

Environmental RD&T Programs

ERDC
Engineer Research and
Development Center

Al Cofrancesco

Technical Director

Engineer Research and
Development Center;
Vicksburg, MS

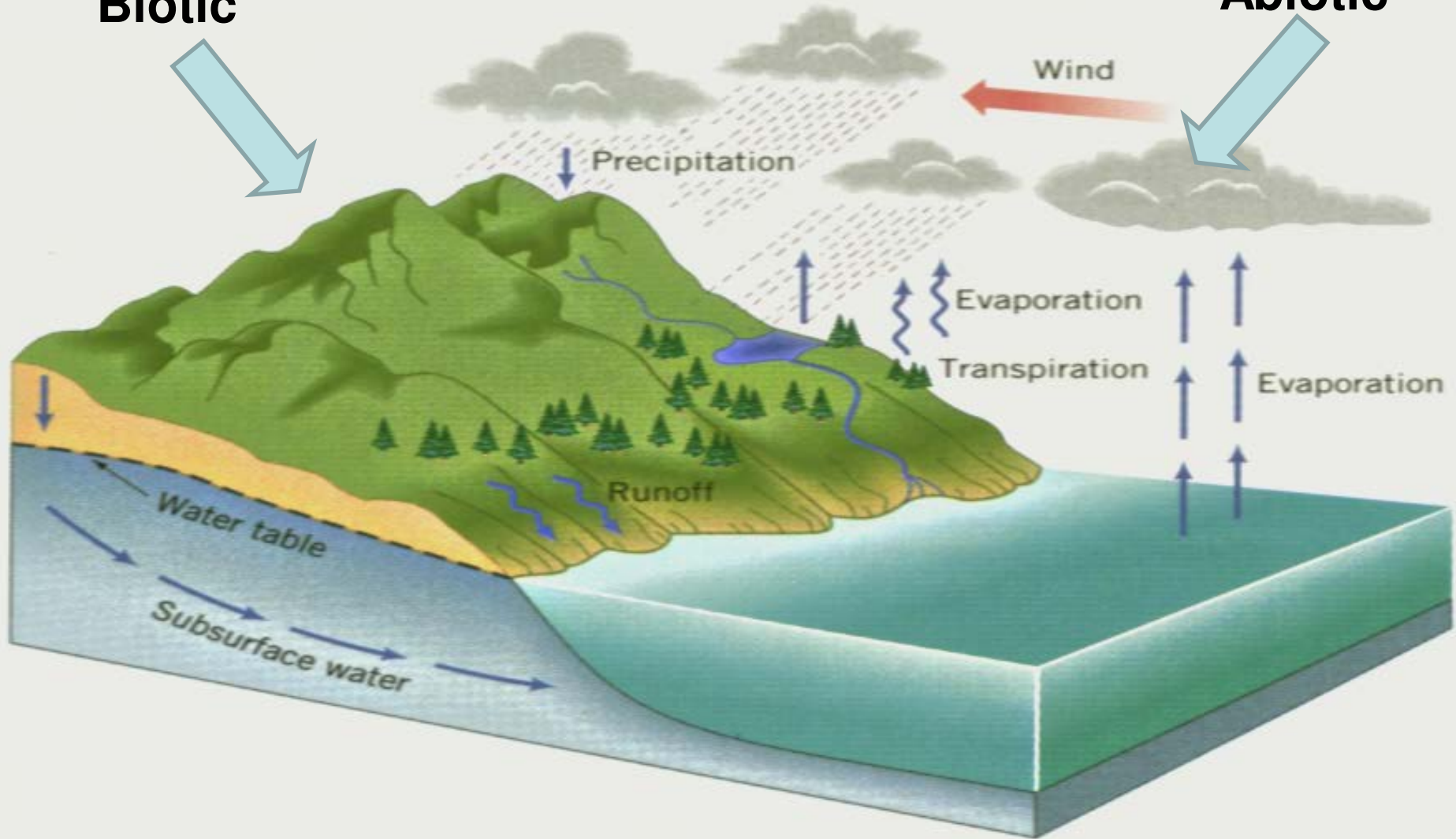
August 2013



Environment/Ecosystems

Biotic

Abiotic



Corps of Engineers Business Areas

Navigation

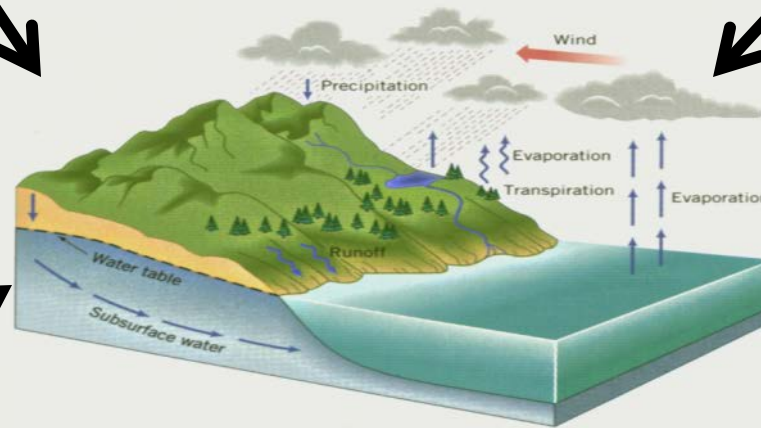
Flood Risk
Management

Hydropower

Regulatory

Ecosystem
Restoration

Recreation



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Vision

Provide the Corps, the Army and the Nation with ecosystem restoration and management technologies that allow effective and economical stewardship of diverse aquatic habitats



Wetlands



Dam Removal



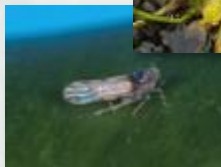
Large & Interdisciplinary



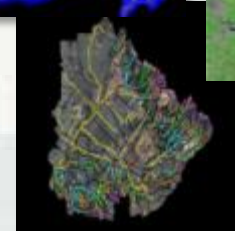
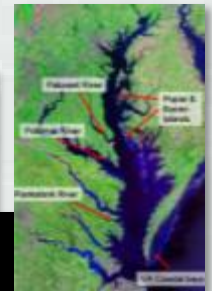
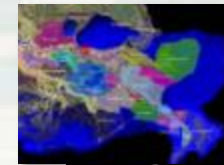
T&E Species



Invasive Species



Beneficial Uses



Civil Works Business Area

Direct-Allotted Programs

Research & Development (R&D)

- Aquatic Nuisance Species -- O&M Funding
- Aquatic Plant Control – CG Funding
- Dredging Operations & Environmental Research – O&M Funding
- Ecosystem Management and Restoration – GI Funding

Technical Support

- Dredging Operations Technical Support -- O&M Funding
- Natural Resources Management -- O&M Funding
- Recreation Management Support -- O&M Funding
- Water Operations Technical Support -- O&M Funding
- Wetlands Regulatory Assistance Program –Regulatory Funding/O&M



Civil Works Business Area

R&D Programs Authorities

- **Aquatic Nuisance Species**
1990 Aquatic Nuisances Species Act
- **Aquatic Plant Control**
1958 River and Harbor Act
- **Dredging Operations & Environmental Research**
Navigation Business Line
- **Ecosystem Management and Restoration**
Ecosystem Restoration Business Line



Aquatic Nuisance Species

- **Authority:** Aquatic Nuisance Species Prevention and Control Act of 1990
- **Products:** Effective, economical, and environmentally compatible management techniques for problems caused by aquatic nuisance animal species associated with Corps and public facilities
- **Research Requirements:** Generated by Headquarters and Invasive Species Leadership Team



Aquatic Plant Control

- **Authority:** River and Harbor Act of 1958, as amended
Chief of Engineers directive “the APCRP is responsible for management of the Nation’s aquatic plant research program”
- **Products:** Effective, economical, and environmentally compatible techniques for identifying, assessing, and managing invasive aquatic plant problems
- **Research Requirements:** Generated by Headquarters and the Invasive Species Leadership Team and Outside Agencies



Aquatic Plant Control



Focus Areas



- **Biological Control**
- **Chemical Control**
- **Ecology Assessment**



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Dredging Operations & Environmental Research

- **Authority:** Established to meet the Navigation Business Line Needs
- **Products:** Research is designed to balance operational and environmental initiatives and to meet complex economic, engineering, and environmental challenges of dredging and disposal in support of the navigation mission
- **Research Requirements:** - Generated by Headquarters and the Navigation Research Area Review Group



Ecosystem Management and Restoration

- **Authority:** Established to meet the Ecosystem Restoration Needs
- **Products:** The EMRRP provides rapid, cost-effective technology to meet the Corps' most pressing research and development needs in ecosystem management and restoration; e.g., functional assessment, restoration techniques, environmental benefits, and stewardship of high priority ecosystems.
- **Research Requirements:** Generated by Headquarters and the Environmental Research Area Review Group



Ecosystem Management and Restoration

- Maximize Value to the Nation from Ecosystem Restoration and Management (ER&M) Activities
- Ensure Ecological Integrity and Sustainability of ER&M Projects
- Improve Capabilities to Design and Implement ER&M in Urban Settings
- Enhance Resilience and Reliability of Coastal ER&M Projects
- Considerations for T&E and Invasive Species in ER&M Projects



Civil Works Business Area

Tech Support Programs

- Dredging Operations Technical Support (DOTS)
- Natural Resources Management (NRM)
- Recreation Management Support Program (RMSP)
- Water Operations Technical Support (WOTS)
- Wetlands Regulatory Assistance Program (WRAP)



Tech Support Programs

- **DOTS:** The Dredging Operations Technical Support Program provides direct environmental and engineering technical support to the U.S. Army Corps of Engineers Operations and Maintenance (O&M) dredging mission. Technology transfer activities have supported diverse field needs for years and have directly benefited O&M dredging operations throughout the United States.



Tech Support Programs

- **NRM:** The Natural Resource Management Program provides tech support to Corps natural resource managers for managing and conserving cultural and natural resources on Corps owned lands/waters. These practices must remain consistent with ecosystem management principles, while providing quality public outdoor recreation experiences to serve the needs of present and future generations.

- **RMSP:** The Recreation Management Support Program is designed to provide support for recreational issues or initiatives that have broad applicability to Corps Civil Works projects nationwide.



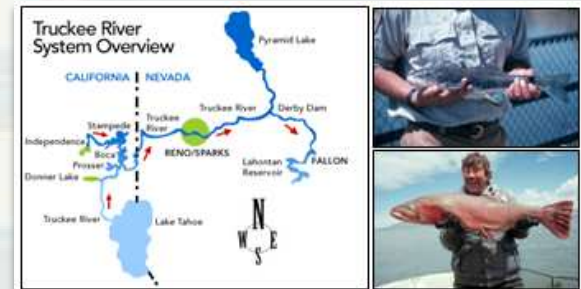
Tech Support Programs

- **WOTS:** The Water Operations Technical Support Program was initiated in FY 1985 and provides effective environmental and water management engineering technology for a wide range of water resource management problems at Corps of Engineers reservoir and waterway projects, and in the river systems affected by project operations nationwide.
- **WRAP:** The Wetlands Regulatory Assistance Program was initiated in the 1990 and provides direct scientific and engineering technical support to the Corps' Clean Water Act Jurisdictional duties under the Regulatory Business practice.



Major Requirements/Mission Drivers

- Water Resources Development Act of 1986 Added the Ecosystem Restoration Mission to the Corps Engineers
- The Corps of Engineers is involved with 10 Major restoration projects and a plethora of other smaller restoration activities in the US
- Corps Campaign Plan-- Objective 2d: Enable Gulf Coast recovery.
- Clean Water Act of 1977
- Environmental Operating Principles



“The best way for us to deal with these issues is to consider the perspectives of all stakeholders, apply the best science and engineering technology available and strive to achieve a synergy among environmental, economic and social interests, using the concept of environmentally sustainable development.”

*LTG Flowers 2003
Policy Memorandum #12*

Revised and Updated August 2012

LTG Bostick



USACE Environmental Operating Principles



Strive to Achieve Environmental Sustainability. An environment maintained in a healthy, diverse and sustainable condition is necessary to support life.

Consider Environmental Consequences. Recognize the interdependence of life and the physical environment. Proactively consider environmental consequences of Corps programs and act accordingly in all appropriate circumstances.

Seek Balance and Synergy among human development activities and natural systems by designing economic and environmental solutions that support and reinforce one another.

Accept Responsibility. Continue to accept corporate responsibility and accountability under the law for activities and decisions under our control that impact human health and welfare and the continued viability of natural systems.

Mitigate Impacts. Seeks ways and means to assess and mitigate cumulative impacts to the environment; bring systems approaches to the full life cycle of our processes and work.

Understand the Environment. Build and share an integrated scientific, economic, and social knowledge base that supports a greater understanding of the environment and impacts of our work.

Respect Other Views. Respect views of individuals and groups interested in Corps activities, actively listen, and learn from their perspective in the search to find innovative win-win solutions to the nation's problems, solutions that also protect and enhance the environment.



Major Research Focus Area

- **Restoration Activities**
- **Integrated Water Resource Management**
- **Environmental Benefits/Good and Services**
- **Threatened and Endangered Species & Invasive Species**



Ecosystem Restoration Mission

- **Water Resources Development Act of 1986**
 - *Reestablished and refined by purpose, the Federal interest in water resources development*
 - *Added Ecosystem Restoration Mission*



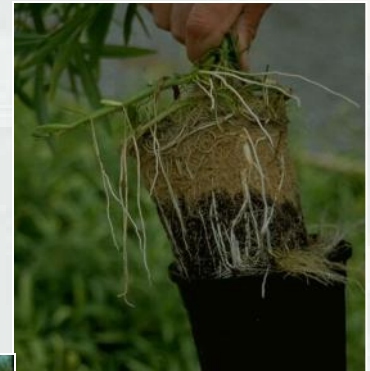
Major Research Focus Area: Restoration

- **Restore degraded ecosystem function, structure, and dynamic processes to a less degraded more natural condition.”**
- **Ecosystem restoration efforts involve a comprehensive examination of the problems contributing to the system degradation, and the development of alternative means for their solution.**
- **Restoration is intended to partially or fully reestablish the attributes of a naturalistic, functioning, and self-regulating system**



What do we mean by ecosystem restoration?

- Are we establishing functional habitats?
- Are we establishing biological processes?
- Is the system self maintaining?
- When is restoration complete?



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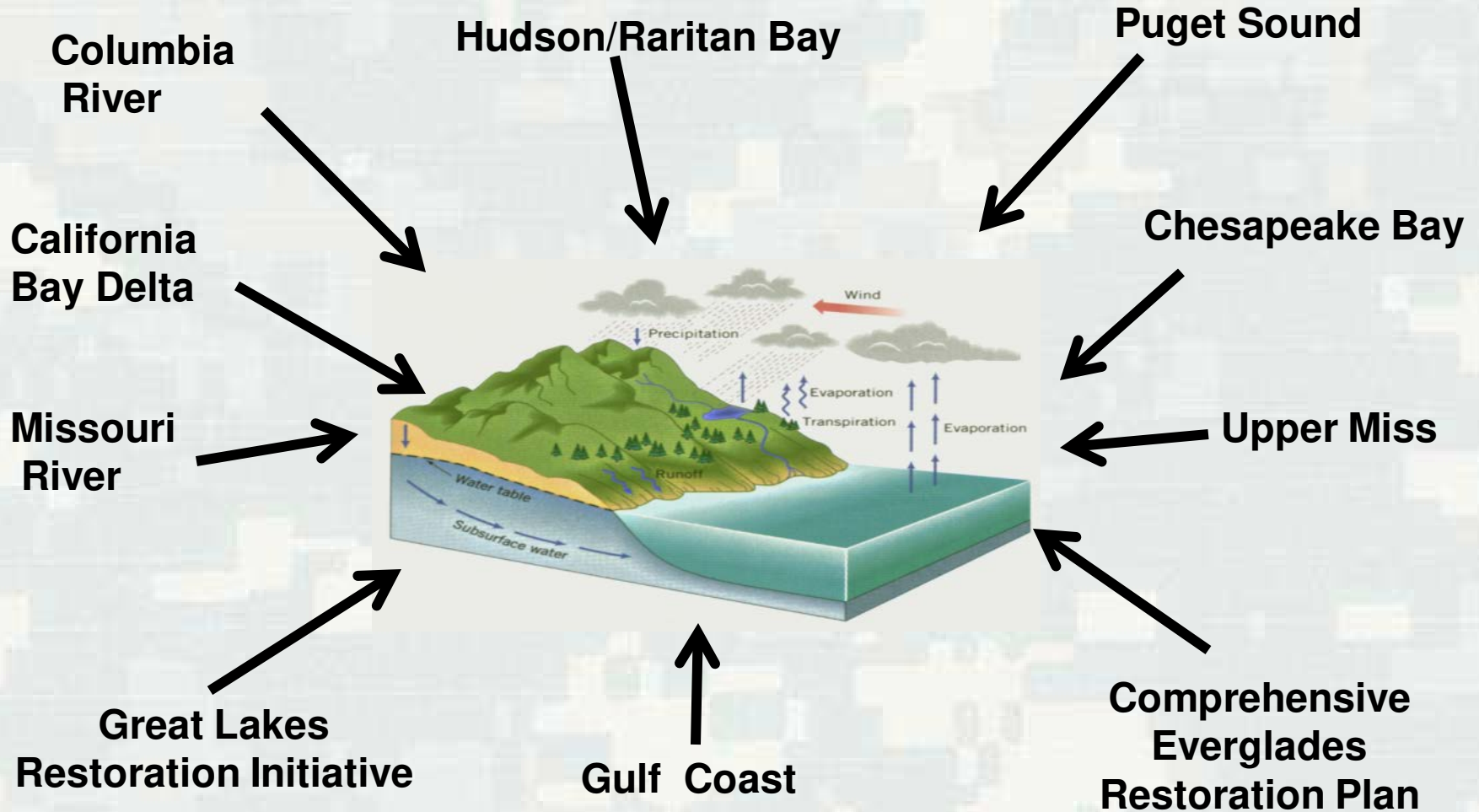
What are the requirements?



- Habitat for animals
- Maintain a water balance
- Recharge water supplies
- Remove nutrients and toxins
- Maintain the natural balance



Corps of Engineers

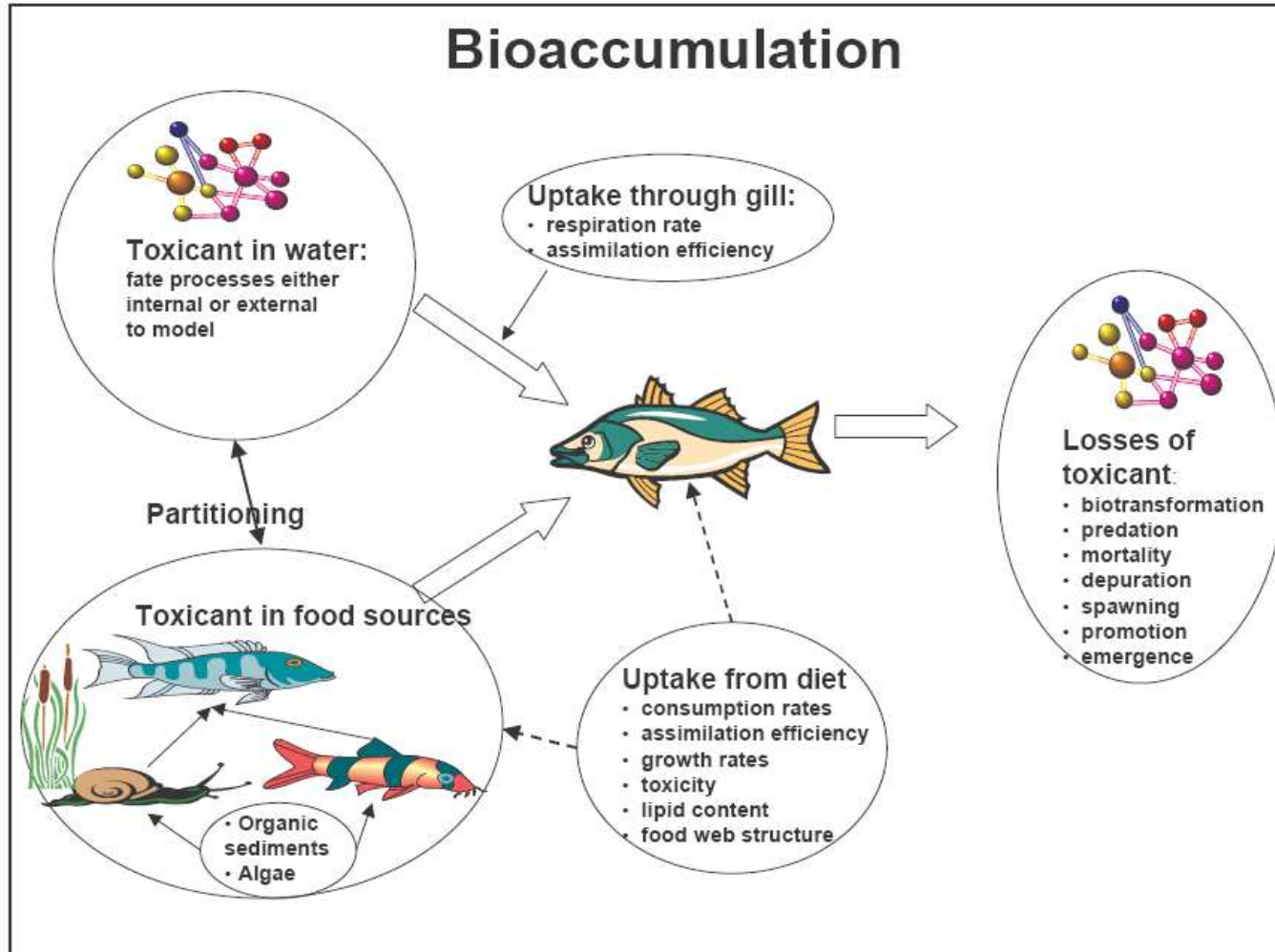


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Bioaccumulation Modeling



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Source: Imhoff et al. (2004)

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Case Study: Fish Passage Restoration

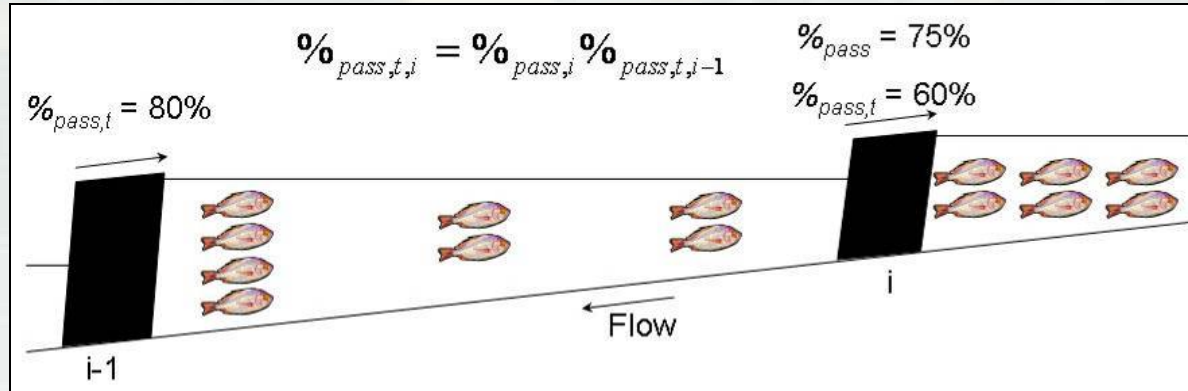
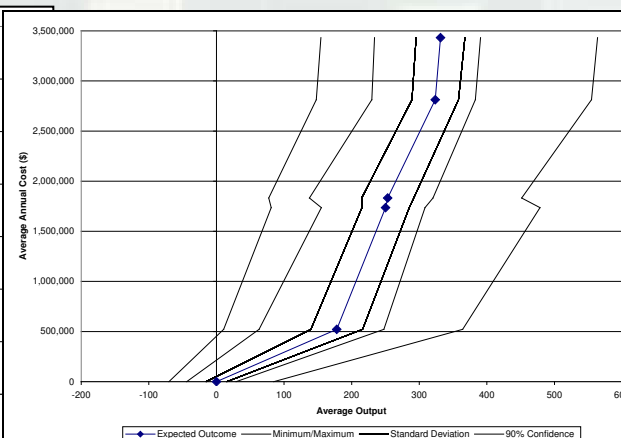
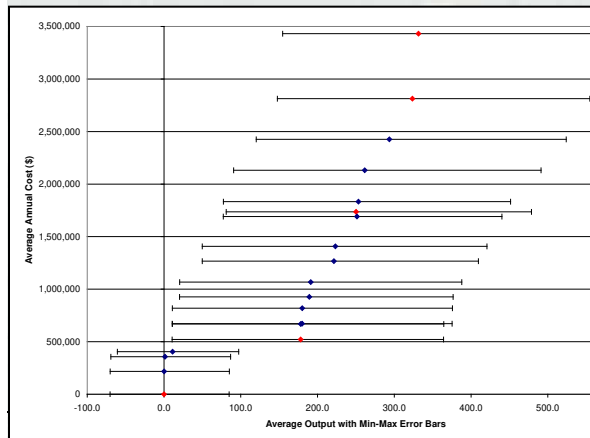
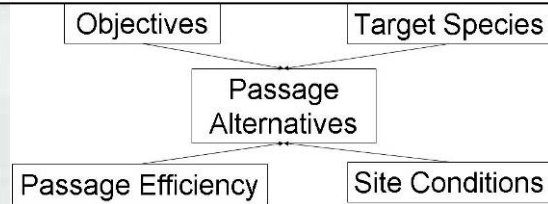


Table 1. Summary of fish passage obstructions on the Truckee River considered in this study.

Structure	River mile (mi)	Relative Diversion Discharge (%)*	Structure Height (ft)
Pyramid Lake	0		
Marble Bluff	4	0.0	35
Numana	12.5	3.1	12
S-S	21.75	0.6	0.3
Fellnagle	27	0.6	4
Hessman	31.5	1.9	2.4
Derby	39.5	25.8	?
Tracy PP	44	3.9	?
Cochran	66	0.8	0.3
Idlewild Ponds	66.5	0.3	0.3
Chalk Bluff	69.8	10.7	3
Orr	70	3.3	0.3
Lake	71.5	1.8	0.3
Last Chance	73	2.6	0.3
Washoe-Highlands	76	34.9	8 - 10
Verdi	80.5	40.6	13
Steamboat	83.5	7.0	10
Fleisch	86	44.0	14
Lake Tahoe	121.1		



Submerged Aquatic Vegetation Restoration (Underwater Grasses)



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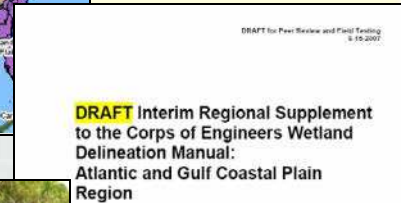
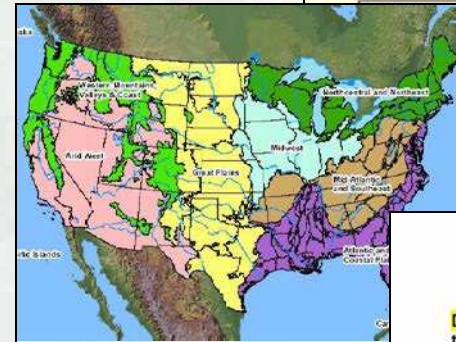
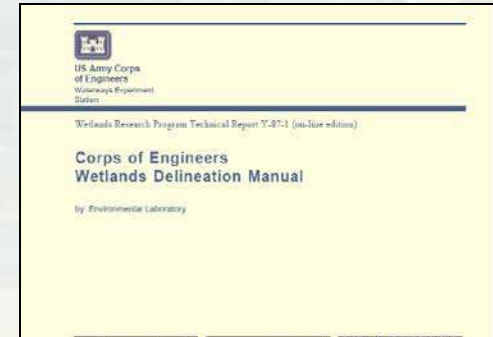
Wetlands Research

ERDC developed Wetlands Delineations Manual mandated for all Section 404 Clean Waters Act wetland delineations used by all Districts

Leading over 200 scientist from Many agencies/universities developing regional supplements as recommended by National Research Council

Developing Hydrogeomorphic (HGM) manuals supporting Section 404 implementations by 28 Districts

Developed special manual for 12 western districts



Dam Decommissioning, Retrofits, & Operations

- 2,500,000 dams in US
 - 58,000 to exceed design lifespan by 2020
 - 61 dam failures and 520 incidents, 2100 structures classified as unsafe
- Alterations to habitat, hydrology, sediment budgets, & water quality
- Ecological and physical impacts of removals and retrofits not considered
- Guidelines needed for effective fate determination and implementation

Teton Dam failure, ID, 1976



Rockfish Creek Dam failure, NC, 2003

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Is Removal Beneficial?



DAM_Explorer: A Modeling Framework for Assessing the Physical Response of Streams to Dam Removal



June 2009

By Jock Conyngham¹ and Chris Wallen²

Data Needs and Case Study Assessment for Dam Fate Determination and Removal Projects; A Checklist

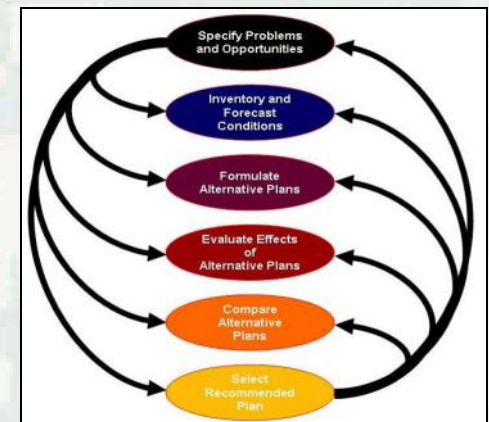
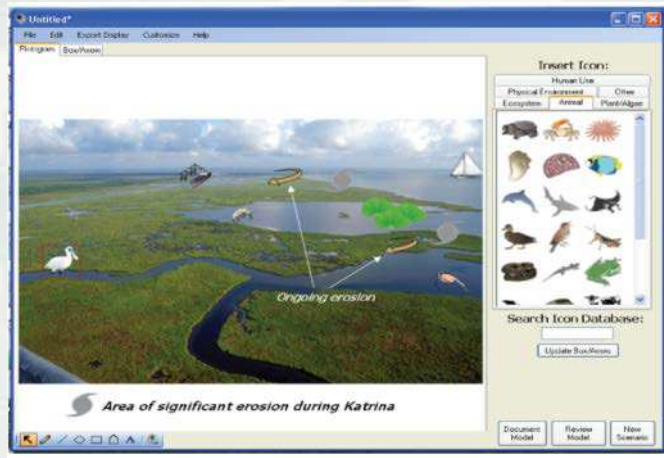


June 2009

By Jock Conyngham¹

Major Research Focus Area: Environmental Benefits/Good and Services

- Developing improved benefit/output evaluation techniques, models and tools with emphasis on scientifically based and peer-recognized metrics for the analysis of ecosystem restoration projects
- Restore degraded ecosystem function, structure, and dynamic processes to a less degraded more natural condition
- Develop self-sustaining ecosystem consisting of natural processes



Environmental Benefits/ Goods and Services

Improve restoration planning practice

- Capability to account for full range of ecological benefits & losses (socio-economic)
- Improved decision making based on more holistic suite of ecological considerations
- Framework development will consider how to integrate the products of other EMRRP work units

Improve communication of benefits to Local Sponsor, stakeholders, and decision-makers

- Better terms to describe ecological benefits, and goods and services that decision-makers and public can understand / value

Corps Capability

- Guidelines / Framework for standard approach to the application of EGS throughout the Corps



Engineering with Nature



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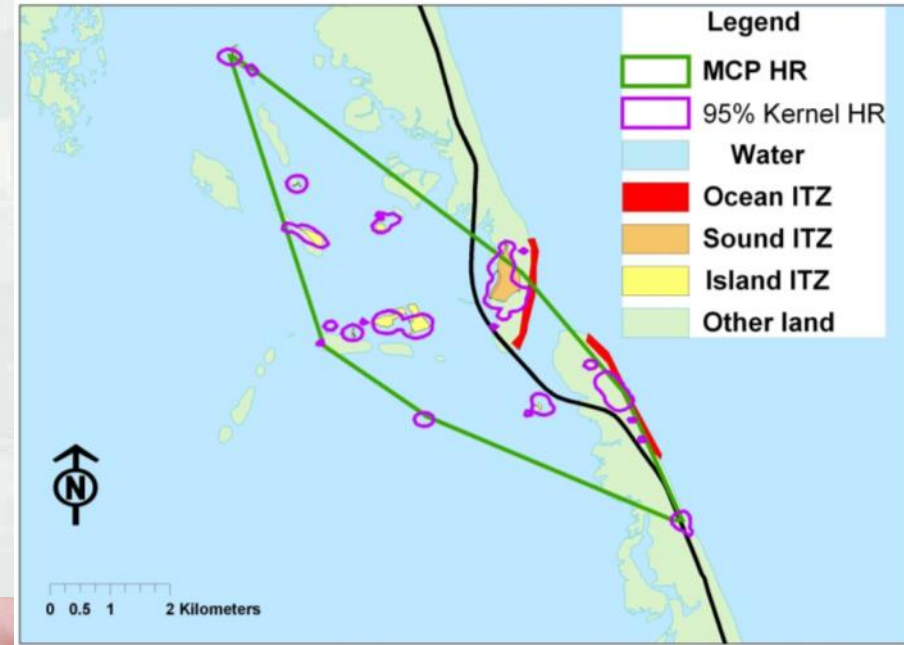
Major Research Focus Area:

Threatened and Endangered Species & Invasive Species

- Research efforts are currently focused on the development of ecologically based, integrated management strategies for controlling invasive species
- Research is conducted on federally protected Threatened and Endangered species that are impacted by Corps of Engineers operations



Winter Ecology of Piping Plovers at Oregon Inlet, North Carolina



Collaborative research between ERDC and Department of Fisheries and Wildlife Sciences, Virginia Tech University



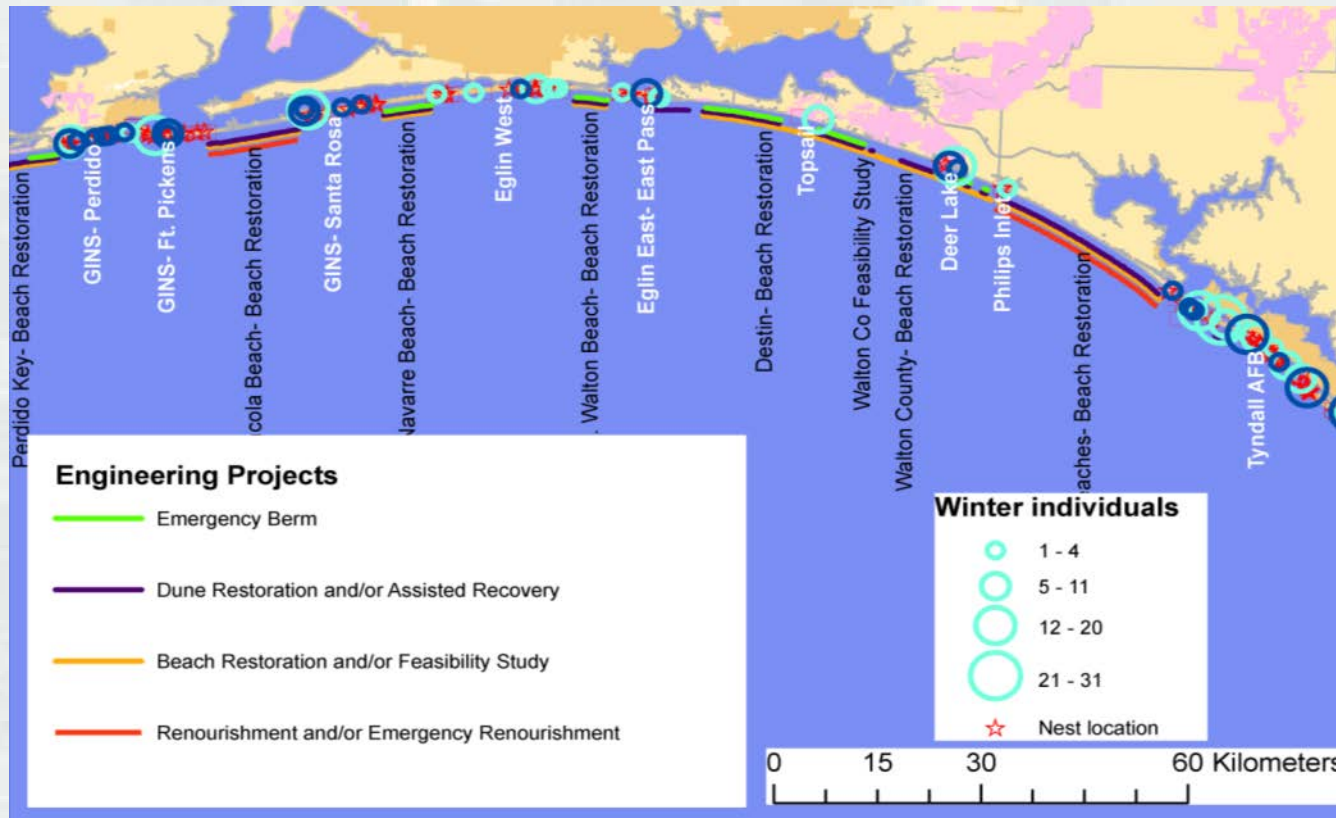
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Factors that Limit Presence of Snowy Plovers in Florida



- SNPL not present in engineering project areas
- Is this due to habitat loss and/or disturbance?



Technology Transition

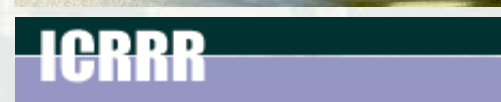
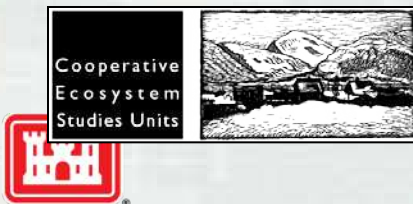
Eco-Restoration Gateway: *web-based repository for available tools, databases, standard methods, protocols, policies, lessons learned...*

Demonstrations: *successful, low maintenance techniques and approaches to ecosystem restoration, Webinars*

Training: *all aspects of Corps ecosystem restoration process*

Technical Support Program: *support districts in model applications, model certification, plan formulation, engineering and ecological design, etc*

Restoration Research Network: *geographically dispersed network of demonstration/ training/ research sites*



Questions



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