



**SIMON FRASER UNIVERSITY**

**SCHOOL OF RESOURCE AND ENVIRONMENTAL MANAGEMENT**

**MEMORANDUM**

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**TO:** Dr. Parveen Bawa  
Associate Dean of FAS

**FROM:** Dr. Randall M. Peterman, Chair  
Graduate Studies Committee  
School of Resource and Environmental Management

**DATE:** November 10, 1995

**SUBJECT:** Calendar Changes

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We propose to make the following changes to the calendar for 1995-96.

**1. New Course Proposal**

**REM 625-5 Risk Assessment and Decision Analysis for Management of Natural Resources.** See attached course description.

**Rationale:**

Uncertainties are often large in natural resource systems and they create risks that managers of natural resources must take into account. No existing course at SFU deals with the use of the above quantitative methods for incorporating uncertainties explicitly into decision making in management of natural resources such as forests, fish, and wildlife. This course will fill that gap.

**2. Course Deletion**

**MRM 615-3 Management of Aquaculture Resources and description.**

**Rationale:**

The Aquaculture program in the department of Biological Sciences has been discontinued. This course will no longer be offered.

**3. Masters in REM and Business.  
1995-96 Calendar, page 275, Under Degree Requirements**

**a) Under courses:**

Replace Old Line 6: "In conjunction with..."

by "In consultation with..."

**b) The 11 required courses (subject to any approved substitutions) are as follows.**

Change from:

- BUS 512-4 - Introduction to Business Finance  
 527-3 - Financial Accounting  
 536-4 - Quantitative Methods in Management  
 543-4 - Introduction to Graduate Marketing  
 572-4 - Organizations and Human Resource Management  
 MRM 601-5 - Natural Resources Management 1: Theory and Practice  
 602-5 - Natural Resources Management 2: Advanced Seminar  
 611-5 - Applied Population and Community Ecology  
 641-5 - Law and Resources  
 and one of  
 MRM 621-5 - Economics of Natural Resources  
 BUS 507-4 - Managerial Economics  
 and one of  
 MRM 644-5 - Public Policy Analysis and Administration  
 BUS 858-4 - Business and the Public Interest

Replace with:

The 11 required courses (subject to any approved substitutions) are as follows:

BUS 512 - Introduction to Business Finance  
 BUS 527 - Financial Accounting  
 BUS 536 - Quantitative Methods in Management  
 BUS 543 - Introduction to Graduate Marketing  
 BUS 572 - Organizations and Human Resource Management  
 REM 601 - Natural Resources Management 1: Theory and Practice  
 REM 611 - Applied Population and Community Ecology  
 REM 801 - Principles of Research Methods and Design in Resource and Environmental Management

and one of

REM 602 - Natural Resources Management 2: Advanced Seminar  
 REM 641 - Law and Resources

and one of

BUS 507 - Managerial Economics  
 REM 621 - Economics of Natural Resources

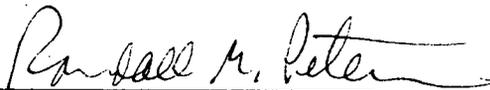
and one of

BUS 858 - Business and the Public Interest  
 REM 644 - Public Policy Analysis and Administration

**Rationale:**

This will make the degree requirements consistent with the change made to the MRM degree in 1995.

Dr. Lindsey Meredith, Graduate Chair, MBA Program has approved the changes to the Joint MRM/MBA degree.

  
 Randall M. Peterman

RMP/jr

*Approved*  
*L. Meredith*  
*Nov 9/95*  
 3.

New Graduate Course Proposal Form

Department: School of Resource and Environmental Management Course No.: REM 625

Course Title: Risk Assessment and Decision Analysis for Management of Natural Resources

Course Description for Calendar (*append a course outline*):

Use of quantitative methods of risk assessment and decision analysis to explicitly take uncertainty into account when making decisions in management of natural resources. Methods of quantifying uncertainty and the resulting risks. Examples from management of forests, wildlife, fisheries, water resources, energy, and toxic chemicals. Communicating information about uncertainties and the resulting risks to resource managers, the public, and scientists. Advantages and limitations of various quantitative methods. Includes computer laboratories.

Credit Hours: 5 Vector: 3-2-0 Prerequisite(s) if any: REM 612 and REM 621 or permission of instructor

Estimated Enrolment: 10 When the course will first be offered: Spring 1997

Frequency of course offering: Every other year.

Justification:

Uncertainties are often large in natural resource systems and they create risks that managers of natural resources must take into account. No existing course at SFU deals with the use of the above quantitative methods for incorporating uncertainties explicitly into decision making in management of natural resources such as forests, fish, and wildlife. This course will fill that gap.

Resources:

Faculty Member(s) who will normally teach this course; *append information about their competency to teach the course:* Randall M. Peterman

Number of additional faculty members required in order to offer this course: none

Additional space required in order to offer this course (*append details*): none

Additional specialized equipment required in order to offer this course (*append details*): none

Additional Library resources required (*append details*): annually: \$ 0 one-time: \$ 0

Any other resource implications of offering this course (*append details*): none

*If additional resources are required to offer this course, the department proposing the course should be prepared to provide information on the source(s) of those additional resources.*

Approvals:

Departmental Graduate Studies Committee: Randall M. Peterman Date: 20 Oct. '95

Faculty Graduate Studies Committee: Parveen Bawa Date: Nov. 7, 1995

Faculty: Parveen Bawa Date: Nov. 7, 1995

*Following approval by the Faculty, this form and all relevant documentation should be forwarded to the Assistant Director - Graduate Studies in the Office of the Registrar for consideration by the Senate Graduate Studies Committee, the Senate Committee on Academic Planning and Senate.*

## Course Outline for REM 625

### Risk Assessment and Decision Analysis for Management of Natural Resources

School of Resource and Environmental Management  
Simon Fraser University

Randall M. Peterman

#### Objectives for Students in the Course

To learn:

1. The fundamental role that uncertainty plays in the observation and management of ecological systems as well as the nature and sources of that uncertainty
2. How to describe and quantify that uncertainty
3. Quantitative methods, especially decision analysis, to explicitly take uncertainty into account when making decisions about management actions in natural resource management. This will include methods to:
  - define a management objective that includes more than one attribute
  - quantify probabilities of different states of nature occurring
  - calculation of outcomes for each contemplated management action, given those states
4. How to communicate information about uncertainties and the resulting risks to resource managers, the public, and scientists
5. The advantages and limitations of decision analysis

#### Required Text from the Bookstore

1. Morgan, G. and M. Henrion. 1990. *Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis*. Cambridge Univ. Press, 332 pp. paperback.
2. Course reading package (includes copies of several journal papers)

#### Tentative Outline for the Lectures

1. Overview of the Course
2. What is Risk Assessment and Why Do We Need It for Management of Natural Resources?
3. Uncertainty -- Its Pervasiveness and Its Sources
4. Implications of Uncertainty in Resource Management
5. Describing and Quantifying Uncertainty
6. Overview of Methods for Assessing Risks and Making Decisions
7. Quantitative Methods for Making Decisions Accounting for Uncertainty
8. The Value of Reducing Uncertainty
9. Limitations of Quantitative Methods of Decision Making

10. Communicating Uncertainty  
 11. Review of Themes of the Course
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**Tentative Topics for the Computer Laboratories**

- Quantifying uncertainty about states of nature
- Using a model to generate outcomes
- Doing decision analyses on an Excel spreadsheet
- Analysis of sensitivity to uncertainties in a model's structure, parameter values, probabilities, assumptions, and management objectives
- Analysis of value of information
- Multiattribute decision analysis
- Decision analysis for a sequence of decisions

**Selected Readings**

- Barnthouse, L.W. 1994. Issues in ecological risk assessment: The CRAM perspective. *Risk Analysis* 14(3): 251-256.
- Cohan, D. S.M. Haas, D.L. Radloff and R.F. Yancik. 1984. Using fire in forest management: decision making under uncertainty. *Interfaces* 14(5):8-19.
- Cordue, P.L. and Francis, R.I.C.C. 1994. Accuracy and choice in risk estimation for fisheries assessment. *Canadian Journal of Fisheries and Aquatic Sciences* 51:817-829.
- Hilborn, R., Pikitch, E.K., Francis, R.C. 1993. Current trends in including risk and uncertainty in stock assessment and harvest decisions. *Canadian Journal of Fisheries and Aquatic Sciences* 50:874-880.
- Holling, C.S. (ed.). 1978. Model invalidation and belief. pp. 95-105, In: Adaptive Environmental Assessment and Management. John Wiley & Sons, New York, 377 pp.
- Keeney, R.L. 1982. Decision analysis: An overview. *Operations Research* 30(5):803-838.
- Lave, L.B. and Dowlatabadi, H. 1993. Climate change: The effects of personal beliefs and scientific uncertainty. *Environmental Science & Technol.* 27(10):1962-1972.
- Maguire, L.A. 1986. Using decision analysis to manage endangered species populations. *Journal of Environmental Management* 22:345-360.
- Manne, A.S. and R.G. Richels. 1994. The costs of stabilizing global CO<sub>2</sub> emissions: A probabilistic analysis based on expert judgments. *The Energy Journal* 15(1):31-56.
- Montgomery, C.A., Brown, G.M. and Adams, D.M. 1994. The marginal cost of species preservation: The northern spotted owl. *J. of Environmental Economics and Management* 26:111-128.
- Parkhurst, D.F. 1984. Decision analysis for toxic waste releases. *J. Environmental Management* 18:105-130.
- Powell, S.G. 1991. A risk analysis of oil development in the Arctic National Wildlife Refuge. *The Energy Journal* 12: 55-76.

- Reckhow, K.H. 1994. Importance of scientific uncertainty in decision making. *Environmental Management* 18(2):161-166.
- Routledge, R.D. 1980. The effect of potential catastrophic mortality and other unpredictable events on optimal forest rotation policy. *Forest Sci.* 26(3):389-399.
- Scherer, C.W. 1990. Communicating water quality risk. *Journal of Soil and Water Conservation*, March-April:198-200
- Sissenwine, M.P. 1984. The uncertain environment of fishery scientists and managers. *Marine Resource Economics* 1(1):1-29.
- Stahl, G. D. Carlsson, and L. Bondesson. 1994. A method to determine optimal stand data acquisition policies. *Forest Science* 40(4):630-649.
- Suter, G.W. 1990. Uncertainty in environmental risk assessment. pp. 203-230, In: Von Furstenberg, G.M. [Ed.], *Acting Under Uncertainty: Multidisciplinary Conceptions*. Kluwer Academic Publ., Norwell, Ma. 485 pp.
- Suter, G.W. 1993. Defining the field. pp. 3-47, In: G.W. Suter (ed.), *Ecological Risk Assessment*. Lewis Publishers, Chelsea, Michigan, 538 pp.

**Competence of the Faculty Member to Teach the Course:**

Randall M. Peterman (Professor, School of Resource and Environmental Management) will teach this course in the future. He already taught it once in the spring of 1995 when it was put on as a special topics course. He has taught and done research on simulation modelling of natural resources since the 1970s. He has numerous publications specifically in the area of dealing with ecological uncertainties and has received commendation awards for his research from the American Fisheries Society, American Institute of Fisheries Research Biologists, and the Canadian Conference for Fisheries Research.