

SAULT COLLEGE  
of Applied Arts and Technology  
Sault Ste. Marie

COURSE OUTLINE

WATERSHED MANAGEMENT

FOR 318 - 4

revised

June 1981 by H. Robbins

WATERSHED MANAGEMENT  
FOR 318-4

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UNIT #1 - Physical Properties of Water Affecting Its Management

- hrs.
- course introduction, assignments, evaluation
  - density changes with salt content and temperature
  - significance and properties of ice, melting point
  - viscosity, surface tension, capillary action
  - specific heat, energy gains and losses
  - seasonal temperature profile
  - dimictic and meromictic lakes
  - wind, waves and seiches
  - river meanders and particle movement

UNIT #2 - Control of Runoff in Watersheds

- hrs.
- water table maintenance through vegetation planting, proper land management practices
  - the role of marshlands, beaver dams
  - the role of small impoundments, reservoirs and farm ponds
  - the construction of small impoundments and ponds
  - the prediction and measurement of runoff

UNIT #3 - The Aquatic Community and its Habitat

- hrs.
- invertebrates and their requirements for life
  - fish and their needs
  - simple water chemistry and its importance
  - biological indicator species
  - field trip to local stream - habitat comparison
  - stream improvement measures for fish-spawning areas, pools, cover, stream stabilization, riffles
  - pond management for recreation, fish, wildlife and waterfowl

UNIT #4 - Erosion Control Along Streams and Rivers

- hrs.
- channelization and its effects, effective methods of erosion control pleasing to the eye
  - materials used in erosion control structures in the urban and rural environments
  - structures used to improve the aquatic habitat in spillways
  - the role of vegetation plantings - what to use and where
  - control of riverbank use - cattle and humans
  - field trip to area channel improvement projects



UNIT #5 - Minimizing Disturbances in Natural Ecosystems

10 hrs.

- effects of management practices on the aquatic environment
- proper logging practices to minimize environmental damage
- importance of soils, slopes and vegetation types in resource development
- the construction of resource roads, location, stream crossing, sedimentary basins, culvert installation

UNIT #6 - Erosion Control Along Lakeshores

10 hrs.

- the behaviour of waves
- beaches, sand bars and their formation
- shifting shores, sand dunes and lagoons
- stabilization devices for beaches, bluff protection
- field trip to Michigan sand dunes, bluffs and lakeshores
- the role of vegetation

UNIT #7 - Eutrophication and Environmental Pollutants

5 hrs.

- natural life of lakes, man's speeding up of this process
- the measurement and signs of eutrophication
- insecticides and the environment
- herbicides and the environment
- industrial pollutants including heavy metals, PCB's and acids



### TEXTS (Suggested)

- AYERS, H.D., H.R. McCrimmon and A.H. Berst. 1976. The Construction and Management of farm ponds in Ontario. Toronto, Ontario, Ontario Ministry of Agric. Food, Publ. 515, 43 p.
- U.S. Department of Agriculture, Forestry Service. 1966. Wildlife Habitat Improvement handbook. Washington, U.S. Forestry Service, FSH 2609.11: 146 p.
- WETZEL, R.G. and G.E. Likens. 1979. Limnological analyses. Toronto, W.B. Saunders. 357 p.

### OTHER REFERENCES

- Case, A.B., and D.A. Rowe. 1978. Environmental guidelines for resource road construction. Fish. Environ. Can., Can. For. Serv., Info. Rep. N-X-162: 41 p.
- CIBA-GEIGY Corp. 1977. Managing Ponds for Recreation and Esthetics. CIBA-GEIGY Corp., Agric. Div., Greensboro, N.C. np.
- CIBA-GEIGY Corp. 1967. Make your pond come alive. CIBA-GEIGY Corp., Agric. Div., Greensboro, N.C. np.
- Great Lakes Basin Commission (about 1978). The role of vegetation in shoreline management; a guide for Great Lakes shoreline property owners. Fish. Environ. Can. and Great Lakes Basin Comm., Ann Arbor. 32 p.
- Kennedy, C.E. 1977. Wildlife conflicts in riparian management: Water. U.S. For. Serv., Gen. Techn. Rep. RM43:52-58
- Latham, K.W. 1979. Shoreline erosion. Paper presented at the Coastal Engineering Design and Construction Conference, Kingston, Ontario, April, 1979. Chupler and Latham Ltd., Willowdale, Ontario p. 49-62
- Migel, J.M. 1974. The Stream Conservation handbook. New York, Crown Publ. 242 p.
- Rothwell, R.L. 1978. Watershed Management guidelines for logging and road construction in Alberta. Environ. Can., For. Serv. Info. Rep. NOR-X-208. 43 p.

U.S. Army Corps of Engineers, no date. Help Yourself. A discussion of the critical erosion problems of the Great Lakes and alternative methods of shore protection. U.S. Army Corps. Engineers, N. Cent. Div., Chicago, map.

U.S. Army Corps of Engineers, 1976. Great Lakes Shoreland Damage Study. U.S. Army Corps Engineers, N. Cent. Div., Chicago, map

#### Scientific American Offprints

Soil Conservation Society of America. 1973. Wildlife and water management, striking a balance. Ankeny, Ohio, Soil Conservation Society of America. 48 p. (includes several papers on channelization and habitat improvement)

U.S. Army Coastal Engineering Center. 1977. Shore protection manual. Washington, U.S. Gov. Printing Office. 3 Vol.

Great Lakes Basin Commission. 1977. Great Lakes vegetation workshop proceedings. Ann Arbor, Gt. Lakes Basin Comm. 113 p.

Soil Conservation Society of America. 1977. Soil erosion: prediction and control; Proc. Natl. Conf. Soil Erosion, May 24-26, 1976, Perdue Univ., West Lafayette, IN. Ankeny, Soil Conserv. Soc. Amer.: 393 p.

Anderson, H.W., M.D. Hoover and K.G. Reinhart. 1976. Forests and water: effects of forest management on floods, sedimentation, and water supply. U.S.D.A. For. Serv., Pac. S.W.. For. Range Exper. Sta., Rep. PSW-18: 115 p.

Goodland, R. 1973. Power lines and the environment. Millbrook, N.Y., Cary Arboretum N.Y. Bot. Gardens: 170 p. (include chapters on wildlife plantings, multiple use of right-of-ways, etc.)

Dane, B.S. 1978. A review and resolution of fish passage problems at culvert sites in British Columbia. Environ. Can., Fish Mar. Serv., Techn. Rep. 810: 126 p.

Dane, B.S. 1978. Culvert guidelines: recommendation for the design and installation of culverts in British Columbia to avoid conflict with anadromous fish. Fish Environ., Fish Mar. Serv., Techn. Rep. 811: 57 p.



- U.S.D.A., Soil Conservation Service. 1970. Controlling erosion on construction sites. U.S.D.A., Soil Conserv. Serv., Agr. Inf. Bull. 347: 32p.
- McEwen, F.L. & S.R. Stephenson. 1979. The use and significance of pesticides in the environment. New York, John Wiley. 538 p.
- U.S.D.A. 1973. Farming terraced land. U.S.D.A., Leaflet 335:16p.
- U.S.D.A. Soil Conservation Service. 1973. How to control a gully. U.S.D.A., Soil Conserv. Serv., Farm. Bull. 2:171:15p.
- U.S.D.A. 1973. Building a pond. U.S.D.A., Soil Conserv. Serv., Farm. Bull. 2256:14p
- U.S.D.A. 1978. Making land produce useful wildlife. U.S.D.A., Soil Conserv. Serv., Farm. Bull. 2035: 29 p.
- U.S.D.A. Soil Conservation Service. 1977. Sources of planting stock and seed of conservation plants used in the northeast 1978-1979. U.S.D.A. Soil Conserv. Serv., Broomall PA. 12 p.
- U.S.D.A. Soil Conservation Serv. 1975. Urban hydrology for small watersheds. U.S.D.A. Soil Conserv. Serv., Tech. Release 55: n.p. (includes water runoff prediction equations, peak discharges, reducing peak discharges)
- Hall, J.D., M.L. Murphy and R.S. Aho. 1978. An improved design for assessing impacts of watershed practices on small streams. Verh. Internat. Verein. Limnol. 20: 1359-1365
- Hall, J.D. and R.L. Lantz. 1969. Effects of logging on the habitat of cho salmon and cutthroat trout in coastal streams pp 355-375 in Symposium on salmon and trout in streams edited by T.G. Northcate. Vancouver, Univ. of British Columbia.
- Bare, B.B., J.A. Ryan and G.F. Schreuder. 1974. Environmental effects of forest land uses: a multi-resource simulation based approach. J. Environ. Sys. 4:309-340.
- Moring, J.R. and R.L. Lantz. 1975. The Alsea watershed study: Effects of logging on the aquatic resources of three headwater streams of the Alsea River, Oregon. Oregon Dep. Fish Wildl., Fish. Res. Rep. 9:3 parts.
- Corrugated Steel Pipe Institute 1972. CSP technical manual, "Solving drainage problems with steel" Mississauga, Corrugated Steel Pipe Institute. 72p.

- Hausman, R.F. and E.W. Pruehl. 1978. Permanent logging roads for better woodlot management. U.S.D.A., Forest Service, N.E. Area. Broomall, PA. 43 p.
- Mattice, C.R. 1977. Forest road erosion in northern Ontario: a preliminary analysis. Can. For. Serv., Dept. Fish. Oceans, Rep. O-X-254: 27p.
- District Engineer. No Date. How to engineer a solution to long-term erosion problems. U.S. Army Engineer District. Roch. Is., IL. n.p.
- Soil Conservation Society of America 1979. Sources of native seeds and plants. Anheny, Soil Conserv. Soc. Amer. 20p.
- Forest Management Branch., Ontario Ministry of Natural Resources 1975
- Vegetation for the rehabilitation of pits and quarries. Toronto, Ont., Min. Nat. Resour. 38 p.
- Fisheries and Environment Canada and Ontario Ministry of Natural Resources. No Date. Shore property hazards. Fish. Environ. Can. and Ont. Min. Nat. Resour. 14 p.
- Fisheries and Environment Canada and Ontario Ministry of Natural Resources 1978. A guide for the use of Canada/Ontario Great Lakes flood and erosion prone area mapping. Fish. Environ. Can. and Ont. Minist. Nat. Resour. 19 p.
- Sawyer, C.N. 1966. Basic concepts of eutrophication pp. 462-472 in Readings in conservation ecology edited by G.W. Cox. New York, Appleton-Century-Crafts.
- Ehrlich, P.R. and A.H. Ehrlich. 1972. Population, resources, environment. San Francisco. W.H. Freeman. 509 p.
- Satterlund, D.R. 1972. Wildlife watershed management. New York, John Wiley 370 p.
- Koger, J.L. 1978. Factors affecting the construction and cost of logging roads. TVA, Div. For. Fish. Wildl. Development. Tech. Note B27: 95 + 5 append.
- Troeh, F.R., J.A. Hobbs and R.L. Donahue. 1980. Soil and water conservation for productivity and environmental protection. Englewood Cliffs, Prentice-Hall Inc. 718 p.
- U.S. Environmental Protection Agency. 1976. Quality criteria for water. Washington, U.S. Environ. Prot. Agency 256p.



STUDENT EVALUATION

Three tests will be written, one at the end of each of units 2, 5 and 7. They will be of approximately equal value.

The assignments will be worth 20% of the course marks and the tests 80%.

Students will receive grades based on their average and consistency of performance. The assignment must be satisfactorily completed. The minimum average on the tests must be 55% for a pass grade. Students not attaining the minimum average will be required to write a make-up test (during the make-up period), covering the total course content.



## ASSIGNMENT

Each student will select, from the list below, a different situation in which erosion has or is likely to become a major problem. Knowing of an actual area which fits one of these situations may be helpful but not necessary. In any case, the area should not have already had the remedial measures applied.

You will prepare a brief but carefully prepared technical report with drawings and specifications on how you would recommend reducing or eliminating the erosion problem. Your report is to be carefully organized in a logical sequence.

Attached is an example of a short paper you may use as a guide in organization. It is also useful in assisting you in setting up tables and diagrams (figures). Your figures should be neat, to scale, labelled by hand-lettering and done solely in black ink.

You will use the author-year system of referencing, as is used in the attached paper. This is the only acceptable system for technical reports in science. Nearly every paragraph in your report should be referenced as to source of material. It is suggested that the 3 to 5 best references you can find be used to provide input into your report. Your job is to evaluate the problem, and using these sources, describe, in your own words and supplemented by your own figures, your proposal for a remedy to the problem.

The report is due no later than November 17 and will be worth 20% of the course mark. Late reports may not be marked until the rewrite period and will be given a maximum "C" grade.

Some situations in which erosion must be prevented:

1. Shifting sand dunes along the shore of a large lake.
2. Loss of beach sand in a provincial park.
3. Steam entering Lake Ontario through a high erodible bluff (no boulders).
4. Low erodible bluff with scattered boulders.
5. Developed beach with sand dunes behind and vegetation loss through human activity.
6. High spring runoff erodes banks of meandering stream through sand.
7. Clay banks spoil clarity and appearance of small stream through rolling countryside.
8. Gullying of seasonal tributaries through sand destroys trout habitat downstream.
9. Gullying of clay hillside destroying farmer's field.
10. Logging road crossing fast flowing trout stream is washed out each spring.



ASSIGNMENT

11. Nature trail stairway breaks away on clay hillside.
12. Steep logging road results in washouts and sedimentation of streams below.
13. Wash water from gravel pit silts up streams into which it is flowing.
14. Heavy angler pressure results in bank erosion along heavily shaded trout stream.
15. Park visitors cause slumping and erosion of banks of stream running through picnic area.
16. Hillside trail on sandy soil results in gullying.
17. Access road to park is often closed by falling boulders along cutout section.
18. Access road to park is undermined during thunderstorms resulting in pavement slumping down a slope.
19. Visitors to a nature area cause vegetation loss in a highly sensitive ecosystem of low sand hills.
20. Ski hills consisting of gravel are eroding in spring and summer.
21. Large river meanders causing erosion on outside banks of sand and gravel.
22. Skidders have removed vegetation on steep hillsides.
23. Exposed loam fields are eroded by wind and farmer wants to stop this loss.
24. Fast flowing trout stream has unstable gravel bottom providing poor habitat for invertebrates and fish.
25. Cattle cause bank erosion by breaking down banks and eating streamside vegetation.
26. Surface runoff from new subdivision development on clay fouls area streams.

Should you have another situation you feel is appropriate, you may submit it for consideration.