UTRB Imperiled Aquatic Species Conservation Strategy

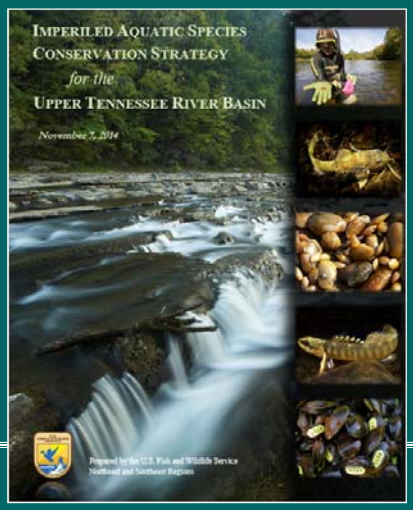
- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*
- Prioritization – Species, Location
- Strategy Organized Around SHC

- [Implementation of the Strategy]

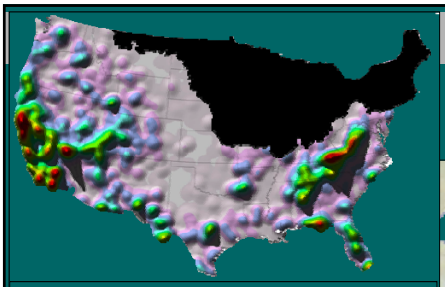
  ….Project Development, Annual Review, Strategy Review and Revision

UTRB Imperiled Aquatic Species Conservation Strategy

- Frame the Conservation Challenge



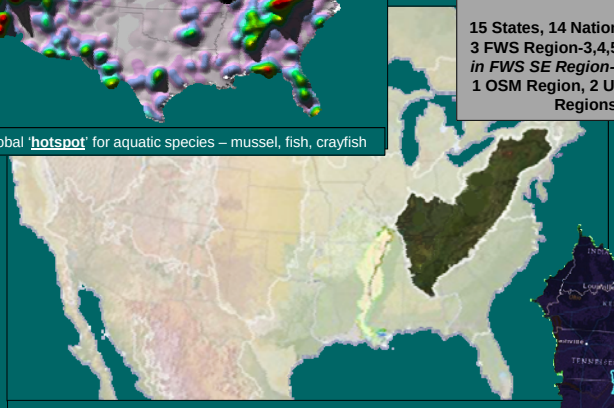
CONSERVATION IMPERATIVE



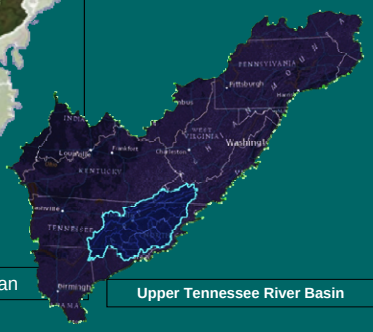
Global '**hotspot**' for aquatic species – mussel, fish, crayfish

Appalachian LCC: Science-Management Partnership *(Cooperative)*

15 States, 14 National Forests, 9 National Park Areas, 3 FWS Region-3,4,5 (6 Wildlife Refuges +3 *(proposed in FWS SE Region-4)*, 3 NPS Regions, 2 USGS Areas, 1 OSM Region, 2 USFS Regions (and 2 FSRS), 3 EPA Regions, 2 DOD ACE Divisions



22 Landscape Conservation Cooperatives: Appalachian



Upper Tennessee River Basin

UTRB – landscape 22,360 sq. mi.

24 imperiled mussel species – all federally listed as endangered

12 imperiled fish species are included in this Strategy

UPPER TENNESSEE RIVER BASIN (UTRB)

- **made up of entire Tennessee River basin upstream of its confluence with and including**
- **the Sequatchie River drainage**

PURPOSE & BOUNDS OF THE FWS UTRB STRATEGY

H

INTENDED (ADMINISTRATIVE) AUDIENCE

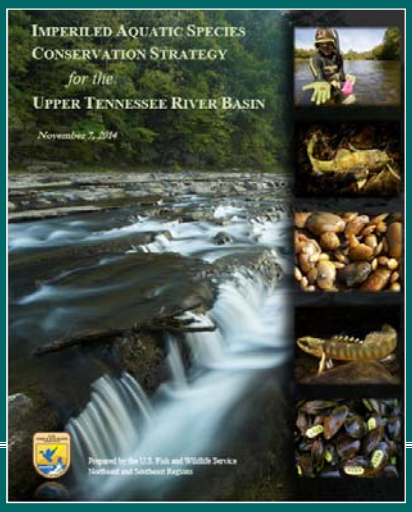
- **WHO** *(for)* **--** U.S. Fish and Wildlife Service Ecological Services Offices (*VA, TN, NC*) overlapping Upper Tennessee River Basing (UTRB)
- **WHAT** *(focus)* **--** management actions towards the Federal candidate, proposed, and listed (*referred to as imperiled*) aquatic species in the UTRB – focus on fish and mussels
- **WHY** *(intent)* **--** to prioritize USFWS efforts – to achieve the most effective use of a limited budget and based: cost-benefit & trade-off analysis

BOUNDING THE DECISION / STRATEGY DEVELOPMENT

- **WHEN --** over a 20-year period^ with periodic review and revision
- **HOW --** identify, prioritize, and guide implementation of on-the-ground actions, including population and habitat management, monitoring, and research, towards the recovery of imperiled aquatic species
- **WHERE --** integrate efforts to complement the work of our conservation partners - internal and external partners

UTRB IMPERILED AQUATIC SPECIES CONSERVATION STRATEGY

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*



Strategy Development Team

[Northeast Region] Meredith Bartron, Rick Bennett, Brian Evans, Catherine Gatenby, Shane Hanlon, Roberta Hylton, Jess Jones, Callie McMunigal, Martin Miller, Mary Parkin, Cindy Schulz

[Southeast Region] Bob Butler, Stephanie Chance, Mary Jennings, Peggy Shute, Kurt Snider

[USGS] Dave Smith *(SDM Facilitator)*

SDM *(deconstructs problem)*
1st - decision / problem statement

Current Management actions by FWS

- implementation of actions under ESA Sections 7 (*consultation, biological assessments, disaster response*) and Section 10 (*permits: incidental take/Habitat Conservation Plan; enhancement/Safe Harbor Agreement; recovery*),
- coordinate with other agencies,
- increase extant populations

(Service Perspective)

SDM Decision/ Problem

"ID management approach to best achieve the conservation objectives"

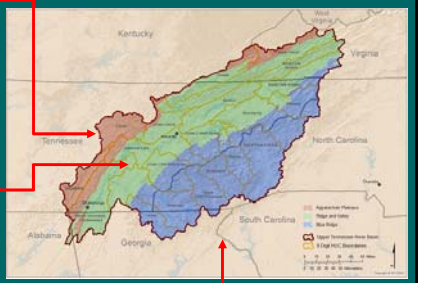
…(and) prioritize USFWS efforts

to achieve the most effective use of limited budgets… based on a cost-benefit and trade-off analysis."

THREAT BY REGION

The significance of various threats to UTRB imperiled aquatic species vary across the basin's three major physiographic provinces (Figure 1).

- **Oil and Natural Gas**
  Appalachian Plateau & Ridge and Valley, (receiving streams) threats from energy extraction activities.
- **Urbanization**
  valley portions of the Ridge and Valley (residential development, transportation corridor construction, and other effects)
- **Forestry, Stream Impoundment, and Agriculture** - all three provinces



THREATS & CURRENT LIMITING FACTORS

Threats

- predation,
- invasive species,
- host fish *(mussels only)*,
- disease, and
- ★depensation *(=low population growth or low density due to genetics / Allee effect)*

24 imperiled mussel species – all federally listed as endangered - represents 29% total mussel fauna in basin

12 imperiled fish species are included in this Strategy which represent approx. 8% of the total fish fauna in the basin

Ecological (limiting factors)

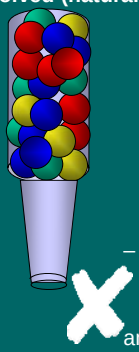
- physical habitat,
- flows,
- water quality (dissolved oxygen, temperature, ★contaminants), and
- lack of ★dispersal / fragmentation

★Top three Limiting Factors for both fishes and mussels

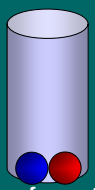
**Experts ranked* the top three limiting factors (fishes and mussels):
(Brian Evans, Catherine Gatenby, Roberta Hylton, Cindy Schulz, Peggy Shute)

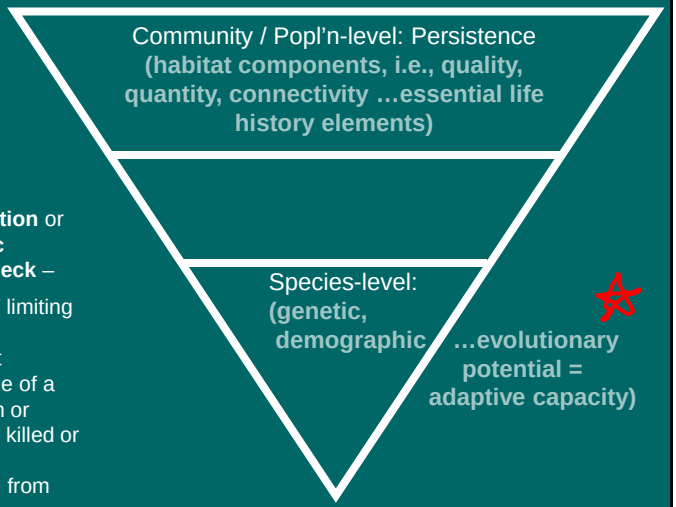
1⁰ PRINCIPLE: MAINTAIN GENETIC DIVERSITY (ADAPTIVE CAPACITY)

– **evolved (natural selection) genetic diversity (= adaptive capacity)**



– **population** or **genetic bottleneck** – an event / limiting factor → significant percentage of a population or species is killed or otherwise prevented from reproducing

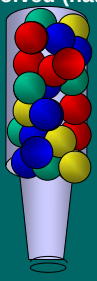




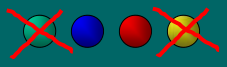
– **loss of genetic diversity (= ability to adapt?)**

1⁰ Principle: Maintain Genetic Diversity (adaptive capacity)

– evolved (natural selection) genetic diversity (= adaptive capacity)



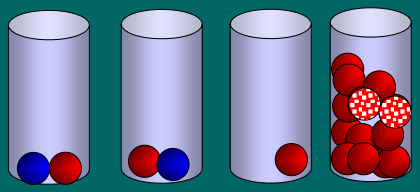
- loss genetic diversity due to bottleneck effect



resilience (ability to adapt)

- loss genetic diversity due to genetic drift (prolong…bottleneck)

t (time)

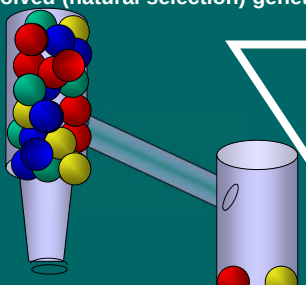


small populations => forced inbreeding

(genetic mutation, reduced reproduction, reduced fitness…adaptive capacity)

1⁰ Principle: Maintain Genetic Diversity (adaptive capacity)

– evolved (natural selection) genetic diversity (= adaptive capacity)

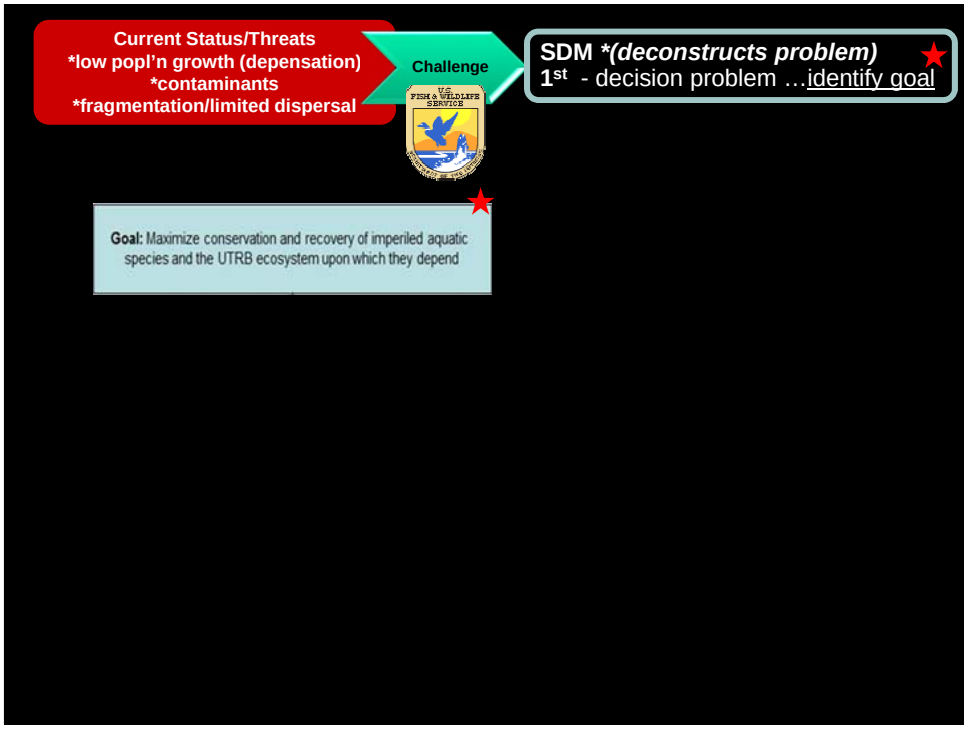


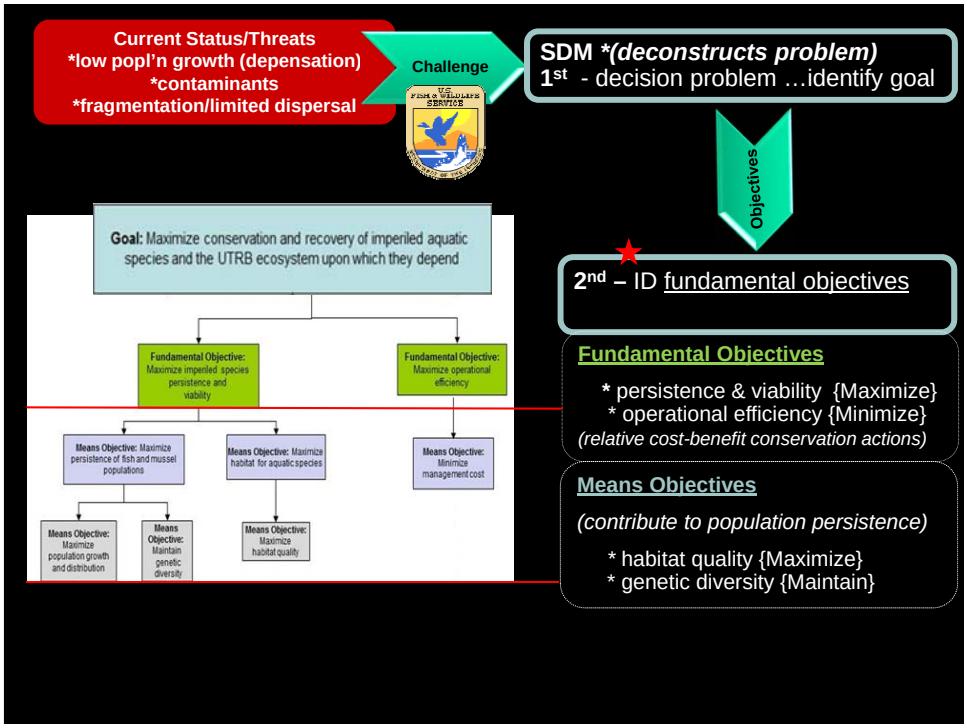
Community / Popl'n-level: Persistence (habitat components, i.e., quality, quantity, connectivity …essential life history elements)

Species-level: (genetic, demographic …evolutionary potential = adaptive capacity)

– Maintain genetic diversity

– *captive propagation & reintroduction*


Current Status/Threats
*low popl'n growth (depensation)
*contaminants
*fragmentation/limited dispersal
Challenge
SDM *(deconstructs problem)
1st - decision problem …identify goal
Goal: Maximize conservation and recovery of imperiled aquatic species and the UTRB ecosystem upon which they depend


Current Status/Threats
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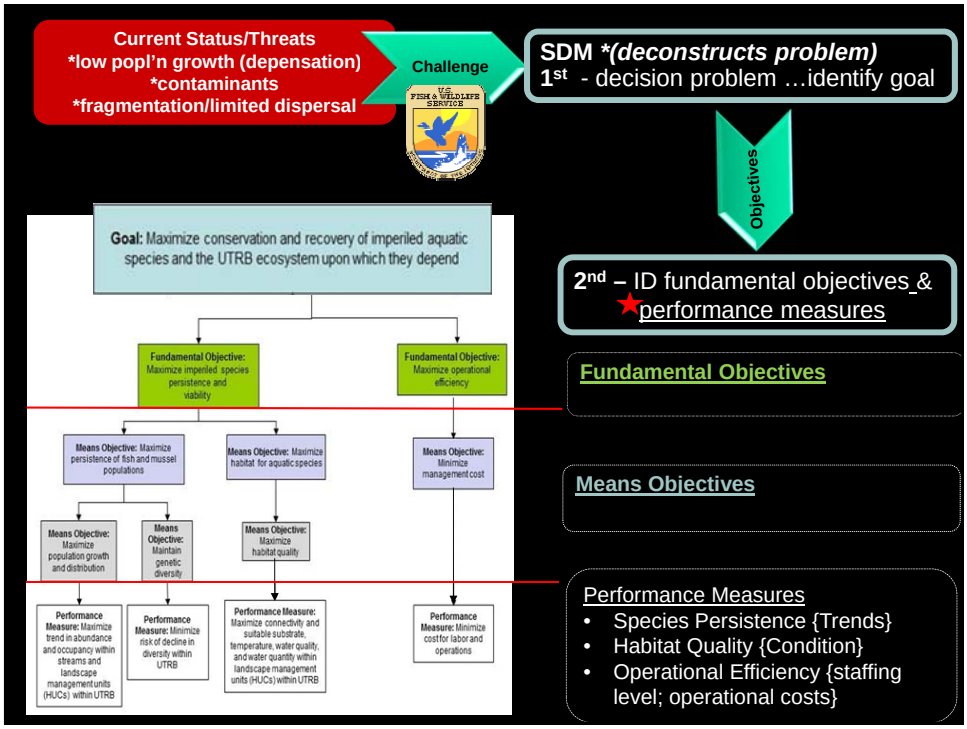
Challenge
SDM *(deconstructs problem)
1st - decision problem …identify goal
Objectives
Goal: Maximize conservation and recovery of imperiled aquatic species and the UTRB ecosystem upon which they depend
Fundamental Objective: Maximize imperiled species persistence and viability
Fundamental Objective: Maximize operational efficiency
Means Objective: Maximize persistence of fish and mussel populations
Means Objective: Maximize habitat for aquatic species
Means Objective: Minimize management cost
Means Objective: Maximize population growth and distribution
Means Objective: Maintain genetic diversity
Means Objective: Maximize habitat quality
2nd – ID fundamental objectives
Fundamental Objectives
* persistence & viability {Maximize}
* operational efficiency {Minimize}
(relative cost-benefit conservation actions)
Means Objectives
(contribute to population persistence)
* habitat quality {Maximize}
* genetic diversity {Maintain}


Current Status/Threats
*low popl'n growth (depensation)
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Challenge
SDM *(deconstructs problem)
1st - decision problem …identify goal
Objectives
2nd – ID fundamental objectives & performance measures
Goal: Maximize conservation and recovery of imperiled aquatic species and the UTRB ecosystem upon which they depend
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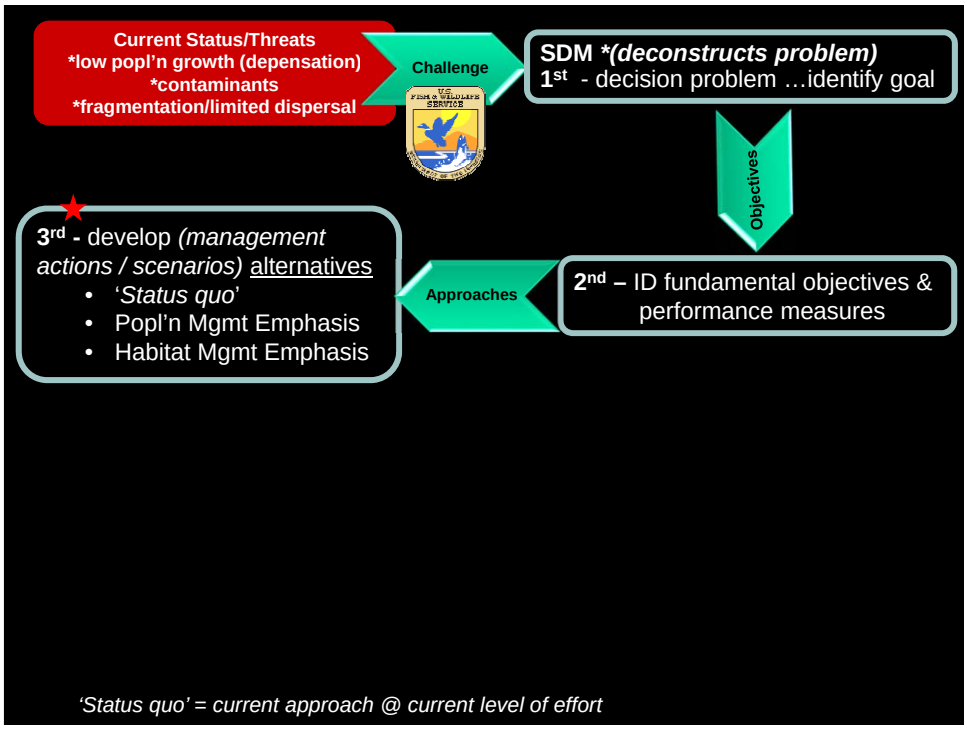
Means Objective: Minimize management cost
Means Objective: Maximize population growth and distribution
Means Objective: Maintain genetic diversity
Means Objective: Maximize habitat quality
Performance Measure: Maximize trend in abundance and occupancy within streams and landscape management units (HUCs) within UTRB
Performance Measure: Minimize risk of decline in diversity within UTRB
Performance Measure: Maximize connectivity and suitable substrate, temperature, water quality, and water quantity within landscape management units (HUCs) within UTRB
Performance Measure: Minimize cost for labor and operations
Fundamental Objectives
Means Objectives
Performance Measures
• Species Persistence {Trends}
• Habitat Quality {Condition}
• Operational Efficiency {staffing level; operational costs}


Current Status/Threats
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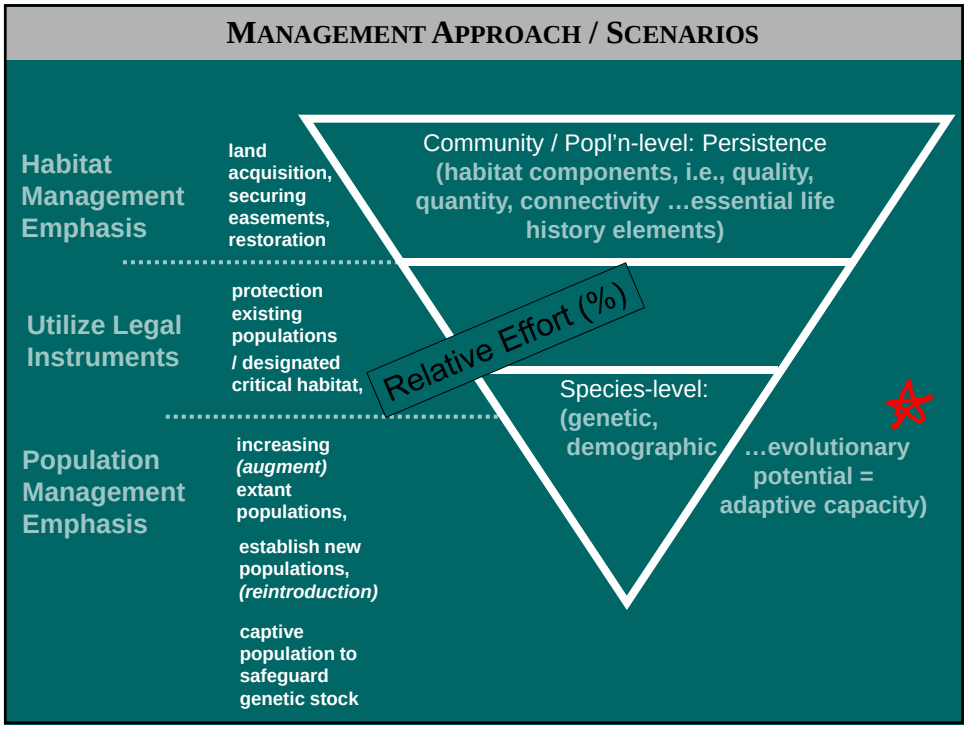
*fragmentation/limited dispersal
Challenge
SDM *(deconstructs problem)
1st - decision problem …identify goal
Objectives
3rd - develop (management actions / scenarios) alternatives
• 'Status quo'
• Popl'n Mgmt Emphasis
• Habitat Mgmt Emphasis
Approaches
2nd – ID fundamental objectives & performance measures
'Status quo' = current approach @ current level of effort

MANAGEMENT APPROACH / SCENARIOS



ALTERNATIVE APPROACHES: MANAGEMENT OR ACTIONS

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Set Mgmt Actions - that address threats & factors limiting recovery

I. '*Status quo*' Management (Current Approach)

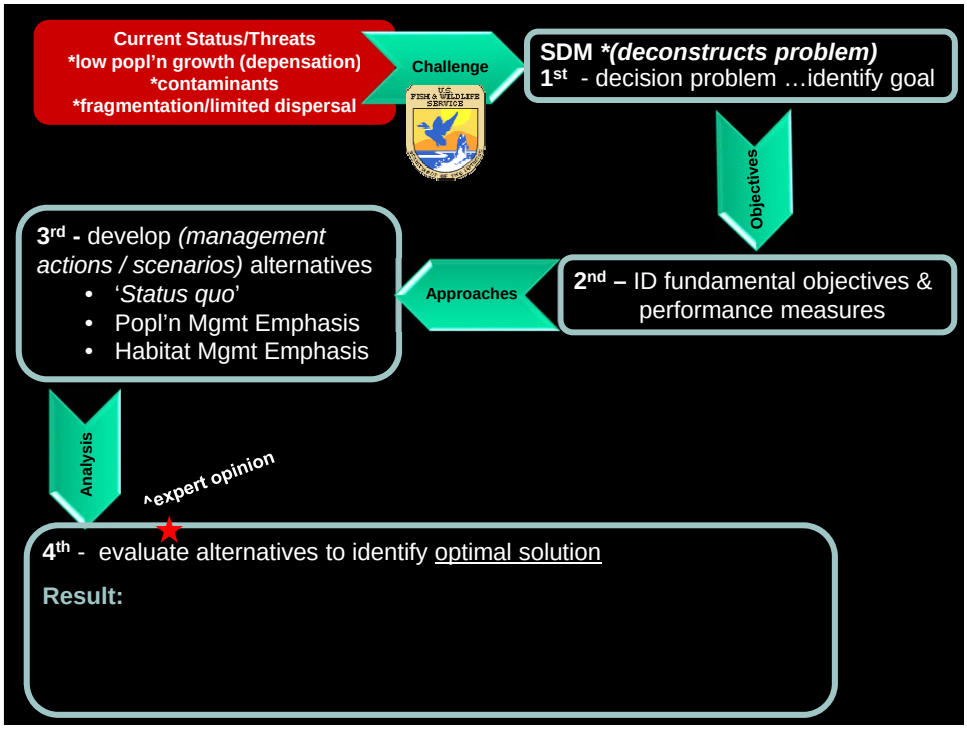
- *Threat/Limiting Factor: depensation, contaminates, dispersal / fragmentation*
- *By:* (continuation of current level of action) Implementing ESA Section 7 and 10 regulations; influence agencies; increasing extant populations

II. Population Management Emphasis

- *Threat/Limiting Factor:* depensation (low population size) and lack of dispersal / fragmentation
- *By:* -- augmentations (increasing extant populations);
  - reintroductions/introductions (establishing additional populations) … propagation and release of cultured individuals and
  - translocate adults into suitable habitat

III. Habitat Management Emphasis

- *Threat/Limiting Factor:* water quality, physical habitat, and flows
- *By:* protecting or restoring occupied and unoccupied habitat within the historical range of imperiled species



Evaluate alternatives to identify optimal solution

H

Consequence Analysis

- projected changes expected by management approach, at the end of a 20-years, with conservation emphasis *(primary focus)* on:
  - protection of population [Population Management],
  - habitat [Habitat Management], or
  - *status quo* management

Projections

trend in abundance: projected for each species, and average across species

distribution: number of habitat units occupied; projected for each species and average across species

habitat quality: *(projected at the 8-digit HUC level)* - presence of suitable habitat components *(components were free-flowing water, suitable substrate, suitable temperature, suitable water quality, and suitable water quantity.)* Average across habitat units

risk of decline in genetic diversity: removal of threats and expanding populations. Risk for all species combined.

–1 = no removal of threats and no additional populations
0 = addressing threats to existing populations
1 = moving individuals using best management practices [BMPs]
2 = both addressing threats and individuals using BMPs

Evaluate alternatives to identify optimal solution

H

Projected conservation benefits and management costs for each management approach were placed in a consequence table, following the simple multi-attribute rating technique.

Rating: utilize expert judgment^ to rate each performance measure -- reflects level of importance or value to each objective

^FWS species experts for fish: Bob Butler, Brian Evans, and Peggy Shute.
^FWS species experts for mussels: Stephanie Chance, Catherine Gatenby, Shane Hanlon, Jess Jones, and Meredith Bartron

Comparison / Trade-off Analysis

1st - normalize the raw projected performance measures (i.e., rows in Consequence Table),

2nd - taking a weighted average within each alternative management approach (i.e., columns in Consequence Table).

3rd - weights used in the weighted average are assigned to each fundamental objective.

4th step - weighted average of normalized measures becomes the final score and the **basis for comparison**

The **optimal approach** is the one with the **highest final score**

Optimal Solution & Sensitivity Analysis

Weighting - was assigned to the fundamental objectives reflect the relative importance of the various objectives, which can (and often does) vary among stakeholders.

Optimal Solution – specific weights for the objectives were not elicited from any specific stakeholders, rather

- a sensitivity analysis was conducted to determine the optimal approach for a wide range of weightings that assigned:
  - (1) relative weight to species persistence/viability versus costs and
  - (2) relative weight to abundance/distribution versus genetic diversity/habitat quality

Purpose: of the sensitivity analysis was to determine if the optimal approach was robust relative to how stakeholders might vary in how they place importance on the conservation objectives.

Result: Population management emphasis approach was found to be optimal across a wide range of objective weightings and by extension, to variation in stakeholder values.

COMPARE: CONSERVATION BENEFITS & MGMT COSTS (EACH)

Performance measures (*measurable attributes*)

- projected over 20-year period
- fish at the 12-digit HUC and mussels at the stream reach level
- standardized, and combined for each
- to account for relative importance => each performance measure was weighted when it was combined into a final score

Cost

- *staffing level & operational cost* using current figures (*status quo)*
- relative effort among alternatives

$4.9M for *status quo* management,
$4.7M for population management,
$5.4M for habitat management

		Expected Conservation Benefit Relative to Current Status		Management Cost	Prioritization Steps		
Common Name	Degree of Imperilment	Net Gain in Abundance Trend	Net Gain in Distribution	Cost of Propagation and Reintroduction	Step One	Step Two	Priority

Current Status/Threats
***low popl'n growth (depensation)**
***contaminants**
***fragmentation/limited dispersal**

Challenge

SDM **(deconstructs problem)*
1st - decision problem …identify goal

Objectives

2nd – ID fundamental objectives & performance measures

Approaches

3rd - develop *(management actions / scenarios)* alternatives
- '*Status quo*'
- Popl'n Mgmt Emphasis
- Habitat Mgmt Emphasis

Analysis

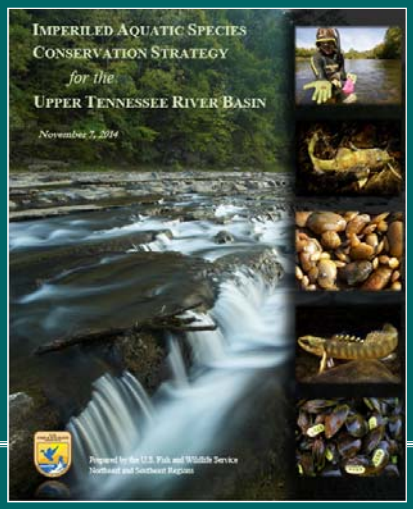
^expert opinion

4th - evaluate alternatives to identify optimal solution

Result: Popl'n Mgmt Approach = *protection of existing popl'n, designation of critical habitat, estab. new popl'n, increase extant popl'n, initiate captive mgmt.*]

UTRB Imperiled Aquatic Species Conservation Strategy

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*
- Prioritization – Species, Location



Because conservation benefit - is not likely to be achieved equally among all species and locations under population management approach Team:

– identified <u>which species and locations</u> would be most likely to benefit from the implementation of the optimal solution (population management approach)

Current Status/Threats
***low popl'n growth (depensation)**
***contaminants**
***fragmentation/limited dispersal**

Challenge

SDM *(deconstructs problem)*
1st - decision problem …identify goal

Objectives

2nd – ID fundamental objectives & performance measures

Approaches

3rd - develop *(management actions / scenarios)* alternatives
- '*Status quo*'
- Popl'n Mgmt Emphasis
- Habitat Mgmt Emphasis

Analysis

^expert opinion

4th - evaluate alternatives to identify optimal solution

Result: Popl'n Mgmt Approach

+ prioritized <u>species & locations</u>

PRIORITIZATION – SPECIES (UNDER POPL'N MGMT APPROACH)

Prioritize for Management: under population management approach

=> prioritized based on trade-off between expected conservation benefit & management costs (accounting degree imperilment) over next 20-yrs.

Strategy: FWS FOs will develop conservation projects (management actions) to improve the conservation status (address/ameliorate the threats) of these high priority species.

These prioritizations are intended to allow for flexibility in decisions regarding specific conservation projects.

PRIORITIZATION – SPECIES (UNDER POPL'N MGMT APPROACH)

H

Prioritize for Management: under population management approach
=> prioritized based on trade-off between expected conservation benefit & management costs (accounting degree imperilment) over next 20-yrs.

Degree of imperilment - qualitative assessment of range-wide extinction risk (Appendices 2 and 3).

Benefit - maximum gain in abundance trend and distribution relative to the current condition -- calculated the difference between current status and what would be expected result (Tables 5 and 6).

Distribution - difference between current status divided by current status to account for species-specific distribution (Table 10 and 11).

Management Cost - categorical scale based on a summary of cost for management actions (Appendix 5).

Prioritization scores

1st score – (based on imperilment and conservation benefit) assigned based on abundance trend and distribution

- o gains in both abundance trend and distribution are expected, assign priority 1
- o gain in either abundance trend or distribution is expected, and degree of imperilment is high, priority 1; but if degree of imperilment not high, assign priority 2
- o no gain in abundance trend and distribution is expected, priority 3

2nd score - categorical scale (Mgmt. costs)

Final Priority Score => was calculated by multiplying the 1st and 2nd scores

PRIORITIZATION OF IMPERILED FISH

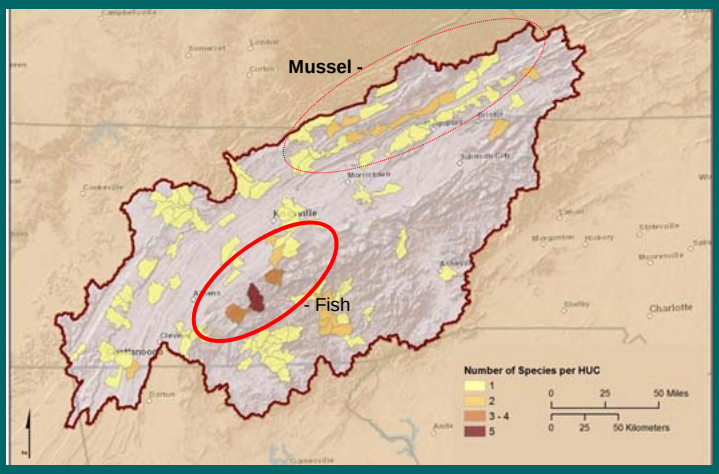
(Table 10) Prioritization -- lower scores indicate higher priority

Common Name	Degree of Imperilment	Expected Conservation Benefit Relative to Current Status: Net Gain in Abundance Trend	Expected Conservation Benefit Relative to Current Status: Net Gain in Distribution	Management Cost: Cost of Propagation	Management Cost: Cost of Reintroduction	Prioritization Steps: Step One	Prioritization Steps: Step Two	Priority
Marbled darter	High	1.5	0.3	Low	Low	1	1	1
Citico darter	High	1.0	0.5	Low	Low	1	1	1
Duskytail darter	High	1.0	0.5	Low	Medium	1	2	2
Laurel dace	High	1.0	0.0	Medium	Low	1	2	2
Pygmy madtom	High	0.5	2.0	Medium	Medium	1	3	3
Smoky madtom	High	0.0	1.0	Medium	Medium	1	3	3
Spotfin chub	Low	1.0	0.1	Medium	High	1	4	4
Yellowfin madtom	Medium	0.0	0.1	Low	Medium	2	2	4
Sicklefin redhorse	Low	0.5	0.0	High	High	2	5	10
Chucky madtom	High	0.0	0.0	High	Medium	3	4	12
Slender chub	High	0.0	0.0	High	High	3	5	15
Snail darter	Low	0.0	0.0	High	Medium to High	3	5	15

12 imperiled fish species are included in this Strategy which represent approx. 8% of the total fish fauna in the basin

- 8 Federally listed Endangered, 4 as Threatened, 1 Federal Candidate
- **9 are endemic only to the UTRB**
- 7 species have critical habitat designated within the basin (Appendix 1)

Listed, Proposed, Candidate **Fish Species** - [Number species per 12-digit HUC]

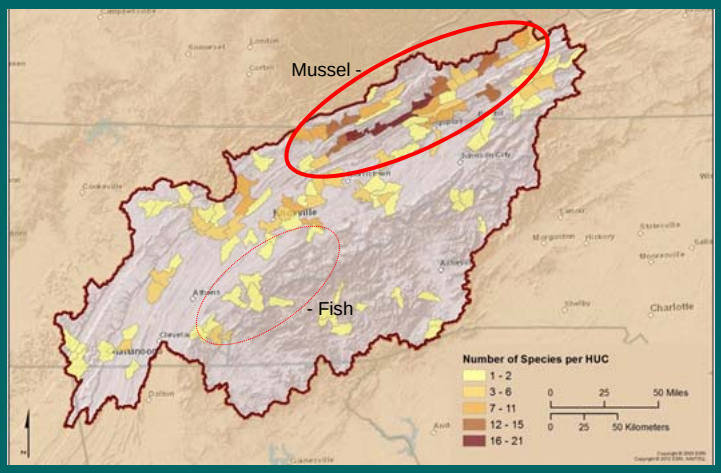


PRIORITIZATION OF IMPERILED MUSSELS

(Table 11) Prioritization -- lower scores indicate higher priority

Common Name	Degree of Imperilment	Expected Conservation Benefit Relative to Current Status: Net Gain in Abundance Trend	Expected Conservation Benefit Relative to Current Status: Net Gain in Distribution	Management Cost: Cost of Propagation and Reintroduction	Prioritization Steps: Step One	Prioritization Steps: Step Two	Priority
Cumberlandian combshell	Medium	0.5	0.7	Low	1	1	1
Alabama lampmussel	High	0.5	0	Low	1	1	1
Oyster mussel	Medium	0.5	0.4	Low	1	1	1
Snuffbox	Low	1.0	1.0	Low	1	1	1
Pink mucket	Low	2.0	9.0	Low	1	1	1
Dromedary pearlymussel	High	1.0	1.0	Medium	1	2	2
Purple bean	High	1.0	0.5	Medium	1	2	2
Fanshell	Medium	1.0	2.0	Medium	1	2	2
Birdwing pearlymussel	Medium	0.5	0.4	Medium	1	2	2
Cumberland bean	High	1.0	0.0	Medium	1	2	2
Golden riffleshell	High	1.0	0.0	Medium	1	2	2
Cracking pearlymussel	High	0.5	2.3	High	1	3	3
Littlewing pearlymussel	High	0.5	2.0	High	1	3	3
Shiny pigtoe	Medium	0.5	0.3	High	1	3	3
Finerayed pigtoe	Medium	0.5	0.4	High	1	3	3
Rough pigtoe	Medium	0.5	9.0	High	1	3	3
Rough rabbitsfoot	Medium	1.0	0.3	High	1	3	3
Cumberland monkeyface	High	1.5	0.0	High	1	3	3
Appalachian monkeyface	High	0.5	0.0	High	1	3	3
Sheepnose	Low	0.5	0.4	High	1	3	3
Appalachian elktoe	Medium	0.5	0.0	Medium	2	2	4
Fluted kidneyshell	Medium	0.5	0.0	Medium	2	2	4
Slabside pearlymussel	Medium	1.0	-0.1	High	2	3	6
Spectaclecase	Medium	0.0	0.0	High	3	3	9

Listed, Proposed, Candidate **Mussel Species** - [Number species per 12-digit HUC]



24 imperiled mussel species – all federally listed as endangered - represents 29% total mussel fauna in basin

- 6 - have critical habitat designated within the UTRB
- **4 - are endemic only to the UTRB**
- **3 - others are now globally restricted to the UTRB**
- 2 - are considered extinct and
- 6 - are extirpated from the UTRB

PRIORITIZATION – LOCATIONS (UNDER HABITAT MGMT. EMPHASIS)

Prioritizations are intended to allow for flexibility in decisions regarding specific conservation projects. **Species richness** of imperiled taxa and **feasibility of management** implementation were used as the driving variables (Table 12).

- **Species richness** – at scale of 8-digit HUC sub-basins (Figure 2).
- **Feasibility of implementing habitat management** actions (Appendix 4) for habitat restoration/protection and threat abatement for each sub-basin, was acquired through an averaged polling of expert opinion:
  - 1 = infeasible to low degree of feasibility = little or no opportunity -- threats will likely continue or increase over time even with significant investments
  - 2 = moderately feasible = limited opportunity -- threats may be reduced over time with significant investments
  - 3 = high degree of feasibility = substantial opportunity -- threats can likely be reduced over time with significant investments

Both variables were standardized as follow:

= difference from the min. divided by -- difference between min. & max.

= standardized input values were multiplied by weighted values derived from averaged opinion of team members [species richness (0.63) and management feasibility (0.37)]

= weighted values were summed, and then divided by the sum of weights to derive final scores.

PRIORITIZATION OF WATERSHEDS

(Table 12) Prioritization – higher scores indicate higher priority

Species richness and management feasibility values were standardized and weighted to provide weighted average scores for prioritization. [Standardize: maximum received 1, minimum received 0, intermediate values were interpolated between 0 and 1.

8-digit HUC	Species Richness	Standardized Richness	Feasibility	Standardized Feasibility	Weighted Average
Upper Clinch	24	1.00	2.50	0.7	0.90
Powell	16	0.65	2.33	0.6	0.65
Nolichucky	7	0.26	2.67	0.8	0.47
Upper Little Tennessee	4	0.13	3.00	1.0	0.45
Hiwassee	7	0.26	2.40	0.7	0.41
Tuckasegee	2	0.04	3.00	1.0	0.40
North Fork Holston	6	0.22	2.33	0.6	0.37
Lower Little Tennessee	6	0.22	2.33	0.6	0.37
Emory	3	0.09	2.60	0.8	0.35
Sequatchie	3	0.09	2.40	0.7	0.31
Upper French Broad	1	0.00	2.50	0.7	0.27
Pigeon	1	0.00	2.50	0.7	0.27
South Fork Holston	4	0.13	2.00	0.5	0.25
Lower French Broad	4	0.13	2.00	0.5	0.25
Holston	5	0.17	1.67	0.3	0.21
Watts Bar Lake	6	0.22	1.40	0.1	0.18
Middle Tennessee-Chickamauga	6	0.22	1.25	0.0	0.15
Ocoee	1	0.00	1.80	0.3	0.13
Lower Clinch	1	0.00	1.17	0.0	0.00

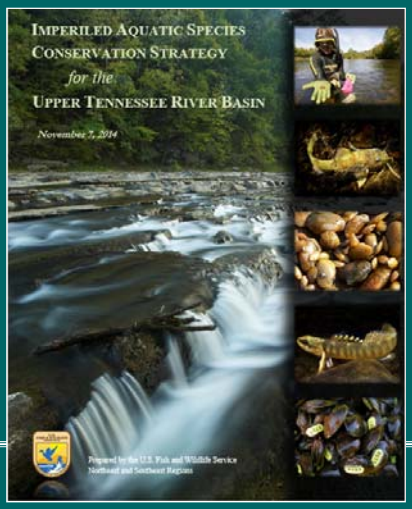
UTRB Imperiled Aquatic Species Conservation Strategy

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*
- Prioritization – Species, Location
- Strategy Organized Around SHC

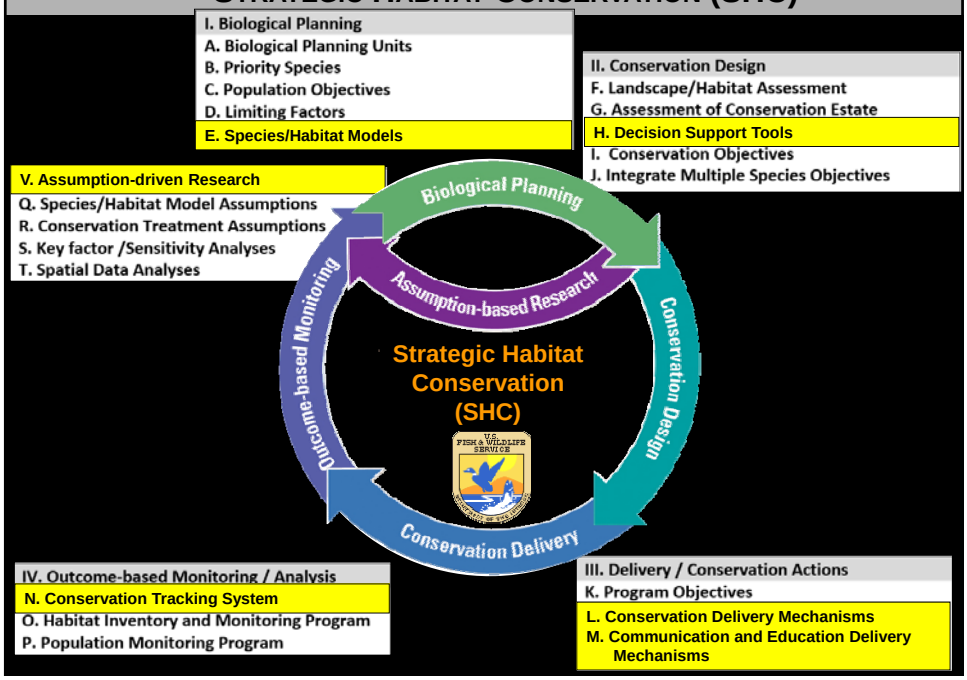
"UTRB Strategy reflects the FWS approach to implementing conservation as organized around the **Strategic Habitat Conservation (SHC**

--&--

Northeast Regional Conservation Framework.



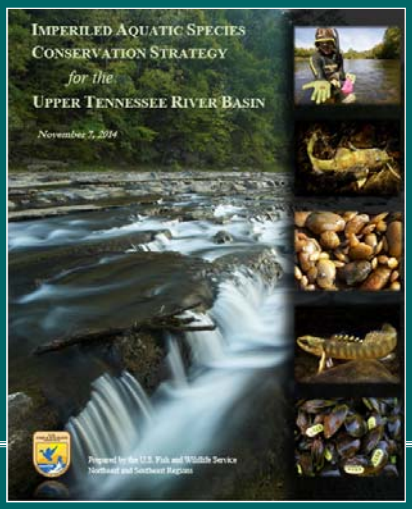
Strategic Habitat Conservation (SHC)



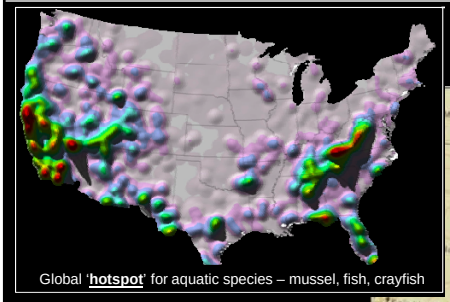
FULLY-IMPLEMENTING SHC & ROLE OF LCCS / COOPERATIVES

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*
- Prioritization – Species, Location
- Strategy Organized Around SHC
  - ***Strategy as building blocks (core) of a* "Pilot" Landscape Conservation Design *(LCD)***

(ex. R4-NALCC Ct River Pilot)



UTRB – "PILOT" WITHIN THE APPLCC



Global '**hotspot**' for aquatic species – mussel, fish, crayfish

24 imperiled mussel species – all federally listed as endangered **- represents 29% total mussel fauna** in basin

12 imperiled fish species are included in this Strategy which represent approx. 8% of the total fish fauna in the basin

UTRB – an area the size of West Virginia

VAFO,SVFO, NCFO, TNFO

UTRB – landscape 22,360 sq. mi.

Map: The Appalachian Landscape Conservation Cooperative (outlined in purple) and the UTRB (outlined in red), illustrating the importance of the UTRB as the core of the south-central portion of the Appalachian Landscape Conservation Cooperative.

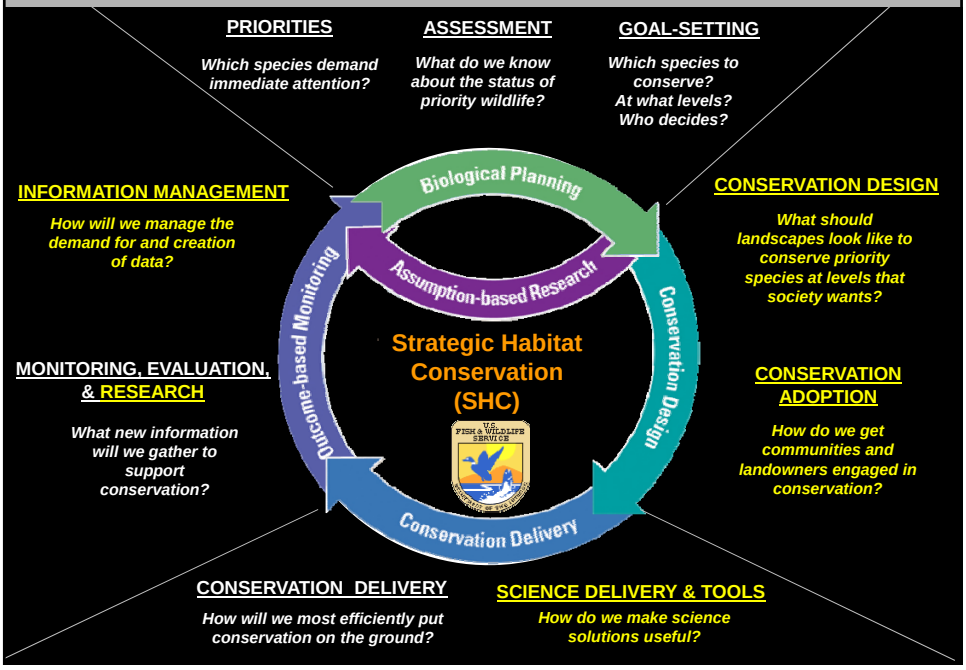
FWS UTRB Strategy Conclusion

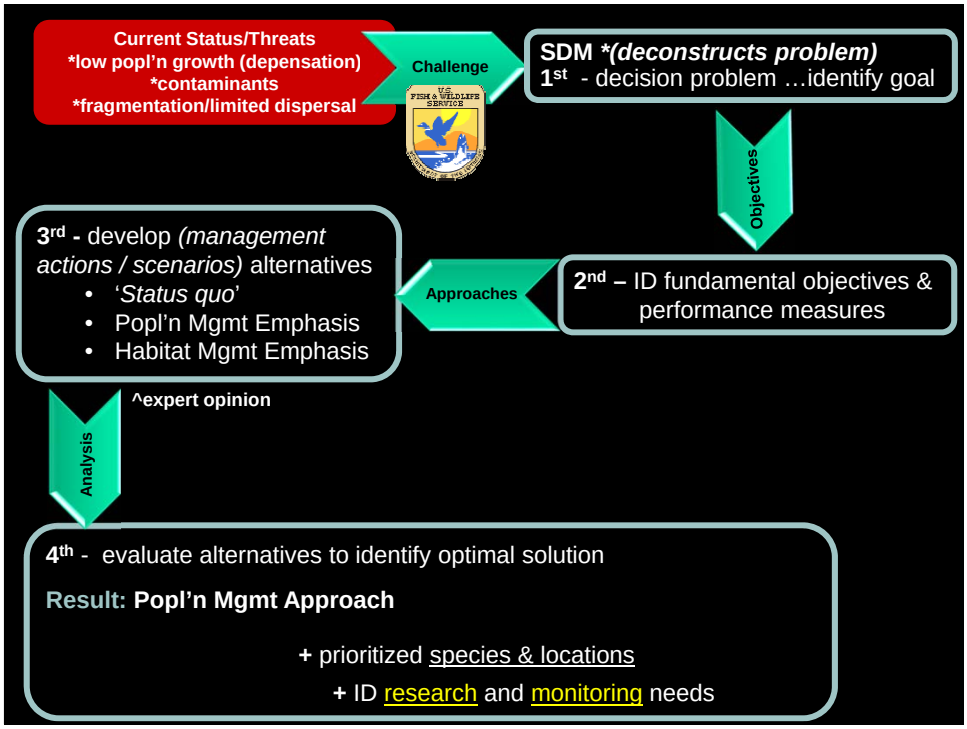
- USFWS will direct more available resources toward implementation of ESA Sections 7 and 10
  - protection of existing populations and designated critical habitat,
  - establishment of new populations,
  - increasing extant populations, and
  - initiation of a program for captive population management.
- Population Management emphasis emerged as the optimal approach.
- Habitat Management will continue but with reduced emphasis (land acquisition, securing easements, and restoration) …development of BMPs^ for stream and riparian habitat will increase.

- Additional research and science information *(and tools)*
  - (*e.g.*, life history research, threat analyses, genetics, population viability analyses, habitat evaluation, propagation and captive management, and evaluation of ecosystem services)
- Increased outreach and establishing new partnerships, while maintaining intra-agency partnerships

^BMPs – NRCs guidance *(collaboration)*

Northeast Conservation Framework





A. POPULATION MGMT – *IN SITU* (APPENDIX 4)

YELLOW: areas the AppLCC could support

2. Protect imperiled species extant occurrences/aggregations:
   2c. Increase population connectivity

B. HABITAT MANAGEMENT

2. Use regulatory authority to maintain or establish habitat connectivity:
   2b. Minimize and avoid impacts to habitat:
   2c. Minimize and avoid impacts to proposed or designated critical habitat:
4. Restore habitat:
   4b. Improve riparian habitat quality/increase riparian habitat quantity
   4c. Restore habitat connectivity:

D. MONITORING/RESEARCH

4. Evaluate and monitor threats to imperiled fish and mussel species. Existing threats assessments should be compiled and reviewed to minimize duplication of effort.
   4a. Assess threats (basin-wide or locally):

10. Identify the social and economic value of functioning aquatic ecosystems.
   10a. Conduct audience analysis of habits, attitudes, behaviors, and uses for aquatic ecosystems.
   10b. Quantify economic value of healthy streams to local, regional, and national economies.
   10c. Quantify ecosystem goods and services provided by fishes and mussels to aquatic resources.

E. COMMUNICATION & PARTNERSHIPS (APPENDIX 4)

YELLOW: areas the AppLCC could support

1. Develop a communication and outreach strategy.

1a. Identify target audiences.
1b. Develop communication message to target audiences.
1c. Engage communication specialist
1d. Provide information and education:
1e. Develop a Friends group:

2. Work with partners (e.g., industry, non-governmental organizations, private landowners, agencies) to maintain and/or restore habitats or populations:

2a. Develop/implement CCAs and CCAs with Assurances for candidate or proposed species:.
2b. Develop Safe Harbor Agreements for listed species: As appropriate.
2c. Develop voluntary agreements, easements, etc.: As appropriate.
2d. Leverage funding for joint projects.
2e. USFWS or partners funding for research, on-the-ground projects, etc

3. Work with industry to restore habitat

3a. Identify priority restoration areas
3b. Promote restoration of priority areas

4. Facilitate external communication and cooperation:

MONITORING

H

MONITORING PROGRAM: will need to be designed

to provide feedback on implementation and effectiveness of the Strategy.
Because of the complexity of designing an effective monitoring program to support this multi-species, landscape wide Strategy

a separate workshop is warranted to:

- coordinate among multiple Federal, State, and NGO regarding monitoring
- design standardization of sampling protocols,
- establish and support a centralized database, and
- identify responsibilities for periodic reporting and processes for incorporating monitoring results in improved future conservation and management actions

DESIGN: monitoring program will

- measure attributes associated with conservation objectives including measures of recovery (e.g., trend in abundance, occupancy, habitat quality) and operational efficiencies and costs (e.g., staff and operational costs)
- account for multiple management scales - both landscape and local
- integrate monitoring data of major threats so that management effectiveness can be determined.
- be determined by examining tradeoffs between the value of the information obtained and associated monitoring costs – e.g., considerations, such as sampling units and frequency, sample size, and location of units

IMPLEMENTATION – PART OF "TIERED" CONSERVATION DESIGN

["micro"] Internal – Individual / Org-level (FWS Ecological Service) will

- emphasize population management approach for (priority) species (Tables 10 and 11) and habitats (Table 12) most likely to contribute most to the Strategy
- focus personnel and financial resources management actions (Table 4, Appendix 4); and
- work cooperatively to implement and monitor, both internally and externally

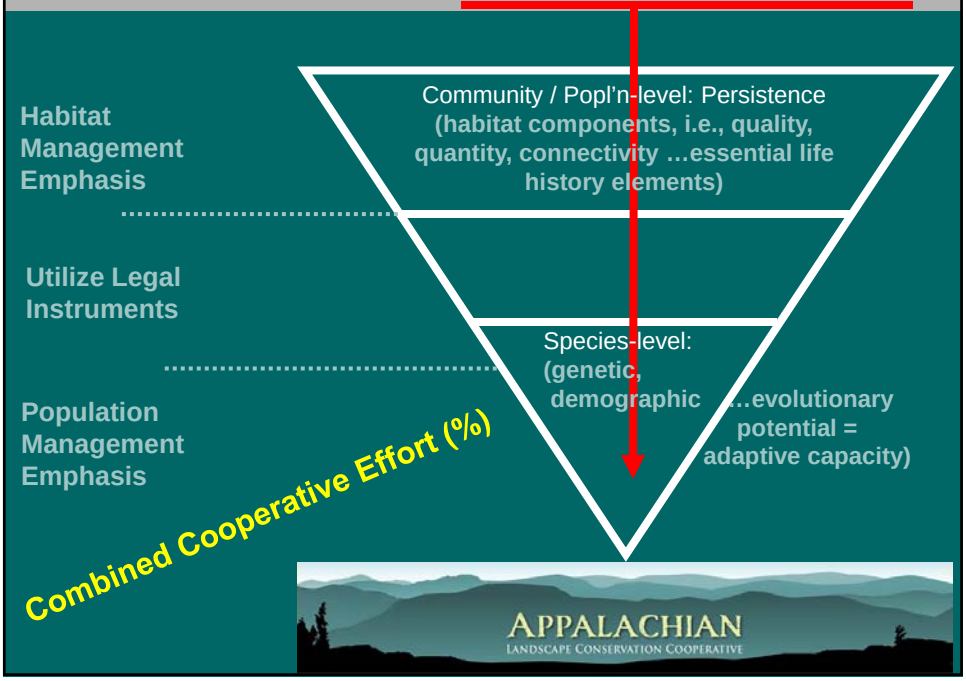
["meso"] Local - Adapt at the Local Practitioner & Project-level Strategy helps guide planning and management across a large and diverse suite of species -- recognize the flexibilities the Strategy affords and adapt its application at the local level to ensure conservation efforts will be effective.

- Next step to advance the Strategy to develop specific projects that implement population management emphasis for priority species and locations.

["macro"] Landscape - Working as Part of the Broader AppLCC Community to

- provide information to all stakeholders & partners involved in conservation efforts;
- support a suite of collaborative efforts (*e.g., management, outreach and training*) among agencies, partners, and stakeholders toward conservation of imperiled aquatic species and the ecosystems they rely upon; and
- expend funding discussions with State agencies concerning traditional Section 6 funds and State Wildlife Grants

RISK MANAGEMENT UNDER CLIMATE & LAND-USE CHANGES



Risk Management (Sp. Conservation - Imperiled & SGCN)

FWS UTRB Strategy - Part of the Broader Landscape

H

Service-level: the Strategy will

- support attainment of relevant reclassification and delisting criteria contained in approved USFWS fish and mussel recovery plans.
- guide updated estimates of time and cost expenditures to achieve reclassification or delisting of UTRB species in the future.

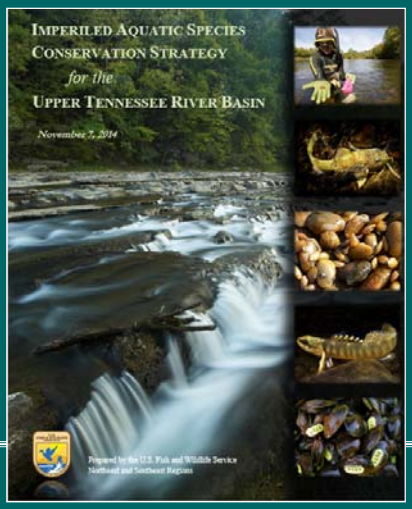
The **Strategy serves to prioritize USFWS efforts** so that the Service *(ES Program)* can make the most effective use of limited budget and continue to complement the work of the conservation partners.

Partnership-level: the Strategy will

- help accomplish goals of ***State agencies and NGOs*** similar to USFWS for conserving and recovering UTRB imperiled aquatic species
- (*e.g., National Native Mussel Conservation Committee 1998*
  - *The Nature Conservancy (TNC) 2009*
  - *Cumberlandian Region Mollusk Restoration Committee 2010*
  - *Virginia Department of Game and Inland Fisheries 2010)*
- [Note that the USFWS does not seek to direct the work of partners]

FWS (UTRB Collaborative) – As Member of the AppLCC

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Developed Using Structured Decision Making (SDM)*
- Prioritization – Species, Location
- Implementing SHC
  - **Landscape-level Conservation Design^ (LCD) … *("Pilot")***



Demonstrates and reinforces Service's new Approach to Conservation in the 21st Century

*Landscape-level Conservation, *Strategic Habitat Conservation, *Adaptive Management

…and *Cross-Programmatic Support…*New Conservation Paradigm*

Outline

H

- Frame the Conservation Challenge
- Service Management Decision: *Strategy Development Using Structured Decision Making (SDM)*
- Prioritization – Species, Location
- Strategy Organized Around SHC
- **Implementation of the Strategy**

The Strategy Implementation by the FWS Field Offices will be

- used to guide internal decisions regarding recovery efforts (staff time and resource dollars) and where to focus its restoration program;
- coordinated with others -- both internally and externally;
- 'translated' into specific projects (i.e., to implement the SDM optimal solution -- population management approach to priority species and location; and
- monitored, reviewed and revised as needed

PROJECT DEVELOPMENT

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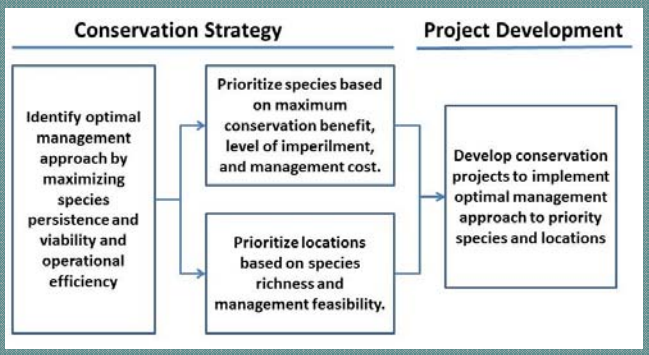
Projects: to implement the population management approach to priority species and location the Strategy will be 'translated' into specific **projects.**



(Figure 9) Diagram of Strategy components which feed into project development.

Monitoring will be a critical component of an adaptive management charge to support specific projects nested within the Strategy.

Adaptive management & **research** to reduce key uncertainties (*for example, there is some uncertainty in BMPs when augmenting or establishing a population*) could improve management effectiveness and future guide population mgmt.

PROJECTS

H

ANNUAL MEETINGS:

- will begin the project planning process --- to discuss completed and ongoing conservation efforts, evaluate lessons learned, and plan future actions and projects.

PARTICIPANTS:

- agencies and organizations involved with related or complementary conservation work in the basin or surrounding region

BROADER CONSERVATION LANDSCAPE:

- pre-meeting survey will serve to assemble the list of all recently completed, ongoing, and planned actions or projects that may help meet the goals and objectives of the Strategy

GOAL:

- through its commitment to host the annual UTRB meeting, the FWS Field Offices hope to build new and strengthen existing partnerships that reinforce the shared mission and conservation commitment reflected in the Strategy
  - (*examples of projects/actions* for consideration could involve fish and mussel propagation, stream habitat restoration, population monitoring, and other activities related to conservation and recovery of imperiled aquatic species.)

Strategy Review and Revision

H

Strategy will be reviewed and revised as needed.

- The initial review will take place four years after finalization of the initial Strategy document, and will be coordinated by the USFWS's Southwestern Virginia Field Office.
- Strategy review may be triggered sooner if monitoring observations indicate a significant inconsistency with underlying assumptions or it is determined that the framework no longer reflects adequately the current state of knowledge or policies.
- Additional Strategy review *(SMD framework = scenarios/problem statement)* and project planning efforts could be triggered by factors such as funding increases/decreases, organizational changes, or other events.
- Other agencies and organizations will be asked to participate and this element of the Strategy will result in modification and/or adaptation of the Strategy, as appropriate.

Adaptive Management Approach

H

BY DESIGN: The Strategy provision for periodic review and modification will provide the opportunity to review and adapt the Strategy as warranted.

MANAGEMENT: How management can be adapted to new information depends on the frequency that decisions are made and the degree to which uncertainty affects those decisions.

DECISION-MAKING: For recurrent (e.g., annual) management decisions, management can adapt to changing conditions (e.g., species status) at each decision point.

IN THE REVIEW: for conservation strategies that are set in place for a period of time strategies can employ adaptive management:

(1) periodic review of the Strategy *(SDM framework = scenarios /problem statement that provided the rationale for the Strategy)*;

(2) when monitoring observations are significantly inconsistent with assumptions underlying Strategy framework; or

(3) at any time when the decision maker(s) determines that Strategy framework components should be revised to reflect new information, new methodologies, or changing values.

H

A. POPULATION MGMT – *IN SITU* (APPENDIX 4)

YELLOW: areas the AppLCC could support

1. Protect imperiled species extant occurrences/aggregations**:**
   - 1a. Implement ESA Sections 7 and 10 regulations:
   - 1b. Support agencies who enforce other regulations (Comprehensive Environmental Response, Compensation & Liability Act; Clean Water Act; National Pollutant Discharge Elimination System; Total Maximum Daily Load, etc.):
   - 1c. Conduct status assessments of rare aquatic species for possible candidate status.
   - 1d. List candidate aquatic species:
   - 1e. Use other available means to protect imperiled aquatic species.
     - 1e1. Protect candidate/proposed aquatic species: Develop/implement Candidate Conservation Agreements (CCAs)
     - 1e2. Protect listed aquatic species:
     - 1e3. Protect or establish refuge populations.

2. Protect imperiled species extant occurrences/aggregations**:**
   - 2a. Develop BMPs for augmenting populations:
   - 2b. Augment existing populations.
     - 2b1. Complete controlled propagation plans:
     - 2b2. Evaluate facilities:
     - 2b3. Stock hatchery-reared fishes and mussels, release glochidia-encysted host fish (using fish native to the stream), or stock adult or sub-adult mussels from more robust populations into river reaches where extant populations exist,
   - **2c. Increase population connectivity**

H

A. POPULATION MGMT – *IN SITU* (APPENDIX 4)

3. Establish new populations of imperiled fishes & mussels within historical range**:**
   - 3a. Develop BMPs for establishing new populations
   - 3b. Reintroduce populations
   - 3c. Designate non-essential experimental populations:
   - 3d. Introduce populations:

C. POPULATION MGMT – *EX SITU* (APPENDIX 4)

1. Prepare for captive management of imperiled fishes and mussels.
   - 1a. Complete controlled propagation plans:
   - 1b. Evaluate facilities:
   - 1c. Develop generic and species-specific BMPs/protocols for captive management:

2. Establish and manage captive populations:
   - 2a. Initiate/manage captive breeding and rearing.
   - 2b. Develop imperiled aquatic species cooperative breeding programs among approved facilities:

H

B. HABITAT MANGEMENT (APPENDIX 4)

YELLOW: areas the AppLCC could support

1. Develop BMPs for managing in-stream and riparian habitat:

2. Use regulatory authority to maintain or establish habitat connectivity:
   - 2a. Support those who enforce other regulations (Comprehensive Environmental Response, Compensation & Liability Act; Clean Water Act; National Pollutant Discharge Elimination System; Total Maximum Daily Load, etc.) to ensure that habitat is protected:
   - **2b. Minimize and avoid impacts to habitat:**
   - **2c. Minimize and avoid impacts to proposed or designated critical habitat:**

3. Land protection including easement and acquisition
   - 3a. Acquire conservation easements
   - 3b. Acquire land:

4. Restore habitat:
   - 4a. Improve in-stream habitat quality:
   - **4b. Improve riparian habitat quality/increase riparian habitat quantity**
   - **4c. Restore habitat connectivity:**

H

D. MONITORING/RESEARCH (APPENDIX 4)

YELLOW: areas the AppLCC could support

1. Conduct basic life history research in the wild (i.e., *in situ*) for imperiled fishes and mussels:

2. Conduct imperiled fish and mussel population surveys/monitoring.
   - 2a. Identify species for which baseline surveys have/have not been completed, and for which regular population monitoring has/has not been conducted.
   - 2b. Conduct baseline surveys and subsequent routine monitoring:

3. Collect and maintain habitat data/monitor habitat for imperiled fishes and mussels.
   - 3a. Assemble baseline habitat data:
   - 3b. Develop habitat monitoring protocols:
   - 3c. Identify hot spots/focus areas:
   - 3d. Monitor habitat:

4. Evaluate and monitor threats to imperiled fish and mussel species. Existing threats assessments should be compiled and reviewed to minimize duplication of effort.
   - **4a. Assess threats (basin-wide or locally):**
   - 4b. Assess species-specific and/or cross-species threats:
   - 4c. Conduct contaminants assessments:
   - 4d. Identify threat response needs (e.g., spill response):

5. Conduct imperiled fish and mussel genetics monitoring/research
   - 5a. Monitor genetic diversity of extant populations
   - 5b. Quantify level of genetic diversity - augmented and newly established populations.
   - 5c. Monitor genetic diversity of captive populations.

H

D. MONITORING/RESEARCH (APPENDIX 4)

YELLOW: areas the AppLCC could support

6. Conduct imperiled fish and mussel population viability analyses (PVA):
   - 6a. Determine species needing and eligible for PVAs:
   - 6b. Conduct needed demographic research:
   - 6c. Conduct species-specific PVAs:

7. Evaluate areas with potential habitat for imperiled fish and mussel reintroductions.
   - 7a. Evaluate quality of occupied habitat:
   - 7b. Identify and evaluate potential reintroduction sites:
   - 7c. Identify and evaluate prospective refuge populations:

8. Conduct research related to imperiled fish and mussel captive propagation and mgmt:
   - 8a. Prioritize species (fishes and mussels) for which propagation techniques have not been developed:
   - 8b. Identify life history and physiological requirements for propagation, growth, and maintenance, including effects of propagation and captive management on condition of broodstock and cultured progeny

9. Evaluate trophic interactions & ecological functions of fishes and mussels in environment.

10. Identify the social and economic value of functioning aquatic ecosystems.
   - **10a. Conduct audience analysis of habits, attitudes, behaviors, and uses for aquatic ecosystems.**
   - **10b. Quantify economic value of healthy streams to local, regional, and national economies.**
   - **10c. Quantify ecosystem goods and services provided by fishes and mussels to aquatic resources.**

H

E. COMMUNICATION & PARTNERSHIPS (APPENDIX 4)

YELLOW: areas the AppLCC could support

1. Develop a communication and outreach strategy
   - 1a. Identify target audiences.
   - 1b. Develop communication message to target audiences.
   - 1c. Engage communication specialist
   - 1d. Provide information and education:
   - 1e. Develop a Friends group:

2. Work with partners (e.g., industry, non-governmental organizations, private landowners, agencies) to maintain and/or restore habitats or populations
   - 2a. Develop/implement CCAs and CCAs with Assurances for candidate or proposed species:.
   - 2b. Develop Safe Harbor Agreements for listed species: As appropriate.
   - 2c. Develop voluntary agreements, easements, etc.: As appropriate.
   - **2d. Leverage funding for joint projects.**
   - **2e. USFWS or partners funding for research, on-the-ground projects, etc**

3. Work with industry to restore habitat
   - 3a. Identify priority restoration areas
   - 3b. Promote restoration of priority areas

4. Facilitate external communication and cooperation


conservation of our natural resources & trust responsibilities
… in a changing climate
…on a changing landscape means
…..we can't do it alone
Photo Source: B. Smith