

ENSC 540 Watershed CPR (Conservation, Preservation, Restoration) Fall 2017 **subject to change**
Vicki Watson, 101 NS, 243-5153, Vicki.watson@umontana.edu office hrs: **10am--noon**, Wed usually or by appointment

GOALS: To increase student understanding of watershed science, policy, actions & organizing with a view to increasing citizen participation in the stewardship of watersheds & training watershed professionals.

Sept. Introduction – 7 C's of Watershed CPR, Watershed CPR plans; grading/projects [United Watershed States of America](#)
Watershed Science – Connections, Condition, Changes, Capacity

Reading: *Postel & Richter 2003. Rivers for Life. Island Press. Ch 1 & 2.*

References: From most basic: Murdoch, T. **Streamkeepers Guide** Ch 1 & 2 (assessments ch 3-7)

To increasingly advanced – Entering the Watershed 93 (esp. exec sum & ch 3)

Naiman, R. 92 Watershed Management (esp chs. 1, 3, 6); Williams, J. 97 Watershed Restoration (esp: chs 1, 5-8, 25)

Rosgen, D. 96 Applied Stream Morphology (esp. ch 3 & 4) & Field Guide

Naiman, R. 99 River Ecology & Mgt (esp: chs 1, 2-4,5,(11,12,16),18,24,26 **Likens, G. 2010. River Ecosystem Ecology**

Online: Google: [Federal Stream Corridor Restoration Handbook](#) (1998, 2001, 2010), read chs 1-3

EPA's online watershed courses at www.epa.gov/watertrain

[Clark Fork Symposium papers: 1985-2015](#) [MT Watershed Clinic](#)

[MT DEQ's Clean Water Act Info Center](#)

National River Restoration Science Synthesis (NRRSS) (part of NBII taken down in 2012) [now here](#)

[Synthesizing U.S. River Restoration Efforts](#), Bernhardt, et al, 2005, Science, 308(5722):636-7. [supporting data](#)

[River restoration in the 21st century](#) By M Palmer et al. 2007. Restoration Ecology 15(3):472-481

[Lolo Watershed Climate Change Vulnerability Assessment](#)

[Gravel Bed River Floodplains](#), Hauer et al 2016 [short summary here](#)

[Measuring the changing pulse of rivers](#) Science Aug 2017 DOI: 10.1126/science.aao2441

[Watershed climate vulnerability assessment, Lolo National Forest](#) & Clark Fork Coalition 2016

Oct – Watershed CPR – Planning & Actions – (Field trips also serve to illustrate this – see field trip list)

References – (more sites may be emailed)

[Federal Stream Corridor Restoration Handbook](#) (planning & design 4-8, implement 9, actions A)

Will email: Aikens article (Blackfoot case study) from [Watershed Restoration](#)

Chris Frissell's articles in [Watershed Restoration](#) & Naiman 99 (also ch 26)

[2015 Montana State Water Plan](#) AND [Clark Fork/Kootenai basin water plan](#)

In Watson lab: many pamphlets & booklets on BMP's, restoration & management

Nov 1st half – Watershed Law/Policy--US & MT water laws/regs, water rights, nondegradation, TMDL law, definition of impairment & sufficient credible evidence of use support

References: **US law:** *Postel & Richter, Ch 3. Ch 22 of Naiman 99 (River Law)*

[River Network's Understanding the Clean Water Act](#) –

[EPA's National Rivers and Stream Assessment](#) 2008-9

ELI, 2008. [State Wetland Protection](#):

EPA on NPS [Non Point Sources](#) & [healthy watersheds](#)

Brown, et al. 1993. Laws controlling nonpoint sources. Water Res Bull. 29(1):1-13.

MT Law: [Mt DEQ web site on water](#) : see Water Quality Info; see Laws & Rules

[MT TMDLs](#) [MT Water Quality Standards](#) [MT Guide to Stream Permits](#)

More guides -- Guide to MT WQ Regulations (2015), MT Water Rights (2014), Index of Env Permits (2016),

SEE all at [MT Legislative Policy office publications](#) see also Guide to MEPA (2015)

Nov, 2nd half – Watershed Organizing/Funding – Communities, Choices, Commitment

References: Chs. 21 & 25 of **Naiman 99**; Conflict resolution -- [CNREP resources/handbooks](#)

[Guide to Effective Outreach in your Watershed](#)

[EPA 2012 Economic Benefits of Protecting Healthy Watersheds. EPA 841-N-12-004](#)

Education: MT Watershed Coordination Council www.mtwatersheds.org see training [newsletter](#)

[MT State of the Watersheds Report](#)

[Clark Fork Coalition publications](#)

FUNDING

[Catalog of Federal Funding Sources for Watershed Protection](#)

[MT funding](#)

[Water Center funding](#)

Dec – Student Presentations **Final meeting – Dec 19 (Mon) 10 - noon** or earlier if we can find a time

Guest Speakers/field trip leaders include: watershed coordinators, land trust managers, planners, fish biologists, mining reclamation engineers, restoration scientists, floodplain managers

Field trips: sign up lists in class or later at M2 Rankin; some listed on www.umt.edu/conservationcalendar

References – Above references **in bold** are at library, online &/or available from me. See also Citations on ref list (emailed)
Many educational pamphlets/booklets are free or cheap (see examples in 102 Natural Science).

1-2 papers & presentation worth 200 pts--10 for proposal(s), 40 for progress report(s), 100 for paper(s); 50 for presentation on one paper; **participation in class/field trips (100pts); report on relevant public meeting (50pts) = 350 pts total.**

1) An academic paper (sort of a mini-thesis) that attempts to be an original creative work. It may involve carrying out an original study designed by you that collects data to answer a question or test a hypothesis. It may instead involve analyzing data collected by others, once again to answer a question or test a hypothesis. These data may come from government data files or appear in the open literature. Often you will be pulling together data from several sources and using it to answer a new question. The paper could also be a review paper on some topic, but it is often a challenge to be really creative and original with this approach.

Your goal is to advance our understanding of a subject (try to teach me & other academics something).

The paper should be publishable. You should identify a target publication and write the paper in its style.

It is wise to identify a model paper that accomplishes a similar goal to yours and ask if a paper with a similar goal/format/sophistication, etc is appropriate. Make use of refereed literature as well as other sources.

2) A more applied paper aimed at an off campus target audience (sort of a mini **professional paper**). Act as a consultant to an off campus target audience. Identify a need and fill it. You might: investigate a subject and develop a position paper or action plan for them (based on scientific info and group's values); critique an EIS or other government decision; conduct a survey or other study that gathers/analyzes data; develop a curriculum or exercise for a teacher. Often this paper will address an issue that may be of local interest only; or address very site-specific questions (ie analyzing local data to address how a site should be managed, restored, etc). The level of sophistication depends on the target audience (but the science must be scientifically defensible).

The two papers can be on the same or different subjects. Either can be produced first. Often the timing needs of the applied paper may dictate this (there may be a deadline for comments, for example).

THE TWO PAPERS MAY BE COMBINED INTO A SINGLE PAPER IF IT CAN SATISFY THE GOALS OF BOTH.

Length of paper(s): About 20 single spaced pages total (+/- 5) of original, well written, tightly crafted, no-wasted-words prose. These pages may be allocated between the two papers as you see fit. (Two 10 pp papers or one 15 pp and one 5 pp). Don't worry about the exact number of pages. It should be as long as it needs to be to address the question, explore the relevant literature, & treat the subject at the agreed upon level of sophistication. Don't put in unnecessary words or explanation to fill up space and don't cut it shorter than you feel necessary to fit into some length. The page guidance given above is to help you establish the scope of the paper. And also to remind you that not much that is longer than 10-20 pages ever gets read or published. If you wish to emphasize one paper over the other, you may negotiate for reapportioning points.

Suggested Milestones (negotiable). Can email me all assignments but the paper --that I need in hard copy & e-copy. Note: I will need at least a week to provide feedback after receiving something in writing.

Week of course: if writing 2 papers, observe these milestones:

Wk 3 (9/15)—Proposal for first paper; wk 6 (10/6)— Progress Report; wk 8 (10/20)—First paper due

Wk 10 (11/3)—Proposal for 2nd paper; wk 12 (11/17)— Progress Report; wk 14 (12/1)—2nd paper due

1 paper: Wk 3 (9/15)—Proposal; wk 8 (10/20)—progress report; wk 12 (11/17) draft paper; wk 14 (12/1) final paper
14-15 th week —Presentation on one of the two papers (you can negotiate for an earlier time if you wish)

Proposal: GIVE TITLE. Explain need for the project/paper: explain questions/hypotheses to be addressed.

Who is the target audience or target publication?

How will you address this question/hypothesis? What study design & methods?

What do you plan to produce and how can it be used?

What relevant resources have you located so far? What problems do you anticipate?

What is your timeline for milestones? (be specific to your project—dont give me my timelines)

Optional – but good practice: Discuss your qualifications for doing this work. Give a budget.

Progress Report: Explain any changes from original proposal;**** provide detailed outline of paper****;

And a bibliography of the sources collected to date (use the CBE citation style; guide emailed on request).

Paper: Single space (double space between paragraphs). Double-sided preferred. Provide 2 copies: one to mark up & return; one for me to keep.

Also an e-copy. **DO NOT EMBED** tables, figures, in text. Put them all at the end. If they are large, put them in a separate file. Keep formatting simple and easy to edit. NUMBER PAGES. If you write a single paper, a double spaced draft is due at least 2 weeks before final is submitted. Revise based on my comments.

540 students must attend at least one water-related public meeting & report back to class. Some meeting possibilities are:

Any watershed group's meeting -- check out their web sites (see MT [Watershed Directory](#)) & subscribe to their newsletters;

Some group's meetings are listed on the [MT Watershed Calendar](#) or the [Conservation Calendar](#)

Sept 14(Thurs)-- MT Wetland Council meets in Helena

Sept 22 (Friday)— Clark Fork Kootenai Basin Council Meeting 10am-1pm at UM

Oct 19-20 (Thurs-Fri) -- AWRA-MT meeting, Helena.

Msl Conservation district meets – 2nd Mon; 7-9pm; USDA Service Center, 3550 Mullan Road (near Mullan Rd & Reserve)Agenda, call 829-3395.

Msl Water Quality Advisory Council – 2nd Tuesdays , 7-9pm; City-County Health Dept. (301 W. Alder, Missoula; 2nd floor).Agenda, 523-4890

For trips with UM vans (*), Students in ENSC 105, 360 & 540 may register for a space in a UM van on a sign up list at Rankin Hall room M-2. Other UM students can ride in the UM van if there is space. Non-students must provide their own transportation.

Sept 1 (Fri, walk/bike to river; Sept 6 Wed, van to river)--**Clark Fork River sampling**--meet at 102 Natural Science at 2:10pm (Sept 2-4 (Sat-Mon), -- **sampling on upper & lower river**. Sign up for available space in vehicle -- grad class gets first chance)
* Sept 16, Sat -- **Clark Fork Superfund tour**. meet at 8am at north end of Van Buren br. (East Gate parking lot). return ~6pm.
* Sept 23, Sat --**Blackfoot Restoration Tour** -- meet at 8am at north end of Van Buren Br. (East Gate parking lot). return ~6pm.
Sept 30 Sat -- Public Land Day (volunteers needed; ecological service work may count as field trip; check with Watson)
* **Oct (TBD) Tour Missoula Wastewater Treatment plant**, Garden City Compost (composts Missoula's sewage sludge; started > 30 years ago by an EVST alum, now run by city) and nearby land application/tree plantation (also started by EVST alums)

Note: Some field trips of ngos, government agencies or other departments may be of interest. You'll need to arrange your own transportation. For more info (time, location, contacts) on field trips, see -- www.umt.edu/conservationcalendar
See field trips offered by Clark Fork Coalition, Audubon, Sierra, MPG Ranch, etc . **Also trainings by WEN. 9/13, 9/16**
Ecological Restoration field trips (courtesy of Cara Nelson) are also recommended. Info on these will be emailed.

Project ideas --

(past projects involved state & basin water plans, TMDLs, nutrient trapping by poplar land application site)

Evaluate EPA's [Final Clean Water Rule](#) clarifying definition of "waters of the US" for regulatory purposes and views of the farm lobby. Clarify what the new rule does and doesn't do, and why it generated such opposition. Comments on rule repeal due Sept 27.

Evaluate one of the many recent TMDLs produced by DEQ. <http://deq.mt.gov/Water/WQPB/TMDL/TPAmap> (CF basin done)

Evaluate watershed part of a Forest Plan. Assist with long term Clark Fork studies.

Relate Clark Fork algae levels to flows. Relate DO levels to temp, algae, flows. (FWP DO & temp, USGS flows, VWalgae) SD

Evaluate potential to land apply Deer Lodge wastewater to a tree plantation -- they are considering building a costly nutrient removal plant that would greatly increase individual sewer rates.

Evaluate remediation needs at abandoned Frenchtown mill in light of EPA superfund assessment there. PD

Work on Water Footprint Analysis with Mike Sweet of Montana Climate Office

Quantify natural storage restoration achieved through various riparian or wetland restoration projects (public & private)

Design a natural storage and/or green infrastructure project for a watershed (Bruce Sims, resource person)

[Evaluate DEQ's Load Reduction Estimation Guide](#) (released July 21, 2014)—(an overview of many models used)

Evaluate watershed simulator. <http://wikiwatershed.org/model/>

Assist Laura Zanolli with field work on Lolo Creek.

Serve as a facilitator/helper to the Clark Fork Kootenai Basin Council) -- good project for someone pursuing the conflict resolution certificate . Organizing meetings, recording minutes, resurrecting web site. Meeting on Sept 22

Maybe of interest to Clark Fork Kootenai Basin Council

--Evaluate relevance to CFKBC this report recommended by Erin of MWCC -- [Confluence of CWA & Prior Appropriation](#)

--Analyze how the Montana Climate Assessment informs actions that CFKBC & WPIC should take

--update work by Drygas and Andis showing how many stream miles are impaired by flow manipulation

--Review Macgruder studies done for CFTF (enhanced conservation; water availability/mitigation options; enhancing instream flows)

- Review studies on methods of conserving irrigation water, esp useful life and water-savings related to various pipe and ditch-liners.

-diversion inventory and flow study of the mainstem Clark Fork River during late August. Collect flows and temperature at various points from the headwaters to Missoula. Also, inventory and photograph all irrigation diversions and pumps. Take flow measurements above and below each diversion. (more of a thesis project)