Watershed management contributions to land stewardship: A literature review

Malchus B. Baker, Jr., Peter F. Ffolliott, Carleton B. Edminster, Karen L. Mora, and Madelyn C. Dillon
Abstract

An international conference to increase people's awareness of the contributions that watershed management can make to future land stewardship was held in Tucson, Arizona, March 13-16, 2000. This bibliography is a compilation of the synthesis and poster papers presented at the conference along with the literature cited in these papers on watershed research projects, applied watershed management activities, and technology transfer mechanisms. This publication furnishes a literature basis for researchers, managers, decision-makers, educators, students, and lay persons with a keen interest in watershed management and better land stewardship in the future. The proceedings from this conference, entitled “Land Stewardship in the 21st Century: The Contributions of Watershed Management,” may be found on the Rocky Mountain Research Station’s World Wide Web pages at www.fs.fed.us/rm/pubs/stewardship.html.

Keywords: Watershed management, ecosystem management, watershed research, applied watershed management

The Authors

Malchus B. Baker, Jr. is a hydrologist with the Rocky Mountain Research Station in Flagstaff, Arizona.

Peter F. Ffolliott is a professor at the School of Renewable Natural Resources, University of Arizona, Tucson.

Carleton B. Edminster is a project leader with the Rocky Mountain Research Station in Flagstaff, Arizona.

Karen L. Mora is a visual information specialist with the Rocky Mountain Research Station in Fort Collins, Colorado.

Madelyn C. Dillon is a technical publication editor with Content Analysis Enterprise Team, Fort Collins, Colorado.

You may order additional copies of this publication by sending your mailing information in label form through one of the following media. Please send the publication title and number.

Telephone  (970) 498-1392
E-mail     rschneider@fs.fed.us
FAX        (970) 498-1396
Mailing Address Publications Distribution
Rocky Mountain Research Station
240 West Prospect Road
Fort Collins, CO 80526-2098
Watershed Management Contributions to Land Stewardship: A Literature Review

Malchus B. Baker, Jr., Peter F. Ffolliott, Carleton B. Edminster, Karen L. Mora, and Madelyn C. Dillon

Contents

Introduction .................................................................................................................. 1
Watershed Management Perspectives ..................................................................... 1
Issues to be Confronted in the 21st Century ....................................................... 6
Case Studies ........................................................................................................... 11
A Retrospective Viewpoint .................................................................................. 20
Watershed Management Contributions to Future Land Stewardship .................. 31
Future Protocols ................................................................................................... 35
Watershed-Related Research Projects ................................................................. 39
  Vegetation Relationships ................................................................................... 39
  Erosion and Sedimentation Processes .............................................................. 41
  Riparian Ecosystems and Wetlands ................................................................. 42
  Fire Effects ........................................................................................................ 46
  Simulation Techniques and Mathematical Modeling ....................................... 47
  Research Support Programs ............................................................................ 48
Applied Watershed Management Activities ........................................................ 49
  Vegetation Management Practices ................................................................... 49
  Erosion and Sedimentation Controls ............................................................... 51
  Riparian Ecosystems and Wetlands ................................................................. 52
  Fire .................................................................................................................. 52
  Operational Management Programs .............................................................. 54
Technology Transfer Mechanisms ........................................................................ 57
  Geographic Information Systems .................................................................... 57
  World Wide Web ............................................................................................. 58
Introduction

The effectiveness of land stewardship must be enhanced to meet a growing population’s need for conservation, sustainable development, and use of natural resources. Ecosystem-based, multiple-use oriented land stewardship is necessary when considering the present and future uses of land, water, and other natural resources on an operationally efficient scale. Holistically planned and carefully implemented watershed management practices and programs will always be needed to meet the increasing demands for commodities and amenities, clear water, open space, and uncluttered landscapes.

An international conference was held in Tucson, Arizona, on March 13 to 16, 2000, to examine this need. The primary purpose of the conference was to increase people’s awareness of the contributions that watershed management can make to future land stewardship in the United States and internationally. Invited synthesis papers were presented by 35 speakers from research institutes, management agencies, and educational organizations in the United States and internationally. More than 50 poster papers on watershed research projects, applied watershed management activities, and technology transfer mechanisms complemented the synthesis papers to broaden the conference scope.

Proceedings of the conference, entitled “Land Stewardship in the 21st Century: The Contributions of Watershed Management,” were published by and are available from the USDA Forest Service, Rocky Mountain Research Station, 240 West Prospect Road, Fort Collins, CO 80526. These proceedings are also available on the Rocky Mountain Research Station’s World Wide Web pages at www.fs.fed.us/rm/pubs/stewardship.html. This bibliography is a compilation of the synthesis and poster papers presented at the conference along with the literature cited in these papers. This publication furnishes a literature basis for researchers, managers, decision-makers, educators, students, and lay persons with a keen interest in watershed management and better land stewardship in the future.

Citations of the bibliography are listed alphabetically by author in categories corresponding to the plenary sessions of the conference. These sessions included the following topics:

- Watershed management perspectives,
- Issues to be confronted in the 21st century,
- A retrospective viewpoint of past lessons learned,
- Case studies,
- Watershed management contributions to future land stewardship, and
- Future protocols.

Technical themes of the poster papers included the following categories:

- Watershed-related research projects,
- Applied watershed management activities,
- Technology transfer mechanisms.

Watershed Management Perspectives


development and environmental rehabilitation in the dry zone. Rome: Food and Agriculture Organization.


Gupta, T. 1988. The Kandi watershed and area development project, Punjab, India: approaches
to financial and economic analysis. Ahmedabad: Indian Institute of Management.


Issues to be Confronted in the 21st Century


Regional Ecosystem Office. 1995. Ecosystem analysis at the watershed scale. Federal Guide for Watershed Analysis. P.O. Box 3623, Portland, OR.


Case Studies


Crossley, D. A., Jr.; Lamoncha, K. L. [In Press]. Response of forest soil microarthropods to a forest regeneration burn at WineSprings (Southern Appalachians). In: Proceedings first biennial North American forest ecology workshop; 1997 June 24-26; Raleigh, NC.


Dils, D. E. 1964. Watershed conditions problems and research needs in Taiwan. Forest Services No. 8. JCRR.


Dils, R. E. 1956. Watershed management research needs in the forests of the Lake States: a problem analysis. [Carbon copy]. Grand Rapids, MN.


Laerm, J.; Menzel, M. A.; Wolf, D. J.; Hicks, N. G. [In press]. Role of riparian zones in structuring...


Romitelli, M. S.; Odum, H. T. 1996. Energy analysis of Coweeta River basin, NC. Final report to the U.S. Department of Agriculture, Coweeta Hydrologic Laboratory, Otto, NC.


Sun, G.; McNulty, S. G.; Swift, L. W., Jr.; Boggs, J. [In press]. Risk assessment of sediment contribution to streams due to forest management...
using a GIS-based simulation model. Pap. 995050. 1999 ASAE annual international meeting; Toronto, Ontario, Canada.


Verry, E. S. 1987. The effect of aspen harvest and growth on water yield in Minnesota. In: Forest hydrology and watershed management. Inter-


A Retrospective Viewpoint


and northern Europe. Environmental Science and Technology. 24: 1100-1105.
Garbrecht, J.; Starks, P. J.; Martz, L. W. 1996. New digital landscape parameterization methodologies. In: GIS and water resources: proceedings...
of the American Water Resources Association
32nd annual conference and symposium; 1966
September 22-26; Fort Lauderdale, FL: 357-
365.
Garraty, J. A. 1986 The Great Depression: an in-
quiry into the causes, course and consequences
of the world-wide depression of the 1930s. San
Goodchild, M. R., Parks, B. O.; Steyaert, L. T., eds.
1993. Environmental modeling with GIS. New
York: Oxford University Press.
Grieder, T.; Krannich, R. S.; Berry, E. H. 1991 Local
identity, solidarity, and trust in changing rural
Griffin, C. B. 1999 Watershed councils: an emerg-
ing form of public participation in natural re-
source management. Journal of the American
Grumbine, R. E. 1994 What is ecosystem manage-
Guay, B. E.; Kunzmann, M.; Grunserg, W.; Guertin,
D. P. 1999. Integrating differential GPS, GIS and
sonar measurements to map the bathymetry of
Topock Marsh, Arizona. In: Proceedings of the
1999 ESRI users conference; 1999 July 26-30; San
Diego, CA. Location at: WEB http://
www.esri.com/library/userconf/proc99/pro-
ceed/papers/pap396/p396.htm
Emerging tools and technologies in watershed
management. In: Ffolioscott, P. F.; Baker, M. B., Jr.;
Edminster, C. B.; Dillon, M. C.; Mora, K. L., tech.
coords. Land stewardship in the 21st century: The
contributions of watersheds management.
Department of Agriculture, Forest Service,
Rocky Mountain Research Station: 194-204.
Guertin, D.P.; Womack, J. D.; MacArthur, R.; Ruyle,
G. B. 1998. Geographic information system based
tool for integrated allotment and watershed
management. In: Proceedings of American wa-
ter resources association specialty conference: rangeland management and water resources.
TPS-98-1. Herndon, VA: American Water
Resources Association: 35-44.
hydrology and sedimentation for small
Hamlett, J. M.; Miller, D. A.; Day, R. L.; Peterson, G.
W.; Baumer, G. M.; Russo, J. 1992. Statewide
GIS-based ranking of watersheds for agricul-
tural pollution prevention. Journal of Soil and
Harr, R. D. 1979. Effects of timber harvest on
streamflow in the rain-dominated portion of the
on scheduling timber harvest for hydrologic
concerns. Portland, OR: U.S. Department of
Harr, R. D. 1983. Potential for augmenting water
yield through forest practices in western Wash-
ington and western Oregon. Water Resources
Harr, R. D. 1986. Effects of clearcutting on rain-on-
snow runoff in western Oregon: a new look at old studies. Water Resources Research. 22(7):
1095-1100.
Held, R. B.; Clawson, M. 1967 Soil conservation in
perspective. Baltimore, MD: Johns Hopkins
University Press.
Helsinki Process. 1994. Proceedings of the ministe-
rial conferences and expert meetings. FIN-00171.
Helsinki, Finland: Liaison Office of the Ministe-
rial Conference on the Protection of Forests in
Europe.
and applications of imaging radar. New York:
John Wiley and Sons.
Hewlett, J. D. 1967. Will water demand dominate
forest management in the East? Society of Ameri-
can Foresters Proceedings, 1966: 154-159.
Hibbert, A. R. 1967. Forest treatment effects on
International symposium for. hydrology; 1965;
University Park, PA. Oxford: Pergamon Press:
527-543.
Hicks, R. 1992 Partnerships equal solutions. Journal
Hoffman, C. 1994 Does anybody really do water-
Hornbeck, J. W.; Adams, M. B.; Corbett, E. S.;
Verry, E. S.; Lynch, J. A. 1993. Long-term im-
pacts of forest treatments on water yield: a sum-
mary for northeastern USA. Journal of Hydro-
logy. 150: 323-344.
Hornbeck, J. W.; Bailey, S. W.; Buso, D. W.; Shanley,
J. B. 1997. Streamwater chemistry and nutrient
budgets for forested watersheds in New En-
Hornbeck, J. W.; Martin, C. W.; Egar,C. 1997. Sum-
mary of water yield experiments at Hubbard
Brook Experimental Forest, New Hampshire.
Canadian Journal of Forest Research. 27: 2043-
2052.


Herndon, VA: American Water Resources Association: 45-44.

Lazarus, R. J. 1991 The tragedy of distrust in the implementation of federal environmental law. Law and Contemporary Problems. 54: 311.


Watershed Management Contributions to Future Land Stewardship


Future Protocols


Boyle, Brian J.; Shannon, Margaret A.; Rose, Robert A.; Halvorsen, Kathleen; Elway, H. Stuart. 1994. Policies and mythologies of the US Forest Service:
a conversation with employees. Seattle, WA: University of Washington, College of Forest Resources, Institute for Resources in Society.


Christensen, Norman L.; Bartuska, Ann M.; Brown, James H.; Carpenter, Stephen; D'Antonio, Carla; Francis, Robert; Franklin, Jerry F.; MacMahon, James A.; Noss, Reed F.; Parsons, David J.; Peterson, Charles H.; Turner, Monica G.; Woodmansee, Robert G. 1996. The report of the ecological society of America committee on the scientific basis for ecosystem management. Ecological Applications. 6(3): 665-691.


Keiter, Robert B.; Milkman, Louise; Boling, Ted. 1995. Legal perspectives on ecosystem management: legitimizing a new federal land management policy. Paper read at: Ecological stewardship workshop; Tucson, AZ.

Kennedy, James J.; Dombeck, Michael P. 1995. The evolution of public agency beliefs and behavior toward ecosystem-based stewardship. Paper read at: Ecological stewardship workshop; Tucson, AZ.


Machlis, Gary E. 1990. The tension between local and national conservation groups in the democratic regime. Society and Natural Resources. 3: 267-279.


Rocky Mountain Forest and Range Experiment Station: 175-177.

Water-Related Research Projects

Vegetation Relationships


Erosion and Sedimentation Processes


Riparian Ecosystems and Wetlands


Guthery, Fred S.; Bingham, Ralph L. 1996. A theoretical basis for study and management of


Department of Agriculture, Forest Service, Rocky Mountain Research Station: 304.


Fire Effects


Terry, J. P. 1994. Soil loss from erosion plots of differing post-fire forest cover, Portugal. In: Sala, M.; Rubio, J. F., eds. Soil erosion and
degradation as a consequence of forest fires—selection of papers from the international conference on soil erosion and degradation as a consequence of forest fires; 1991; Barcelona, Spain. Logrono, Spain: Geoforma Ediciones: 133-148.


Simulation Techniques and Mathematical Modeling


Hernandez, Mariano; Miller, S. N. 2000. Integrated landscape/hydrologic modeling tool for


Research Support Programs


Edminster, Carleton B.; Gottfried, Gerald J. 1999. Achieving ecosystem management in the borderlands of the Southwestern United States through coordinated research/management partnerships: an overview of Research Unit RM-4651. In: Gottfried, Gerald J.; Eskew, Lane G.; Curtin, Charles G.; Edminster, Carleton B.,


Applied Watershed Management Activities

Vegetation Management Practices


Minnesota Department of Natural Resources. 1995. Short rotation woody culture: analysis of a 10,000 acres per year hybrid poplar planting program. St. Paul, MN: Division of Forestry.


Photogrammetric Engineering and Remote Sensing. 50(12): 1709-1716.


Erosion and Sedimentation Controls


Riparian Ecosystems and Wetlands


Fire

Everett, R. L.; Sharrow, S. H. 1985. Soil water and temperature in harvested and nonharvested...


Hartford, R. A.; Frandsen, W. H. 1992. When it’s hot, it’s hot—or maybe it’s not (surface flaming may not portend extensive soil heating). International Journal of Wildland Fire. 2: 139-144.


Operational Management Programs


Jiménez C. 1994. Contaminación por metales pesados y metaloides en Baja California Sur y Sus Costas: Revisión Bibliográfica. Área de Ciencias del Mar, UABCS.


Technology Transfer Mechanisms

Geographic Information Systems


Zhang, Xiaohui; [and others]. 1999. Integration of GIS and RS with urban hydrology, ESRI 19th international user conference; 1999 July 26-30; San Diego, CA.

**World Wide Web**


Watershed Management Council web site: http://watershed.org/wmchome


The Rocky Mountain Research Station develops scientific information and technology to improve management, protection, and use of forests and rangelands. Research is designed to meet the needs of National Forest managers, federal and state agencies, public and private organizations, academic institutions, industry, and individuals.

Studies accelerate solutions to problems involving ecosystems, range, forests, water, recreation, fire, resource inventory, land reclamation, community sustainability, forest engineering technology, multiple use economics, wildlife and fish habitat, and forest insects and diseases. Studies are conducted cooperatively, and applications can be found worldwide.

Research Locations

Flagstaff, Arizona  Albuquerque, New Mexico
Fort Collins, Colorado* Rapid City, South Dakota
Boise, Idaho Logan, Utah
Moscow, Idaho Ogden, Utah
Bozeman, Montana Provo, Utah
Missoula, Montana Laramie, Wyoming
Lincoln, Nebraska
Reno, Nevada

* Station Headquarters, 2150 Centre Avenue, Building A, Fort Collins, CO 80526

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA’s TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal employment opportunity provider and employer.