Syllabus

1. Course Information
   
   Title: Introduction to Watershed Management
   
   Course Number: NRM F370
   
   Credits: 3
   
   Prerequisites: NRM F101 or instructor approval
   
   Location: University of Alaska Fairbanks O’Neill 359 and nearby field sites
   
   Lecture: Tuesday/Thursday 11:45 am – 12:45 pm
   
   Lab: Friday 11:45 am – 2:45 pm

2. Instructor: Christina Buffington, M.S., M.Ed.
   
   203E Akasofu, UAF Main Campus
   
   Office hours by appointment
   
   907-474-2794
   
   cbuffington@alaska.edu

   Course Description: What happens on land affects the water and everything that lives in it; this central concept of watershed management frames every aspect of the course. Students will work with local watershed to sample water quality using Global Learning and Observations to Benefit the Environment (GLOBE) atmosphere, hydrology, and soil protocols and assess runoff and groundwater pollution prevention practices. After learning to calculate inputs and outputs in the hydrologic cycle at the local watershed scale, students will apply modeling tools to calculate nutrient and sediment loads; participate in education and outreach training, host a Water Day for middle school students and the public, and earn the Environmental Protection Agency (EPA) Watershed Academy Web Training Certificate. Catalog Description: The hydrologic cycle and the influence of land management techniques on water quantity, quality and timing. Water yield, soil erosion and non-point pollution, snowpack management, and land use alternatives.

3. Course Goals:
   
   ▪ To enhance students’ awareness of the connection between watershed management, hydrological equations, water quality/quantity and soil infiltration/frost sampling, and their own major/career path.
   
   ▪ To increase understanding of the impacts and feedbacks of land and water management practices on water bodies.
   
   ▪ To increase student ability to contribute to watershed management and problem solving in the local community through the use of GLOBE hydrology investigations, collaboration with scientists and planners, and public education and outreach.

4. Student Learning Outcomes:

   By the end of the course, participants will have:
   
   ▪ An increased understanding of the concepts of hydrology, including the water budget, water flow and stream flow analyses, erosion and sedimentation, fluvial processes,
water quality, and best management practices.

- An increased awareness of social-ecological land use changes to watersheds.
- An increased resource base, including physical, conceptual, and mathematical models, for watershed education and outreach, watershed planning, non-point source pollution prevention, scientific investigation, and mathematical literacy.
- An increased understanding of and ability to implement monitoring protocols (including GLOBE or other protocols for monitoring atmosphere, hydrology, water quality, land cover, soils, frost, and soil active layer).
- Designed and implemented an inquiry-based monitoring investigation in collaboration with a scientist or watershed manager to address an identified watershed-related issue.
- Presented a project and published a poster on the GLOBE website, with the opportunity to participate in the International Virtual Science Symposium.
- Earned the EPA Watershed Academy Web Training Certificate.

5. **Instructional Methods:** The intensive semester-long course will consist of lectures, guest presentations, field studies, discussions, physical, conceptual, and mathematical models, and hands-on inquiry learning activities with mentoring from NRM instructors, scientist experts, and watershed managers. The field implementation phase will include a Chena River raft trip with data collection and inspection of shoreline management practices, data collection at campus field sites, and a visit to Cripple Creek, the site of a channel bypass and channel restoration project. Students will use learning games, models, simulations, and to teach watershed management concepts to school children and the public. For this reason, instructional methodology incorporates aspects of the 5E Instructional Model.

6. **Course Readings and Materials:**

   **Texts:**

   **Weekly Readings:** found on the Course Website on Blackboard

7. **Course Calendar and Instructional Outline:**

   Students will be responsible for reading course material each week and completing two graded assessments (assignments, rubrics, projects, and/or exams) per week according to the following course calendar and instructional outline (subject to modification). Learning target handouts and pop quizzes will be employed, but these are ungraded assessments to gauge preparation and understanding.
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Lab</th>
<th>EXPLORE</th>
<th>EXPLAIN</th>
<th>ELABORATE</th>
<th>EVALUATE</th>
<th>DUE DATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9/3, 9/5, 9/6</td>
<td></td>
<td>Activity: trip to Chena river, snow dump &amp; stormwater sites (Andrew Ackerman); habitat restoration (Mitch Osborne)</td>
<td>Chena Slough and River Changes Over the Past 100 Years, with Guest: Bob Henszey</td>
<td>Field Trip: Chena River float, erosion control assessment, DO &amp; temperature sampling</td>
<td>3. Q/A Speaker Rubric</td>
<td>9/3 in class</td>
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<td>2</td>
<td>9/10, 9/12, 9/13</td>
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<td>Game: Tragedy of the Commons (Cloud Institute of Sustainability Education)</td>
<td>Potluck in Akasofu 501, Climate Change &amp; Watersheds, with Guest: Dr. Katharine Hayhoe</td>
<td>Fish Game: Change over time, Systems Archetypes, GLOBE Research Plan</td>
<td>5. Q/A Speaker Rubric</td>
<td>9/10 in Akasofu 501</td>
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<td>6</td>
<td>10/8, 10/10, 10/11</td>
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<td>Models: Awesome Aquifer, EnviroScape Model Game: An Incredible Journey (WET)</td>
<td>Ripples of Change: Incredible Journey of Flathead River to Lake</td>
<td>Prevent runoff pollution; Socratic Lab (1) Watershed 8th gr. Plans (2) Education &amp; Outreach Day; *</td>
<td>13. Hydrology Problem Set &amp; Socratic Lab write-up</td>
<td>10/15 in class</td>
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<td>8</td>
<td>10/1, 10/3, 10/4</td>
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<td>Game: An Incredible Journey (WET)</td>
<td>Reflections: An Incredible Journey of Flathead River to Lake</td>
<td>Fishers: Monitoring Temperature and Dissolved Oxygen (DO)</td>
<td>8. Demystify equation 2.4</td>
<td>9/23 in Bb (Monday)</td>
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<tr>
<td>Week Dates</td>
<td>Lab Readings</td>
<td>EXPLORE</td>
<td>EXPLAIN</td>
<td>ELABORATE</td>
<td>EVALUATE</td>
<td>DUE DATES</td>
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<td>Week 9 10/22, 10/24 no lab Ch. 9 &amp; 14 STEPL reading</td>
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<td>Model: Spreadsheet Tool for Estimating Pollutant Load (STEPL)</td>
<td>Load = Flow x Concentration: How to Identify &amp; Quantify Pollutant Loads</td>
<td>Moly in the Mountains: Using STEPL &amp; Integrated Watershed Management to Select Sediment BMPs *</td>
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<td>Week 10 Lab only 11/1</td>
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<td>Models: RUSLE2 and STEPL Activity: Present GLOBE poster &amp; project</td>
<td>Student present GLOBE projects &amp; posters to Dr. Susan Todd &amp; AE SIGNs</td>
<td>Guest: Dr. Susan Todd and Arctic &amp; Earth STEM Integrating GLOBE and NASA (SIGNs) team *</td>
<td>Reminder #12 GLOBE 11/6 in Bb (Wed.) 11/6 Bb (Wed.) test screenshots = Exam 2</td>
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<td>Week 11 11/5, 11/7, 11/8 Ch. 13 Outreach reading</td>
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<td>Activity: Lead Water Day for 8th Grade Watershed School students</td>
<td>Outreach Training: Living in Fairbanks &amp; Riparian Communities</td>
<td>Guests: ~25 8th grade students from Watershed School 11:30 am-1:30 pm, Public 1:30-2:30 pm *</td>
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<td>11/8 (Location TBA)</td>
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<td>Week 12 11/12, 11/14, 11/15 Ch. 10 Checklist reading</td>
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<td>Activity: Field Trip (bring snow boots &amp; warm gear) Demonstration: Channel design in situ &amp; checklist</td>
<td>Riverbank Restoration in the Golden Heart City, with Mitch Osborne</td>
<td>Activity: Field Trip to Cripple Creek and Happy Creek, near confluence with Chena River *</td>
<td>20. Water Day Outreach stations - rubric 21. Water Day Reflection 11/13 in Bb. (Wed.)</td>
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<td>Week 13 11/19, 11/21, 11/22 Ch. 10 &amp; 12 Ck. Design Plan</td>
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<td>Activity: Student-led comparison</td>
<td>Student-led Cripple Creek Constructed Channel Checklist</td>
<td>GIS Watershed Lab; Work-day Cripple Creek Checklist *</td>
<td>Reminder #23 DUE FRI.</td>
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<td>Week 14 11/26 (no lab) Ch. 15 Fairbanks reading</td>
<td></td>
<td>Activity: Final Exam Review Video Lecture</td>
<td>Putting it all together: Watershed Final Exam Review</td>
<td>Reminder #12: Upload Final Poster &amp; Abstract</td>
<td>12/2 on GLOBE.gov</td>
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<td>Week 15 12/3, 12/5, 12/6</td>
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<td>Game (revisit): Incredible Journey</td>
<td>Fairbanks Green Infrastructure, with Andrew Ackerman</td>
<td>FINAL EXAM</td>
<td>24. Q/A Speaker Rubric 12/6 in Bb. (Fri.)</td>
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**Final Exam**
8. **Course Policies:**

- Punctuality and attendance at the workshop is expected. Absences may be excused for legitimate reasons e.g. sickness, time conflict with other required activities, etc.
- Engaged participation and respect for instructors, guests and other participants is expected, including closing laptops and storing digital devices unless being used as instructed for specific learning activities. Computers are available.
- Plagiarism will not be tolerated and will result in the student earning a failing grade.

9. **Evaluation:** Letter grades will be based on absolute scores totaling 1000 points.

<table>
<thead>
<tr>
<th>Grading Scale</th>
<th>Points</th>
<th>Percentage (no rounding. 899 points is a B)</th>
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<tbody>
<tr>
<td>A</td>
<td>1000-900</td>
<td>100-90</td>
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<tr>
<td>B</td>
<td>899-800</td>
<td>89.9-80</td>
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<tr>
<td>C</td>
<td>799-700</td>
<td>79.9-70</td>
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<tr>
<td>D</td>
<td>699-600</td>
<td>69.9-60</td>
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<tr>
<td>F</td>
<td>&lt;600</td>
<td>&lt;60</td>
</tr>
<tr>
<td>I</td>
<td>Incomplete. Missing tests and/or final exam.</td>
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</tbody>
</table>

**Q/A Speaker rubric** (5 x 10 points each = 50 points): With a partner, students draft questions in advance to ask each of the six guests speakers. One student asks the question during or after the presentation and the other student records both the question and the response. Students use a rubric to self-evaluate.

- Dr. Dr. Bob Henszey, 9/3/19. Due 9/3/19 in class.
- Dr. Katharine Hayhoe, 9/10/19. Due 9/10/19 in class (Akasofu 501).
- Dr. Susan Todd, 11/1/19. Due 11/4/19 in Bb.
- Dr. Mitch Osborne, 11/14/19. Due 11/14/19 in class.
- Andrew Ackerman, 12/3/19. Due 12/3/19 in class.

**GLOBE e-Training modules** (10 x 10 point each = 100 points): Full credit (10 points per module) will be issued if eTraining is logged on student’s GLOBE account on or before due date. Reduced credit (7 points) will be given for training modules completed after the due date.

- Introduction to Globe; Intro. to Atmosphere; Clouds; Intro. to Hydrosphere; Water Temperature; Dissolved Oxygen; Nitrates (~2 hours) Due 9/3/19 on GLOBE.gov
- Precipitation – rain; Precipitation – snow; Soil Infiltration Due 9/23/19 on GLOBE.gov

**Demystify Equation** (5 x 20 points each = 100 points): Discussions in Blackboard (Rubric and grading in Blackboard). The textbook has hundreds of mathematical equations, formulas and figures. Each one represents years of work in the lab and field, questioning, trying, testing, failing, and trying again. Rather than skip over the math, students will explore and discuss five essential equations in online discussion forums. Students must write an original post, respond to two other posts, reply to responses on their own original post, and cite sources. Students use one or more of the following methods to demystify equations and gain mathematical literacy: description of the equation or others that lead to it throughout the text; challenges faced by the person or people who developed the equation; failures that happened in order to develop the equation; graphs of results showing what happens when variables or factors change; explanation of real-world examples; variability across regions, land uses and soil types; unit analyses, and perturbation interrogation (e.g. What will happen if...?). Feel free to ask instructor for help!
• Equation 4.22: \( ET = (PET) f(AW/AWC) \)  
  Due 9/16 in Blackboard

• Equation: 2.4: \( P + GW_i - Q - ET - GW_o = \Delta S \)  
  Due 9/23 in Blackboard

• Equation: 5.3 (Darcy’s Law): \( Q = k_v A \frac{\Delta H}{l} \)  
  Due 9/30 in Blackboard

• Equation: 6.3 (Manning equation): \( V = \frac{1.49}{n} R_h^{2/3} S^{1/2} \)  
  Due 10/7 in Blackboard

• Equation: 8.10 (Modified Universal Soil Loss Equation): \( A = RL (LS) (VM) \)  
  Also see RUSLE2 on pages 214-215  
  Due 10/24/19 in Blackboard

Water Day (100 points):
  • E&O Plan (20 points)  
    Due 10/5/19 in Blackboard
  • Implementation (50 points)  
    Due 11/8/19 in Room TBA
  • Reflection (15 points)  
    Due 11/13/19 in Blackboard
  • Follow-up with 8th grade students (15 points)  
    Due 12/6/19 (submit copy at final)

Lab/Field Assignments (5 x 20 points = 100 points):
  • Chena Field Report & GLOBE data entry  
    Due 9/13 in Blackboard
  • Hydrology Problem Set & Socratic Lab Write-up  
    Due 10/15 in class
  • Cultural Survey & Simulation Notes  
    Due 10/21 in Blackboard
  • Moly Mining BMP plan  
    Due 11/6 in Blackboard
  • Constructed Channel Checklist Report  
    Due 11/22 in Blackboard

GLOBE Project Poster and Abstract (100 points):  
  DRAFT 11/1/19 in lab.  
  FINAL 12/2/19 GLOBE.gov

Exam 1: 100 points.  Chapters 1-5 and 11-14 plus assigned readings.

Exam 2 - Watershed Academy Web Certification (EPA): 100 points.  Due 11/6/19 online
Students will take screenshots of each online exam as they complete them to upload to Blackboard. They save a copy of the final certificate as proof of completion. Completing the certification counts as Exam 2. Full credit (100 points) will be issued if the Certificate is earned on or before the November 6 due date. Partial credit (70 points) if completed after the due date.

Final Exam: 150 points  
  FINAL 12/6/19 in lab on Blackboard

10. Support Services: The instructor will be available for follow up support through emails, phone calls, office hours, in-person GLOBE training, and, where possible, field-site visits.

11. Disability Services, Veterans’ Services, Rural Student Services: The instructor will work with the Office of Disabilities Services, the Department of Military and Veteran Services, and/or Rural Student Services to provide reasonable accommodation to eligible students.

12. Title IX: Students at this university are protected against sexual harassment and discrimination and minors have additional protections. As required, if the instructor notices or is informed of certain types of misconduct, then he/she is required to report it to the appropriate authorities.