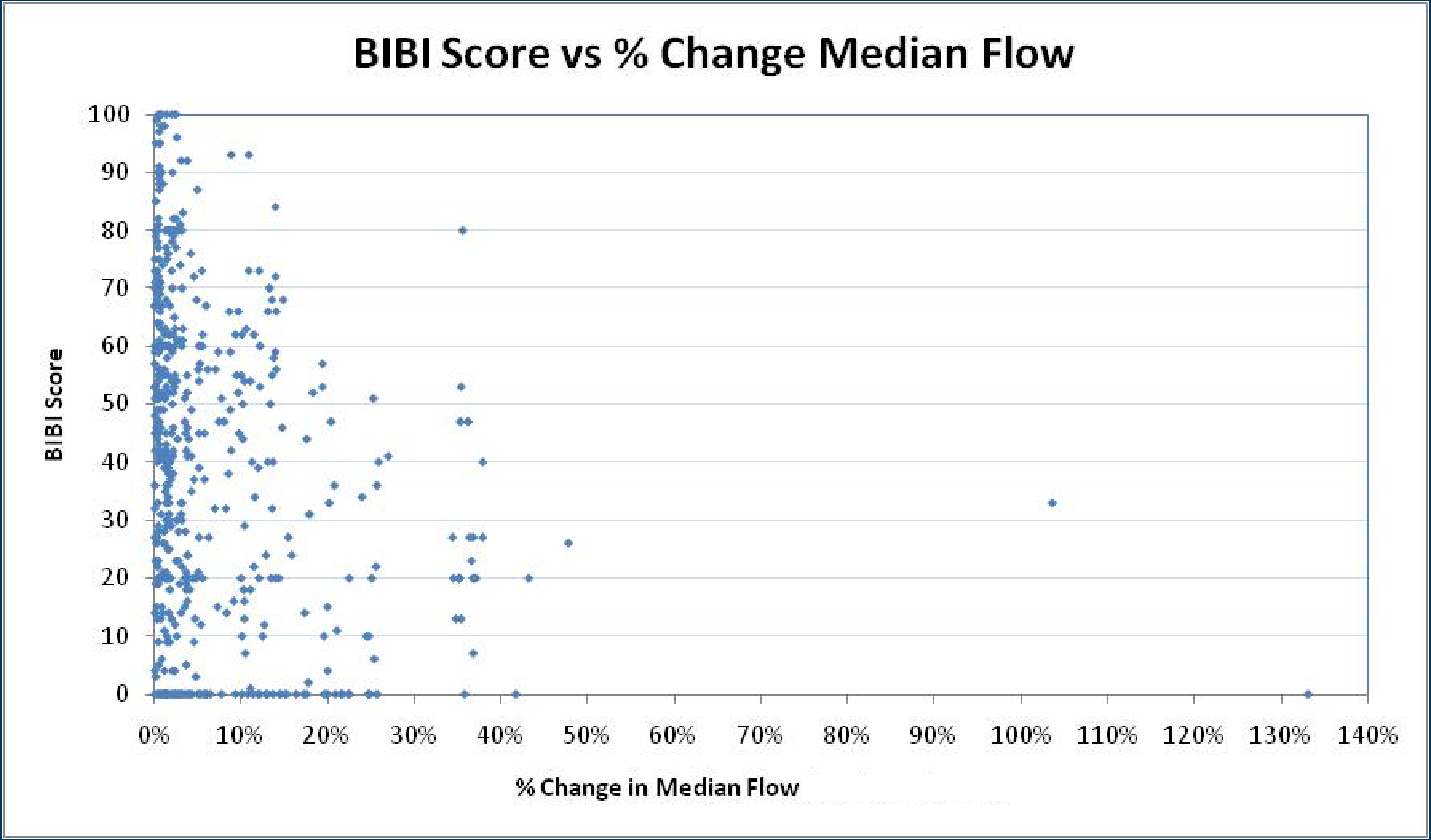
River Classification (Final)

1) "One size does not fit all"
2) Previous work indicates biometrics respond differently to watershed size, bioregion, karst, anthropogenic stress, etc.
3) Removing sites from our analysis that are strongly influenced by anthropogenic impacts allows us to quantify the natural influences on each biometrics of:
4) Watershed size (River Continuum Concept)
5) Bioregion and karst (geomorphology)
6) Classifying streams according to the sensitivities of each biometrics will
7) Minimize variability due to natural factors
8) Bring out responses to anthropogenic-related flow alteration (impoundments, withdrawals, land uses)

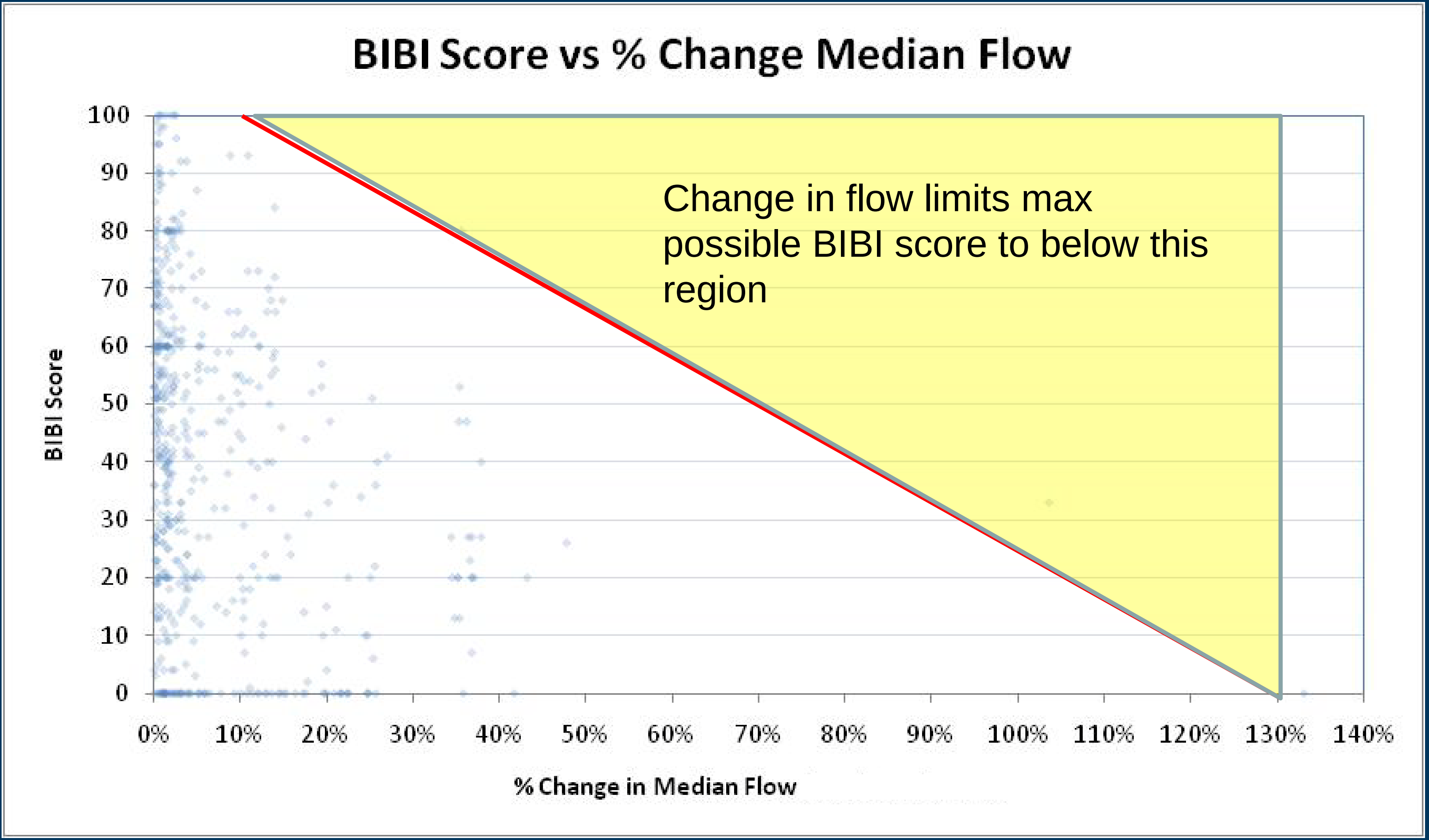
Flow alteration – ecological response

1) For each location and each flow metric, compute flow alteration (baseline-current or current-future)
2) Plot versus biometrics, by river type, each biometric
3) Biometric score reflects multiple influences other than flow, but decline in maximum biometric score as flow alteration increases is an indication of flow alteration effect
4) Synthesis and Interpretation
5) Results inform Decision Making process

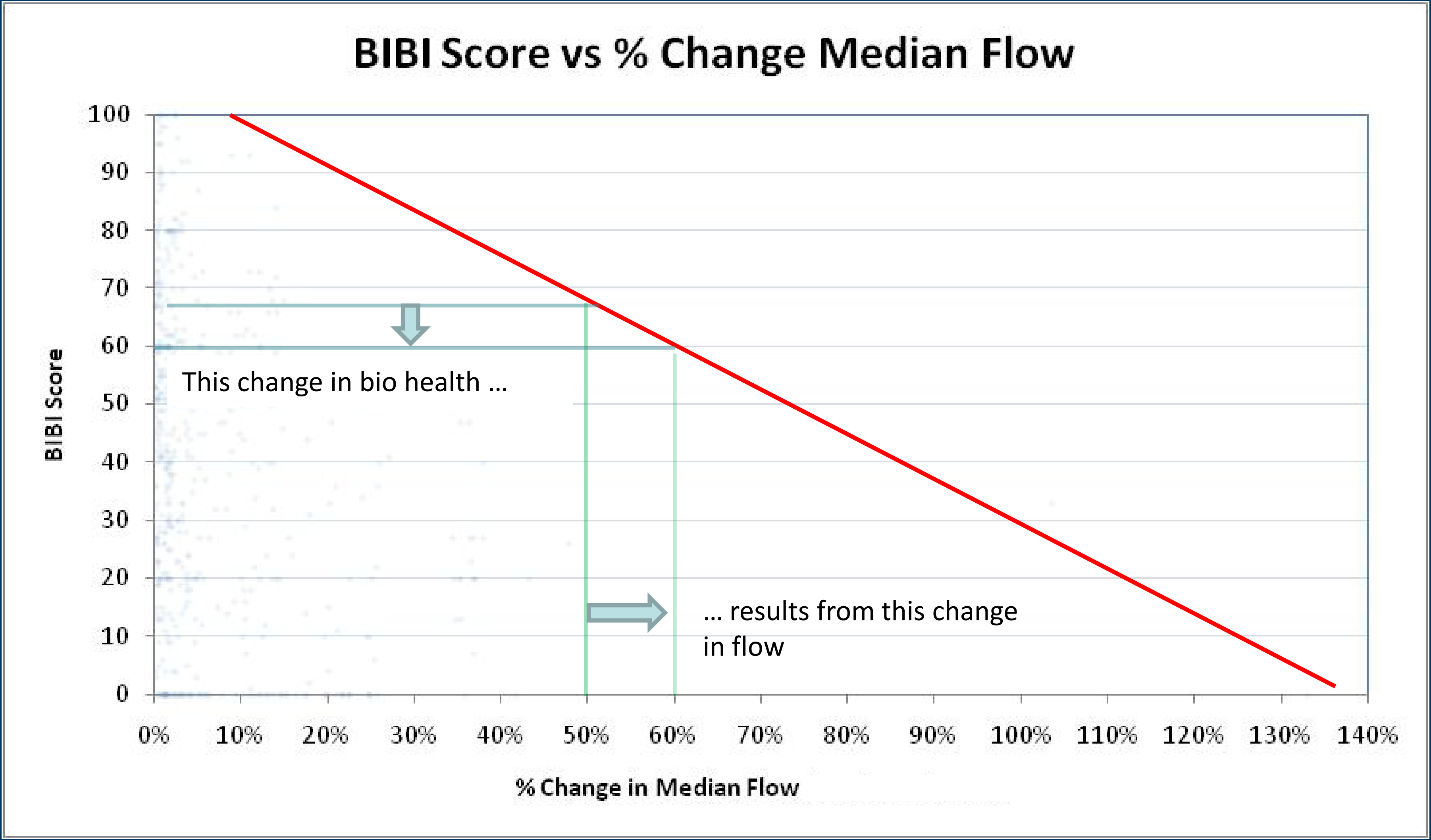
Example flow-ecology plot



Example flow - ecology plot



Example flow - ecology plot



Decision making for protecting environmental flows

Oct 27 webinar: From Science to Management Applications
Nov 29-Dec 1 workshop:

Volunteers wanted to participate in a Technical Advisory workgroup

1) Review with project team the flow alteration – ecological impact relationships as they are being developed.
2) Provided additional briefing materials beyond webinars and asked to comment on them.
3) Attend a workshop in mid to late summer.

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