

Stream Restoration Education and Professional Development: Working Toward a Consensus

ASCE Stream Restoration Educational Materials
Task Committee

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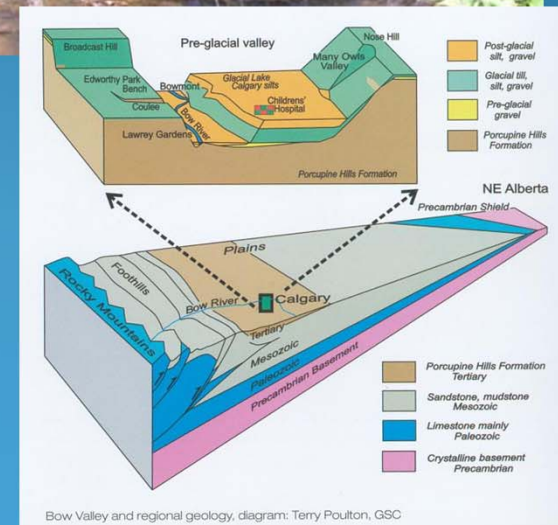
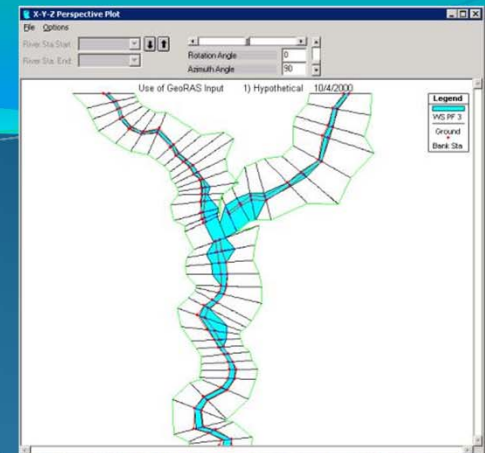


Introduction

- Who are we?
 - **ASCE Hydraulics and Waterways Council, River Restoration Committee**
 - **ASCE Stream Restoration Educational Materials Task Committee**
 - Chair: Sue L. Niezgoda
 - Vice-Chair: Donald Carpenter
 - Secretary: John Schwartz
 - Active Members:
 - **Practitioners:** Clayton Anderson, Will Harman, Greg Koonce, Dave Rosgen, Louise Slate
 - **Government:** Janine Castro, Andrew Simon, Doug Shields
 - **Academics:** Jeffrey Clark, Rollin Hotchkiss, Jeff Marr, Joanna Curran, Garey Fox, Peggy Johnson, Christine Pomeroy, Jack Schmidt, Peter Wilcock, Tess Wynn

Introduction

- Restoration is Multi-Disciplinary
 - Engineering, Geology, Fisheries Biology, Landscape Architecture
 - Professional Certification or Licensure
 - Engineering – PE License – NCEES
 - Geology – PG License – ASBOG
 - Fisheries Biology – AFS Certification
 - Landscape Architecture – LA License – ASLA and CLARB
 - **What do all these have in common?**



Professional Certification and Licensure



- Professional Engineering License (NCEES)
 - Graduate from ABET Program
 - Fundamentals of Engineering Exam
 - **minimum level of competence**
 - Four years of professional experience under a PE
 - Pass the Principles and Practices of Engineering Exam
- *Professional licensure protects the public by enforcing standards that restrict practice to qualified individuals who have met specific qualifications in education, work experience, and exams.*

Professional Certification and Licensure

- Professional Geologist
 - Degree in Geology or Related Geologic Science
 - Fundamentals of Geology Exam
 - **minimum level of competence**
 - Earn five years experience working with a PG
 - Pass the Practice of Geology Exam (ASBOG)
 - *Promote the profession of geology and to provide a framework for establishing standards of excellence*



National Association of State Boards of Geology

Professional Certification and Licensure

Degree	Experience Requirements
Bachelor of Science, Bachelor of Arts or equivalent degree	five years of full-time qualifying experience, post-bachelor's degree.
Master of Science, Master of Arts or equivalent degree	four years of full-time qualifying experience, post-bachelor's degree.
Doctor of Philosophy or equivalent degree	two years of full-time qualifying experience, post-bachelor's degree.

- Fisheries Biology
 - American Fisheries Society – Certification
 - Fisheries Professional Associate
 - **meet minimum education requirements**
 - Fisheries Professional Certified – meets minimum education, professional development, and experience requirements
 - *(1) to provide . . . a definitive minimum standard of experience and education for fisheries professionals; and (2) to foster broader recognition of fisheries professionals as well-educated and experienced, acting in the best interest of the public.*

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ASCE Task Committee Goals

- Goals:
 - Developing a recommended curriculum
 - Identifying suitable educator traits
 - Developing logistics to disseminate info
- Why are we doing it?
 - Advance the quality of restoration planning, design, implementation, monitoring, and management
 - Clarify the education/training needs of professionals
 - ***Define a minimum level of competence for practicing professionals***





Prior Studies



- RRNW, OSU, PSU(2003) - Survey
 - Multidisciplinary field training required
 - Fisheries /CE's greatest range across disciplines
 - Results region specific - left questions on logistics
- AFS Bioengineering Section (2003)
 - BS and MS Level (thesis) Curriculum
 - Great for university curriculum, but what about the practicing professional?




Prior Studies



- NCEd (2006) – SR Training Evaluation Team
 - Conclusions:
 - Practitioners have degree but do not have restoration coursework
 - Short courses fill this gap
 - No consistent content or pattern to short course curricula
 - Introductory in nature, require no pre-requisites, does anyone ever fail?
 - Result:
 - Need for professional certification to test for a **minimum level of qualifications** across disciplines



NATIONAL CENTER FOR EARTH-SURFACE DYNAMICS

A National Science Foundation Science and Technology Center 



Task Committee Efforts

- How are we achieving our goals?
 - **Task #1 – Determine what is out there now**
 - Compile information on existing restoration educational materials/courses
 - Institution or Organization
 - Course Title
 - Course Instructor
 - Course Objectives/Outcomes/Content
 - **Summarize the current state-of-the-art in restoration education**



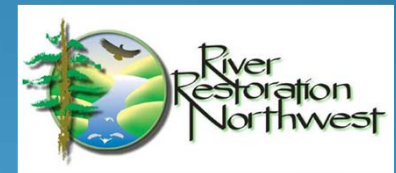
Portland State University
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Continuing Education
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Task Committee Efforts



- How are we doing it?
 - Task #2 – Determine what is needed by the profession
 - Survey of restoration professionals
 - MASRC(November 2009)
 - RRNW Annual Symposium (February 2010)
 - UMSRS (February 2010)
 - Listserves, Email, Word of Mouth, etc.



PRRSUM

PARTNERSHIP FOR RIVER RESTORATION AND SCIENCE IN THE UPPER MIDWEST





National Association of State Boards of Geology

Practitioner Survey

- Demographic Information
- What is Needed in a Curriculum (Body of Knowledge)?
 - Courses?
 - Level of Learning?
 - Instructor?
- Is Professional Certification Warranted and Feasible?



Results

- 150 Completed Surveys
 - 65% - Northwest/Upper Mid-West
 - 15% - Mid-Atlantic
 - 9% - Southwest
 - 6% - Southeast
- Demographic Information
 - Expertise and Responsibilities
 - 24% Engineering, 18% Fluvial Geomorphology
 - 31% Design, 20% Project Management
 - Experience Level
 - 49% > 8 years – “experts”
 - 17% - 4-8 years
 - 17% - 2-4 years
 - 17% - < 2 years

Table 1
Practitioner Expertise and Responsibility

	Frequency
Discipline of Expertise	
Construction Management	1%
Ecology	14%
Engineering	24%
Environmental Science	6%
Fisheries Biology	11%
Fluvial Geomorphology	18%
Forestry	1%
Hydrology	8%
Landscape Architecture	1%
Project Management	8%
Other	7%
Stream Restoration Responsibilities	
Design	31%
Implementation	12%
Monitoring/Assessment	13%
Operations/Maintenance	1%
Project Management	20%
Regulatory Review	6%
Research	12%
Teaching	2%
Other	4%

Demographics

- Sector
 - Private consulting
 - State, Local or Tribal Government
- Practitioner Education
 - On-the job
 - University Degree or Continuing Ed

Figure 2

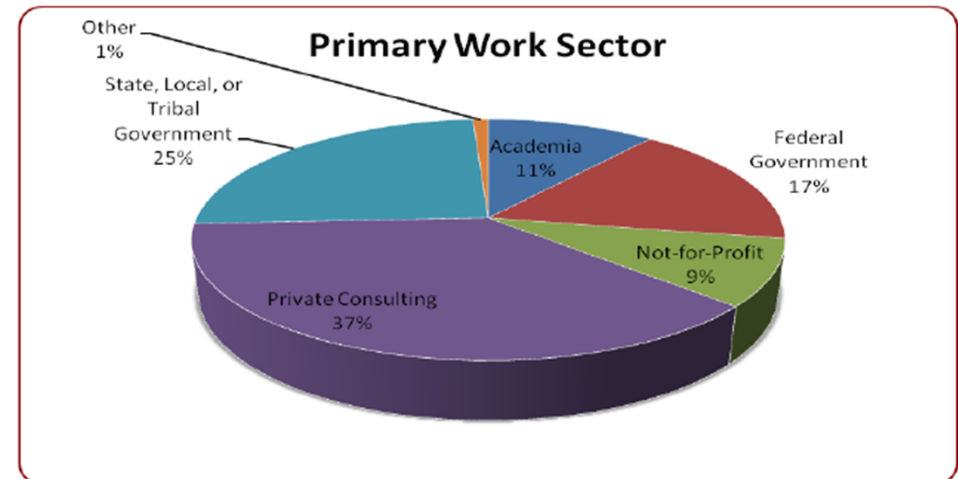
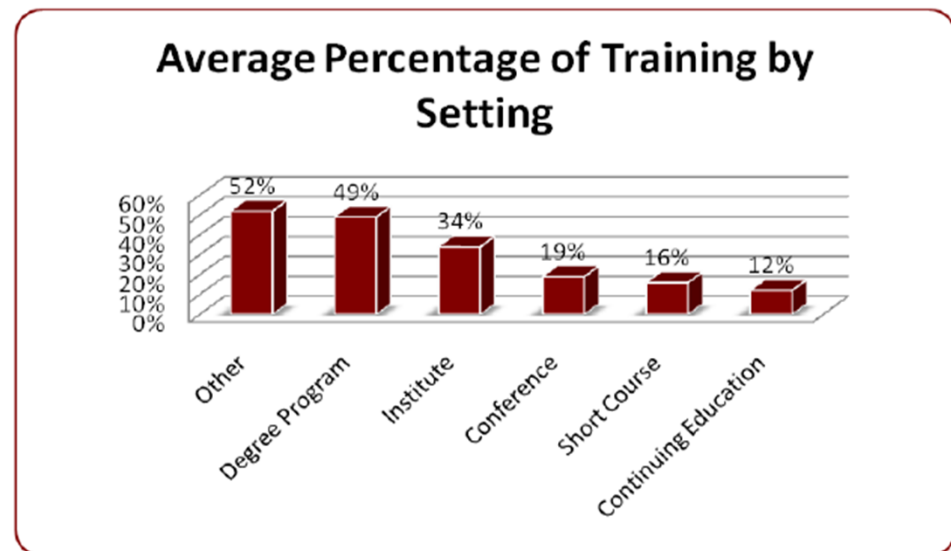


Figure 4



Body of Knowledge - Courses

- Physical Processes Fundamentals
 - **Watershed Processes/Hydrology**
 - **Open Channel Flow**
 - **Geomorphology**
 - **Sediment Transport**
- Ecological and Biological Processes Fundamentals
 - **Stream Ecology**
 - **Habitat Structure and Function**
 - **Fish and Wildlife Biology**
 - **Botany/Riparian Dynamics**
- SR Assessment and Monitoring
 - **Surveying**
 - **Watershed Analysis**
 - **Geomorphic/Habitat Assessment**
 - **Biomonitoring/Bioassessment**
- Restoration Design
 - **Design Approaches/Fundamentals**
 - **Alternatives Analysis**
 - **Analytical Techniques**
 - **Ecohydraulics**
- Restoration Project Management
 - **Project Development**
 - **Risk and Uncertainty**
 - **Communication**
 - **Construction Management**

Results

- Rank level of agreement with these topics/courses
 - Majority agreed that courses presented were appropriate

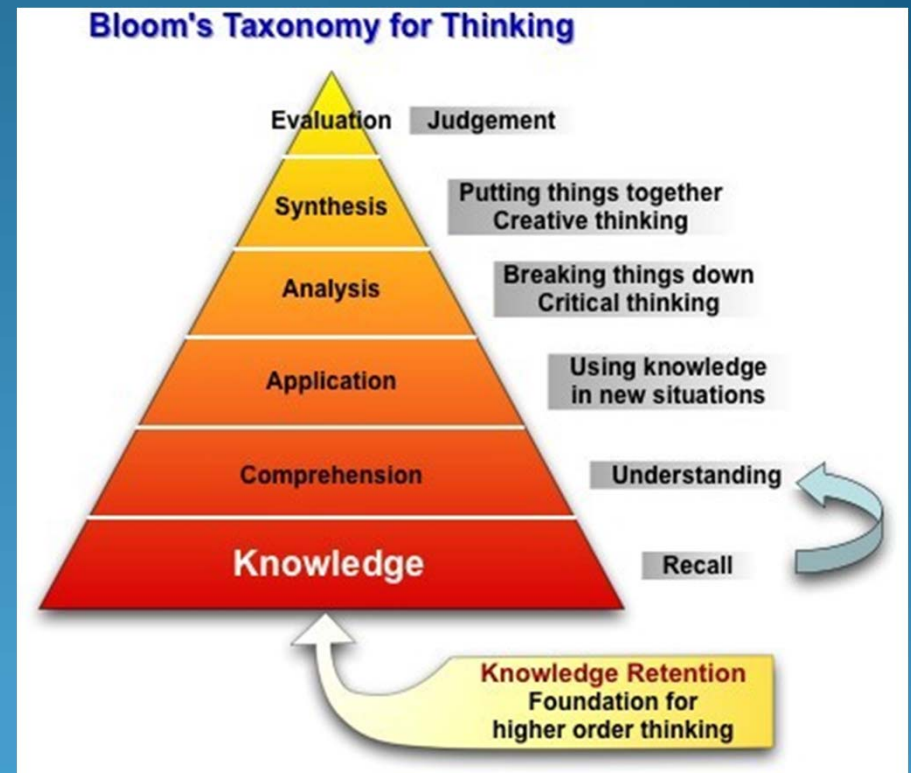
Table 2
Agreement with Body of Knowledge Content
Scale: 4 = Strongly Agree; 1 = Strongly Disagree

Body of Knowledge	Mean
Physical Processes	3.54
Ecological & Biological Processes	3.45
Stream Restoration Assessment & Monitoring	3.30
Restoration Design	3.20
Restoration Project Management	3.16

- **Additional Courses Suggested:**
 - GIS, soil mechanics, adaptive management, water quality, ethics
 - Others?

Outcomes

- Body of Knowledge – Minimum Level of Learning
 - **Bloom's Taxonomy**
 1. **Define** key aspects of topic.
 2. **Explain** key concepts and problem solving processes.
 3. **Apply** knowledge and **Solve** simple problems.
 4. **Analyze** complex systems or processes.
 5. **Design** a complex system or **Create** new knowledge.
 6. **Evaluate** the design of a complex system or process.



Results

- Outcomes
 - 6 = Evaluate
 - 5 = Design
 - 4 = Analyze
 - 3 = Apply
 - 2 = Explain
 - 1 = Define
 - Average Level of Learning
 - *Apply and Solve Simple Problems*
 - Design Approaches
 - *Analyze Complex Systems or Processes*
 - Seasoned Experts
 - *Analysis in Physical Processes Fundamentals and Restoration Design*

Material	Mean
Physical Processes (Fundamentals)	
Watershed Processes/Hydrology	3.34
Open Channel Hydraulics	3.25
Geomorphology	3.46
Sediment Transport	3.26
Ecological and Biological Processes (Fundamentals)	
Stream Ecology	3.20
Habitat Structure and Function	3.50
Fish and Wildlife Biology	2.94
Botany/Riparian Vegetation Dynamics	3.14
Stream Restoration Assessment and Monitoring	
Surveying	3.08
Watershed Analysis	3.52
Geomorphic/Habitat Assessment	3.58
Biomonitoring/Bioassessment	3.12
Restoration Design	
Design Approaches/Fundamentals	4.01
Alternative Development and Analysis	3.95
Analytical Techniques	3.73
Ecohydraulics	3.15
Restoration Project Management	
Project Development	3.54
Risk and Uncertainty	3.44
Communication	3.63
Construction Management/Implementation	3.56

Results

- Body of Knowledge – Suggested Instructors
 - (1) University Faculty
 - (2) Researcher
 - (3) Professional Practitioner
 - (4) Government Regulator/Reviewer
- Results:
 - Physical and Ecological Processes – University Faculty
 - Design, M&A, and Proj. Management - Practitioners



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Eric Petersen / The Livingston Enterprise

Results

- Requirements for Certification:

Table 5

Average Rating of Potential Certificate Requirements

Scale: 5 = One of the Best; 1 = One of the Worst

Potential Requirement	Mean
Established Curriculum	3.69
Continuing Education Credit	3.52
National Exam	2.83
Portfolio	3.99
Professional Experience	4.14
Endorsements	3.26

Summary of Results

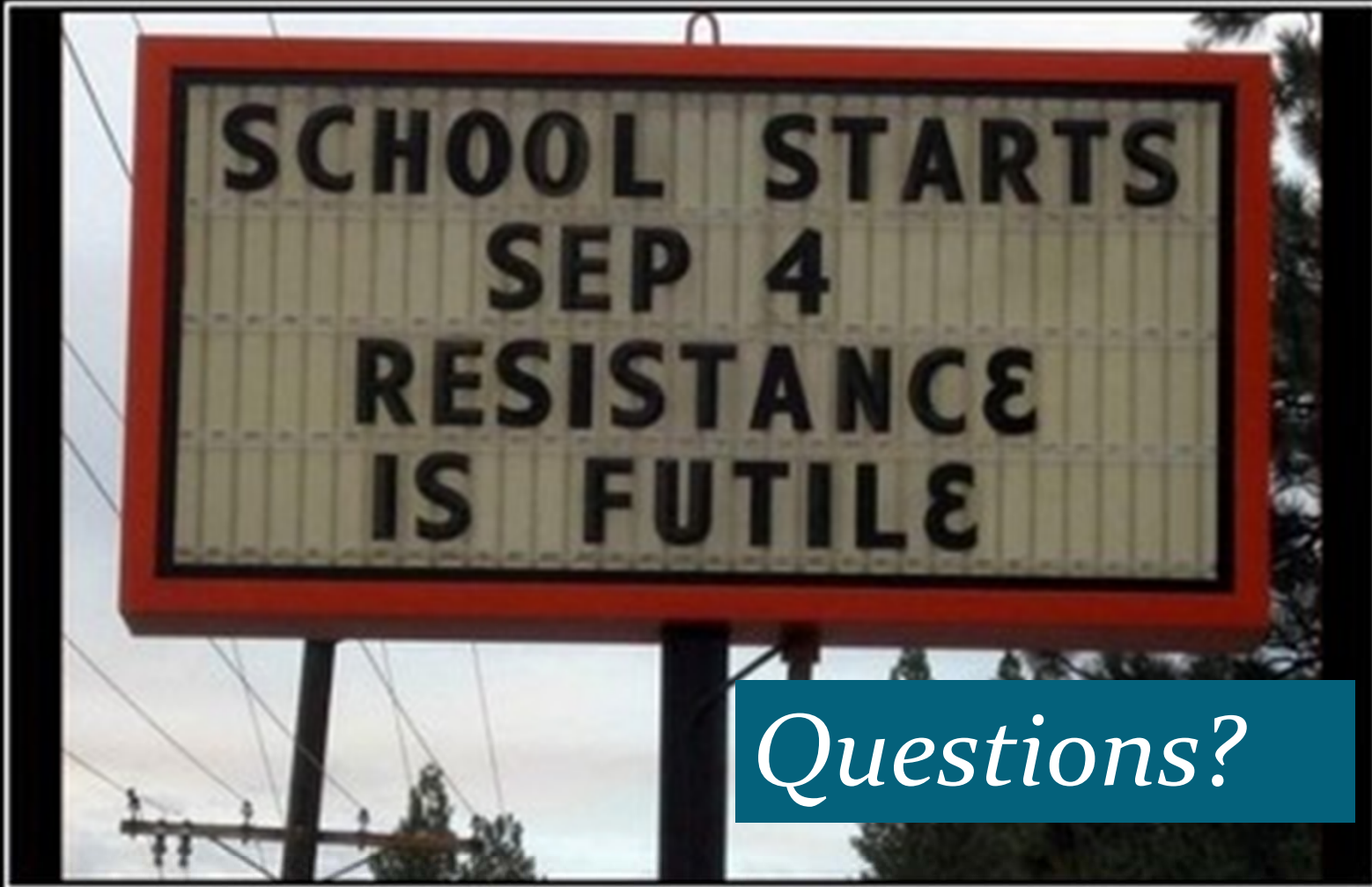
- Educational background and areas of expertise
 - Multi-disciplinary and diverse
 - On-the job training and college/short courses
- Restoration curriculum – multi-disciplinary with courses in
 - Physical Processes
 - Ecological and Biological Processes
 - Monitoring and Assessment
 - Restoration Design
 - Restoration Project Management
- Average Level of Learning in Courses = **Application**
- University **faculty** should teach **fundamentals**
- **Practitioners** should teach **M&A, Design, Project Management**
- Professional **certification warranted**
Requirements - professional experience and portfolio of projects

Civil Engineering Outcomes

Outcome Title	Level of Achievement					
	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
<i>Foundational</i>						
Mathematics	B	B	B			
Natural Sciences	B	B	B			
Humanities	B	B	B			
Social Sciences	B	B	B			
<i>Technical</i>						
Material Science	B	B	B			
Mechanics	B	B	B	B		
Experiments	B	B	B	B	M/30	
Problem Recognition and Solving	B	B	B	M/30		
Design	B	B	B	B	B	E
Sustainability	B	B	B	E		
Contemporary Issues and Historical Perspectives	B	B	B	E		
Risk and Uncertainty	B	B	B	E		
Project Management	B	B	B	E		
Breadth in Civil Engineering Areas	B	B	B	B		
Technical Specialization	B	M/30	M/30	M/30	M/30	E
<i>Professional</i>						
Communication	B	B	B	B	E	
Public Policy	B	B	E			
Business and Public Administration	B	B	E			
Globilization	B	B	B	E		
Leadership	B	B	B	E		
Teamwork	B	B	B	E		
Attitudes	B	B	E			
Life Long Learning	B	B	B	E	E	
Professional and Ethical Responsibility	B	B	B	B	E	E

ASCE BOK₂ (2008)

B Bachelor's Level
 M/30 Master's Specialization
 E Engineer In Training Professional Experience



BACK TO SCHOOL

Resistance is futile at Borg High

