



**The Tenth William T. Pecora
Memorial Remote Sensing Symposium**

Program



Pecora 10

REMOTE SENSING IN
FOREST AND RANGE RESOURCE MANAGEMENT

August 20, 21, 22, 1985
Student Center
Colorado State University
Fort Collins, Colorado

THE TENTH
WILLIAM T. PECORA MEMORIAL
REMOTE SENSING SYMPOSIUM
IS PRESENTED UNDER THE SPONSORSHIP OF



IN COOPERATION WITH



The Pecora Symposium was established in 1975 to foster the exchange of scientific and applications findings on the use of remotely sensed data for resource management programs. The symposium series honors the memory of William T. Pecora, former Director of the U.S. Geological Survey and Undersecretary, Department of the Interior. Dr. Pecora played a major role in the development and establishment of satellite remote sensing systems.

The focus of Pecora 10 is on applications of remote sensing in forest and range resource management. The purpose of this symposium is to expose participants in all aspects of forest and range management to opportunities to use this technology.

SYMPOSIUM COMMITTEE:

William M. Ciesla, Symposium Co-Chairperson
Richard S. Driscoll, Symposium Co-Chairperson
Dr. Robert Haas, Program Chairperson
Richard J. Myhre, Poster Session Chairperson
Dr. James Smith, Tutorials Chairperson
Raymond A. Byrnes, Logistics Chairperson
Lawrence R. Pettinger, Special Activities Chairperson
Dr. Richard Mroczynski, Exhibits Chairperson
Craig A. Sommer, Local Arrangements Chairperson
Patricia M. Ciesla, Spouse Events Chairperson

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IN COOPERATION WITH:

United States Geological Survey
National Aeronautics and Space
Administration
National Oceanic and Atmospheric
Administration
United States Department of
Agriculture

SYMPOSIUM CALENDAR

MONDAY, AUGUST 19, 1985

- 8:00 a.m.-9:30 a.m.** SYMPOSIUM REGISTRATION
9:00 a.m.-5:00 p.m. PRE-SYMPOSIUM TUTORIALS
- Introduction to Remote Sensing
 - Introduction to Geographic Information Systems
 - Vegetation Damage Mapping
 - Geobotanical Remote Sensing
 - Advanced Remote Sensing
- 1:00 p.m.-6:00 p.m.** SYMPOSIUM REGISTRATION
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TUESDAY, AUGUST 20, 1985

- 7:30 a.m.** SYMPOSIUM REGISTRATION
9:00 a.m. OPENING AND WELCOME
9:15 a.m. PLENARY SESSION
- Evolution of Remote Sensing in Range Management, Speculations on its Future
- 10:00 a.m.** COFFEE AND ROLLS
10:30 a.m.
- Status of Remote Sensing in Forestry
 - New Horizons in Remote Sensing for Forest and Range Resource Management
- 11:45 a.m.** LUNCHEON — Guest Speaker
1:30 p.m. CONCURRENT TECHNICAL SESSIONS
- Integrated Resource Inventory
 - Land Use/Land Cover Mapping
- 3:00 p.m.** COFFEE BREAK
3:30 p.m. CONCURRENT TECHNICAL SESSIONS
- Geographic Information Systems Applications
 - Change Detection and Monitoring
- 6:00 p.m.-7:00 p.m.** PECORA 10 MIXER
-

WEDNESDAY, AUGUST 21, 1985

- 8:00 a.m.** SYMPOSIUM REGISTRATION
8:30 a.m. CONCURRENT TECHNICAL SESSIONS
- Vegetation Damage Assessment
 - Mapping Soil and Water Resources
- 10:00 a.m.** COFFEE AND ROLLS
10:30 a.m. CONCURRENT TECHNICAL SESSIONS
- Fire Fuels Mapping
 - Mapping and Monitoring Wildlife Habitat
- 12:00 noon** LUNCH
1:30 p.m. SPECIAL POSTER SESSION (Rooms 228 & 230)
3:00 p.m. COFFEE BREAK
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- 3:30 p.m.** SPECIAL FORUM SESSIONS
- Interfacing Remote Sensing with Spatial Data Systems
 - Integrating Remote Sensing into Operational Systems
 - Remote Sensing for Detection and Monitoring of Atmospheric Deposition Damage
 - Research and Development Priorities in Remote Sensing for Forest and Range Resource Management
- 6:00 p.m.** PRE-BANQUET SOCIAL
- 7:00 p.m.** AWARDS BANQUET
- Dinner
 - Keynote Speech
 - William T. Pecora Award Presentation
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THURSDAY, AUGUST 22, 1985

- 8:00 a.m.** SYMPOSIUM REGISTRATION
- 8:30 a.m.** TECHNICAL SESSION
- Global Resource Assessment
- 10:00 a.m.** COFFEE AND ROLLS
- 10:30 a.m.** TECHNICAL SESSION
- New and Emerging Technology—Data Acquisition
- 12:00 noon** LUNCH
- 1:30 p.m.** TECHNICAL SESSION
- New and Emerging Technology—Data Processing
- 3:00 p.m.** COFFEE BREAK
- 3:30 p.m.** SUMMARY SESSION
- Forum Summaries
 - Symposium Overview
 - Closing Remarks
 - Adjourn
-

FRIDAY, AUGUST 23, 1985

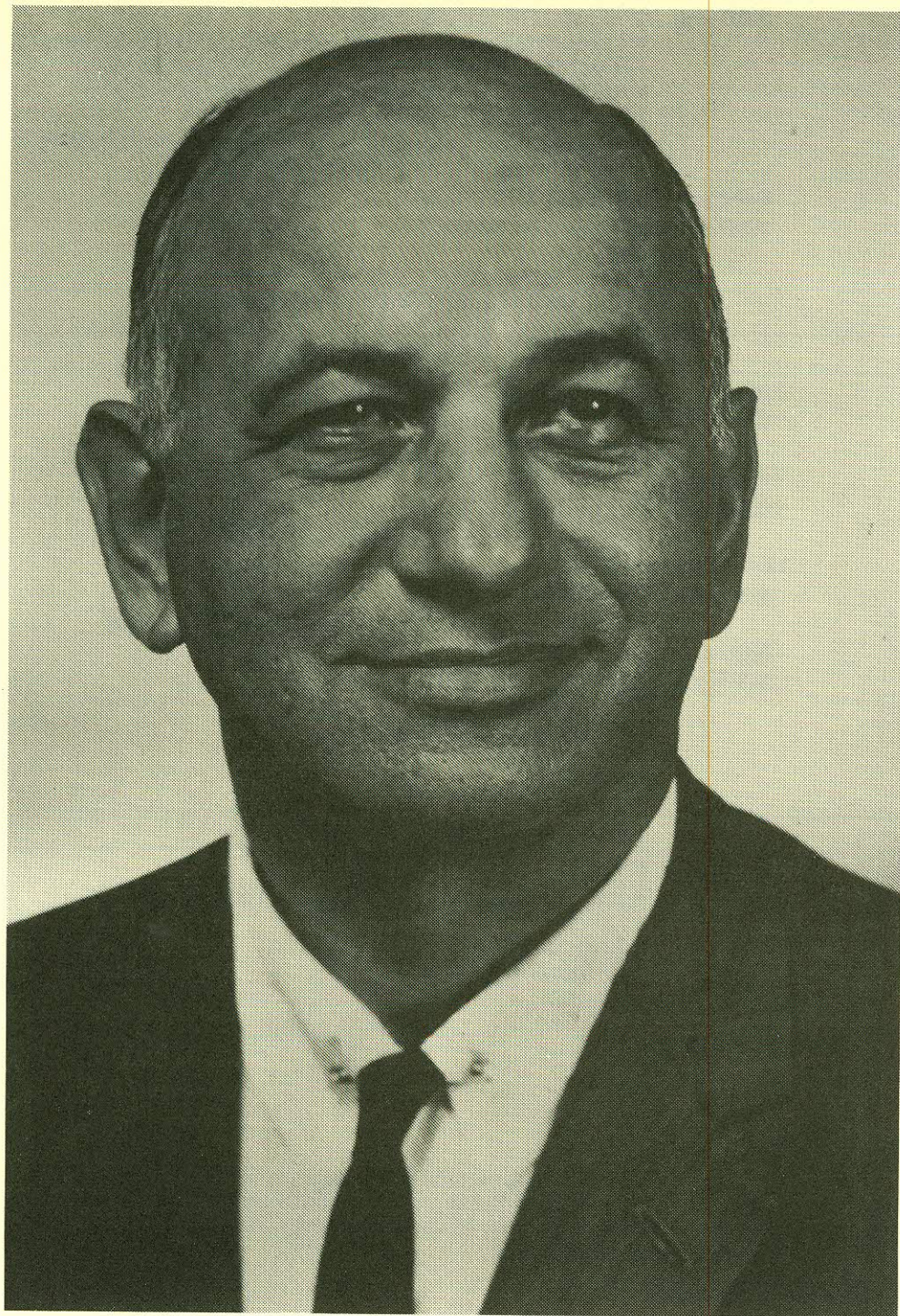
- 8:30 a.m.** POST-SYMPOSIUM FIELD TRIP
- Bus Trip to Poudre River/Pingree Park
 - Lunch
 - Area Interest Stops
 - Dinner at Pingree Park
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PROCEEDINGS

Pecora 10 Proceedings will be published by the American Society for Photogrammetry and Remote Sensing following the symposium. Each participant paying full registration will receive one bound copy of the proceedings. Additional copies may be purchased directly from the ASPRS.

SPEAKERS' AID ROOM

Room 227



WILLIAM T. PECORA, the Man We Honor

Dr. William T. Pecora was an internationally known geologist whose professional career as a scientist and government leader spanned nearly four decades. He was the eighth director of the U.S. Geological Survey from 1965 to 1971 and Undersecretary of the Interior from 1971 until his untimely death on July 19, 1972.

Born February 1, 1913, in Belleville, New Jersey, Dr. Pecora attended public schools in Newark, New Jersey. He graduated with honors in geology from Princeton University in 1933, and received his doctorate in geology from Harvard University in 1940. He also received honorary degrees from Franklin and Marshall College in 1969 and the Colorado School of Mines in 1970.

In addition to his academic and professional achievements, Dr. Pecora was an accomplished athlete. He was the U.S. Intercollegiate Fencing Champion in 1933 and was a member of the 1936 U.S. Olympic Team.

Dr. Pecora joined the Geological Survey in 1939 and soon became a widely acclaimed expert in mineralogy, petrology and geochemistry. His work emphasized the use and development of scientific principles as guides in exploration for mineral, fuel and water resources. He authored more than 50 scientific publications and received international recognition for his work on rare minerals and the geology of volcanic regions. He conducted research throughout the United States and in many parts of Latin America. As a result of his work in Brazil, nine new minerals were identified for the first time.

In 1965, Dr. Pecora was elected to the National Academy of Sciences for his achievements in original research and as a Fellow in the American Academy of Arts and Sciences. In 1968 he received the Department of Interior's highest honor, the Distinguished Service Award. The following year he received the Rockefeller Public Service Award for career servants.

Under Dr. Pecora's leadership the Geological Survey moved into several new areas. The Survey assumed leadership of the Interior Department's Earth Resources Observation Systems (EROS) Program, involving the use of orbiting satellites to gather Earth resources data for analysis. He also established the Survey's National Center for Earthquake Research at Menlo Park, California.

As Undersecretary of the Interior, he coordinated and guided the preparation of the environmental impact statement on the trans-Alaskan oil pipeline proposal. He also helped Interior Secretary Rogers Morton formulate the Department's position on the numerous and complex problems relating to development of the nation's mineral, water and energy resources.

A decisive and frequently colorful administrator, Dr. Pecora proved unusually effective at advancing programs and policies in which he strongly believed. Long-time associates credited him with a blend of precision, wit and personal warmth that made him a memorable figure in the Federal bureaucracy. He was recognized for his adeptness in explaining complex and puzzling scientific phenomena in layman's terms.

The William T. Pecora Memorial Remote Sensing Symposium Series was initiated in 1975 in recognition of Dr. Pecora's commitment and support of this technology. Past symposia have emphasized remote sensing applications in cartography, petroleum and mineral exploration, wildlife management, and hydrology. The 1985 symposium on applications of remote sensing in forest and range resource management marks the tenth anniversary of this series.

Pecora 10 Symposium Program

Tuesday, August 20

9:00 a.m.

Theatre

OPENING AND WELCOME

PLENARY SESSION — Moderator: L. Pettinger

- **Evolution of Remote Sensing in Range Management, Speculations on its Future**, by C.E. Poulton, Consultant, Natural Resources Assessment and Management.

10:00 a.m.

COFFEE AND ROLLS: Ice Rink

10:30 a.m.

- **Status of Remote Sensing in Forestry**, by R.C. Heller, Professor Emeritus, University of Idaho.
- **New Horizons in Remote Sensing for Forest and Range Resource Management** by D.T. Lauer, U.S. Geological Survey.

11:45 a.m.

West Ballroom

LUNCHEON - Mr. Guy Baier, Acting Deputy Director for Lands and Renewable Resources, Bureau of Land Management, Speaker

CONCURRENT SESSIONS - 1:30 p.m.

1:30 p.m.

Theatre

INTEGRATED RESOURCE INVENTORY

Moderator: M. Goldblatt

- **The Potential Impact of Thematic Mapper, SPOT and Microprocessor Technology on Forest Type Mapping Under Lake States Conditions**, by T. M. Lillesand, P. F. Hopkins, M. P. Buchheim, and A. L. Maclean, University of Wisconsin-Madison.
 - **An Operational Interagency GIS: The Glacier National Park/Flathead National Forest Project**, by D. B. Wherry, J. A. Hart, Washington State University. C. H. Key, Glacier National Park. S. A. Bain, Flathead National Forest.
 - **Leaf-Off, Remotely-Sensed Data as a Source of Forest Resource Information**, by W. D. Hudson and D. P. Lusch, Michigan State University.
 - **The Evaluation of Thematic Mapper Data for Range Management Applications in Western Canada**, by K. P. B. Thomson, Canada Centre for Remote Sensing. C. Gosselin, Intera Technologies Ltd. B. W. Adams, Alberta Energy and Natural Resources. I. Sutherland, Alberta Remote Sensing Center.
 - **Multispectral Video Applications in Natural Resource Inventories**, by D. E. Meisner, University of Minnesota.
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1:30 p.m.
East Ballroom

LAND USE/LAND COVER MAPPING

Moderator: W. Miller

- **Interim Program for Land Cover Mapping in Alaska Utilizing Landsat Digital Data**, by M. Shasby, Technicolor Government Services, Inc., L. Gaydos, K. Fitzpatrick-Lins, D. Carneggie, D. Lauer, U.S. Geological Survey. S. Benjamin, V. Ambrosia, Technicolor Government Services, Inc.
- **Mapping Rangeland Vegetation Using Landsat MSS Digital Data for Resource Management Planning**, by W. R. Rush, Bureau of Land Management. S. M. Howard, Idaho Dept. of Water Resources. W. D. Harrison, Soil Conservation Service.
- **The Use of Landsat "Rangeland Enhancements" to Monitor Public Rangelands in Southern Alberta**, by S. G. Klumph and B. W. Adams, Alberta Energy and Natural Resources.
- **Current Forest Mapping Techniques in Southeast Asia**, by L. Fox III, Humboldt State University.
- **Tropical Deforestation and the Implications of Microcomputer-Based Image Processing Technology: Case Study Indonesia**, by S. C. Ahearn, R. W. Kiefer, and T. M. Lillesand, University of Wisconsin-Madison.

3:00 p.m.

COFFEE BREAK: North Ballroom

CONCURRENT SESSIONS - 3:30 p.m.

3:30 p.m.
Theatre

GEOGRAPHIC INFORMATION SYSTEMS APPLICATIONS

Moderator: D. Hunter

- **Updating Range Surveys Using a Geographic Information System**, by J. C. Eidenshink, Technicolor Government Services, Inc. D. Sjasstad, Bureau of Indian Affairs.
- **Cost-Efficiencies of Surface Cover Mapping for Geographic Information System Applications**, by S. C. Williamson, U.S. Fish and Wildlife Service. I. E. Lindauer, P. DePlazes, University of Northern Colorado.
- **Developing a Resource Management Data Base for the Okanogan National Forest from Multispectral Imagery and the Use of GIS**, by G. O. Klock, G. O. Klock and Associates. P. Gum, U.S. Forest Service. L. E. Jordan, ERDAS, Inc.
- **Geographic Information System and Remote Sensing Applications in Rural Alaska Subsistence Use Protection**, by K. G. Meyer, Colorado State University.

3:30 p.m.
East Ballroom

CHANGE DETECTION AND MONITORING

Moderator: J. Merchant

- **A Perspective on Using Remote Sensing for Detecting and Monitoring Change in Renewable Resources**, by L. F. Werth and F. T. Batson, Bureau of Land Management.

- **Change Detection in Rangeland Environments Using Landsat MSS Data — A Quantitative Approach**, by D. C. Johnston and R. H. Haas, Technicolor Government Services, Inc.
- **Assessing Dynamic Forage Conditions in Individual Range Pastures Using Thematic Mapper Imagery and an IBM Personal Computer**, by L. D. Miller, Y. K. Yang, T. Cheng, M. Unverferth, and K. Wills, University of Nebraska.
- **Evaluation of a Layered Approach for Classifying Multitemporal Landsat MSS Data**, by D. F. Lozano-Garcia and R. M. Hoffer, Purdue University.
- **Comparative Evaluation of Digital Change Detection Methods in Forestland and Rangeland Environments Using Landsat Multispectral Scanner Data**, by G. S. Burns, NASA/National Space Technology Laboratories.

6:00-7:00 p.m. PECORA 10 MIXER: University Park Holiday Inn

Wednesday, August 21

CONCURRENT SESSIONS - 8:30 a.m.

8:30 a.m.
Theatre

VEGETATION DAMAGE ASSESSMENT

Moderator: P. Murtha

- **Large-Scale Color-IR Photographs for Incipient Bark Beetle Attack Detection**, by P. A. Murtha, University of British Columbia.
- **The Use of Landsat MSS Digital Data to Detect Mortality of Lodgepole Pine Caused by the Mountain Pine Beetle**, by J. A. Brockhaus, H. M. Cheshire, and S. Khorram, North Carolina State University.
- **Surveying Spruce Budworm Defoliation with an Airborne Pushbroom Scanner**, by F. J. Ahern, Canada Centre for Remote Sensing, W. J. Bennett, Intera Technologies, Ltd. E. G. Kettela, Maritime Forest Research Centre.
- **Digital Airborne and Satellite Data for Evaluating Spruce Budworm Damage in Quebec**, by J. Beaubien, Laurentian Forest Research Centre. P. Laframboise, Centre quebecois de l'Energie et des Ressources.
- **Use of Color Infrared Aerial Photography for Assessing Red Spruce Mortality and Decline**, by M. J. Weiss, L. R. McCreery, and W. M. Ciesla, USDA/Forest Service.

8:30 a.m.
East Ballroom

MAPPING SOIL AND WATER RESOURCES

Moderator: E. Horvath

- **Landsat Imagery: A Tool for Monitoring Snowmelt and Predicting Runoff Patterns for Mountain Watersheds**, by R. W. Marrs, University of Wyoming.
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- **Microwave Remote Sensing of Snowcover in Forested and Non-Forested Areas**, by D. K. Hall, A. T. C. Chang, and J. L. Foster, NASA/Goddard Space Flight Center.
- **Photogrammetric Input to a Geographic Information System for Modeling Soil Erosion**, by R. Welch, T. R. Jordan, University of Georgia. A. W. Thomas, U.S. Department of Agriculture.
- **The Relationship Between Soils Data and Forest Clearing and Forest Regrowth Trends in Costa Rica**, by R. E. Pelletier and S. A. Sader, NASA/National Space Technology Laboratories.
- **Mapping Soil and Soil Degradation Using Remote Sensing Techniques**, by H. S. Iyer, M. L. Manchanda, and J. Prasad, Indian Institute of Remote Sensing.

10:00 a.m.

COFFEE AND ROLLS: North Ballroom

CONCURRENT SESSIONS - 10:30 a.m.

10:30 a.m.
Theatre

FIRE FUELS MAPPING — Moderator: W. Bonner

- **Vegetation and Fire Fuel Models Mapping of North Cascades National Park**, by R. R. Root, S. C. F. Stitt, M. O. Nyquist, G. S. Waggoner, and J. K. Agee, National Park Service.
- **Operational Fire Fuels Mapping with NOAA-AVHRR Data**, by R. A. McKinley, E. Chine, Technicolor Government Services, Inc. L. Werth, Bureau of Land Management.
- **Comparison of Fire Fuel Maps Produced Using MSS and AVHRR Data**, by W. A. Miller, U.S. Geological Survey. D. C. Johnston, Technicolor Government Services, Inc.
- **The Use of Wildland Fire Fuel Maps Produced with NOAA AVHRR Scanner Data**, by L. Werth, Bureau of Land Management. R. A. McKinley, E. Chine, Technicolor Government Services, Inc.
- **Fire Management's Use of Landsat Derived Resource Data Bases**, by P. W. Gum, U.S. Forest Service.

10:30 a.m.
East Ballroom

MAPPING AND MONITORING WILDLIFE HABITAT

Moderator: B. Schrumppf

- **Landsat-Facilitated Vegetation Classification of the Kenai National Wildlife Refuge and Adjacent Areas, Alaska**, by S. S. Talbot, U.S. Fish and Wildlife Service. M. B. Shasby, Technicolor Government Services, Inc. T. N. Bailey, U.S. Fish and Wildlife Service.
 - **Elk Habitat Evaluation Using Distance-Transformed Landsat Data**, by R. Murray, Oregon State University. D. A. Leckenby, Oregon Dept. of Fish and Wildlife.
 - **Stream/Riparian Area Inventory and Monitoring Using Large Scale Color Infrared Airphotos**, by P. Cuplin and F. Batson, Bureau of Land Management.
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- **Operational Methods and Emerging Technologies for the Assessment and Monitoring of Wildlife Habitat in Developing Countries**, by B. D. Treadwell, Wildlife and Remote Sensing Consultant. S. Berwick, International Institute for Environment and Development. P. L. Warren, Arizona Remote Sensing Center.
 - **Mapping the Green Leaf Area Index of Rangeland with Airborne Multispectral Scanner Data**, by P. J. Curran and H. D. Williamson, University of Sheffield, United Kingdom.

12:00 noon

LUNCH

1:30 p.m.

SPECIAL POSTER SESSION

Rooms 228 & 230

Chairperson: Richard Myhre

The Forest Fire Advanced System Technology Project System Configuration. J.D. Nichols and J.R. Huning, Jet Propulsion Laboratory; and J.R. Warren, USDA Forest Service.

LANDSAT - A Tool for Mapping Fuel Types in the Boreal Forest of Manitoba: A Pilot Study. R. Dixon, W. Shipley, and A. Briggs, Manitoba Department of Natural Resources.

Applications of Landsat Imagery in Large Scale Fire Fuels Mapping Projects. J.M. Willis, Bureau of Land Management.

Thematic Mapper Analysis of Coniferous Forest Stands. J. Franklin, University of California.

The Use of Low-Resolution Satellite Image Data for Rangeland Monitoring. T.M. Holm, Technicolor Government Services, Inc.; W.C. Draeger, U.S. Geological Survey, and P.T. Williams and R.F. Buzzard, Bureau of Indian Affairs.

Sensitivity of Vegetation Indices to Variations in Soil Color. A. Morse, Idaho Department of Water Resources; and E.L. Maxwell, Solar Energy Research Institute.

Determination of the Appropriate Regression Models for the Prediction of Rangeland Biomass from Landsat Vegetation Indices. A. Morse, Idaho Department of Water Resources; and E.L. Maxwell, Solar Energy Research Institute.

Predicting Iron and Organic Carbon in Soils, Sediment, and Mine Samples Using Spectral Reflection Measurements. H. Schreier, University of British Columbia.

The Use of a Field Portable Spectroradiometer in Evaluating Vegetation Signatures. D.L. Hawley, EG&G Energy Measurements, Inc.

Comparison of Multiple Altitudes of Aerial Photography and Multispectral Scanner Imagery. L.R. Tinney, C.E. Ezra, and J.E. Shines, EG&G Energy Measurements, Inc.

Multiphase Sample of Vegetation and Related Resources Using Landsat, Aerial Photo, and Ground Survey Data. K.E. Winterberger and F.R. Larson, USDA Forest Service.

Small Format Aerial Photography for Monitoring Southern Pine Plantations. H.R. Stoin, University of Arkansas.

Southeast Alaska Aerial Photo Stand Volume Tables. T.S. Setzer and D.R. Mead, USDA Forest Service.

Feasibility Study Using Ultralight and Other Small Aircraft to Obtain Large Scale Photography for Photogrammetric Operations. W.A. Crisco, Bureau of Land Management.

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- Evaluating Biofuel Amounts Using Image and Spatial Data Analyses.** H.N. Anderson and B.L. Kessler, Idaho Department of Water Resources.
- A Micro Computer GIS Workstation.** D.O. Hunter, U.S. Fish and Wildlife Service.
- Aerial Photographic Project Planning and Cost Estimation on a Micro Computer.** C.W. Dull, USDA Forest Service.
- E. Line Tracer: An Economical Digitizing System.** R.R. Chamard, E. Coyote Enterprises.
- Forest Pest Management on the Nicolet National Forest, Wisconsin, Using a Geographic Information System.** B.W. Morse, Autometrics, Inc.
- Aerial Photography for Post-Mine Vegetation Inventory.** R.V. Dams, Intera Technologies, Ltd.; and R.E. Francis, USDA Forest Service.
- Comparison Between Digital and Manual Interpretation of High Altitude CIR Aerial Photography of the West Tanana River Basin, Alaska.** P.W. Snook, K.E. Winterberger, N.E. Merritt, and R.L. Czaplewski, USDA Forest Service.
- Indian Integrated Resource Information Program.** J.E. Getter and W.J. Bonner, Jr., Bureau of Indian Affairs.
- Close-Range Photogrammetry of Stream Channel Parameters for the Estimation of Stream Discharge.** K.G. Coulton, Washington State University.
- Hardwood Crown Cover Over Impervious Urban Surfaces.** H.G. Halverson and F.P. Weber, USDA Forest Service.
- Digital Elevation Data in Large-Area Resource Studies.** R.A. McKinley, Technicolor Government Services, Inc.
- An Evaluation of Simulated Thematic Mapper Data and Landsat MSS Data for Mapping Hardwood Stand Density Characteristics in Central California.** J.A. Brockhaus, North Carolina State University.
- The Pulsed Airborne Laser Profiler: A New System to Quantify and Evaluate Forests.** R.D. Baker and M.C. Whatley, Texas A&M University; and L.A. LeSchack, LeSchack Associates, Ltd.
- The Use of Landsat Data in Determining Empirical Evapotranspiration Rates of Sierra Nevada Forest Cover in Washoe Valley, Nevada.** V.G. Ambrosia, J.A. Brass, and F.E. Arteaga, Technicolor Government Services, Inc.
- Landsat for Monitoring Rangeland Burning Spatial Characteristics in the Kansas Flint Hills.** S.R. Wilds and M.D. Nellis, Kansas State University.
- Study of Flood Moderating Capability of Forest Cover Using Remotely Sensed Data.** O.P. Dubey, University of Roorkee, India.
- Remote Sensing of Plant-Water Status in a Desert Shrub Community.** D.L. Isaacson, W.J. Ripple, and B.J. Schrupf, Oregon State University.
- A Comparison of X- and L-Band Radar Data for Discriminating Forest Cover Types.** R.M. Hoffer, P.W. Mueller, D.F. Lozano-Garcia, and D.J. Knowlton, Purdue University.
- The Use of Landsat's Thematic Mapper for Wetlands Inventory.** G.L. Koeln and J.E. Jacobson, Ducks Unlimited, Inc.; and C.L. Hill, NASA.
- Millimeter-Wave Imaging Sensor for Fire Mapping.** W.J. Wilson and R.J. Howard, Jet Propulsion Laboratory.
- Fire Detection Using NOAA Polar Orbiting Satellite Data.** M. Matson and G. Stephens, National Oceanic and Atmospheric Administration.
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3:00 p.m.	COFFEE BREAK: North Ballroom
3:30 p.m.	FORUM SESSIONS — Coordinator: G. Johnson
East Ballroom	• Interfacing Remote Sensing with Spatial Data Systems Moderator: D. Asherin
Student Senate Room	• Integrating Remote Sensing into Operational Systems Moderator: B. Barker
Rooms 203-05	• Remote Sensing for Detection and Monitoring of Atmospheric Deposition Damage — Moderator: W. Ciesla
Rooms 207-09	• Research and Development Priorities in Remote Sensing for Forest and Range Resource Management Moderator: P. Tueller
6:00 p.m.	PRE-BANQUET SOCIAL: North Ballroom (Exhibits)
7:00 p.m.	PECORA AWARDS BANQUET
West Ballroom	Mr. C.P. Williams, President, EOSAT, Keynote Speaker

Thursday, August 22

8:30 a.m.	GLOBAL RESOURCE ASSESSMENT
Theatre	Moderator: G. Thorley
	• Monitoring the Earth — Too Many Players? , by G. A. Thorley, U.S. Geological Survey.
	• The Relationship of Global Green Leaf Biomass to Atmospheric CO₂ Concentrations , By C. J. Tucker, NASA/Goddard Space Flight Center. I. Y. Fung, NASA/Goddard Institute for Space Studies. C. D. Keeling, Scripps Institution of Oceanography. R. H. Gammon, NOAA.
	• Quantity and Areal Distribution of Soil Organic Carbon as Related to Vegetation Cover Classes Derived from Landsat Data , by P. J. Zinke, E. Katibah, H. Jenny, and A. Stangenberger, University of California-Berkeley.
	• Monitoring Tropical Forests from Satellite and Aircraft Platforms: Some Limitations and New Approaches , by S. A. Sader, A. T. Joyce, and R. B. Waide, NASA/National Space Technology Laboratories.
	• An Ecoregion-Continuum Approach to Global Vegetative Biomass Estimation , by T. L. Logan, Jet Propulsion Laboratory.
	• Predicting Change in Basic Ecosystem Processes from Properties of the Vegetative Canopy , by R. H. Waring, Oregon State University.

10:00 a.m.

COFFEE AND ROLLS: North Ballroom

10:30 a.m.
Theatre

NEW AND EMERGING TECHNOLOGY — DATA ACQUISITION — Moderator: W. Barnes

- **An Airborne Imaging System for Measuring Bi-Directional Reflectance**, by W. L. Barnes, F. G. Huegel, and J. R. Irons, NASA/Goddard Space Flight Center.
- **High Spectral Resolution Remote Sensing with the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS)**, by G. Vane, Jet Propulsion Laboratory.
- **Research Optical Sensor**, by C. F. Schueler, Hughes Santa Barbara Research Center.
- **MODIS: A Moderate-Resolution Imaging System for the Space Station Polar-Orbiting Platform**, by W. L. Barnes, NASA/Goddard Space Flight Center.
- **Imaging Spectrometry: What the Future Holds**, by A. F. H. Goetz, Jet Propulsion Laboratory.

12:00 noon

LUNCH

1:30 p.m.
Theatre

NEW AND EMERGING TECHNOLOGY — DATA PROCESSING — Moderator: M. Devirian

- **The Massively Parallel Processor - Programming and Applications**, by H. K. Ramapriyan, J. P. Strong, and J. C. Tilton, NASA/Goddard Space Flight Center.
- **Concurrent Processing Technology for Land Remote Sensing**, by J. E. Solomon and M. Lee, Jet Propulsion Laboratory.
- **Employing Geographic Reasoning in Ecoregion Mapping**, by J. W. Merchant, University of Kansas.
- **Analysis of Image Processing Algorithms for Classifying the Forests of Northern Minnesota**, by S. R. Yool, J. L. Star, J. E. Estes, and D. B. Botkin, University of California-Santa Barbara.
- **Interpretation of Forest Cover on Microwave and Optical Satellite Imagery**, by P. W. Mueller, R. M. Hoffer, and D. F. Lozano-Garcia, Purdue University.

3:00 p.m.

COFFEE BREAK: Ice Rink

3:30 p.m.
Theatre

SUMMARY SESSION

- Forum Summaries
- Symposium Overview
- Closing Remarks
- Adjourn

THE WILLIAM T. PECORA AWARD

THE WILLIAM T. PECORA AWARD, presented annually in recognition of outstanding contributions of individuals or groups toward the understanding of the Earth by means of remote sensing, is sponsored jointly by the National Aeronautics and Space Administration and the Department of the Interior. The award was established in 1974 to honor the memory of Dr. William T. Pecora, former Director of the U.S. Geological Survey, and later, Undersecretary, Department of the Interior. Dr. Pecora was a motivating force behind the establishment of Earth resource sensing from space. He was a Government leader with broad vision and deep appreciation for the use of satellite programs in continually inventorying and managing our national resources.

PREVIOUS RECIPIENTS

- 1974** William A. Fischer, U.S. Geological Survey, Department of the Interior
- 1975** William Nordberg, National Aeronautics and Space Administration, and Carlos Brockmann, Director of the LANDSAT-Bolivia Project
- 1976** Awarded jointly: Environmental Research Institute of Michigan and Laboratory for Applications of Remote Sensing of Purdue University
- 1977** Robert N. Colwell, School of Forestry, University of California, Berkeley and Michel T. Halbouty, Consulting Geologist and Petroleum Engineer, The Halbouty Center
- 1978** David S. Johnson, National Environmental Satellite Service, Department of Commerce
- 1979** John M. DeNoyer, U.S. Geological Survey, Department of the Interior and Virginia T. Norwood, Senior Scientist, Hughes Aircraft Company
- 1980** Verner E. Suomi, Professor of Meteorology, University of Wisconsin
- 1981** Leonard Jaffe, National Aeronautics and Space Administration and James R. Anderson (posthumously), U.S. Geological Survey, Department of the Interior
- 1982** Alexander F.H. Goetz, National Aeronautics and Space Administration and Lawrence C. Rowan, U.S. Geological Survey, Department of the Interior
- 1983** Floyd F. Sabins, Jr., Senior Research Associate, Chevron Oil Field Research Company
- 1984** Archibald B. Park, GLOBEX, Inc.
- 1985** Charles Elachi, Jet Propulsion Laboratory
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1985
William T. Pecora Award Citation
Dr. Charles Elachi

In recognition of his outstanding contributions as a scientist, engineer, and manager in developing and demonstrating synthetic aperture imaging radar techniques for Earth sciences and practical applications.

Dr. Charles Elachi has been a leader in satellite-borne synthetic aperture imaging radar remote sensing for studying the solid Earth and oceans. The remarkable capabilities of this technique have been demonstrated by three space systems flown under NASA sponsorship: (1) the Seasat satellite, launched in 1978; (2) SIR-A, carried into orbit on the Shuttle in November 1981; and (3) SIR-B, on the Shuttle flight in November 1984. These three systems were designed and developed at the Jet Propulsion Laboratory under Dr. Elachi's guidance and expert leadership.

The Seasat radar was designed primarily to observe ocean features, but also proved capable of producing highly useful images of land. The Seasat mission was the first flight in space of an imaging radar and its success assured a sound basis for further development and application.

The SIR-A and SIR-B missions have been progressively more impressive. The SIR-A instruments delineated land surface features in great detail and also penetrated the extremely dry sand of the Eastern Sahara to a depth of several meters to reveal alluvial deposits and drainage patterns which had not been detected by conventional imaging. These findings opened new areas of investigation. The SIR-B mission provided images at a variety of incidence angles and illumination geometrics, enabling the construction of stereographic images from the data.

Demonstration of the capability of imaging radar involves considerably more than the flight apparatus, for by its nature the technique produces huge quantities of raw data. Dr. Elachi led the effort to update earlier optical processors and is playing a key supportive role in developing advanced digital techniques for SIR-B data.

The satellite missions have received wide public acclaim. But during the decade prior to these highly visible contributions, Dr. Elachi conducted pioneering work in theoretical analyses and airborne systems to show the potential of imaging radar for oceanography and meteorology on Earth and for studying Venus. The breadth of these contributions, represented in over one hundred publications in a variety of technical fields, arises from his unique skill in interpreting radar images and his intimate knowledge of Earth science. Beyond these notable technical abilities, Dr. Elachi has unusual skill in communicating with his co-workers, engineers and scientists from other disciplines, and with management.

In recognition of these accomplishments, the National Aeronautics and Space Administration and the Department of the Interior take great pleasure in presenting the William T. Pecora Award to Dr. Charles Elachi.



Secretary of the Interior



Administrator, National Aeronautics
and Space Administration

SYMPOSIUM INFORMATION

FORT COLLINS — The Host City for Pecora 10

Fort Collins is a modern community of approximately 80,000 people, located on the east side of the Colorado Front Range, about 70 miles north of Denver. It is the home of Colorado State University, which has an active program in forestry, range science, remote sensing, and related disciplines. A number of Federal and State agencies engaged in natural resource management also have offices here. Several clean industries are located in Fort Collins, including Woodward-Governor, Hewlett Packard, and Teledyne Water Pik. Colorado Kodak has a major facility about 15 miles southeast of Fort Collins.

The city has excellent shopping malls and a recently restored Old Town District with a number of gift and curio shops and a variety of restaurants. The city is within an hour's drive of major recreational areas including Estes Park, Rocky Mountain National Park, and Roosevelt National Forest.

Weather in Fort Collins in late August is generally warm and pleasant but afternoon thunderstorms are common and evenings may be cool. The city's elevation is approximately 5,000 feet above sea level.

EXHIBITORS

An up-to-date exhibitor list is provided separately with registration materials. All exhibits are in the CSU North Ballroom. Exhibit hours are 10 a.m. - 4 p.m. Tuesday, 10 a.m. - 7 p.m. Wednesday, and 10 a.m. - 1 p.m. Thursday.

SPOUSE EVENTS

A get-acquainted tea featuring a demonstration of home spinning and weaving techniques and a fashion show will take place at the University Park Holiday Inn from 2-4 p.m. on Tuesday. A walking tour of the recently restored Old Town district of Fort Collins is scheduled for Wednesday—buses will leave from the University Park Holiday Inn at 10:30 a.m. and return at 2:30 p.m. On Thursday, a tour of Rocky Mountain National Park will be conducted for \$15 per person. A lunch stop near the summit of 12,000-foot Trail Ridge is included, along with time to browse in the quaint shops at Estes Park.

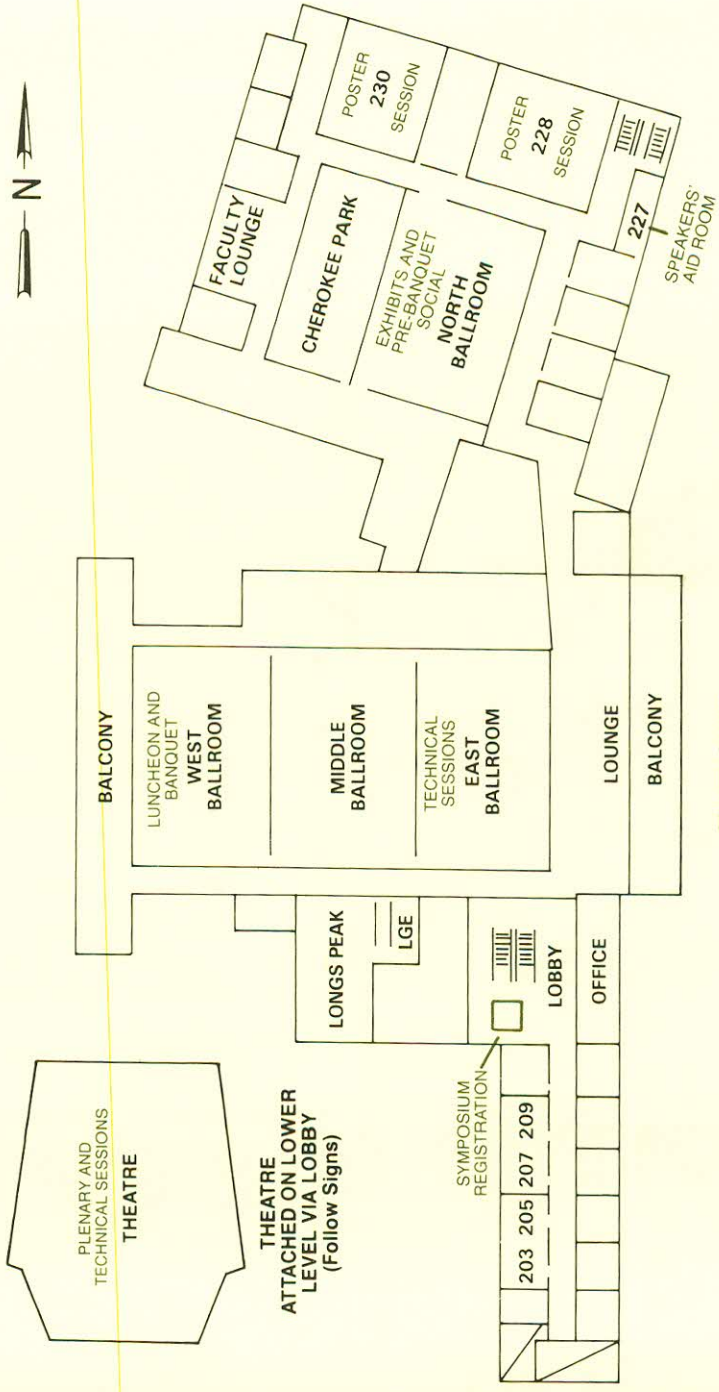
POST-SYMPOSIUM FIELD TRIP

A special field trip is scheduled for Friday, August 23. This trip will provide an opportunity to view a variety of forest and range management activities in the scenic Cache La Poudre canyon west of Fort Collins. The trip will include a picnic lunch and an evening barbecue at Pingree Park — Colorado State University's summer field camp. Cost of the field trip is \$25 per person. Space is limited to 70 persons. Reservations are on a first-come, first-served basis. Participants should bring rain gear. Buses will depart from University Park Holiday Inn at 8:30 a.m. Buses will leave Pingree Park at 7:30 p.m. and return to Ft. Collins approximately two hours later.

BADGES AND MEAL TICKETS

Pecora 10 badges are required for admittance to all events, and tickets will be collected for the luncheon and evening mixer (Tuesday) and for the Pecora Awards Banquet and Pre-Banquet Social (Wednesday).

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