CBT GIT Scope 10: Updating the Chesapeake Conservation Partnership (CCP) Priority Habitat Dataset

Final Report Appendices

Contents

Appendices

Appendix A. Guiding Ecological Principles

Examples of Guiding Ecological/Scientific Principles for Landscape Scale Habitat Mapping

From Conservation Planning in the Hudson River Estuary Watershed (Cornell University)

1. Protect large, contiguous, undisturbed areas wherever possible.
2. Preserve working forests and farmland potential wherever possible.
3. Maintain, create, or restore broad buffer zones between natural areas and human-dominated land uses, including development and agriculture.
4. Locate and plan new development in ways that protect natural areas; direct human uses toward the least sensitive natural areas; and provide buffers between sensitive natural areas and intensive use areas.
5. Minimize disruption to storage and movement of water across and through the landscape to protect water quality and quantity, reduce flooding, recharge ground water, and preserve habitat for fish and other aquatic life
6. Encourage the use of green infrastructure to manage stormwater in developed areas.

From *NRCS Conservation Corridor Planning at the Landscape Level – Chapter 5 Planning & Design Principles*

PRINCIPLES

Patches

- Large reserves/patches are better than small reserves/patches.
- Connected reserves/patches are better than separated reserves/patches.
- Unified reserves/patches are better than fragmented reserves/patches.
- Several reserves/patches (redundancy) are better than one reserve/patch.
- Nearness is better than separation.

Corridors

- Continuous corridors are better than fragmented corridors.
- Wider corridors are better than narrow corridors.
- Natural connectivity should be maintained or restored.
- Introduced connectivity should be studied carefully.
- Two or more corridor connections between patches (redundancy) are better than one.

Matrix

- Manage the matrix with wildlife in mind.

Structure

- Structurally diverse corridors and patches are better than simple structure.
- Native plants are better than introduced plants

Scale: The habitat model should be relevant at:

- Regional scale
- Watershed scale
- Conservation plan and practice scale

From *The Nature Conservancy Conservation Gateway*

- The conservation portfolio is a set of sites that collectively represent the best examples of the species and habitats that characterize the ecoregion.

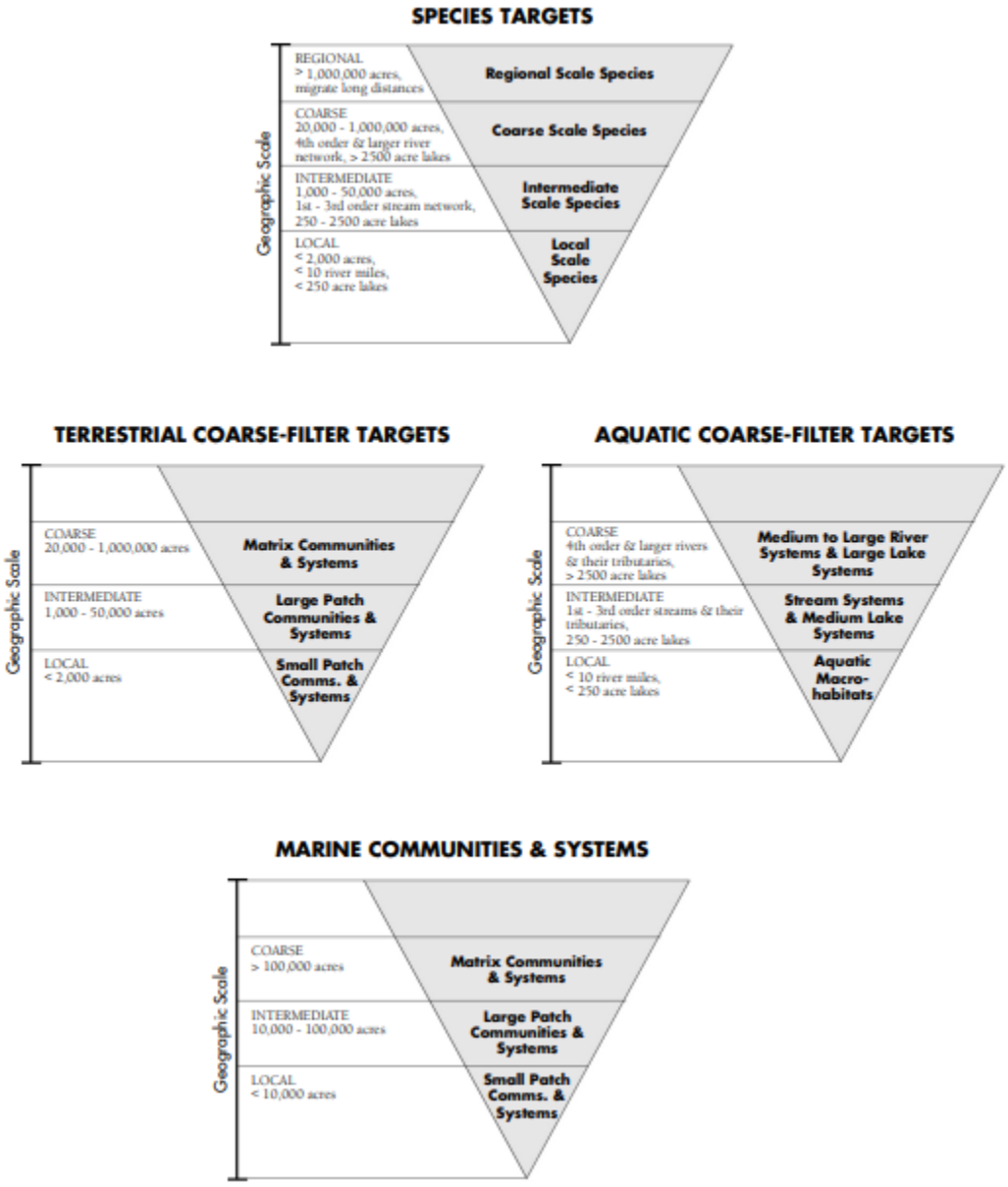
From *Patrick Comer (NatureServe) Ecoregional Planning and Climate Change Adaptation*

- Common planning steps include defining the planning region, selecting focal targets, mapping target distributions, assessing current conditions, establishing representation objectives, designing regional scenarios, identifying conservation strategies, and measuring success of regional plans.

From *The Nature Conservancy* *Designing a Geography of Hope*

- Ecoregional Conservation Planning—Selecting and designing networks of conservation sites that will conserve the diversity of species, communities, and ecological systems in each ecoregion.
- Site Conservation Planning—Applying the 5-S approach (systems, stresses, sources, strategies, success) to priority conservation sites in ecoregional portfolios for the purpose of applying site-based strategies and actions.
    - 1. Conservation Targets: Conservation targets are selected at multiple spatial scales and levels of biological organization. Targets should include both aquatic and terrestrial types (and marine/ estuarine where appropriate) and should represent the range in diversity of ecological systems found within an ecoregion. Information on the distribution and viability of conservation target occurrences is sought from a wide variety of information sources.
    - 2. Conservation Goals: Conservation goals are set for all targets or groups of targets. Goals should have two components: the number of populations or occurrences of species, communities, and ecological systems, and how those populations/occurrences will be distributed or stratified across the ecoregion.
    - 3. Viability: To the extent practical, the long-term viability (100 years) of populations and occurrences of conservation targets is assessed with the three criteria of size, condition, and landscape context. No site should be included in the portfolio of sites unless the coarsest-scale target at that site has been assessed as viable with these three criteria or can be feasibly restored to a viable status.
    - 4. Portfolio Assembly: Coarse-scale targets (e.g., matrix communities), including those that are feasibly restorable, are the foundation of the portfolio. All targets should be represented in sites across the range of environmental conditions in which they occur in the ecoregion. A map delineating conservation sites or areas of biodiversity significance is the product of this standard. Tabular data on each site should accompany the map

and include the following information: conservation targets at the site and general land ownership information (e.g., federal, state, private).



From *Dinerstein et al 2017* [*An Ecoregion-Based Approach to Protecting Half the Terrestrial Realm*]

- Nature Needs Half addresses the spatial dimensions of conservation biology, which comprises four goals:
    - (1) represent all native ecosystem types and successional stages across their natural range of variation,
    - (2) maintain viable populations of all native species in natural patterns of abundance and distribution,

    - (3) maintain ecological and evolutionary processes, and
    - (4) address environmental change to maintain the evolutionary potential of lineages

From *Landscape Conservation Cooperative Network* *"Recommended Practices for Landscape Conservation Design"*

- The spatial design will be most effective if it is more than the sum of the parts (i.e., the individual locations). Taking into account large-scale socio-ecological systems and connectivity will enhance the long-term viability of the design and its linkages to neighboring geographies. To the degree consistent with LCD objectives, configure the spatial design to reflect landscape-scale processes and the benefits of an interconnected network of landscapes and waterscapes. Such benefits include representation of natural and cultural diversity, resilience to current stressors and future change, redundancy, complementarity, and connectivity to allow animals and plants to move and disperse over time.

From *Breece Robertson (2021) Protecting the Places We Love*

- Examples of themes and criteria
    - Protect water quality
    - Protect streams, rivers, water features, and wetlands
    - Protect floodplains against development
    - Protect aquifer recharge areas
    - Protect headwater areas
    - Protect and restore wildlife corridors
    - Protect intact core habitat blocks
    - Protect riparian areas
    - Protect lands with biological richness and rarity

From *Firehock and Walker (2019) Green Infrastructure: Map and Plan the Natural World with GIS*

(Note – this book contains a wide range of potential habitat and other goals and suggested GIS approaches for addressing them)

- There is no ideal scale of analysis for all species
- There is no ideal scale for assessing habitat fragmentation
- Model should be locally relevant, adaptable, and easy to use
- Assess risks to habitat cores:
    - Zoned for development
    - Are new roads planned?
    - Which streams are impaired; which are good but threatened?
- Consider local plans
- Consider common and rare species habitats
- Rank and prioritize cores and connectors
- ESRI Cores dataset contains metrics/attributes such as:
    - Geometry (size, shape, interior depth, and perimeter-to-area ratio)
    - Physical characteristics (topographic diversity, landform diversity, dominant land cover)

    - Ecological characteristics (dominant ecoregion and ecosystem rarity)
- Consider thematic overlays or goal-specific partitions of data
- Consider natural heritage elements
- Consider the role of cores/habitat in the rural-urban interface
- Incorporate existing protected lands
- Consider development pressure
- Consider parcel boundaries and ownership

Nature's Network Design Principles

- Terrestrial Habitat
- Imperiled Species
- Aquatic Habitat
- Connectivity

Representation across Ecoregions

Conservation Design with potential for measuring Change over Time (e.g., indicators)

Appendix B. Stakeholder Engagement Framework

Project: Chesapeake Conservation Partnership (CCP): High Value Habitat Scoping Project

October 24, 2022

Document Purpose:

The purpose of this document is to outline the stakeholder engagement strategy for the High Value Habitat Scoping Project including:

- The participants that the project team will engage to gather current and future habitat mapping needs, data considerations, end user needs etc.
- The type of engagement venue
- The specific questions for each group

Internal Bay Program Stakeholders

This group includes stakeholders that fall under the Chesapeake Bay Program (CBP) umbrella and have a direct interest in the contents of a Chesapeake wide habitat dataset or may utilize such a dataset to inform Bay Program related goals and outcomes.

Goal and Key Questions: Understand current and future mapping needs including:

- Are you familiar with the Chesapeake Conservation Partnership Priority Habitat Dataset?
- How do you use the current Chesapeake Conservation Partnership High Value Habitat dataset?
- Where does the current dataset fall short in helping you complete your work? What are the habitat mapping needs for additional Chesapeake Bay Program Vital Habitat outcomes (https://www.chesapeakebay.net/what/goals/vital_habitats) that could benefit from high value habitat data?
- What are the most important considerations for updating the habitat dataset for CCP?
- What additional data, methods or models could be considered to improve the habitat model?
- What are examples of how a stakeholder might use the data or information to make decisions related to land conservation or other management action, including restoration (for example, targeting tree planting to fill gaps in forested corridors to network connectivity).

What stops you from using this data to its fullest potential?

Proposed avenue to obtain input*:* Host a webinar explaining existing high value habitat data, provide a round robin to attendees to outline how their work influences, informs this data or how this data informs their work. Provide a menti or other live format to obtain feedback related to specific datasets, functionality, use cases, or other input. Compile all data and contact individuals as needed for follow-up.

End Users / Internal Stakeholders

Internal Bay Area Stakeholder Group	Name and Organization	Email
Chesapeake Conservation Partnership representative(s)	John Griffin, CCP, Ben Alexandro, CCP	griffin@chesapeakeconservation.org benalexandro@gmail.com
Habitat Goal Team	Bill Jenkins, EPA, Chair	jenkins.bill@epa.gov
	Gina Hunt, MD DNR, Chair	gina.hunt@maryland.gov
	Chris Guy, FWS, Coordinator	chris_guy@fws.gov
Healthy Watersheds Goal Team	Jeff Lerner, EPA, Chair	Lerner.Jeffrey@epa.gov
	Renee Thompson, USGS, Coordinator	rthompso@chesapeakebay.net
Forestry Workgroup	Katie Brownson, USFS, Coordinator	Katherine.Brownson@usda.gov
	Julie Mawhorter, USFS	julie.mawhorter@usda.gov
Fish Passage Workgroup	Chris Guy, USFW (placeholder for chair)	chris_guy@fws.gov
	Katlyn Fuentes, CRC, Staffer	fuentesk@chesapeake.org
Stream Health Workgroup	Alison Santoro, MD DNR, Chair	alisona.santoro@maryland.gov
	Sara Weglein, MD DNR, Co-Chair	sara.weglein@maryland.gov
Wetland Workgroup	Pam Mason, VIMS, Chair	mason@vims.edu
	Todd Lutte, EPA, Chair	lutte.todd@epa.gov
Brook Trout Action Team	Steve Faulkner, USGS, Chair	faulkners@usgs.gov
	Katie Ombalski, Woods and Waters, Chair	katie@woodswaters.com
Black Duck Action Team	Benjamin Lewis, VA DWR, Chair	benjamin.lewis@dgif.virginia.gov
	Alicia Berlin, USGS, Chair	aberlin@usgs.gov
Scientific, Technical Assessment and Reporting (STAR)	Breck Sullivan, USGS, Coordinator; others?	bsullivan@chesapeakebay.net

Climate Resiliency Workgroup	Julie Reichert-Nguyen, NOAA, Coordinator	julie.reichert-nguyen@noaa.gov
Land Use Workgroup	Peter Claggett, USGS, Coordinator	pclaggett@chesapeakebay.net
Cross-GIT Program Coordinator	Kristin Saunders, UMCES	ksaunders@umces.edu
GIS Team	John Wolf, USGS, team lead	jwolf@chesapeakebay.net
Leadership	Carin Bisland, EPA	cbisland@chesapeakebay.net
Steering Committee members	Britt Slattery, NPS	Britt_Slattery@nps.gov
	Aurelia Gracia, NPS	aurelia_gracia@nps.gov

Existing known tools utilized by Stakeholders:

- Existing CCP Priority Habitat model (GIT 5)
- Natures Network composite model and individual components (GIT2, GIT 5)
- Watershed Resources Registry (Forestry Workgroup, Wetlands Workgroup)
- Chesapeake Healthy Watersheds Assessment (GIT 4)
- Stream Health Assessment (Chessie BIBI) (Stream Health Workgroup)
- Brook Trout Assessment Tools (Brook Trout Action Team, Eastern Brook Trout Joint Venture)
- Black Duck Watershed Prioritization (Black Duck Action Team)
- Predicted species occurrence and biodiversity abundance through various machine learning models (USGS, NatureServe)
- National Fish Habitat Assessment (Fish Habitat Action Team)
- Freshwater Network Fish Passage Prioritization (Fish Passage Workgroup)
- Others as identified by project leads and stakeholder interviews.

External Conservation Agencies and Organizations

This group of stakeholders may not have a direct interest in CBP outcomes but do have interest and knowledge in the use and application of high value habitat datasets as well as a specific interest in some building block data related to species, climate and other interests.

Goal and Key Questions: Determine what is needed to provide a more comprehensive foundation to support decision-making for programs and how the model can provide a better understanding of high value habitats in need of protection. Questions would include:

- How does your organization/agency use high value habitat maps?
- What official plans or products incorporate habitat maps?
- What existing decision support tools related to high value habitat or habitat restoration do you currently use?

- Are you in need of an additional/improved spatial map and decision tools to understand where high value habitats are located?
- Are there any capabilities beyond a static map that are present in your go to tools or desired? (e.g., Weighting or manipulating individual data layers to come up with different scenarios.)
- How would you use the data or information to make decisions related to land conservation or other management action, including restoration (for example, targeting tree planting to fill gaps in forested corridors to network connectivity)?
- Are the high value habitat maps/data you are utilizing easily understandable? If not, how can they be improved?
- What stops you from utilizing these types of data to their fullest potential? Are there Subject Matter Experts you would recommend we contact?
- State natural resources agency representative: What questions do you think we should ask people? Get input on what the questions should be.

Proposed avenue to obtain input: Host a webinar explaining existing high value habitat data, provide a round robin to attendees to outline how their work influences, informs or how this data informs their work. Provide a menti or other live format to obtain feedback related to specific datasets, functionality, use cases, or other input. Compile all data and contact individuals as needed for follow-up.

End Users / External Stakeholders

Name	Organization / Contact information	Habitat Dataset significance to user
Land conservation organizations Erik Meyers	The Conservation Fund / emeyers@conservationfund.org	Prioritized land conservation targeting Climate and Water sustainability
Land Trusts John Turgeon	Maryland Environmental Trust / john.turgeon@maryland.gov	Direct assistance to land trusts; Prioritized high value habitat for land conservation targeting
Mark Bryer	The Nature Conservancy / mbryer@tnc.org	Chesapeake Bay director, ecosystem services, (may have another contact for us)
Dave Curson	Audubon Maryland David.Curson@audubon.org	High value avian habitat, bird conservation
Kirsten Luke	Atlantic Coast Joint Venture (ACJV) / Kirsten_Luke@fws.gov	GIS, outreach, decision support
Suzan Bulbulkaya	PA DCR / suzan.bulbulkaya@dcr.virginia.gov	State Land Conservation program leads and staff

Land Use planners Name	(organization / email) (Could LGAC/Laura Cattell Noll help ID someone here?)	Comprehensive plan development; understanding where high value habitat exists in their locality
State wildlife/natural heritage staff Brad Georgic	Western PA Conservancy / bgeorgic@paconserve.org	GIS Manager
State wildlife/natural heritage staff Paul Peditto	Maryland DNR / paul.peditto@maryland.gov	State wildlife/natural heritage staff
State wildlife/natural heritage staff Jason Bullock	VA DCR / jason.bullock@dcr.virginia.gov	Natural Heritage Director
State wildlife/natural heritage staff Rebecca Bowen	PA NHP / rebbowen@pa.gov	Chief, Conservation Science and Ecological Resources Division
Mike Slattery	USFW/ Michael_Slattery@fws.gov	Landscape Conservation Coordinator
Faren Wolter	USFW/ faren_wolter@fws.gov	Conservation Social Scientist and Science Coordinator
Genevieve LaRouche	USFW / Genevieve_LaRouche@fws.gov	Field Office Supervisor
Kevin DuBois	DoD / kevin.r.dubois.civ@us.navy.mil	DoD Chesapeake Bay Program Coordinator with specialized expertise in living shorelines and tidal wetland restoration
Jamie Simon	DoD/ jaime.simon@ag.tamu.edu	Program manager for the Texas A&M Institute of Renewable Natural Resources' Military Sustainability Program
USFS	Genevieve LaRouche genevieve_larouche@fws.gov	USFS Chesapeake Bay Field Office Supervisor, experience with WILD and mapping of species
Christine Conn	MD DNR / christine.conn@maryland.gov	Habitat

Becky Gwynn	Virginia Department of Wildlife Resources / becky.gwynn@dwr.virginia.gov	State wildlife management
Paul Johansen	West Virginia Department of Natural Resources / paul.r.johansen@wv.gov	
Scott Bearer	PA Game Commission / sbearer@pa.gov	
Karen Bennett	DE F&W (DNREC) / Karen.Bennett@delaware.gov	
Jonathan McKnight	MD DNR / jonathan.mcknight@maryland.gov	
Sarah Fleming	Ducks Unlimited / sfleming@ducks.org	
Amy Wolf	Trout Unlimited / amy.wolfe@tu.org	
Laura Prezioso	Eastern Shore Land Conservancy / lprezioso@eslc.org	
Steve Stork / Louis Keddell	Chesapeake conservancy / sstorck@chesapeakeconservancy.org; lkeddell@chesapeakeconservancy.oorg	
Mark Symborski	Montgomery County Department of Environmental Protection / mark.symborski@mncppc-mc.org	
Michael Stringer	Anne Arundel County / pzstri20@aacounty.org	
Erik Michelson	Anne Arundel County Bureau of Watershed Protection and Restoration / pwmich20@aacounty.org	
Erik Fisher	Chesapeake Bay Foundation / efisher@cbf.org	

Subject Matter Expert (SME) Technical Advisory

Goal and Key Questions: *To understand specific scientific and technical information that could inform options to improve the future habitat model. Questions could include:*

- What key or emerging datasets, or modeling/analytical approaches, related to habitat are important for sustaining native wildlife populations (e.g., migratory birds, fish), plants and at-risk species, to guide land conservation, and terrestrial and aquatic habitat conservation, restoration, and stewardship?
- How can higher resolution land cover data be put into use?
- In what scenarios can utilizing higher resolution land cover data improve scientific understanding of vital lands and habitat, and identify and help prioritize conservation and restoration opportunities?
- What important data or considerations related to climate change projections may affect habitat?
- What are the limitations of the current habitat layer for targeting conservation and restoration?
- What additional (emerging technology) data, methods or models that should be considered to improve the habitat model?

Proposed avenue to obtain input: One-on-one interviews (30-60 min) to dive deeper into specific technical questions. *potential early interviewees to help inform the stakeholder webinars.

Participants/Interviewees

Subject Matter/Topic	Name	Email	Organization
Habitat mapping	BJ Richardson*	bj_richardson@fws.gov	USFWS
Habitat mapping, climate resiliency	Michelle Canick	mcanick@tnc.org	The Nature Conservancy
Salt marsh sparrow, Ducks	Maureen (Mo) Correll	Maureen_Correll@fws.gov	Atlantic Coast Joint Venture
GIS MD Natural Heritage Program/biodiversity	Lynn Davidson	lynn.davidson@maryland.gov	MD DNR
Landscape/systems ecology	Ted Weber	Tweber@defenders.org	Defenders of Wildlife
Landscape/systems ecology	Kevin McGarigal	mcgarigalk@eco.umass.edu	UMASS Amherst
Green Infrastructure Planning Lead	Ryan Perkl	RPerkl@esri.com	ESRI
	Will Allen*	wallen@conservationfund.org	The Conservation Fund
Habitat mapping	Mark Anderson	kfoerstel@TNC.ORG	The Nature Conservancy
Coordinator, SECAS	Amanda Sesser Rua Mordecai	amanda_sesser@fws.gov	Southeast Conservation Adaptation Strategy
EPA/Office of Research and Development	Jim Wickham		

Appendix C. Workshop Agendas

Agenda
Priority Habitat Map Update
Chesapeake Bay Program (CBP) Workshop
DECEMBER 13, 2022 | 11:00-1:00PM

THIS MEETING WILL BE RECORDED FOR INTERNAL USE TO ASSURE THE ACCURACY OF MEETING NOTES

Purpose: Gather input from CBP staff on data, uses and other considerations to help scope how to approach the update of the Chesapeake Conservation Partnership Priority Habitat Map to meet conservation goals

1. Welcome & Introduction (15 min)
   - Introductions
   - Welcome
   - Project overview
2. Current Priority Habitat Map Use (40 min)
   - Show of hands: Are you familiar with the Chesapeake Conservation Partnership Priority Habitat Dataset? Do you use this high value habitat model?
   - What existing decision support tools related to high value habitat or habitat restoration do you currently use?
   - How do you use the current Chesapeake Conservation Partnership High Value Habitat dataset?
   - Where does the current dataset fall short in helping you complete your work?
   - What are the habitat mapping needs for additional Chesapeake Bay Program Vital Habitat outcomes (https://www.chesapeakebay.net/what/goals/vital_habitats) that could benefit from high value habitat data?
3. Conservation Decision-Making (35 min)
   - What are examples of how a stakeholder might use the data or information to make decisions related to land conservation or other management action, including restoration (for example, targeting tree planting to fill gaps in forested corridors to network connectivity).
   - What stops you from using this data to its fullest potential?
4. Future Habitat Map Considerations (25 min)
   - What are the most important considerations for updating the habitat dataset for CCP?
   - What additional data, methods or models could be considered to improve the habitat model?
5. Closing (5 min)
   - Recap discussion themes
   - Next steps and thank you

Agenda
Priority Habitat Map Update
CBP Workshop

FEBRUARY 9, 2023 | 3:00-5:00PM

Purpose: Gather input from CBP staff on data, uses and other considerations to improve the value of CCP Priority Habitat Map in meeting conservation goals

1. Welcome & Introduction (20 min)
   - Welcome
   - Introductions
   - Project overview
2. Current Priority Habitat Map Use (5 min)
   - Do you currently use the CCP habitat model/map in your work?
   - If yes, how? If not, what are the barriers?

3. Conservation Decision-Making (70 min)
   - Round Robin: how would you use a watershed-wide high value habitat model in your work?
   - What would be useful to consider in that model?
     - Scale
     - 1M vs 30M
     - Resiliency factors
     - Ecological function and/or biotic outcomes
     - Dynamic interface/one stop shop
     - Current data/continuous updates

4. Future Habitat Map Considerations (25 min)
   - What are the barriers for utilizing habitat data/maps?
   - What additional data, methods or models could be considered to improve the habitat model?
5. Closing (5 min)
   - Recap discussion themes
   - Next steps

Agenda

Priority Habitat Map Update

External Workshop

February 14, 2023 | 3:00 – 5:00 pm

This meeting will be recorded for internal use to assure the accuracy of meeting notes

Purpose: Gather input from external stakeholders on data, uses and other considerations to help scope how to approach the update of the Chesapeake Conservation Partnership Priority Habitat Map to meet conservation goals

1. Welcome & Introduction (20 min)
   - Welcome
   - Introductions
   - Project overview
2. Current Priority Habitat Map Use (5 min)
   - Do you currently use the CCP habitat model/map in your work?
   - If yes, how? If not, what are the barriers?

3. Conservation Decision-Making (70 min)
   - Round Robin: how would you use a watershed-wide high value habitat model in your work?
   - What habitat decision tools do you currently use?
   - What habitat maps and decision tools do you need in your work?
   - What would be useful to consider in a new watershed wide habitat model?
     - Scale
     - 1M vs 30M
     - Resiliency factors
     - Ecological function and/or biotic outcomes
     - Dynamic interface/one stop shop
     - Current data/continuous updates

4. Future Habitat Map Considerations (25 min)
   - What are the barriers for utilizing habitat data/maps?
   - Are there Subject Matter Experts you would recommend we contact?
   - What additional data, methods or models could be considered to improve the habitat model?

5. Closing (5 min)
   - Recap discussion themes
   - Next steps

Appendix D. Workshop Invitee/RSVP Tables

External Workshop

Stakeholder Type	Name and Organization	Email	RSVP	Attended
State wildlife/natural heritage staff	Emily Domoto, PA DCNR	edomoto@pa.gov	Accepted	x
Landscape Conservation Coordinator	Mike Slattery , USFW	Michael_Slattery@fws.gov	Accepted	x
State wildlife management	Jonathan McKnight , MD DNR	jonathan.mcknight@maryland.gov	Accepted	x
NGO	Shawn Rummel, Trout Unlimited	Shawn.Rummel@tu.org	Accepted	x
Land Trusts	Laura Prezioso, Eastern Shore Land Conservancy	lprezioso@eslc.org	Accepted	x
CCP/ NGO	Louis Kadell, Chesapeake Conservancy	lkadell@chesapeakeconservancy.org	Accepted	x
Local Planner	Erik Michelson, Anne Arundel County Bureau of Watershed Protection and Restoration	pwmich20@aacounty.org	Tentative	x
Conservation Social Scientist and Science Coordinator	Faren Wolter, USFW	faren_wolter@fws.gov		x
State wildlife management	Scott Bearer, PA Game Commission	sbearer@pa.gov		x
Local Planner	Mark Symborski, Montgomery County Department of Environmental Protection	mark.symborski@mncppc-mc.org		x
High value avian habitat, bird conservation	Dave Curson, Audubon Maryland	David.Curson@audubon.org	Accepted	
Habitat Expert	Christine Conn, MD DNR	christine.conn@maryland.gov	Declined	
State wildlife management	Paul Johansen , West Virginia Department of Natural Resources	paul.r.johansen@wv.gov	Declined	
DoD Chesapeake Bay Program Coordinator	Kevin DuBois, DoD	kevin.r.dubois.civ@us.navy.mil	Declined	
Land Use planners	Michael Stringer, Anne Arundel County	pzstri20@aacounty.org	Tentative	

State wildlife/natural heritage staff	Brad Georgic, Western PA Conservancy	bgeorgic@paconserve.org	Tentative	
NGO	Sarah Fleming, Ducks Unlimited	sfleming@ducks.org	Tentative	
Brook Trout Coordinator	Lori Maloney, Canaan Valley Institute	lori.maloney@canaanvi.org	Tentative	
Land conservation organizations	Erik Meyers,The Conservation Fund	emeyers@conservationfund.org		
Land Trusts	John Turgeon, Maryland Environmental Trus	john.turgeon@maryland.gov		
Chesapeake Bay director, ecosystem services	Mark Bryer,The Nature Conservancy	mbryer@tnc.org		
GIS	Kirsten Luke, Atlantic Coast Joint Venture (ACJV)	Kirsten_Luke@fws.gov		
State Land Conservation program leads and staff	Suzan Bulbulkaya , PA DCR	suzan.bulbulkaya@dcr.virginia.gov		
State wildlife/natural heritage staff	Paul Peditto , Maryland DNR	paul.peditto@maryland.gov		
State wildlife/natural heritage staff	Jason Bullock , VA DCR	jason.bullock@dcr.virginia.gov		
USFS Chesapeake Bay Field Office Supervisor, experience with WILD and mapping of species	Genevieve LaRouche, USFW	Genevieve_LaRouche@fws.gov		
program manager for the Texas A&M Institute of Renewable Natural Resources' Military Sustainability Program	Jamie Simon, DoD	jaime.simon@ag.tamu.edu		

State wildlife management	Becky Gwynn, Virginia Department of Wildlife Resource	becky.gwynn@dwr.virginia.gov		
State wildlife management	Karen Bennett , DE F&W (DNREC)	Karen.Bennett@delaware.gov		
CCP / NGO	Steve Stork, Chesapeake Conservancy	sstorck@chesapeakeconservancy.org		
NGO	Erik Fisher, Chesapeake Bay Foundation	efisher@cbf.org		

Internal Workshops

Internal Bay Area Stakeholder Group	Name and Organization	Email	RSVPs	Attended
Habitat Goal Team	Bill Jenkins, EPA, Chair	jenkins.bill@epa.gov	Accepted	x
Climate Resiliency Workgroup	Julie Reichert-Nguyen, NOAA, Coordinator	julie.reichert-nguyen@noaa.gov	Accepted	x
Land Use Workgroup	Peter Claggett, USGS, Coordinator	pclaggett@chesapeakebay.net	Accepted	x
Healthy Watersheds Goal Team	Renee Thompson, USGS, Coordinator	rthompso@chesapeakebay.net	Accepted	x
GIS Team Leadership	John Wolf, USGS, team lead	jwolf@chesapeakebay.net	Accepted	x
Habitat Goal Team	Chris Guy, FWS, Coordinator	chris_guy@fws.gov	Tentative	x
	Faren Wolter, USFWS	faren_wolter@fws.gov		x
	Sophie Waterman			x
Cross-GIT Program Coordinator	Kristin Saunders, UMCES	ksaunders@umces.edu	Accepted	
CCP representative(s)	Ben Alexandro, CCP	benalexandro@gmail.com	Accepted	
Stream Health Workgroup	Alison Santoro, MD DNR, Chair	alisona.santoro@maryland.gov	Accepted	
Wetland Workgroup	Pam Mason, VIMS, Chair	mason@vims.edu	Declined	
Brook Trout Action Team	Katie Ombalski, Woods and Waters, Chair	katie@woodswaters.com	Declined	
Steering Committee	Britt Slattery, NPS	Britt_Slattery@nps.gov	Declined	
members	Aurelia Gracia, NPS	aurelia_gracia@nps.gov	Declined	

Forestry Workgroup	Katie Brownson, USFS, Coordinator	Katherine.Brownson@usda.gov	Declined	
Fish Passage Workgroup	Katlyn Fuentes, CRC, Staffer	fuentesk@chesapeake.org	Tentative	
Black Duck Action Team	Alicia Berlin, USGS, Chair	aberlin@usgs.gov	Tentative	
Scientific, Technical Assessment and Reporting (STAR)	Breck Sullivan, USGS, Coordinator	bsullivan@chesapeakebay.net	Tentative	
CCP representative(s)	John Griffin, CCP,	jgriffin@chesapeakeconservation.org		
Habitat Goal Team	Gina Hunt, MD DNR, Chair	gina.hunt@maryland.gov		
Healthy Watersheds Goal Team	Jeff Lerner, EPA, Chair	Lerner.Jeffrey@epa.gov		
Forestry Workgroup	Julie Mawhorter, USFS	julie.mawhorter@usda.gov		
Stream Health Workgroup	Sara Weglein, MD DNR, Co-Chair	sara.weglein@maryland.gov		
Wetland Workgroup	Todd Lutte, EPA, Chair	lutte.todd@epa.gov		
Brook Trout Action Team	Steve Faulkner, USGS, Chair	faulkners@usgs.gov		
Black Duck Action Team	Benjamin Lewis, VA DWR, Chair	benjamin.lewis@dgif.virginia.gov		
GIS Team Leadership	Carin Bisland, EPA	cbisland@chesapeakebay.net		

Internal Bay Area Stakeholder Group	Name and Organization	Email	RSVPs	Attended
Wetland Workgroup	Pam Mason, VIMS, Chair	mason@vims.edu	Accepted	x
Brook Trout Action Team	Katie Ombalski, Woods and Waters, Chair	katie@woodswaters.com	Accepted	x
Steering Committee	Britt Slattery, NPS	Britt_Slattery@nps.gov	Accepted	x
members	Aurelia Gracia, NPS	aurelia_gracia@nps.gov	Accepted	x
Scientific, Technical Assessment and Reporting (STAR)	Breck Sullivan, USGS, Coordinator	bsullivan@chesapeakebay.net	Accepted	x
Stream Health Workgroup	Sara Weglein, MD DNR, Co-Chair	sara.weglein@maryland.gov	Accepted	x

Fish Passage Workgroup	Ray Li, USFWS, Co-Chair	ray_li@fws.gov	Accepted	x
GIS Team Leadership	Carin Bisland, EPA	cbisland@chesapeakebay.net	Accepted	x
	Faren Wolter, USFWS	faren_wolter@fws.gov	Tentative	x
Forestry Workgroup	Katie Brownson, USFS, Coordinator	Katherine.Brownson@usda.gov		x
Brook Trout Action Team	Steve Faulkner, USGS, Chair	faulkners@usgs.gov		x
Habitat Goal Team	Gina Hunt, MD DNR, Chair	gina.hunt@maryland.gov		x
	Sophie Waterman			x
Healthy Watersheds Goal Team	Renee Thompson, USGS, Coordinator	rthompso@chesapeakebay.net		x
Habitat Goal Team	Bill Jenkins, EPA, Chair	jenkins.bill@epa.gov		x
Cross-GIT Program Coordinator	Kristin Saunders, UMCES	ksaunders@umces.edu	Accepted	
CCP representative(s)	John Griffin, CCP,	jgriffin@chesapeakeconservation.org	Declined	
CCP representative(s)	Ben Alexandro, CCP	balexandro@chesapeakeconservation.org	Tentative	
Fish Passage Workgroup	Katlyn Fuentes, CRC, Staffer	fuentesk@chesapeake.org	Tentative	
Stream Health Workgroup	Alison Santoro, MD DNR, Chair	alisona.santoro@maryland.gov		
Fish Passage Workgroup	**Jim Thompson, MDNR, Co-Chair**	jim.thompson@maryland.gov		
Black Duck Action Team	Alicia Berlin, USGS, Chair	aberlin@usgs.gov		
Healthy Watersheds Goal Team	Jeff Lerner, EPA, Chair	Lerner.Jeffrey@epa.gov		
Forestry Workgroup	Julie Mawhorter, USFS	julie.mawhorter@usda.gov		
Wetland Workgroup	Todd Lutte, EPA, Chair	lutte.todd@epa.gov		
Black Duck Action Team	Benjamin Lewis, VA DWR, Chair	benjamin.lewis@dgif.virginia.gov		
GIS Team Leadership	John Wolf, USGS, team lead	jwolf@chesapeakebay.net		

Appendix E. Habitat Scoping Stakeholder Engagement Summary

Scope of Work #10: Updating the Chesapeake Conservation Partnership (CCP) Priority Habitat Dataset of the Chesapeake Conservation Atlas: A Scoping Project

Introduction

Purpose

As part of the Chesapeake Bay Program Goal Implementation Team (GIT) Project Initiative, the Chesapeake Bay Trust funded Scope of Work (SOW) #10 to be performed by Skeo Solutions and directed by the Chesapeake Bay Program (CBP) on behalf of the Chesapeake Conservation Partnership (CCP). The purpose of SOW #10 is to produce a report that describes potential approaches and associated resources required to update the watershed-wide dataset of important habitat to guide land and habitat conservation, restoration, and stewardship and achieve CBP habitat conservation goals for the Chesapeake Bay. The scope includes hosting a series of subject matter expert interviews and workshop sessions for internal and external CBP stakeholders to gather input to understand current and future mapping needs. This memo summarizes the methods, process and outcomes of this series of user need dialogues.

Scope Considerations

The CCP Priority Habitat dataset depicts habitat related to the Chesapeake Conservation Partnership's long-term habitat conservation goal to "protect a network of large natural areas and corridors sufficient to allow nature to respond to a changing climate and land development and to support thriving populations of native wildlife, migratory birds, fish and plants and sustain at-risk species." Future efforts utilizing this habitat dataset will primarily involve investigating higher resolution land cover data applications and how to incorporate climate change projections into those analyses. Within the Chesapeake Bay Watershed Agreement Vital Habitats Goal, there are many habitat "endpoints" (e.g., stream health, wetlands, fish passage, forest buffers and tree canopy), as well as ones that are species specific ((e.g., brook trout, bay grasses, black duck).

The CBP geospatial research has considerations for using such a dataset such as addressing known CBP user needs, cross GIT-relevance, having multiple benefits, relevance at a range of scales, and tracking change over time. New data products that can potentially be incorporated into this model must also be considered, such as high-resolution data products, land use/cover data at different spatial resolutions and temporal scales, elevation, hyper-resolution hydrography, parcels, ecosystem services, and land and climate change. New and emerging science and advances in technological approach must also be analyzed, to weigh if new scientific findings can be incorporated into the habitat model design. Lastly, the needs or preferences may shift given the current climate of large landscape work, multiple efforts and tools already available, and fast-paced funding opportunities. This project aims to determine the current needs and appetite for utilizing this new data layer.

The goal of this scoping project is to produce a report on potential approaches and resources required for an updated watershed-wide dataset of important habitat that addresses these considerations, and that would suit current needs for use of mapping tool(s) that include the habitat layer. This first phase is intended to inform any future updates to the Chesapeake Conservation Partnership Priority Habitat

dataset. Specific objectives of this effort are to identify where utilizing higher resolution land cover data would improve understanding of vital lands and habitat and identify other considerations and data that could improve the Priority Habitat model.

Previous User Needs Research

Prior to this scope, a contractor RTI Innovation Advisors, under the direction of the Chesapeake Conservancy's Conservation Innovation Center (CIC), conducted a user needs assessment to better understand the needs of the six Chesapeake Bay Program GITs and to determine potential products and decision support mapping products that will be most beneficial to them. RTI conducted interviews with 20 key stakeholders from Chesapeake Bay Program Goal Implementation Teams and workgroups. The questions were aimed at characterizing the needs, data, and priorities across all GITs. Insights gained from the stakeholder interviews informed an online survey of GIT members. From the online survey, GIT mapping data needs include higher resolution data, more timely data, new formats of data, and new types of data. The recommendations from this research include focusing near-term efforts on 1) creating a central location for tools and new types of data, and 2) to conduct additional stakeholder interviews, surveys, and/or focus groups to further refine needs and best actionable solutions. We utilized the results from this user needs research to inform the approach for stakeholder engagement for this scoping project.

Summary of Stakeholder Input

The project team, led by the project technical leads, drafted a stakeholder engagement strategy to outline the purpose, methods, stakeholders, and key questions to be used for collecting feedback. The strategy included conducting subject matter expert (SME) interviews and holding a series of workshops with CBP staff and external conservation partners with direct knowledge and interest in habitat mapping and data, which are summarized in this section.

Summary of Subject Matter Interviews

The project team and Skeo conducted two subject matter expert interviews during the following dates and times. The significant perspectives and recommendations of each interview are captured below.

Subject Matter Expert Interviewees

Name	Organization	Dates
BJ Richardson	USFWS	Friday, December 2nd, 2022, 12:00-1:00 p.m.
Michael Schwartz	The Conservation Fund	Thursday, December 8th, 2022, 3:00-4:00 p.m.

BJ Richardson, USFWS

BJ Richardson with U.S. Fish and Wildlife Service (USFWS) provided important background information on the development of the current model as well as insights to consider for an update process. BJ was involved from the beginning of the development of Nature's Network "Conservation Design." The base map for the project was the Northeast Terrestrial Habitat Conservancy from The Nature Conservancy (TNC). It is a 30m dataset with over 100 classes that supplement the Conservation Design. USFWS worked with 2 contractors. University of Massachusetts Amherst (UMASS) developed the terrestrial and aquatic cores. NatureServe developed the imperiled species dataset. UMASS developed a National Land Cover Dataset (NLCD) based on LANDSAT data to depict urban and agricultural areas in what they call the "Designing Sustainable Landscapes" (DSL) version of the data that

is still based on that original TNC layer. The differences in the CCP Priority Habitat Map are the tier classifications (which were an early iteration and no longer exist in the Nature's Network model) and the black duck habitat model which was added by Chesapeake Conservancy. BJ can send along any documentation that would be helpful. Chris Guy is also an SME on the model.

Andrew Milken, USFWS, is currently leading updates to Natures Network to incorporate better data and methods. A full Nature's Network 2.0 version would be a multiple year effort. It is coded and can be more easily updated and replicated. The terrestrial cores and connectors are already completed. They expect to integrate the imperiled species in the spring of 2023.

They do have a desktop toolbox that can be downloaded and customized. The toolbox runs on the Nature's Network website and can create a custom model, change weights, change metrics, etc. It coarsens the datasets from 30 m up to HUC 12 catchments scale and so the spatial resolution isn't as high as people want.

BJ shared perspectives on the following specific topics:

- High resolution data: BJ did not have specific suggestions on how to incorporate high resolution data. He suggested it could provide a higher-level detail in generic areas such as urban or agriculture, but maybe not in forested areas. UMASS has already done updates to their version using Microsoft building footprints, which is very detailed and may exceed resolution of the 1m. The updated high resolution land cover dataset is 1m, but only has 12-15 classes. There is a difference between high spatial resolution vs high classification. The high res. land cover is potentially missing classes such as specific forest types, for example.
- Climate Change: Climate change data was incorporated in the first version of Nature's Network. There is an updated climate dataset, but BJ is unsure if it was included in this recent update of the individual Natures Network datasets - though it most likely was. There are no climate change projections in Conservation Design, except for individual species, and with urban development there are separate modules called "sprawl", which show the probability of development. Renee mentioned that they use climate change data and similar processes with the high-resolution land cover data to look at changes over time from 1985- 2040 potentially.
- Dynamic tool: BJ suggested that it would be a difficult lift to make a truly dynamic tool. As the spatial resolution increases, the ability to make a customized tool would be difficult to process in a live web tool, with high performance. All the data is summarized into tables, so that is all the current custom tool is running, not actually running any live analysis. Renee noted that they have created similar pre-calculated tables to help serve up land conservation data at CBP.
- Regional applications: When asked whether a regional model could be created for the Chesapeake, they would need funding to make a custom version of the models. However, they do want to proceed in that direction and are interested in making more custom datasets for subregional partnership groups with their own priorities and available datasets. For example, they are currently developing one for Delaware Blueprint. Renee mentioned there may be an opportunity in using Chesapeake WILD funding to make a customized version with Chesapeake Bay wide data, and BJ suggested that UMASS and NatureServe would be interested in that.
- Classification granularity. Nature's Network helps differentiate forest types. 1m dataset has generalized 18 class dataset, and a less generalized 54 class dataset. Participants suggested a crosswalk between the new 1M classes and those of Natures Network. Is there a way to pick and choose between both? For example, using the 1m data to update or burn into the 30 m

data. BJ cautioned that completing the land cover is only the beginning, followed by many more steps needed to result in a custom habitat model for this specific project.

To consider developing a Chesapeake Bay model, BJ recommended bringing the relevant parties together - TNC, developers of high-resolution land cover, maybe UMASS - to have a conversation about what can be done versus what people want. The partners need to define the specific goals, objectives and outcomes and then identify what is possible and what isn't. For Nature's Network, decisions about what wasn't going to be done were as important as what could be done. For example, we can't use data that isn't comprehensive or consistent across that scale. They also decided not to include access, DEIJ, cultural/historical preservation, etc. so that it would be focused on highlighting the best habitat.

Michael Schwartz, Conservation Fund

Michael was involved in the Natures Network work since 2014 as the representative for West Virginia and been working on this kind of work for years as a GIS modeler in habitat connectivity modelling. Michael offered the following perspectives and recommendations:

- Include better species data - there are always new species models being developed.
- Having the tiers/categorizing of the data is very important, and dynamic capabilities, such as the ability to turn the layers on and off and being able to change the weighting.
- Consider how to focus the model on water quality for the Chesapeake Bay.
- Consider the TNC resiliency tool which looks at biodiversity and climate resilience.
- Considering inclusion of species models that are done on different climate change scenarios would be interesting. Many of them are national datasets and a couple years old. Audubon bird models and Joint Ventures don't cover the full Chesapeake Bay.
- SECAS may be good to talk to. They do constant updates to their model through USFWS.
- Michael used to make suitability models that used economic, social, environmental data together that could be weighted, but that process has been less popular recently.
- The more flexibility users have to make their own map is helpful, but it is also good to have a pre-made model as a starting point and not overwhelm people with starting from scratch.
- Virginia may have a tool where you can bring in your own data which could be useful. There are pros and cons to having that ability to bring in your own data.
- John Gallo from Conservation Biology Institute works on prioritization issues that could be a helpful resource.
- Michael suggested that the model may not be that much improved by looking at 1m data at the bay wide scale but it would be useful at the parcel scale.
- Individual states (for example West Virginia) can feel differently on how this kind of data is categorized due to politics of prioritizing so much land for conservation.
- Liz Byers (WV) has data on biodiversity ranks at HUC10 or 12.
- There is an "Ecoscore" that identifies unfragmented forest that could be useful at the Chesapeake Bay scale with thresholds to meet such as not dealing with property owners.
- Matching up the model with the bay restoration goals will help with other efforts such as aligning with NFWF grant selection criteria.

- Ecosystem services would be useful to land trusts and local conservation organizations, especially if there are dollar values associated with it.

Summary of Workshops and Participant Perspectives

The project team and Skeo also hosted three workshop sessions during the following dates and times.

- Tuesday, December 13th, 2022, 11:00-1:00 p.m. Internal CBP staff
- Thursday, February 9th, 2023, 3:00-5:00 p.m. Internal CBP staff
- Tuesday, February 14th, 2023, 3:00-5:00 p.m. Conservation stakeholders external to CBP

Skeo sent invitations out to 57 stakeholders identified by the project team guiding this scope of work. We received 24 RSVPs and a total of 25 participants across the three workshops. The workshop sessions were conducted by Microsoft Teams and included an overview of the current CCP Priority Habitat model and a discussion session to gather feedback on potential model improvements and considerations for incorporating climate resiliency factors and a high-resolution land cover dataset.

Participants were engaged to gather current and future habitat mapping needs, data considerations, and end user needs. One-on-one interviews with subject matter experts were conducted to dive deeper into specific technical questions. Two workshops were held for internal CBP stakeholders that have a direct interest in the contents of a Chesapeake wide habitat dataset or may utilize such a dataset to inform Bay Program related goals and outcomes. One other workshop was held with external stakeholders who may not have a direct interest in CBP conservation outcomes but do have interest and knowledge in the use and application of high value habitat datasets as well as a specific interest in some building block data related to species, climate and other interests.

Internal Stakeholders

Internal Bay Area Stakeholder Group	Name and Organization
Chesapeake Conservation Partnership representative(s)	John Griffin, CCP Ben Alexandro, CCP
Habitat Goal Team	Bill Jenkins, EPA, Chair
	Gina Hunt, MD DNR, Chair
	Chris Guy, USFWS, Coordinator
Healthy Watersheds Goal Team	Jeff Lerner, EPA, Chair
	Renee Thompson, USGS, Coordinator
Forestry Workgroup	Katie Brownson, USFS, Coordinator
	Julie Mawhorter, USFS
Fish Passage Workgroup	Chris Guy, USFWS
	Katlyn Fuentes, CRC, Staffer
Stream Health Workgroup	Alison Santoro, MD DNR, Chair
	Sara Weglein, MD DNR, Co-Chair
Wetland Workgroup	Pam Mason, VIMS, Chair
	Todd Lutte, EPA, Chair
Brook Trout Action Team	Steve Faulkner, USGS, Chair
	Katie Ombalski, Woods and Waters, Chair

Black Duck Action Team	Benjamin Lewis, VA DWR, Chair
	Alicia Berlin, USGS, Chair
Scientific, Technical Assessment and Reporting (STAR)	Breck Sullivan, USGS, Coordinator
Climate Resiliency Workgroup	Julie Reichert-Nguyen, NOAA, Coordinator
Land Use Workgroup	Peter Claggett, USGS, Coordinator
Cross-GIT Program Coordinator	Kristin Saunders, UMCES
GIS Team	John Wolf, USGS, team lead
Leadership	Carin Bisland, EPA
Stewardship Goal Team	Britt Slattery, NPS
	Aurelia Gracia, NPS

End Users / External Stakeholders

Name	Organization / Contact information
Erik Meyers	The Conservation Fund
John Turgeon	Maryland Environmental Trust
Mark Bryer	The Nature Conservancy
Dave Curson	Audubon Maryland Pennsylvania
Kirsten Luke	Atlantic Coast Joint Venture
Suzan Bulbulkaya	PA DCR
Brad Georgic	Western PA Conservancy
Paul Peditto	Maryland DNR
Jason Bullock	VA DCR
Rebecca Bowen	PA NHP
Mike Slattery	USFWS
Faren Wolter	USFWS
Genevieve LaRouche	USFWS
Kevin DuBois	DoD
Jamie Simon	DoD
Christine Conn	MD DNR
Becky Gwynn	Virginia Department of Wildlife Resources
Paul Johansen	West Virginia Department of Natural Resources
Scott Bearer	PA Game Commission
Karen Bennett	DE F&W (DNREC)
Jonathan McKnight	MD DNR
Sarah Fleming	Ducks Unlimited
Amy Wolf	Trout Unlimited
Laura Prezioso	Eastern Shore Land Conservancy
Steve Stork / Louis Kadell	Chesapeake conservancy
Mark Symborski	Montgomery County Department of Environmental Protection
Michael Stringer	Anne Arundel County
Erik Michelson	Anne Arundel County Bureau of Watershed Protection and Restoration

Erik Fisher	Chesapeake Bay Foundation

Key Questions and Responses

During the development of the Stakeholder Engagement Strategy, the project team identified the questions below to use during the workshops held for both internal and external stakeholders to gain feedback and suggestions for high priority habitat mapping.

- Do you currently use the CCP habitat model/map in your work?
    - If yes, how? If not, what are the barriers?
- How do you use the current Chesapeake Conservation Partnership High Value Habitat dataset?
- How would you use a watershed-wide high value habitat model in your work?
- What existing decision support tools related to high value habitat or habitat restoration do you currently use?
- What are the barriers for utilizing habitat data/maps? What habitat decision tools do you currently use?
- What are the habitat mapping needs for additional Chesapeake Bay Program Vital Habitat outcomes that could benefit from high value habitat data?
- What are examples of how a stakeholder might use the data or information to make decisions related to land conservation or other management action, including restoration?
- What are the most important considerations for updating the habitat dataset for CCP?
- What would be useful to consider in that model?
    - Scale
    - 1M vs 30M
    - Resiliency factors
    - Ecological function and/or biotic outcomes
    - Dynamic interface/one stop shop
    - Current data/continuous updates
- What additional data, methods or models could be considered to improve the habitat model?
- Are there Subject Matter Experts you would recommend we contact?

Significant Themes and Considerations

1. **Value of High Value Habitat Model**
    - Participants agreed there is value in CBP maintaining a high value habitat model that is science-based and formally adopted.
    - The model serves a purpose in setting and tracking habitat conservation goals.
2. **Scale**
    - Participants acknowledged that the habitat model cannot be a one-size-fits all particularly regarding scale. The high value habitat model is best used as a screening tool at the watershed scale and not at the parcel scale.
3. **Use and Audience**
    - Most participants do not use the current model.
    - Some suggested CBP could provide more technical assistance/training in how to use the model to inform grant funding requests and conservation priorities.

- Some suggested that conservation organizations don't want another tool, they just want a map of the priorities.
- Participants noted that a new or updated high value habitat model needs to be tied to achieving purposeful CBP conservation goals and outcomes.
- Participants noted the need for the model to have the greatest utility possible for conservation users.
- Participants described the following use-cases for watershed-wide high value habitat model:
    - Funders could use the model to better prioritize grant funding, project proposal review, and conservation investments.
    - State agencies and conservation organizations could use the model as a connection tool to overlay with local models and help identify multiple benefits for project selection.
    - Local government could use this tool in land use decisions, environmental guidelines review, parks planning, habitat stewardship, facilities planning, and master planning efforts.
    - Stakeholders could use it for targeting restoration work and ensure that conservation would be done in the right places.
    - Local conservation organizations could use this tool to work with a broad number of partners to get to multi-species impacts and understand where those areas may overlap with different species.
    - Conservation organizations could also use this tool to have access to where interconnected habitat is occupied but other datasets do not show as occupied year round.
    - Stakeholders could use this tool to help identify where flood prone corridors are located and target research for acquisition.

4. Value of 1M data

- Participants questioned the additional value in using the high resolution 1m land cover dataset relative to investment.
- Participants expressed concern that the 1m data would not change the outcome significantly and may create more fragmentation.
- The 1m data can be useful for parcel level, on-the-ground-work but it doesn't seem like that is how this model is currently being used, or if it should ever be used at that scale. Many feel that the 1m land cover dataset won't be useful at the current watershed scale.
- The 1m data may be useful for some partners with things such as grant proposals, depending on the metrics and weighting used with that dataset.
- Other participants expressed that higher resolution data would be helpful for restoration, wetland conservation, for grantees, and for land trusts when considering where to acquire land.

5. Resiliency factors:

- There needs to be an incorporation of resiliency factors and strategies into habitat models.
- Resilience GIS tools currently don't incorporate habitat well, and vice versa is true with habitat tools. (The Tidal Marsh is one current effort tackling that integration).
- Participants noted that connections and corridors are one aspect of resiliency.
- Species models are more often incorporating resiliency data.

- Participants expressed that this model would be helpful in working with partners to determine multi-species impacts.
- The 1M data has 3 time stamps that could be used to develop a trend model over time that highlights changes in habitat quantity and configurations.

6. **Model Indicators**
   - This scoping effort highlights the opportunity to make a better Chesapeake Bay watershed tool that reflects the range of CBP goals beyond habitat including stream condition, water quality, marshes, ecologic function and biotic health outcomes. Remote sensing is limited in what it can capture.
   - Participants think the amount of healthy watershed is currently being overestimated without these factors.
7. **Dynamic Interface.**
   - The current model is a static black box – there is no clear communication of the metrics and methods used to identify high value habitat.
   - A dynamic mapping interface/ environment would be a very useful update to the current model allowing users to toggle different layers on/ off or change the weights and work through different scenarios depending on the users' values/ priorities. No one tool can be a one size fits all to meet everyone's needs.
   - A dynamic interface would allow for new and updated models to be added over time as available.
   - A dynamic interface would also allow users to add local habitat or species-specific data.
   - Not everyone works with GIS tools and many stakeholders don't want another tool or set of maps to try to use or understand.
   - Participants expressed that providing a data portal or landing page like the CBP Targeting website would be useful.
8. **Model Documentation and Maintenance.**
   - There needs to be consideration for data storage, maintenance, updates, and clearly identifying and documenting the methods and metadata used.
   - CCP and CBP are already currently experiencing issues with maintaining their existing tools. This is an issue with many tools that currently exist, as they quickly become outdated or have a lack of documentation.
   - The metadata should provide clear documentation of the data layers and any indices or metrics used.

Suggested Resources

Participants identified the following resources and subject matter experts that could inform additional habitat model update considerations.

Resources

- Potomac Conservancy Parcel Prioritization
- CBP Targeting website-decision tree/flow chart - Fish, Wildlife, and Habitats
- Blueprint Tools developed by Fish and Wildlife Service
- Virginia DCR
- Conservation Explore and Conservation Opportunities Area tool (suggested by Emily from Pennsylvania Bureau of Forestry as a tool that models ecosystem services.)

- Fire Models
- TNC Resilient landscapes dataset
- Maryland Healthy Watersheds Assessment
- Chesapeake Healthy Watershed Assessment

Subject Matter Experts

- USGS Scott Phillips and Ken Hyre
- David Barensfeld, Western Pennsylvania Conservancy
- Scott Bearer, Pennsylvania Game Commission
- Andrew Milken, USFWS
- John Gallo, Conservation Biology Institute
- Chris Guy, CBP Habitat GIT
- Liz Byers, West Virginia
- SECAS Blueprint

Conclusion and Next Steps

The project team's observations from the feedback received from the subject matter interviews and workshops conducted included the following ideas:

- There was a nice mix of representation of entities involved in the meetings, such as state, county, and conservation organization staff.
- It remains important to meet the primary goal of the CCP Atlas Protected Lands Outcomes, regardless of the additional goals able to accommodate.
- There is an opportunity to identify where there are overlaps of differing priorities that can have multiple benefits.
- We must consider how the habitat model can complement local/ specific models and tools specifically designed for local goals.
- The feedback received regarding the most valuable scale varied, ranged from incorporating parcel information to only keeping the model at the watershed wide scale.
- Those working in the habitat space have a range of goals and different focuses.
- There needs to be an increased focus on communication and outreach so conservation partners are both aware of the tool and know how to use it effectively.

There is concurrence on the idea of being able to view and access different data layers within the model, and that a portal would be helpful to allow viewing those multiple layers. Additional outreach will be conducted to interview a set of prioritized subject matter experts identified during the stakeholder engagement. The results from the feedback received during the stakeholder engagement revealed general consensus on important priorities and considerations in developing or updating the high value habitat model. The model needs to incorporate a level of flexibility and be dynamic to help address specific needs and goals for topics such as resiliency and getting the most use out of a 1m dataset. The themes and considerations from the interviews and stakeholder workshops will inform the summary assessment that will incorporate findings and recommendations related to updating the habitat model and inform the final report that will ultimately include potential approaches, data, and methods needed. These final two components of the scoping project will be completed at the beginning of April and the end of May 2023, respectively.

Appendix F. Subject Matter Expert (SME) Interview Notes

BJ Richardson, USFWS

December 2, 2022

Could you briefly share your role and relation to the current model?

BJ was involved from the beginning with Nature's Network. "Conservation Design" is the final product but there are hundreds of datasets that go into the model and that supplement the Conservation Design. He was asked to join the partnership to help with the various CCP data/ atlas products a few years ago and habitat was one of them where they adopted the Natures Network Conservation Design as the habitat map.

Differences in the CCP Priority Habitat Map: CCP took the black duck habitat model, which is a separate standalone model, and incorporated it into the Conservation Design dataset. CCP wanted more emphasis on the black duck data. Someone from the Chesapeake Conservancy integrated that data (potentially Jake), and he is not aware of the details on that piece.

BJ can send along any documentation that would be most helpful, though he does not have anything on the black duck process. The datasets are the same as Nature's Network just with the additional black duck dataset. A 30 m raster for the black duck layer was used.

What is your understanding of how the model was developed?

The basemap for entire project was the Northeast Terrestrial Habitat Conservancy from TNC. It is a 30m dataset with over 100 classes. The updated high resolution land cover dataset is 1m, but only has 12-15 classes. There is a difference between high spatial resolution vs high classification. The high res. land cover is potentially missing classes such as specific forest types for example.

NLCD is based on LANDSAT data. It was used at various stages of the modelling project, for urban and agricultural areas, maybe on roads too for example. That part of the work was done by UMASS in what they call the DSL "Designing Sustainable Landscapes" version of the data, but it is still based on that original TNC layer.

What important data or considerations related to *climate change* projections may affect habitat?

Climate change data was incorporated in the first version of Nature's Network. There is an updated climate dataset, but BJ is unsure if it was included in this recent update of the individual Natures Network datasets - though it most likely was. There are no climate change projections in Conservation Design, except for individual species, and urban development there are separate modules called "sprawl", which show the probability of development.

Renee mentioned that they use climate change data and similar processes with the high-resolution land cover data, to look at changes over time. Will be 1985- 2040 potentially.

How can *higher resolution land cover data* be put into use?

- In what scenarios can utilizing higher resolution land cover data improve scientific understanding of vital lands and habitat, and identify and help prioritize conservation and restoration opportunities?

- What are the limitations or considerations of higher resolution land cover data?

No specific suggestions yet. It could provide higher level detail in generic areas such as urban or agriculture, maybe not in forested areas. UMASS has already done updates to their version using Microsoft building footprints, which is very detailed and may exceed resolution of the 1m.

His overall suggestion is to get the relevant parties together - TNC, developers of high resolution land cover, maybe UMASS - to have a conversation about what can actually be done vs what people want.

What other factors should be considered in the update? (For example, Consider utilizing a dynamic mapping interface/model with multiple outputs based on scenarios or changing weights according to end user's needs, or according to scale)

- Thoughts on making a dynamic tool?

It would be a difficult lift to make a truly dynamic tool. As the spatial resolution increases, the ability to make customized tool would be difficult to process in a live web tool, with high performance. All of the data is summarized into tables, so that is all the current custom tool is running, not actually running any live analysis.

Renee said that they have worked around that through using landscope in the past, which were also in tables.

If people want to do analysis around ecosystem function/ services, how could the 1m be used/ would it be helpful?

It is important to define what the outcomes we want to help identify what is possible and what isn't. Decisions about what wasn't going to be done was as important as what could be done, when this was initially created. For example, we can't use data that isn't comprehensive or consistent across that scale.

Nature's Network helps differentiate different forests type. 1m dataset has generalized 18 class dataset, and a less generalized 54 class dataset. Should there be a crosswalk between that are Nature's Network? Is there a way to pick and choose between both? For example, using the 1m data to update or burn into the 30 m data. BJ hasn't seen the 54 class dataset. A crosswalk sounds like a reasonable approach to start talking about if it would be possible. The caution would be that the land cover/ eco systems/ land use data sets are only at the beginning. There are more steps after to make the models. It would be an extensive discussion to result in a custom habitat model for this specific project.

What do they use to run their models?

Worked with 2 contractors, UMASS and NatureServe, to make these. UMASS did the terrestrial and aquatic cores. NatureServe did the imperiled species dataset. They would need funding to make a custom version of that work. They do want to proceed in that direction and are interested in doing more custom datasets for subregional orgs/ partnership groups with their own priorities and available datasets. Currently working with Delaware Blueprint to make them one.

Updates to Natures Network is also going on in the background. UMASS and NatureServe are working with BJ now on those updates. It is now coded and can be more easily updated/ replicated. They do have a desktop toolbox that can be downloaded and customized. Runs on the Nature's Network website and can create a custom model, change weights, change metrics, etc. It is only HUC 12 or catchments. It coarsens the datasets from 30 m up to catchments scale. Spatial res isn't as high as people want. The desktop toolbox may work best.

Renee: we may be interested in doing that cooperation to use Chesapeake Bay wide data to make a customized version.

BJ: There is potential to do that/ get funding through Chesapeake WILD. They need to develop a template for working with subregional partners and customizing the outputs to what they need/ available data. UMASS and NatureServe would be interested in that.

The Natures Network update is not complete yet. It will most likely be in the spring to get the imperiled species incorporated with terrestrial cores and connectors which are already completed. We are doing this update because they have better data and/ or better process. A full Nature's Network 2.0 version would be a multiple year effort. BJ does not know yet if 2.0 will have anything different in it because it is partner driven and they may ask for more things. Andrew Milken is leading the process; he led it last time too.

How CCP version should be updated?

The update needs to be partnership driven, with defining the goals/ objectives first, then engaging with technical folks on what is possible. The process they used on the first version showed that one map can't be applied to everything. They made specific decisions to not address certain things such as access/ DEIJ, historical preservation, etc. so that it would be focused on where the best habitat was.

Renee: Want to use the more recent Nature's Network data rather than CCP data. She also has difficulty with understanding the "tiers" categorizing of the data on the CCP version. The Nature's Network map just shows where is overlap vs standalone areas. This evolution hadn't been done when initially adapting it for CCP (hence the tiers, which no longer exist in the Nature's Network version).

Chris Guy is another contact and SME of the model.

Michael Schwartz, Conservation Fund
December 8th, 2022

- Could you briefly share your role and relation to the current model?

Around 2014 he was working on conservation work in WV and was the rep for WV in Natures Network. He has been working on this kind of work for years as a GIS modeler in habitat connectivity modelling. Noticed that according to the CCP 44% of land area is considered important habitat –

which is a high number and can create political unease is some areas. Was not aware of the habitat map until recently.

- What is your understanding of how the model is used?

  There are a lot of different prioritization tools, etc., that have happened over the years. There are always new species models being developed.

- What are the ***limitations*** of the current habitat layer for targeting conservation and restoration?

  Having the tiers/ categorizing of the data is very important. Having the ability to turn the layers on and off would be nice, and being able to change the weighting, etc., also simplifying the number of categories/ number of colors on the map. This model is not water quality focused, and that is very important in the Chesapeake Bay. Having better species data is important.

- What additional (emerging technology) data, methods or models that should be considered to improve the habitat model?
  - What key or emerging datasets, or modeling/analytical approaches specifically related to ***habitat*** are important (for sustaining native wildlife populations (e.g., migratory birds, fish), plants and at-risk species, to guide land conservation, and terrestrial and aquatic habitat conservation, restoration, and stewardship)?
  - What important data or considerations related to ***climate change*** projections may affect habitat?

The TNC resiliency tool looks at biodiversity and climate resilience.

He worked with FWS Region 3 on bird distribution projections with different climate data, and having species models that are done on different climate change scenarios would be interesting. Many of them are national datasets, and are a couple years old. Eastern brook trout, Audubon bird models are regional but many are at the state scale. Joint Ventures doesn't cover the full Chesapeake Bay. Having that species data is really important to integrate in the habitat datasets.

SEACAS may be good to talk to. They do constant updates to their model through USFWS.

- Renee- Social vulnerability data often doesn't also match up with conservation data. How can it better account for those type of socioeconomic data? And help with prioritization?

He used to make suitability models that used economic, social, environmental data together. Then you could pick and choose which factors to use/ weight them. That process has been less popular recently. The more flexibility you can give users to make their own map is helpful, but it is also good to have a pre-made model as a starting point and not overwhelm people with starting from scratch.

Virginia may have a tool where you can bring in your own data which could be useful. There are pros and cons to having that ability to bring in your own data. John Gallo from Conservation Biology Institute works on prioritization issues, and is worth looking into.

- How can *higher resolution land cover data* be put into use?

- In what scenarios can utilizing higher resolution land cover data improve scientific understanding of vital lands and habitat, and identify and help prioritize conservation and restoration opportunities?
- What are the limitations or considerations of higher resolution land cover data?

It helps prioritize forest areas. 30 m is coarse to try to identify properties/ adjacent properties. It will eventually get down to the ground level/ practitioner level and it needs to be useful to them. May be able to use the high resolution data across the whole bay, at about 3m. You may not gain a lot by looking at 1 m data at the bay wide scale.

- What other factors should be considered in the update? (For example, Consider utilizing a dynamic mapping interface/model with multiple outputs based on scenarios or changing weights according to end user's needs, or according to scale)

It depends on what their goals are. Having the cores and connectors are good to use/ keep included. The Bay program has goals for land conservation. It is always good to have those protected areas. WV didn't like the habitat categorization in natures network. Individual states can feel differently on how this kind of data is categorized.

- Does WV have priority habitat data they use statewide?

  Liz Byers, has data on Biodiversity ranks at HUC10 or 12. There has been a lot of recent turnover with staff who deal in that space. Politically, there is a concern that there is plenty of protected land in WV already.

  There is an "Ecoscore" to look at unfragmented forest - it has thresholds to meet such as not dealing with property owners. If it is more Chesapeake centric it will be more useful, than at the current scale. Matching up with the bay restoration goals will help with other efforts, getting grants, etc. For example, NFWF has grants and if they used a more Chesapeake Bay centric model that prioritizes bay wide goals, it will add more value to the proposal.

- Would having ecosystem services be useful to land trusts/ local conservation orgs?

  Yes, it should. Especially if there are dollar values associated with it.

Rua Mordecai Interview Notes

April 28th, 2023

- Southeast conservation goals have been set and the Blueprint was made to help track and focus efforts to meet those goals
- The biggest difference between Natures Network and he Blueprint is cultural data- it is fully coupled with the Blueprint model, and they go all the way out into the marine areas
- Big push on communication and usability – as much attention given to communication side so they can get feedback and make updates

- Over 350 people are using it now- they track the users, how are they using it, those who aren't using it and why
    - Used for proposal writing, proposal scoring, etc.
- They were getting requests for more consistently-so they will eventually have the rest of the country covered
    - They were piecing state/ ecoregional data together before
- Working with Midwest conservation blueprint to be similar in indicators, approach, but will have some small differences
- ChesWILD also having those conversations on the northeast
- Crucial habitat assessment tool- in certain states
- Natures network also looks across states so they were already doing this type of work

Balancing species vs generic model:

- A good plan will work through multiple lenses
- It is a communication challenge more than anything
- Ex. TNC resilience lands tool is more habitat based- habitat features that work for multiple species
- Species thresholds are helpful when understanding how much areas are needed- how much species may be lost if area is under a certain size
- Not having data for all species and making a model only based on a few is not truly representative
- Thresholds can get murky with habitat
- If you have a habitat model- test it on certain species and see how it is working
    - They use NatureServe to run the blueprint across all of their species models and see where less than 90% is getting captured
- Blueprint both a habitat-based model that is informed by species data, but many of the species thresholds are based on habitat data
    - Some indicators are purely species anchored, some are habitat anchored, some are in between
- Blueprint uses 30m, it is as fine as they can go because it is based on existing data and they don't have 1m. They aren't creating new data
- They were considering 10m in the Caribbean
- They use LANDFIRE and if they make a 10m data SECAS will use it for Caribbean
- Wouldn't consider going to finer resolution until the indicators are all available at that scale
- Using 1m datasets are huge and difficult to use/ store, running any models will take much longer.
- Using a web viewer for 1m will be hard to see things at the watershed scale
- Test using 1m dataset in a web viewer, and with people who don't have fast internet
- 30m is pretty good, highly developed urban areas are where 1m data is most useful/ needed
- Test parcel areas map with 30m pixels to see coverage
- Most blueprint uses are at the parcel level

Frequency of updates:

- Blueprint updates annually
- They did a survey and found that people mostly used regularly updated tools and not those that are on longer schedules
- Accept that no matter what you make it will have problems, but they will get fixed/ an update every year rather than every 5 years
- They use core staff who work on it, they don't contract that work out. They work collectively on the yearly update. Incremental improvement, not a complete rebuild
- LOE: used same model as south Atlantic blueprint. First few years had 3 people total working on it, 1 or 2 GIS people but it was their entire job. Grew to having more support staff, GIS people, and coordinators. Now when scaled up to the whole southeast- they have 3 GIS people, 5 user support. Full team of 16 now. Still short on GIS people though. User support is spread out across the area. If you build off of existing things, it makes it easier.
- Critical to have communications/ user support people, who track people using it which is helpful for lessons learned
- User support staff are the ones who track users/ uses. As they develop the update, it is a buddy system that uses both GIS and user support at same time

Funding:

- Core staff funded from FWS
- In the past, funding came from a variety of places, like wildlife resource commissions
- They found it better to use as much as you can from one place, rather than looking across multiple sources- it is more intensive on time and resources to balance multiple funding sources. Easier to use 1 source in FWS

Incorporating cultural aspects:

- Many parks are anchored by both natural and cultural areas for example
    - Not split up between natural and cultural is because they are coupled at ecosystem level

Peter Claggett Interview Notes

April 28th, 2023

- He developed the 1-meter CBP land cover dataset
- He is a research geographer with USGS
- Did habitat mapping with GIS in West Virginia in the past
- His concerns based on work on the past:
    - Developed models for both specific species and generic hubs and corridor analysis
    - Lasting questions: habitat model for what? What scale?
- Depends on what you're looking for- if you're looking for large unfragmented forest areas you don't need 1m
- Certain things won't show up in 30m data- like small subdivisions of second homes, and low-density developments can introduce other species like cats
- University of Vermont did actual land cover mapping from NAIP program from USDA
- 12 class land cover dataset

- 1m high resolution dataset: Integrates other ancillary datasets and has 64 classes
    - More detailed in all classes
    - Has simplified 18 class version
    - Has 2013/14 and 2017/18
    - Currently has 54 classes and by next summer it will be completed, so will have 3 timeframes
- They have had people work on fragmentation metrics
    - Guidos software- tiles imagery that you feed it, creates classes of fragmentation
- If you have species that likes intact, interior habitat, and another species that likes the edges, if you try to conflate them it will cancel out within a model
- Did an exercise where experts went through and ranked the areas and found wide range of responses- too much data in it. Worked with land trust who used pairwise comparison
    - Quantified weights based on stakeholder group survey responses

Value of general watershed model vs species specific models:

- He tends to like species-based models as they are more focused, science backed versus just using a hub and corridor network
- Hub and corridor networks can be helpful for comprehensive planning- as long as you can have adjustable scores depending on scale that you are looking at
    - Ex. Arlington county should be able to look at what is highest priority in just their county, because if you look in comparison to rest of watershed it will all be low
- Recreation aspect- CCP and CBP agreed to preserve 30-50% of watershed. If it is all done on private lands it will not be visible to public, accessible, or appreciated
- Having more recreation opportunities for people. Could have a recreation data layer included
- A more generic habitat model looks like hubs and corridors and parks and trails, and this would be more palatable to the public if they can see recreation areas
- What aspects of habitat model may or may not be amenable to public access

Option to develop Natures Network version for CB watershed- Would it make sense to replace 30m with 1m in that model?

- Could try to do the whole model with 1m
- Will need to give thought to what will fragment areas or not, and setting thresholds to parameterize the model
    - Ex. If you have a road through the woods will that fragment it?
    - Kevin M. would know best on that aspect, what would be the most efficient
- Could build the model at 30m and use it to pull the info out at 1m
    - Ex. Identify large forest tract at 30m then use 1m to pull out the features that match. That may work, but may not match up once you use 1m- If you find large forests areas at 30m, then look at 1 m and see homes there
    - 1m makes us ask questions we never had to with 30m
- There is a lot of overlap with habitat and forests models
- When you overlap all CCP priority models- almost everywhere is a priority

How do forest and habitat layers differ?

- Forestry staff may define areas differently
- Is timber harvest removing or adding habitat? This is where it may differ from the forest model
- 1m has different classes for forest
- DEIJ is also a focus- most low-income minority groups are in urban areas that would need a 1m data to identify those green spaces
- 2011 fractional tree canopy dataset
- Will have to grapple with how to classify "forested" areas near homes and if they have a habitat value

Use of 1m data:

- Using 1m data will be more relevant to underserved communities
- He does not think we need 1m data in order for it to be good science
- Who is the audience- 1m can be helpful for transparency, usefulness for communities in terms of locating "priorities" according to CCP for decision making
- 1m useful for parcel scale
- 1m would be useful at watershed scale, if it is picking up things the 30m isn't that need to be considered for habitat
    - Ex. Black ducks need isolated areas, away from humans. 1m data is meaningful at that point
- Making models that change scores according to scale shouldn't be that difficult GIS wise
    - If they are all valued numerically, you can re-order and rank them according to scale
- Do we know what the deficiencies are by using Natures Network at 30m? Maybe people have raised the same concerns about changing value according to scale
    - Can ask Kevin where it falls short
- Computational challenges by using 1m data are difficult
    - Peter and his team don't use GIS, they code everything from scratch
    - He would be expecting python code, open data to come with a premade model that CBP or USGS would be expected to use/ re-run or maintain. Not receiving model builder or things they have to run in ArcPro
    - Having code is best way to manipulate the data
- Data is published on sciencebase with metadata- Peter will send links and to ppt

Jim Wickham Interview Notes

May 1, 2023

- He is familiar with the Midatlantic area
- Has background in remote sensing & GIS
- He is the point person for EPA participation in NLCD

Thoughts on using 1m data:

- It is less about the science, but more about the money and resources related to using 1m
    - You would use cloud computing, and need people who can operate in that environment
    - Jeremy B. for them was involved with Peter Claggett on using that data

- They looked at core intact forest from NLCD data and reran it for the Chesapeake with 1m data, which took 1 month to run on his computer
    - Would then need cloud computing for 1m data or high performing computer (HPC) so it won't take as long
- 1m will show forest in places not shown with 30m
- 1m will help give better definition of the edges, topography of habitat
- Jeremy is a coder and is moving all of their info to the EPA cloud
- Their HPC computer is continually being updated, and uses ArcPy
- MD does good work with conservation data
- He is interested in linkages between biodiversity, preservation and drinking water protection
    - Land protection- land set aside from development
    - Safe drinking water act- only gets a small amount of funding from the state drinking water revolving fund for land conservation
    - There is a big benefit for EPA to work with conservation people to protect drinking water sources because state revolving fund does poor job
    - Drinking water protection may be easier sell than habitat/ biodiversity
- There is a new paper on biodivsity-12HUC level. Latest modelling on 900 species. Can tell by HUC which species are vulnerable, biodiversity metrics. GAP Analysis Program publication

Generic Habitat modelling v species specific:

- He has not seen a trend between the two but is also not an expert
- The lead author of that paper is from Boise state and may be good to talk to
- GAP program – gap in protection, modelled at 30m for types of species habitats. It shows whether or not the pixel is habitable, uses nature serve data too, though it doesn't tell if species is actually located there

Is there a smaller scale GAP work done with 1m data?

- No there is not
- Most likely because most 1m data only has very generic land cover designations- either forest or not
- GAP used to be a part of making the NLCD, but then taken over by LANDFIRE
- 30 m products have very detailed legends- over 100 vegetation classes
- NOAA SEACAT program uses high resolution data now. They got money through the Infrastructure Law, and is now mapping 1m data for contiguous US + Alaska
    - They are working with Peter- they are not going to duplicate the Chesapeake Bay work there
    - Nate Harold is the lead- Jim can send his contact

Does land use data enhance/ add to this?

- Land use is more inferential
- Not much other knowledge on that
- You can synthesize land use to see if there are changes in the vicinity of certain types of land use

Thoughts on "degrading" 1m data to 5,10m?

- Depends on the project level
- Need to examine the cost benefit- Maybe for the Chesapeake bay scale you don't need cloud computing resources
    - Need to determine if there is a slightly coarser resolution that would be useful- guess that it would give you similar answers/ locations- and potentially reduce computing costs
    - NOAA SEACAT has 10m data for NH and ME- they are going to make 1m data there too
    - US at 30m is 8.5M pixels- over 1B pixels with 1m
    - Definitely worth looking at 5m to reduce data processing
- He works on accuracy with the NLCD
    - There is no good way to look at the accuracy of 1m data- because you would reference it to a higher resolution source data- and those that are available will be at a lower resolution that 1m
    - Literature on 1m data is very new- Chesapeake Bay is first to put out change data
    - There are errors in NLCD at 30m that you can see
    - How much processing will it take to get to answers we want? Is degrading to 5m going to get us to the same/ similar answers?

Update frequency:

- From the land cover perspective: if using 1m, probably not going to be able to generate on a yearly basis
- Big push to do land cover at annual time steps- NLCD wants to do that
    - Jim disagrees with this- how much of the land cover has actually changed in a year
    - Also a cost benefit to consider- not much of the Chesapeake Bay is going to change in a year- is it worth time/ money to run?
    - Would opt to 5 years
    - Could be that we make yearly maps only of urban/ urbanizing areas and then do a full watershed at 5 years

Scale:

- Do we need the whole Chesapeake Bay done at 1m or only certain parts? Or at same update interval?
    - He would like that kind of approach

Staffing needs:

- Jessica Daniel would be good to ask questions on outreach staffing needs – with EPA
    - Works on outreach
- GIS side- it is hard to know without knowing specifics on the model
- There is a new USGS program- LCMAP
    - Taking all LANDSAT images, then making land cover map to detect change
    - They produce annual land cover maps- these can be used to get a good sense of how fast things are changing in Chesapeake Bay- if we go multi-resolution direction
    - Spectral change maps

Greg Podniesinski Interview Notes

May 3rd, 2023

- Chief, PA Department of Conservation and Natural Resources
- Heritage program has been making an ongoing survey inventory since 1980s
    - County by county inventories for 'natural heritage areas'
    - They are all ground-truthed, not modelled- about 3500 areas
    - Better than model data because of ground-truth
    - Staff looked at remote sense data
    - They work with county planning commissions
    - Natural heritage areas capture endangered species and natural habitats
- County natural heritage inventory website- conservation explorer
- They only do full inventory reports if a county asks for them now
- They can share natural heritage data with us if we need to incorporate
- They have to show endangered species separate from species of special concern
- Core habitat layers- can click on an area in the map viewer and it links to the actual report location
- Their staff would use aerial imagery and other overlays like geology, and historical photos to compare land uses- ex. Looks like forest areas but can see historically it was agriculture
- NatureServe did species distribution modeling for them
- They use the online tool for environmental review screening- doesn't rely on heritage areas
- Map viewer tool allows you to draw polygon for a project area that will show you any potential conflicts
    - Can also run conservation planning report- draw area and shows information from natural heritage report, summarize conservation planning layers
- Did modelling for climate change for landscapes, migration corridors
    - Climate change connectivity layer
    - Color coded in importance for connecting a landscape
- 200-250 development projects screened in tool yearly
    - 400-500 conservation planning reports run in tool yearly
    - They are either screening land they own or for potential acquisition

Using state data:

- We could use PA natural heritage areas to QC the Chesapeake Bay model- for example if we are calling out habitat not shown in PA tool or vice versa, how well did the model do in capturing everything
    - They have permission rules so some private land might not be captured

Using bay wide tool in PA:

- They know they have important species that extend past state lines, and PA is so diverse ecologically

Natural Heritage Areas:

- The goal is to have every rare, threatened or endangered species captured

- They track around 200 significant geologic features, those are captured too in Natural Heritage Areas
- County reports have recommendations for management needs

Value of 1m data:

- Better resolution data is better to use
- NatureServe has a relationship with ESRI, and helped them put together a library of GIS datasets- 80-90 layers to use for modelling
- They've done advanced species modelling Ex. NatureServe biodiversity modelling- Chris Tracy
- Reagan Smith in charge of modelling- habitat suitability modelling

Staffing/ LOE:

- Their tool services 4 different state agencies, and FWS
- There is 1 person who dedicates most of their time on this, taking questions from public
- Annual update for needed layers- 1 FTE maybe for updates
- They charge $40 for users to running certain reports. No charge for conservation planning report
- NatureServe does the hosting and maintenance. They use AWS, but they generate revenue to cover that cost
- Annual updates would be sufficient for us, may even be able to access their data from a live connection
- It was cheaper using NatureServe than hiring new people internally – NatureServe are under contract to immediately work on issues that arise
- Costs $184k a year for NatureServe. PA is by far the biggest/ most expensive state and version of the tool NatureServe has
- If we are just using conservation planning reports, could host internally
- NatureServe's only role is to make sure tool is up and running, they do logistics with AWS and pass cost onto the state
- Costs associated for an ESRI license and paying for SQL server
- NatureServe does this for a lot of states, 11-13 others. They have a template/ basic version of the tool hat they then tweak for each state needs/ requirements
    - PA provides all data, they just create platform and functionality
- Costs related to development and costs for ongoing maintenance by using NatureServe. If there is less traffic, may be done in internal server
- Rental fee with renting AWS servers
- $250k for initial development for NatureServe.
    - Cheaper compared to other quotes- $500k-1M

Additional Thoughts:

- Different state to state in terms of regulatory side
- ConserveVA tool also hosted through NatureServe
- No political influence in how they draw or map Natural Heritage Areas
- Not regulatory, strictly information/ guidance
- If Natural Heritage Areas are on state or private land it doesn't compel anyone do anything

- These areas haven't caused any political backlash, or issues with people wanting them drawn off their property

Donovan Drummey Notes

May 4th, 2023

- Works on set of contracts of RSGCN- Regional Species of Greatest Conservation Need
    - SGCN has too much data across states- 13 states in Northeast and DC
    - Each state has own priority listing and ranking. They want to know what is going on at the regional level
    - Pare down to shorter list of species- just released 2023 list of 382 species, both proposed and SGCN
    - 418 species at SGCN plus 400 as watchlist species where there are data gaps, inconsistencies, etc. indication that more research/ monitoring is needed
    - RSGCN has a database- intended to be one stop shop for NE region to learn about species. Has state level info, ecology, limiting factors, and info on habitat
    - It is at a coarse level for habitat because of scale, not getting very detailed in terms of habitat classes- really either forested or not
    - RSGCN every 5 years the list gets updated- state wildlife action plans are updated every 10 years (SWAP) to accommodate rapidly changing understanding of species
    - USFWS administer many grants- some rely on having approved SWAP
        - Within plans they designate SCGN, species that use can use SWIG funds for
- ChesWILD will adopt RSGCN list as their primary source- how do you prioritize them and focus/ target funding in a way that is helpful and support state goals/ priorities
- Their database is not currently mapped- concern about putting spatial info out
- They map internally to help with other efforts, but they aren't storing it and keeping it up to date
- They are working on priority landscapes info that is mapped internally
    - Overlay species with habitat priority areas to help make general checklist of species within a geography- but won't give specific maps
- There are other publicly available spatial data on species
- RSGCN list: https://northeastwildlifediversity.org/rsgcn
- Database is not public yet, it is in process. Some info can be shared- state data and listing information

Reconciling state data:

- Some of SWAP requirements are species, habitats, threats, actions
- There are inconsistencies across how states created these
- Led to developing SWAP database lexicon- finding common things like habitat classification, species that are common across all states to start categorizations but still leaving flexibility for states
    - Detailed state habitat types need to fit under a broader category/ rolled up to regional scale
    - Working to translate 2015 SWAP descriptions to match new categories

- No relation of the habitat work/ categories to the NLCD
    - They start vary coarse will 10 total categories, then breaks into 24 habitat types both terrestrial and aquatic- to allow states flexibility to add more detail relevant to the state
    - They aren't spatial so matching to other land cover datasets wasn't a necessity

https://northeastwildlifediversity.org/project/development-and-production-2022-northeast-lexicon

- Crosswalks of state natural heritage classification to rolled up lexicon category- https://northeastwildlifediversity.org/project/northeast-regional-conservation-synthesis-2025-state-wildlife-action-plans

Is there value in a regionally consistent product for the states? Does it matter to them?

- TNC terrestrial dataset of Northeast is a basemap/ starting place for many states
- Many states us classifications from state natural heritage programs

- Chesapeake Bay not sure what habitat would provide the most water quality benefits
- The only 2 species specific goals in Chesapeake Bay agreement are brook trout, black duck
    - brook trout more associated with water quality and temperature, black duck more about habitat function

How do we track and measure degraded habitats spatially?

- Habitat quality and status in Northeast: https://northeastwildlifediversity.org/project/conservation-status-natural-habitats-northeast
    - Based on TNC terrestrial habitat layer
- Data at 30m but is very useful at small scale

LOE of state agreement:

- RSGCN is a very intensive process
- RSGCN update process went from Nov-May
    - Put the initial list of species through pre-screen- use distribution data from NatureServe as a piece
    - Hosted webinar for state scientists to show them pre-screen list and have them check
    - Disagreements led to more discussions- let scientists come to consensus
    - At least 1 state biologist for each taxonomy group

BJ Richardson and Lin Perez Interview Notes

May 19th, 2023

Lin- Academy of Natural Sciences

- Bridging conservation metrics with people based metrics
- Worked in Delaware river watershed , Chesapeake conservancy
- High resolution modelling side- aggregating up to watershed scale to see impacts

What is the resolution needed:

- Chesapeake has a lot of data/ high res data
- 30 m is most common for landscape level decisions. Not ideal for parcel scale, max is HUC 12 level.
- 10 m has rich scale where you can pull out landscape level dynamics. Delaware used NHD Plus network- you can scale up and down using that for aggregating statistics
- Parcel level- 10 m still serves that need.
- 1 m serves looking at green infrastructure needs. It is a lot of info and presents a lot of issues with data processes, speeds, generating stats for things.
- If want a landscape level tool that produces parcel level stats will take a lot of power/ complexity- if you need those analyses done live
    - Lin develops decision support tools that require interactive stats
    - Thinks many people have expectation of live analysis

BJ:

- Do we need a live decision tool or not? If so, it will limit ability. That question will drive what the resolution will need to be
- Nature's network includes about 30 species data

Lin:

- They are using Nature's Network as foundational- not reinventing model workflow
- Have 4 bins of data typologies for conservation blueprint. One of them is habitat
- Habitat is the most complex and reaching typologies
- Starting with natures network. Academy is currently suggesting datasets, then will put in front of a steering committee. SC will set goals led by Christina Ryder. Taking high level recs from people leading conservation work in the Delaware. Academy will cross walk suggestions with the goals, then identify gaps.
- Suggested layers for the Delaware
    - A user will click on parcel and tool will generate stats for things like amount of wetlands, active river area, acres of headwater in forest, stream reaches, etc.
    - Past work had set thresholds for % forest, diff types of forest
    - One of their recs will be to operate at mid-level, don't need to go down to species level unless SC says so
- One of the objectives of the blueprint is to provide stats to help with grant applications. Agreement that a blanket weighted composite score wouldn't be helpful, unless it is at a regional scale then maybe

BJ: difference between spatial v categorical resolution

- Harder to extract details at smaller level
- Is partnership looking to summarize data at levels like HUC12/ parcels? Or a weighted composite score
- Natures network wasn't able to include everything but it is very comprehensive/ sophisticated
    - In millions of dollars range for using 30 m. Doing the same process for 1 m would be major.
    - Northeast terrestrial habitat from TNC drives/ basis for nature network
    - Don't do live spatial analysis, too intensive to do in a live web tool. It is pre-done in tables

Lin:

- Delaware falls within purview of Nature's Network
- They have had data component be the first step- data layers, organizations, setting up infrastructure of what will be done
- Do not pull implementation/ community engagement ppl separate from GIS people until answers are found
- Iterating twice- at least 2 meetings each
- Can ask about tech related questions with surveys

BJ:

- Delaware does have separate set of partners
- Contracted with NatureServe to do imperiled species part of model
- Bulk of money went to UMASS
- Most of modelling was done by contractors- UMASS and NatureServe are the 2 big ones

Lin:

- Can think of 1 app where operating at 1 m resolution was appropriate
- Diane Russel leading part of work
- Christina Ryder is USFWS
- Both making a tool and build a network of need/ people who will actually use the tool. Relationship building drives need for technology
- Delaware conservation blueprint made to serve Delaware conservation fund which is funded directly from FWS
- Intent is to iterate, but timeline is 2 years and they are a year into it already. Will have first rollout in September- January and have webinars. Have recorded webinars and flexible TA sessions/ office hours
- $875k for first year of development, cumulative costs for 5 years of maintaining servers- hosting and updates. Does not include ICL, has separate contract with FWS.
    - Inclusive of development, server maintenance, staff time
    - Does include all 4 bins not just habitat cost
- Lin can provide workflow chart, budget with cost breakdown

Appendix G. Habitat Model Assessment Table

CBT GIT Scope 10: Updating the Chesapeake Conservation Partnership (CCP)
Priority Habitat Dataset of the Chesapeake Conservation Atlas: A Scoping Project

Large Landscape Habitat Assessment Tools & Models

Tool or Model Assessment	Goals/ Objectives	Tool Capabilities (if applicable)	Data Requirements	Spatial Scale	Management Questions	Using High-Resolution Land Use/Land Cover	Inform The Habitat Scoping Project
Chesapeake WILD **Chesapeake WILD webpage**	• Coordination among federal, state, local, and regional entities to establish a shared vision for sustaining natural resources and human communities throughout the Chesapeake Bay and its watershed • Engagement of diverse agencies and organizations to build capacity and generate	N/A	N/A	N/A	• Sustain a resilient network of fish and wildlife habitats and connecting corridors. • Advance climate change adaptation and land-use planning by increasing science capacity • Increase capacity and support for coordinated	Chesapeake WILD landscape conservation design process is in development and will likely begin late 2023 or early 2024. Because landscape scale planning (i.e., identifying areas of agreement related to the 5 pillars/priority areas) occurs over large geographic regions, 30m resolution dataset is more useful;	This may be a parallel effort and could potentially be joined into the habitat model update project upon the scoping being finished.

	funding that address shared restoration and conservation priorities • Collaboration to administer a grant program and implement projects to conserve, steward, and enhance fish and wildlife habitats and related conservation values				restoration and conservation activities in the watershed • Enhance recreational opportunities and public access • Improve and sustain water quality, upgrade water management capability, and reduce flood damage	especially, important so that it aligns with other regional conservation blueprints. However, partners and prospective grantees may have a need for 1m resolution for project planning and implementation.	
ESRI's Green Infrastructure Initiative <u>Green Infrastructure Initiative Launch</u>, <u>Tool</u>	• Combines local data with Esri's map to visualize and prioritize which landscapes to protect and connect, such as natural systems that mitigate flooding, green spaces that boost property values, and	Online web app has ability to show the local balance of development with green infrastructure, and summarizes data/ results at the watershed, county and state levels. Can compare current land-	• National Land Cover Database (NLCD) 2011. • National Elevation Dataset, USGS. • National Wetlands Inventory. • NHD USGS National Hydrography Dataset.	Primarily 30m grid (This is a series of datasets/ tools). Data not summarized at any level. National coverage.	• Depicting every intact natural area greater than 100 acres, regardless of ownership or preservation status. • Overview of the resources and places that are important to conserve	The CBP high resolution land cover dataset can supplement the national datasets.	Provides a perspective on defining priority habitats based on green infrastructure/ planning development, as well as depicting every intact natural area greater than 100 acres. Has the flexibility to allow users to switch datasets and get more localized information.

	trails that enable recreation. • A collection of authoritative geospatial resources, newly generated data, online applications, and downloadable models with the aim of empowering local organizations engaged in GI work, all while initiating a national vision of GI planning.	use conditions with 2050 land cover predictions.	• Gridded Soil Survey Geographic Database for the United States, USDA. • NOAA CCAP Coastal Change Analysis Program Regional Land Cover and Change. • TNC Terrestrial Ecoregions • US protected lands mismatch biodiversity priorities, PNAS vol.112, no. 16 • Ecologically-Relevant Maps of Landforms and Physiographic Diversity for Climate Adaptation Planning. • 2015 LCC Network Areas • GAP Level 3 Ecological System		before planning development. Can be used to construct corridors at the local level • Communities can identify, protect, and connect local places of natural and cultural significance before development occurs.		

			Boundaries - NOAA CCAP Coastal Change Analysis Program Regional Land Cover and Change				
Center for Conservation Innovation Tool	Habitat Patrol app allows you to detect and visualize land cover changes over a period of time.	Detect and delineate land clearing across habitat types. Automated change detection is powered by AI. Data updates every 5 days.	• European Space Agency's Sentinel-2 satellite system, provided through the Google Earth Engine	10 m grid. Data not summarized at any level. National Coverage.	• Locating where land clearing occurred • How has land cover changed over time	Does not appear to have ability to substitute land cover data	May use as a reference tool for determining data to use to show habitat changes over time.
NatureServe's Biodiversity Importance Models Webpage	A collaborative effort to identify the places most important for conserving at-risk species. Provides a portfolio of maps that identify areas critical to sustaining national biodiversity.	N/A	• PAD-US 2.0 • National Hydrography Dataset • NatureServe's Biodiversity Location Data (BLD) • USGS BISON	990 m grid. Data not summarized at any level. National coverage.	• Locating areas of biodiversity importance critical to preventing extinctions • Locating habitats for over 2,200 at-risk species	Does not appear to have ability to substitute land cover data	Provides priority habitat mapping with the emphasis on various species types. Can serve as an example on how to incorporate species considerations.

Department of Interior's America the Beautiful/American Conservation and Stewardship Atlas Press Release	Tool that will be used to reflect baseline information on the lands and waters that are conserved or restored. Used to measure the progress of conservation, stewardship, and restoration efforts across the country.	N/A	Tool not yet released	Tool not yet released	Tool not yet released	Tool not yet released	N/A
TNC Resiliency Model Webpage, Tool	Comprehensively maps resilient lands and significant climate corridors across Eastern North America.	Ability to add other datasets, generate resilience statistics on a given area.	• 2011 National Land Cover Database (NLCD) • 10 m SSURGO data • 30 m digital elevation model • NOAA 2010 Coastal Change Analysis Program (C-CAP) • National Wetland Inventory • NHDPlus • 10-m National Elevation Dataset	30 m grid. Data not summarized at any level. National coverage.	• Locating climate-resilient sites, and places that could serve as strongholds for diversity both now and in the future	Does not appear to have ability to substitute land cover data within the tool, but the data is available for download to use	Emphasis placed on resilience in the context of climate change. May be very useful to understand how to weigh various factors to determine resiliency of a site

			• 30-m landform model with 17 classes for the Eastern US • USGS SPARROW 2002 Total Nitrogen Model • TNC's Eastern Conservation Science team's 2013 dataset of Secured Land • Land Transformation Model (LTM) Version 3 developed by the Human-Environment Modeling and Analysis Laboratory at Purdue				
CEQ Eco Connectivity Guidance for Federal Agencies	Guidance that establishes a policy for federal agencies to promote greater connectivity across terrestrial, marine, and freshwater habitats, as well as across airspaces, to	N/A	N/A	N/A	• Understanding what policies, regulations, guidance, or other means federal agencies are doing to	N/A	May help frame how an updated CCP habitat model can be used to address these goals and may influence which data layers are prioritized and built into the

	sustain the biodiversity that exists in the U.S. and enable wildlife to adapt to fluctuating environmental conditions, including those caused by climate change.				consider how to conserve, enhance, protect, and restore corridors and connectivity during planning and decision-making, and to encourage collaborative processes across management and ownership boundaries.		model or used as overlays

Existing CBP Decision Support Tools & Models

Tool or Model Assessment	Goals/ Objectives	Tool Capabilities (if applicable)	Data Requirements	Spatial Scale	Management Questions	Using High-Resolution Land Use/Land Cover	Inform The Habitat Scoping Project
Existing CCP Priority Habitat model (GIT 5) **Webpage**, **Tool**	Protect a network of large natural areas and corridors sufficient to allow nature to respond to a changing climate and land development and to	N/A	• Nature's Network products: ○ The Terrestrial Core-connector Network	30 m resolution. Data not summarized at a certain scale. Northeast	• Locating important habitats, lands, waters, and connectors in the	Will be replaced and updated with 1 m high resolution land cover data, in some capacity.	Previous CCP habitat model to reference for needed updates/ changes.

	support thriving populations of native wildlife, migratory birds, fish and plants and sustain at-risk species.		○ Aquatic Core Network ○ Habitat Condition for Imperiled Species	regional coverage.	watershed, ranking these areas		
Natures Network composite model and individual components (GIT2, GIT 5) Webpage	Depicts an interconnected network of lands and waters that, if protected, will support a diversity of fish, wildlife, and natural resources. Outlines some of the most important natural areas in the region and provides an entry point to learn more about the information used to identify them.	N/A	• Nature's Network products: ○ The Terrestrial Core-connector Network ○ Aquatic Core Network ○ Habitat Condition for Imperiled Species	30 m resolution. Data not summarized at a certain scale. Northeast regional coverage.	• Outlines some of the most important natural areas in the region • Provides an entry point to learn more about the information used to identify them.	This dataset was used in the previous habitat model and this scoping project is investigating replacing it with the 1m high resolution dataset.	Will be used to compare methodologies between datasets on how the increased resolution will affect the modelling/ outcome.
Watershed Resources Registry (Forestry Workgroup, Wetlands Workgroup) Webpage	State-specific, preservation and restoration models displayed on an interactive online mapping tool that also features a large number of high-quality datasets for	Add additional data, generate a report, "Find Opportunity" filter according to potential restoration	• NLC 2016 • CCP Land Cover • Natures Network Dataset • National Hydrography Dataset • Additional datasets various	Analysis layers at 1 m resolution. Delaware, Maryland, Pennsylvania, Virginia, and West	• Avoid or minimize impacts to high quality aquatic and terrestrial	It is not possible to introduce additional GIS data into the various spatial analyses completed for a WRR. It is possible to add	This tool can serve as an example of identifying priority areas/ running models at the state level.

	regulatory and other environmental planning goals.	score, Draw tool	across states- Priority Conservation Areas, Fish Passage Connectivity, Water Quality, Stormwater, Coastal Resiliency, Geology and Soils, Biota, Forests	Virginia and South Carolina.	natural areas • Find candidate locations for mitigation projects nearby or in the same watershed • Assess and compare potential mitigation projects	external GIS data layers to the map interface.	
Chesapeake Healthy Watersheds Assessment (GIT 4) StoryMap	The assessment will support the Chesapeake Bay Program and its jurisdiction partners in detecting signals of change in the state-identified healthy watersheds, providing information useful to support strategies to protect and maintain watershed health.	Add data, Filter data, generate reports	• (EPA) Preliminary Healthy Watershed Assessment (PHWA) • National Hydrography Dataset Plus Version 2 • Chesapeake Bay high-resolution land use/cover data 2013/14 • Nature's Network Conservation Design for the Northeast	30m grid. Data summarized at 12-digit HUC watersheds. Chesapeake Bay scale.	• Detecting signals of change in the state-identified healthy watersheds • Identifying potentially vulnerable or resilient areas based on landscape, climate,	Potential to substitute 1 m dataset and re-run models.	Useful source for defining watershed health, and serve as an example of including vulnerability of healthy watersheds to future degradation as a factor.

			• StreamCat • NFHP 2015 data • LANDFIRE		and other factors		
Stream Health Assessment (Chessie BIBI) (Stream Health Workgroup) Webpage	A multi-metric index of biological health for freshwater streams and small, wadeable rivers in the Chesapeake Bay watershed. Describes the quality of assessed streams in relation to all of the streams in the watershed.	N/A	• Stream macroinvertebrate data and water quality and in-stream variables were obtained from twenty-nine federal, state, county, and non-profit agencies/programs that collect samples within the Chesapeake Bay basin	Data summarized at HUC12 watersheds. Chesapeake Bay scale.	• Measures the biological quality of streams and wadeable rivers on a common scale • A tool to track progress towards the CBP Stream Health management goal	Potential to substitute 1 m dataset and re-run models outlined in documentation.	May be very useful dataset/ analysis for defining and understanding aquatic priority areas specifically.
Brook Trout Assessment Tools Webpage	Identifies priority focal areas for implementing on-the-ground actions that will produce the best wild Brook Trout conservation outcomes.	Set various filters, add additional data	• Land use/land cover- EPA StreamCat • Fragmentation- EBTJV, EPA StreamCat • Flow regime- USACE National Inventory of Dams 2008, EPA StreamCat	EBT population patches. Data summarized at HUC12 watersheds. Northeast and Mid Atlantic Regions.	• Interprets spatial data related to the pattern of EBT populations, their habitats, and threats to	It is not possible to introduce additional GIS data to the analysis. It is possible to add external GIS data layers to the map interface.	Helpful source to understand specific threats/ threatened areas to brook trout and how to incorporate that as a factor into overall the priority areas.

			• Water Quality-2012 303(d)-listed impaired waters, EPA, FracTracker, 2015, USGS Mineral Resources Data System 2005 • TNC/App LCC energy development forecast • USGS Protected Areas Database 1.4 2016		those habitats. • Identify generalized conservation strategies – such as restoration or protection - within EBT patches		
Black Duck Watershed Prioritization Tool	Identifies areas of importance and priority watersheds that are crucial for meeting habitat requirements for black ducks.	Print maps from the tools	• U.S. Fish and Wildlife's National Wetland Inventory (NWI) data • UMASS ABDU Habitat Capability model for American Black Duck. • UMASS Land cover used in HC model with SLAMM	Data summarized at HUC12 watersheds. Chesapeake Bay Watershed.	• Estimate black duck habitat needs under current and future landscape conditions to guide strategic habitat conservation	Potential to substitute 1 m dataset and re-run models.	Helpful source to understand specific threats to black ducks, now and in future conditions, and how to incorporate that as a factor into overall the priority areas.

			• Sea-level Rise Affecting Marshes Model • Coastal Relief Model Bathymetry • USGS Sea-level Rise and Coastal Change				
National Fish Habitat Assessment Tool	Summarizes the results of a nationwide assessment of human effects on fish habitat in the rivers and estuaries of the United States.	Download data/ reports	• National Hydrography Dataset Plus Version 1 • USTRAT (US Stratigraphy) • USGS MRP (US Geological Survey Mineral Resources Program) • EPA OAR (US Environmental Protection Agency Office of Radiation and Indoor Air • NABD (National Anthropogenic Barrier Dataset) • USGS (U.S. Geological Survey) • 6IGER U.S. Census	Unclear what spatial resolution is used. Includes all watersheds in the Mid-Atlantic states.	• Assigns a risk of current habitat degradation scores for watersheds and estuaries across the nation and within 14 sub-regions. • The results also identify some of the major sources of habitat degradation.	Potential to substitute 1 m dataset and re-run models.	Can serve as a key example/ guide on how to incorporate sources of habitats threats/ degradation into the overall priority dataset.

			(Topologically Integrated Geographic Encoding and Referencing) • MRLC (Multi-Resolution Land Characteristics Consortium) • SPARROW (Spatially Referenced Regressions On Watershed attributes) • NED (National Elevation Dataset) • PRISM (Parameter-elevation Relationships on Independent Slopes Model)				
Freshwater Network Fish Passage Prioritization Tool	Identify potential dam removals and fish passage projects, secure and allocate funds for these projects, and help to communicate the importance of aquatic connectivity	View results/ generate summary statistics, query/ filter results, download data, annotate a	• Dams-The Nature Conservancy's Northeast Aquatic Connectivity project, and the National Inventory of Dams.	Unclear what spatial resolution is used. Chesapeake Bay Watershed coverage.	• Direct limited resources to projects that can have the greatest benefit • Investigate previously	Potential to substitute 1 m dataset and re-run models.	This tool will be helpful in identifying barriers to aquatic connectivity and factoring that into priority habitat areas.

	in the Chesapeake Bay watershed.	map, print or save a map	• Waterfalls-USGS GNIS database • Hydrography-High-Resolution (1:24,000) National Hydrography Dataset. • Diadromous fish habitat- Initial data from the Northeast Aquatic Connectivity • Land Cover- 2011 National land Cover Database (NLCD2006) • Chesapeake Bay High Resolution Land Cover- Chesapeake Conservancy • Rare fish, mussels & crayfish. Native fish species richness.- NatureServe HUC8-scale data. • Road stream crossings- North Atlantic Aquatic		unvisited dams to assess them for potential passage projects • Database of 40 ecologically relevant metrics can be used to investigate many aspects of aquatic connectivity on a dam-by-dam basis or other off-shoot analyses.		

			Connectivity Collaborative • Brook trout catchments- Eastern Brook Trout Joint Venture • Stream health / water quality- Chesapeake Bay Program Stream Health score "Chessie-BIBI" ; Maryland Biological Stream Survey (MBSS); Virgina's Interactive Stream Assessment Resource (INSTAR) • Human disturbance- National Fish Habitat Partnership 2010 HCI Scores and Human Disturbance Data (linked to NHDPLUSV1) • Species of Greatest				

			Conservation Need -Virginia WERMS				

Important Overlays

Tool or Model	Goals/ Objectives	Tool Capabilities (if applicable)	Data Requirements	Spatial Scale	Management Questions	Using High-Resolution Land Use/Land Cover	Inform The Habitat Scoping Project
The Nature Conservancy's Resilient Landscapes	Prioritizes a conservation portfolio that naturally aligns features into a network of resilient sites integrated with the species movement zones, and represents all habitats while allowing nature to adapt and change.	Allows additional GIS data to be added and draw a shape to get resilience statistics for a parcel or other polygon.	• 2011 National Land Cover Database • Circuitscape program	30 m	• Evaluate capacity are areas to maintain species diversity and ecological function as the climate changes	High potential to use 1 m land cover data in new model	Offers important climate related factors to be viewed alongside an updated habitat model for additional context.
Chesapeake Bay Land Change Model	Empirical model based on housing and population data, land cover and conversion trends and sewer service areas.	N/A	• Satellite imagery and the USDA Census of Agriculture. • Land management features such as cover crops on	1m	• Forecasts the effects of urban land use and population on sewer and septic systems in the	Uses high resolution land cover	Simulate how land use will change over time while, to view alongside high value habitat to view potential changes

			farm fields and stormwater controls in urban areas.		Chesapeake Bay watershed. • Predict the impacts of population growth and climate change • Simulation period that runs over 20 years		
EPA EJScreen	Environmental justice mapping and screening tool based on nationally consistent data and an approach that combines environmental and demographic indicators in maps and reports.	Allows users to access high-resolution environmental and demographic information and compare their selected locations to the rest of the state, EPA region, or the nation.	• Environmental and demographic indicators from census	Census Block Groups	• Identify areas with people of color and/or low-income populations, potential environmental quality issues, and a combination of environmental and demographic indicators that is greater than usual.	N/A	Understand current environmental and demographics risk factors around high value habitat and how future change may impact these communities
CDC/ ATDSR Social	Index identifying potential negative effects	N/A	• Demographic and population	Census Tracts	• Ranking of each tract on 16 social	N/A	Understand current level of social vulnerability around

Vulnerability Index	on communities caused by external stresses on human health, including natural or human-caused disasters, or disease outbreaks.		data from census		factors for socioeconomic status, household characteristics, racial and ethnic minority status, and housing type & transportation • Public health officials and emergency response planners meet the needs of socially vulnerable populations in emergency response and recovery efforts		high value habitat and their relation to those areas
FEMA National Risk Index	Dataset and online tool that shows US communities most at risk for 18 natural hazards	Allows users to create and download reports and compare their selected locations to the rest of the nation.	• Data from academia, local, state and federal government, and private industry on social vulnerability, community	Counties and Census Tracts	• What is driving a community's natural hazard risk • Baseline risk measurement for each community	N/A	Understand current overall risk from factors social vulnerability, community resilience and expected annual loss of communities near high value habitat and how

			resilience and expected annual loss				climate change may impact them and the land
USGS Protected Areas Database	National inventory of U.S. terrestrial and marine protected areas that are dedicated to the preservation of biological diversity and to other natural, recreation and cultural uses, managed for these purposes through legal or other effective means.	N/A	• Best available aggregation of federal land and marine areas provided directly by managing agencies	Varies	• Conservation status of our country's protected areas • How they are being managed for conservation purposes • Measure of public access for recreation	N/A	Identify areas of overlap or potential synergies between already protected lands and high value habitat