Ernie Ables

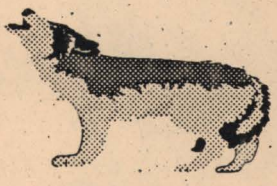
PROGRAM
1995
ANNUAL MEETING

March 9,10,11, 1995
Northwest Scientific Association
Idaho Chapter, The Wildlife Society
The Northwest Lichen and Moss Guild

Idaho State University at the
Idaho State University/University of Idaho
Center for Higher Education
Idaho Falls, Idaho

Northwest Scientific Association

IDAHO CHAPTER
THE WILDLIFE SOCIETY



68th Annual Meeting
Northwest Scientific Association
and the
Annual Meeting of the Idaho Chapter, The Wildlife Society

Idaho Falls, Idaho–March 8-11, 1995

COORDINATORS

Barry L. Keller and Fred L. Rose
PROGRAM NWSA

James W. Unsworth and Martha C. Wackenhut
PROGRAM ICTWS

SPONSORS

IDAHO STATE UNIVERSITY
IDAHO POWER
LOCKHEED ENVIRONMENTAL SYSTEMS & TECHNOLOGIES CO.
(Environmental Technologies Division)

SESSION CHAIRS

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Scott Feltis
William R. Hackett
Karl E. Holte
Scott S. Hughes
Michael O. McCurry
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Timothy D. Reynolds
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John Welhan

ICTWS
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Richard P. Howard
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KEYNOTE SPEAKER

G. Wayne Minshall

OFFICERS

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Northwest Scientific Association
Idaho Chapter, The Wildlife Society
The Northwest Lichen and Moss Guild

Summary of Events

Wednesday, March 8, 1995

1:00p-5:00p	Partners in Flight Convener: Sharon Ritter,Idaho Department of Fish and Game Grangeville, Idaho	CHE 209
7:00p-9:00p	Reception	Shilo Inn
	Registration	Shilo Inn
7:00p-9:00p	NWSA Board meeting	Shilo Inn
	ICTWS Board meeting	Shilo Inn

Thursday, March 9, 1995

7:30a-noon	Registration	Center for Higher Education Main Entrance
8:00a-5:00p	Preview Room for speakers only	CHE 206
1:30p-5:30p	Poster/Display Session	CHE 207

Shuttle Van: Check at Shilo Inn Front Desk for schedule
Open Parking at CHE--no permit required (see map in packet)
Bookstore hours: 9:00a-6:00p

THURSDAY ROOM SUMMARY

Morning Sessions:

Plenary Session Opening		Auditorium
NWSA Symposium:	Ecological Aspects of Waste Management	CHE 213
ICTWS Symposium:	Wolf Recovery	Auditorium

Lunch: NWSA Business Luncheon **Shilo Inn**

Afternoon Sessions:

NWSA Botany:	Contributed Papers Session 3	CHE 213
NWSA Forestry:	Contributed Papers Session 4	CHE 214
NWSA Aquatic Ecology:	Contributed Papers Session 5	CHE 215
Lichen Guild Workshop:	How to Dye with Lichens	CHE 107
ICTWS Wildlife Management:	Contributed Papers Session 1	CHE 209
ICTWS Nongame Species:	Contributed Papers Session 2	CHE 210

Thursday, March 9, cont.

6:30p-9:00p	**NWSA/ICTWS Banquet**	**Shilo Inn**

STREAM ECOSYSTEM INTEGRITY: A TEMPORAL PERSPECTIVE OF DISTURBANCE IN THE PACIFIC NORTHWEST

Keynote Speaker: G. Wayne Minshall, Ph.D.
Idaho State University, Pocatello, Idaho
Recipient of the 1993 NWSA Outstanding Scientist Award

Friday, March 10, 1995

8:00a-noon	Registration	Center for Higher Education Main Entrance	
8:00a-5:00p	Preview Room for speakers only		CHE 206
1:30p-5:30p	Poster/Display	Session 7	CHE 209
		Session 8	CHE 218
		Session 9	CHE 207

Shuttle Van: Check at Shilo Inn Front Desk for schedule
Open Parking at CHE--no permit required (see map in packet)
Bookstore hours: 9:00a-6:00p

FRIDAY ROOM SUMMARY

Morning Sessions:

Lichen Guild Workshop	How to Process and Identify Microbiotic Crusts	CHE 107
NWSA Symposium:	Geology of the Eastern Snake River Plain	CHE 213
ICTWS Symposium:	Riparian Management	CHE 211

Lunch: On own

Afternoon Sessions:

NWSA Symposium:	Distance Education: The New Frontier	CHE 211
NWSA Geology/Geography:	Contributed Papers Session 7	CHE 209
NWSA Ecology/Zoology:	Contributed Papers Session 8	CHE 218
NWSA Lichen and Mosses:	Contributed Papers Session 9	CHE 220
ICTWS Upland Game/Waterfowl:	Contributed Papers Session 6	CHE 210

6:00p-10:00p	**Social/Auction**	**Shilo Inn**

Sponsored by Idaho Chapter, The Wildlife Society

Program Agenda
Northwest Scientific Association
The Northwest Lichen and Moss Guild

Thursday, March 9

8:00a-8:25a Plenary Session Welcome (Wood and Lava Rock Bldg, right side of CHE) — Auditorium, University Place

Symposium: Ecological Aspects of Waste Management — **CHE 213**
Chairs: Randall C. Morris and Timothy D. Reynolds, Environmental Science and Research Foundation, Idaho Falls, Idaho

Time	Abstract #	Title/Author
8:30a-8:40a	1	Introduction to Symposium: ECOLOGICAL ASPECTS OF WASTE MANAGEMENT Randall C. Morris and Timothy D. Reynolds, Environmental Science and Research Foundation, Idaho Falls, Idaho
8:40a-9:05a	2	THE PURPOSE OF WASTE ISOLATION: LEGAL REQUIREMENTS AND DESIGN CRITERIA. Catherine Massimino, Environmental Protection Agency, Seattle, Washington
9:05a-9:30a	3	EXISTING LOW-LEVEL WASTE REPOSITORIES. W.J. Waugh, Environmental Sciences Laboratory, US Department of Energy, Grand Junction, Colorado
9:30a-9:55a	4	CHALLENGES TO WASTE REPOSITORIES: ANIMAL INTRUSION. Paul E. Blom, University of Idaho, Moscow, Idaho, and John W. Laundre', Idaho State University, Pocatello, Idaho
10:00a-10:20a	Break	
10:20a-10:45a	5	CHALLENGES TO WASTE REPOSITORIES: PALEOCLIMATE. Kenneth L. Petersen, Pacific Northwest Laboratory, Richland, Washington
10:45a-11:10a	6	CHALLENGES TO WASTE REPOSITORIES: PLANT BIOINTRUSION. Charles J. Burt and Mark L. Miller, Roy F. Weston Inc., Uranium Mill Tailings Remedial Action Project (UMTRA), Albuquerque, New Mexico
11:10a-11:35a	7	COMBINED TREATMENT OF LOW-LEVEL AND MIXED WASTE WITH EXEMPLARY DISPOSAL. G. Ross Darnell, formally with Lockheed Idaho Technologies Company, Idaho Falls, Idaho
11:35a-noon	8	MEETING THE CHALLENGES: ECOLOGICAL SOLUTIONS. Jay E. Anderson, Idaho State University, Pocatello, Idaho
12:15p-1:30p		**NWSA Business Luncheon** — **Shilo Inn** (NWSA Luncheon included in registration fee)

2:00p-5:00p **Workshop--How to Dye with Lichens** — **CHE 107**
Convener: Karen Dillman, Idaho State University, Pocatello, Idaho

Session 3	Contributed Papers--Botany Chair: Karl Holte, Idaho State University, Pocatello, Idaho	CHE 213

Time	Abstract #	Title/Author
1:30p-1:50p	29	ENDANGERED AND THREATENED PLANT SPECIES IN WASHINGTON STATE: PLANNING AND PARTNERSHIPS. Ted Thomas, US Department of Interior Fish and Wildlife Service, Olympia, Washington
1:50p-2:10p	30	A HOLOCENE VEGETATION AND DISTURBANCE HISTORY OF THE WILLAMETTE VALLEY, WESTERN OREGON, U.S.A. Christopher A. Pearl, Cathy Whitlock, Marc A. Worona, Peter K. Schoonmaker, University of Oregon, Eugene, Oregon, and Oregon State University, Corvallis, Oregon
2:10p-2:30p	31	POPULATION STUDIES OF *Primula alcalina* IN ITS VARIED HABITAT. Robert Fitts, Utah State University, Logan, Utah
2:30p-2:50p	32	THE HISTORIC AND PRESENT DISTRIBUTION OF *Bromus tectorum* ON THE IDAHO NATIONAL ENGINEERING LABORATORY. Teresa D. Ratzlaff, Kaylie E. Rasmuson, Tracy R. Bowlin, Jay E. Anderson, and Richard S. Inouye, Idaho State University, Pocatello, Idaho
2:50p-3:10p		Break
3:10p-3:30p	33	GROWTH AND PHYSIOLOGICAL RESPONSES OF Bromus tectorum TO INCREASING LEVELS OF SALINITY. Kaylie E. Rasmuson, Idaho State University, Pocatello, Idaho
3:30p-3:50p	34	THE EFFECTS OF SEED-PRIMING ON THE GROWTH OF *Elymus lanceolatus* IN COMPETITION WITH *Bromus tectorum*.. W. Eric Limbach, Idaho State University, Pocatello, Idaho, and Stuart P. Hardegree, Northwest Watershed Research Laboratory, Boise, Idaho
3:50p-4:10p	35	DISTINGUISHING BETWEEN *Elymus lanceolatus* AND *Pascopyrum smithii* (GRAMINEAE: TRITICEAE). Mary E. Barkworth and C.A.B. Gilbert, Intermountain Herbarium, Utah State University, Logan, Utah, and K.H.Asay, US Department of Agriculture-ARS, Logan, Utah
4:10p-4:30p	36	FLORA AND PLANT COMMUNITIES OF THE DARLINGTONIA WAYSIDE STATE PARK, LANE COUNTY, OREGON. Marie J. James, Washington State University, Pullman, Washington, and Ralph L. Thompson, Berea College, Berea, Kentucky
4:30p-4:50p	37	EVALUATING SNOWMELT EROSION FROM SIMULATED WASTE BURIAL TRENCH CAPS. Eric K. Duffin and James P. Dobrowolski, Utah State University, Logan, Utah
4:50p-5:10p	38	GRAVITROPISM AND W-WAVE VELOCITIES. Orvin E. Wagner, Wagner Research Laboratory, Rogue River, Oregon

Session 4	Contributed Papers--Forestry Chair: Scott Feltis, Caribou National Forest, Pocatello, Idaho	CHE 214

1:30p-1:50p	39	FIRST-YEAR PERFORMANCE OF CONIFERS AND HARDWOODS PLANTED IN COMMERCIALLY THINNED DOUGLAS-FIR STANDS. Kathleen Maas and W.H. Emmingham, Oregon State University, Newport, Oregon
1:50p-2:10p	40	FIRE HISTORY AND SUCCESSIONAL PROCESSES WITHIN THE PONDEROSA PINE DOUGLAS-FIR/BEARDLESS BLUEBUNCH WHEATGRASS PLANT ASSOCIATION WITHIN THE OKANOGAN NATIONAL FOREST. Therese H. Ohlson, Okanogan National Forest, Winthrop, Washington, and Benjamin A. Zamora, Washington State University, Pullman, Washington
2:10p-2:30p	41	WATERSHED ANALYSIS FOR FOREST VEGETATION. Richy J. Harrod and William E. Hartl, US Department of Agriculture-Forest Service, Leavenworth, Washington

Session 4, cont. **Contributed Papers--Forestry** **CHE 214**

Time	Abstract #	Title/Author
2:30p-2:50p	42	SOIL AND AIR TEMPERATURE RELATIONS IN FORESTED HABITATS IN WESTERN WASHINGTON. Jan A. Henderson and David H. Peter, US Department of Agriculture-Forest Service, Mountlake Terrace, Washington
2:50p-3:10p		Break
3:10p-3:30p	43	EFFECTS OF POSTFIRE ENVIRONMENT AND COMPETITION ON GROWTH OF LODGE-POLE PINE SEEDLINGS IN YELLOWSTONE NATIONAL PARK. Jay E. Anderson, Idaho State University, Pocatello, Idaho
cancelled see abstract	44	VEGETATION CHARACTERISTICS OF SPOTTED OWL SITES IN THE NORTHWEST WASHINGTON CASCADES. Wayne F. Iverson, Seattle Central Community College, Seattle, Washington

Session 5 **Contributed Papers--Aquatic Ecology** **CHE 215**
Chair: Chris Robinson, Idaho State University, Pocatello, Idaho

1:30p-1:50p	45	ECOSYSTEM METABOLISM AND CARBON SPIRALING IN AN IMPOUNDED, COLD WATER RIVER SYSTEM. Eric B. Snyder and G.Wayne Minshall, Idaho State University, Pocatello, Idaho
1:50p-2:10p	46	CARBON SPIRALING IN THE MIDDLE REACH OF THE SNAKE RIVER, IDAHO. Steven A. Thomas and G. Wayne Minshall, Stream Ecology Center, Idaho State University, Pocatello, Idaho
2:10p-2:30p	47	DIATOM COMMUNITY STRUCTURE IN RELATION TO HABITAT HETEROGENEITY FOLLOWING WILDFIRE. Todd V. Royer, Chris T. Robinson, G.Wayne Minshall, Idaho State University, Pocatello, Idaho, and S. R. Rushforth, Brigham Young University, Provo, Utah
2:30p-2:50p	48	THERMAL STRESS RESPONSE OF A STONEFLY (PLECOPTERA: *Hesperoperla pacifica*). Jason Nelson, Stream Ecology Center, Idaho State University, Pocatello, Idaho
2:50p-3:10p		Break
3:10p-3:30p	49	LOTIC ECOSYSTEM FUNCTION: COMPARISON OF TWO HEADWATER STREAMS THAT DIFFER IN ASPECT. Scott E. Relyea, Chris T. Robinson, and G. Wayne Minshall, Stream Ecology Center, Idaho State University, Pocatello, Idaho

Poster **CHE 207**

1:30p-4:30p	50	COASTAL OREGON PRODUCTIVITY ENHANCEMENT ADAPTIVE COPE PROGRAM: A FOREST RESOURCE RESEARCH AND TECHNOLOGY TRANSFER PROGRAM. Liz Dent, Kathleen Maas, John P. Hayes, and Michael D. Adam, Coastal Oregon Productivity Enhancement, Hatfield Marine Science Center, Newport, Oregon

6:30p-9:00p **NWSA/ICTWS Banquet** **Shilo Inn**

STREAM ECOSYSTEM INTEGRITY: A TEMPORAL PERSPECTIVE OF DISTURBANCE IN THE PACIFIC NORTHWEST

Keynote Speaker: G. Wayne Minshall, Ph.D.
Idaho State University, Idaho
Recipient of the 1993 NWSA Outstanding Scientist Award

Friday, March 10, 1995

8:00a-12:00noon	**Registration**	**CHE Main Entrance**
8:00a-5:00p	**Preview Room available for speakers**	**CHE 206**

9:00a-11:30a Workshop--How to Process and Identify Microbiotic Crusts - Lichen Guild CHE 107

Conveners: Roger Rosentreter, Bureau of Land Management, Boise, Idaho
Bruce McCune, Oregon State University, Corvallis, Oregon
Ann DeBolt, Bureau of Land Management, Boise, Idaho

Symposium: Geology of the Eastern Snake River Plain CHE 213

Chairs: Mike McCurry, Idaho State University, Pocatello, Idaho,
William R. Hackett, WRH Associates, Salt Lake City, Utah

Time	Abstract #	Title/Author
8:30a-9:00a	9	TECTONICS AND EVOLUTION OF THE YELLOWSTONE HOTSPOT. Robert B. Smith, University of Utah, Salt Lake City, Utah
9:00a-9:20a	10	UPPER CRUSTAL SEISMIC AND GEOLOGIC STRUCTURE OF THE EASTERN SNAKE RIVER PLAIN (ESRP): EVIDENCE FROM DRILL HOLES AND REGIONAL GEOPHYSICS AT THE IDAHO NATIONAL ENGINEERING LABORATORY (INEL). Richard P. Smith, N.E. Josten, INEL, Lockheed Idaho Technologies Company, Idaho Falls, Idaho, and W.R. Hackett, WRH Associates, Salt Lake City, Utah
9:20a-9:40a	11	CRUST-MANTLE STRUCTURE ALONG THE EASTERN SNAKE RIVER PLAIN. Ken Dueker, CIRES, University of Colorado, Boulder, Colorado, and Eugene Humphreys, University of Oregon, Eugene, Oregon
9:40a-10:00a	12	VOLCANIC GEOLOGY OF THE EASTERN SNAKE RIVER PLAIN, IDAHO. William R. Hackett, WRH Associates, Salt Lake City, Utah
10:00a-10:20a	Break	
10:20a-10:40a	13	GENESIS OF QUATERNARY RHYOLITE DOMES AND FLOWS OF THE EASTERN SNAKE RIVER PLAIN. Michael McCurry, Idaho State University, Pocatello, Idaho, Karl P. Hayden, Denver, Colorado, and W.R. Hackett, WRH Associates, Salt Lake City, Utah
10:40a-11:00a	14	AIR-FALL TUFFS AT TRAPPER CREEK, IDAHO: RECORD OF MIOCENE EXPLOSIVE VOLCANISM IN THE SNAKE RIVER PLAIN VOLCANIC PROVINCE. Michael E. Perkins, William P. Nash, and Francis H. Brown, University of Utah, Salt Lake City, Utah
11:00a-11:20a	15	DISTRIBUTION AND SOURCES OF LOESS IN SOUTHEASTERN IDAHO. Thomas V. Dechert and Paul A. McDaniel, University of Idaho, Moscow, Idaho
11:20a-11:40a	16	USE OF RADIOISOTOPIC TRACERS TO REFINE THE CONCEPTUAL MODEL OF GROUND-WATER MOVEMENT, SNAKE RIVER PLAIN AQUIFER, SOUTHEASTERN IDAHO. Larry J. Mann, U.S. Geological Survey, Water Resources Division, Idaho Falls, Idaho
noon-1:30p	**Lunch on own**	

Symposium: Distance Education: The New Frontier **CHE 211**
Chair: Fred Rose, University Programs, Idaho Falls, Idaho

1:30p-1:55p OVERVIEW AND TRENDS IN DISTANCE EDUCATION.
Russ Poulin, WICHE, Boulder, Colorado

1:55p-2:20p REVIEW OF THE UTAH SYSTEM. Ed Ridge, Utah Education Network, Salt Lake City, Utah

2:20p-2:45p FACILITATING SOFTWARE DEVELOPMENT AND IMPLEMENTATION.
Sharlyn Belzer, Idaho State University, Pocatello, Idaho

2:45p-3:00p DISCUSSION AND QUESTIONS

Session 7 **Contributed Papers--Geology/Geography** **CHE 209**
Chairs: Scott Hughes, Idaho State University, Pocatello, Idaho
John Welhan, Idaho Geological Survey, Pocatello, Idaho

Time	Abstract #	Break	Title/Author
1:30p-1:50p	51		GEOSTATISTICAL ESTIMATION OF REGIONAL HYDRAULIC CONDUCTIVITY VARIATIONS AT THE IDAHO NATIONAL ENGINEERING LABORATORY, John A. Welhan, Idaho Geological Survey, Pocatello, Idaho, and Michael F. Reed, Idaho State University, Pocatello, Idaho
1:50p-2:10p	52		GEOCHEMICAL CORRELATION OF BASALT LAVA FLOWS BENEATH THE IDAHO CHEMICAL PROCESSING PLANT (ICPP), IDAHO NATIONAL ENGINEERING LABORATORY. Scott S. Hughes and Michael F. Reed, Idaho State University, Pocatello, Idaho
2:10p-2:30p	53		THE PLIOCENE SNAKE RIVER FLOWED NORTH AT HAGERMAN FOSSIL BEDS NATIONAL MONUMENT, IDAHO. Dana E. Lee and Paul Karl Link,Idaho State University, Pocatello, Idaho
2:30p-2:50p	54		ORIGIN OF MCLAUGHLIN CAVES, WASHINGTON, PRELIMINARY REPORT. Eugene P. Kiver, John P. Buchanan, Michael Alcorn, Steven Harris and Mark Schuler, Eastern Washington University, Cheney, Washington
2:50p-3:10p		Break	
3:10p-3:30p	55		BETTER INFORMATION TRANSFER BY MAKING INTERESTING LANDSCAPES AVAILABLE TO YOUNG MINDS. Nancy B. Hultquist, Central Washington University, Ellensburg, Washington
3:30p-4:30p			DISCUSSION/QUESTIONS/POSTER SESSION

Posters **CHE 209**

3:30p-4:30p	56	CHANGES IN GLACIER RUNOFF IN CLE ELUM RIVER, NORTH CASCADES. Mauri Pelto, Nichols College, Dudley, Massachusetts, and Bill Prater,Twin Falls, Idaho
	57	MOUNDED MICRORELIEF ON THE EASTERN SNAKE RIVER PLAIN (ESRP), IDAHO, Julie A. Tullis, Idaho State University, Pocatello, Idaho

Session 8 **Contributed Papers--Ecology/Zoology** **CHE 218**
Chair: Bruce Eshelman, Idaho State University, Pocatello, Idaho

1:30p-1:50p	58	BUSINESS AND THE ENVIRONMENT: CAN THEY CO-EXIST? Steven C. Dunn and Robert Picard, Idaho State University, Pocatello, Idaho
1:50p-2:10p	59	DRIFTING AND HIVE FIDELITY IN HONEYBEES DURING AUTUMN. Margo M. Kanz, Western Washington University, Bellingham, Washington

Session 8, cont. **Contributed Papers--Ecology/Zoology** **CHE 218**

Time	Abstract #	Title/Author
2:10p-2:30p	60	ECOLOGICAL COMPLIANCE ASSESSMENT ON THE HANDFORD SITE. Charles A. Brandt, Pacific Northwest Laboratory, Richland, Washington, Gretchen L. Fortner, and Rhett K. Zufelt, AScI Corporation, Richland, Washington
2:30p-2:50p	61	WILDLIFE POPULATION TRENDS ON THE HANFORD SITE, SOUTH-CENTRAL WASHINGTON STATE. Larry L. Cadwell, Brett L. Tiller, Dennis A. Dauble, Mary Ann Simmons, Janelle L. Downs, William H. Rickard, Pacific Northwest Laboratory, Richland, Washington, and Rosemary Mazaika, Pacific Northwest Laboratory, Portland, Oregon
2:50p-3:10p		Break
3:10p-3:30p	62	THE EFFECTS OF HABITAT FRAGMENTATION ON THE DEMOGRAPHY AND SOCIAL STRUCTURE OF THE GRAY-TAILED VOLE. Jerry O. Wolff, Eric M. Schauber, and W. Daniel Edge, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon
3:30p-3:50p	63	SIMPLE HORIZONTAL TRANSFER MODELS. Harry Oxley and Patrick Lang, Idaho State University, Pocatello, Idaho
3:50p-4:10p	64	EFFECTS OF ADRENALECTOMY AND ANDROGENIC HORMONE REPLACEMENT ON WINTER FUR GROWTH IN MINK. Michael D. Kennedy, Brady K. Cottle, Bruce Eshelman, and Jack Rose, Idaho State University, Pocatello, Idaho
4:10p-4:50p	65	THE USE OF SHEEP GRAZING TO CONTROL POCKET GOPHERS ON FORESTED RANGELANDS OF SOUTH CENTRAL WASHINGTON. Anna M. Owsiak, Washington State University, Pullman, Washington, and Gary W. Witmer, USDA/APHIS/DWRC, Pullman, Washington
4:50p-5:10p	66	UTILIZATION OF SUMMER THERMAL ENVIRONMENTS BY FRESHWATER WESTERN PAINTED TURTLES *Chrysemys picta* IN LAKE DEPUDDLE, PULLMAN, WASHINGTON. Peg Bartels and Ken Kardong, Washington State University, Pullman, Washington

Posters **CHE 218**

1:30p-4:30p	67	A COMPARISON OF THE DISTRIBUTION AND ABUNDANCE OF THE HERPETOFAUNA OF THE IDAHO NATIONAL ENGINEERING LABORATORY: 1975 AND 1994. Sarah L. Cooper, Charles R. Peterson, Idaho State University, Pocatello, Idaho
	68	BREEDING BIOLOGY AND NESTING HABITAT OF NORTHERN GOSHAWK AND GREAT GRAY OWL IN EASTERN IDAHO. Susan M. Patla and Charles Trost, Idaho State University, Pocatello, Idaho
	69	DISTRIBUTION, RELATIVE ABUNDANCE AND HABITAT ASSOCIATIONS OF AMPHIBIANS AND REPTILES ON THE CRAIG MOUNTAIN WILDLIFE MITIGATION AREA (CMWMA). Robin Llewellyn and Charles R. Peterson, Idaho State University, Pocatello, Idaho
	70	THE EFFECTS OF HABITAT MODIFICATIONS ON A SPOTTED FROG POPULATION IN YELLOWSTONE NATIONAL PARK. Debra A. Patla and Charles R. Peterson, Idaho State University, Pocatello, Idaho

Display **CHE 207**

	71	GEOGRAPHICAL INFORMATION SYSTEM: FROM SIMPLE MAPPING TO CRITICAL HABITAT ANALYSIS. Larry L. Cadwell, Pacific NorthwestLaboratory, Richland, Washington

Session 9	Contributed Papers--Lichen and Mosses Chair: Karen Dillman, Idaho State University, Pocatello, Idaho	CHE 220

Time	Abstract #	Tittle/Author
1:30p-1:50p	72	THE EFFECTS OF POST-FIRE RANGELAND REHABILITATION ON THE RECOVERY OF MICROBIOTIC SOIL CRUSTS ON THE WESTERN SNAKE RIVER PLAIN. Julie Kaltenecker and Marcia Wicklow-Howard, Boise State University, Boise, Idaho
1:50p-2:10p	73	MICROBIOTIC SOIL CRUST COMPOSITION OF A HIGH DESERT JUNIPER SAVANNA IN OREGON. Jeanne Ponzetti and Bruce McCune, Oregon State University, Corvallis, Oregon
2:10p-2:30p	74	EFFECT OF MICROBIOTIC CRUSTS ON THE GERMINATION AND ESTABLISHMENT OF THREE GREAT BASIN GRASSES. Kelly D. Larsen and Marcia Wicklow-Howard, Boise State University, Boise, Idaho
2:30p-2:50p	75	ECOLOGY OF VAGRANT LICHENS IN ARID STEPPE COMMUNITIES. Roger Rosentreter, Bureau of Land Management, Boise, Idaho
2:50p-3:10p	Break	
3:10p-3:30p	76	LICHEN COMMUNITIES IN FOREST HEALTH MONITORING AND POSSIBLE EXTENSIONS TO ARID ECOSYSTEMS. Bruce McCune, Oregon State University, Corvallis, Oregon
3:30p-3:50p	77	LICHENS AS AIR QUALITY INDICATORS IN SOUTHWESTERN MONTANA. Lisa Schubloom, Montana State University, Bozeman, Montana
3:50p-4:10p	78	LEAD CONCENTRATIONS IN THE LICHEN *Parmelia sulcata* ADJACENT TO A MAJOR HIGHWAY. Scott Rash, Kris Rhode, Paul Przybylowicz, The Evergreen State College, Olympia, Washington
4:10p-4:30p	79	LICHEN COMMUNITIES IN *Pinus contorta* PEATLANDS IN SOUTHEAST ALASKA. Chiska C. Derr and Bruce McCune, Oregon State University, Corvallis, Oregon
4:30p-4:50p	80	ABUNDANCE AND DISTRIBUTION OF LICHENS IN PACIFIC SILVER FIR CROWNS AT FINDLEY LAKE, WASHINGTON CASCADES. Robin D. Lesher and Jan A. Henderson, USDA Forest Service, Mountlake Terrace,Washington
4:50p-5:10p	81	DYES FROM UMBILICARIACEAE SPECIES AND CHEMOTYPES. Sherman G. Brough, Sandy, Utah
Posters		**CHE 207**
1:30p-4:30p	82	DISTRIBUTION OF EPIPHYTIC PLANT FORMS ON TREE TRUNKS IN THE TILARAN MOUNTAINS NEAR MONTEVERDE, COSTA RICA. Karen L. Dillman, Idaho State University, Pocatello, Idaho, and Margot S. Bass, Princeton University, Princeton, New Jersey
	83	ELEMENTAL ANALYSIS OF THE LICHEN *Rhizoplaca melanophthalma* IN RELATION TO PHOSPHATE REFINERIES NEAR POCATELLO, IDAHO. Karen L. Dillman, Idaho State University, Pocatello, Idaho

6:00p-10:00p — **Social/Auction**
Sponsored by Idaho Chapter, The Wildlife Society
Shilo Inn

Program Agenda
Idaho Chapter, The Wildlife Society

Wednesday, March 8

1:00p-5:00p	Partners in Flight Convener: Sharon Ritter, Idaho Department of Fish and Game, Grangeville, Idaho	CHE 209
7:00p-9:00p	Registration	Shilo Inn
7:00p-9:00p	Reception	Shilo Inn
8:00p-9:00p	Idaho Chapter, The Wildlife Society Board Meeting	Shilo Inn

Thursday, March 9

7:30a-12noon	Registration	CHE Main Entrance
8:00a-8:25a	Plenary Session Welcome (Wood and Lava Rock Bldg, right side of CHE)	Auditorium, University Place

Symposium: Wolf Recovery — **Auditorium**
Chair: Ted Koch, US Fish and Wildlife Service, Boise,Idaho

Time	Abstract #	Title/Author
8:30a-9:00a	17	WOLF RECOVERY AND REINTRODUCTION IN CENTRAL IDAHO. Ted Koch, Alice Whitelaw, and Valpa Asher, US Fish and Wildlife Service, Boise, Idaho 83705 4696 overland Rm 576
9:00a-9:20a	18	WOLF NATURAL HISTORY. Alice Whitelaw, Valpa Asher, and Ted Koch, US Fish and Wildlife Service, Boise, Idaho
9:20a-9:40a	19	WOLF CONTROL IN IDAHO. Layne Bangerter, US Department of Agriculture, Animal Damage Control, Boise, Idaho 1828 Airport Way Boise 83705
9:40a-10:00a	20	STATE PERSPECTIVE ON WOLF RECOVERY AND MANAGEMENT OF WOLVES IN IDAHO. Jon S. Rachael, Idaho Department of Fish and Game,Boise, Idaho 83707 600 S. Walnut P.O. Box 25
10:00a-10:20a	Break	
10:20a-10:40a	21	NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN. Rod Evans, D.V.M., Idaho Farm Bureau, Challis, Idaho 83226
10:40a-11:00a	22	THE CONSERVATIONISTS PERSPECTIVE ON WOLF RECOVERY IN IDAHO. David Langhorst, Wolf Education and Research Center, Ketchum, Idaho 83340
11:00a-noon	Panel Discussion and Questions	
12:15p-1:30p	**Lunch on own**	

Session 1 — **Contributed Papers--Wildlife Management** — **CHE 209**
Chair: Jim Unsworth, Idaho Department of Fish and Game, Nampa, Idaho

Time	Abstract #	Title/Author
1:30p-1:50p	84	HABITAT SELECTION IN DRY VS. VERY DRY SAGE STEPPE IN SUMMER BY MULE DEER. Gregory B. Milner and Clint J. Gray, Montana State University, Bozeman, Montana
1:50p-2:10p	85	STRONTIUM-90 CONCENTRATIONS IN DEER ANTLERS IN RELATION TO DEER MOVEMENTS ON THE HANFORD SITE. Brett L. Tiller, L.E. Eberhardt, and T.M. Poston, Pacific Northwest Laboratory, Richland, Washington

Session 1 cont. **Contributed Papers--Wildlife Management** **CHE 209**

Time	Abstract #	Title/Author
2:10p-2:30p	86	THE STATUS AND MANAGEMENT OF MOOSE IN IDAHO. Bradley B. Compton, Idaho Department of Fish and Game, Pocatello, Idaho, and Lloyd E. Oldenburg, Idaho Department of Fish and Game, Boise, Idaho
2:30p-2:50p	87	EFFECTS OF PRESCRIBED BURNING AND HARVESTING ON SURVIVAL AND VIGOR OF BITTERBRUSH AND WILLOW IN WESTERN MONTANA. Dayna Ayers and Don Bedunah, University of Montana, Missoula, Montana
2:50p-3:10p		Break
3:10p-3:30p	88	YOUNG STAND THINNING AND DIVERSITY IN THE CENTRAL OREGON CASCADES: AN ANALYSIS OF PRETREATMENT VEGETATION AND WILDLIFE HABITAT. Gabriel F. Tucker and Joan C. Hagar, Oregon State University, Corvallis, Oregon
3:30p-3:50p	89	YOUNG STAND THINNING AND DIVERSITY IN THE CENTRAL OREGON CASCADES: AN ANALYSIS OF PRETREATMENT WILDLIFE ABUNDANCE. Joan C. Hagar, Gabriel F. Tucker, and William C. McComb, Oregon State University, Corvallis, Oregon
3:50p-4:10p	90	4-H WILDLIFE HABITAT EVALUATION PROGRAM: A NEW WILDLIFE OUTREACH OPPORTUNITY. Dean Rose, Idaho Department of Fish and Game, Pocatello, Idaho, and Steve Bouffard, US Fish and Wildlife Service, Pocatello, Idaho
4:10p-4:30p	91	WILDLIFE HABITAT MITIGATION FOR FEDERAL HYDROPOWER PROJECTS IN IDAHO. H. Jerome Hansen, S.H. Stovall, M.Beucler, and K.E. Ragotzkie, Idaho Department of Fish and Game, Boise, Idaho

Session 2 **Contributed Papers--Nongame Species** **CHE 210**
Chair: Richard P. Howard, US Fish and Wildlife Service, Boise, Idaho

1:30p-1:50p	92	STATUS OF NEOTROPICAL MIGRATORY BIRDS AND PARTNERS IN FLIGHT ACTIVITIES IN IDAHO. Sharon A. Ritter, Idaho Department of Fish and Game, Grangeville, Idaho
1:50p-2:10p	93	PREDICTING NEST-HABITAT FOR *BUTEO* spp. HAWKS USING A MULTIVARIATE MODEL AND A GEOGRAPHIC INFORMATION SYSTEM. John J. Nugent, University of Montana, Missoula, Montana, and Larry L. Cadwell, Pacific Northwest Laboratory, Richland, Washington
2:10p-2:30p	94	AN INVESTIGATION OF CLIFF-NESTING RAPTORS IN THE HAGERMAN STUDY AREA. Von R. Pope and Anthonie M.A. Holthuijzen, Idaho Power Company, Boise, Idaho
2:30p-2:50p	95	SMALL MAMMAL COMMUNITIES IN THE HAGERMAN VALLEY, SOUTHWESTERN IDAHO. Anthonie M.A. Holthuijzen and Kelly D. Wilde, Idaho Power Company, Boise, Idaho
2:50p-3:10p		Break
3:10p-3:30p	96	SPECIAL PLANT COMMUNITIES IN THE HAGERMAN VALLEY: FLORAL AND FAUNAL CHARACTERISTICS. Kelly D. Wilde and Anthonie M.A. Holthuijzen, Idaho Power Company, Boise, Idaho
3:30p-3:50p	97	ROOST SELECTION IN A PLEISTOCENE RELICT-*Plecotus townsendii*. J. Mark Perkins, J.R. Peterson, and A.J. Perkins, PNW Bat Research Team, Portland, Oregon

Poster **CHE 207**

1:30p-4:30p	98	CARNIVORES IN A TROPICAL DRY FOREST OF WESTERN MEXICO: TEST OF METHODS. Carlos A. López González, John W. Laundre', and Kelly Altendorf, Idaho State University, Pocatello, Idaho, and Alberto González Romero, Instituto de Ecología, Xalapa, Mexico

6:30p-9:00p **NWSA/ICTWS Banquet** **Shilo Inn**

STREAM ECOSYSTEM INTEGRITY: A TEMPORAL PERSPECTIVE OF DISTURBANCE IN THE PACIFIC NORTHWEST

Keynote Speaker: G. Wayne Minshall, Ph.D.
Idaho State University, Pocatello, Idaho
Recipient of the 1993 NWSA Outstanding Scientist Award

Friday, March 10

8:00a-noon **Registration** **CHE Main Entrance**
8:00a-5:00p **Preview Room available for speakers** **CHE 206**

Symposium: Riparian Management — CHE 211

Chair: Kirk Lohman, University of Idaho, Moscow, Idaho

Time	Abstract #	Title/Author
8:50a-9:00a		Introduction to Symposium: Kirk Lohman, University of Idaho, Moscow, Idaho
9:00a-9:20a	23	BIRD POPULATION RESPONSES TO RECOVERY OF WESTERN RIPARIAN HABITATS. Terry Rich, Bureau of Land Management, Boise, Idaho, Dave Krueper, Bureau of Land Management, Sierra Vista, Arizona
9:20a-9:40a	24	RESTORATION AND MANAGEMENT OF RIPARIAN HABITATS AT HART MOUNTAIN NATIONAL ANTELOPE REFUGE, SOUTH-CENTRAL OREGON. Barry Reiswig, US Fish and Wildlife Service, Pocatello, Idaho
9:40a-10:00a	25	DEMONSTRATION OF TWO TECHNIQUES TO MEASURE VEGETATIVE CHANGE IN RIPARIAN HABITATS. Howard G. Hudak, US Department of Agriculture, Sawtooth National Forest, Twin Falls, Idaho
10:00a-10:20a	Break	
10:20a-10:40a	26	DECLINING RIPARIAN ECOSYSTEMS IN THE WESTERN UNITED STATES: CAUSES AND PROPOSED FIXES. Robert A. Obedzinski and Charles G. Shaw, III, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado
10:40a-11:00a	27	THE IMPORTANCE OF RIPARIAN HABITAT TO AMPHIBIANS AND OF AMPHIBIANS TO RIPARIAN ECOSYSTEMS. Charles R. Peterson, Department of Biological Sciences, Idaho State University, Pocatello, Idaho
11:00a-11:20a	28	RIPARIAN ZONES AND BIG GAME. James M. Peek, Department of Fish and Wildlife Resources, University of Idaho, Moscow, Idaho
11:20a-noon	Panel discussion and questions	
noon-1:30p	**Lunch on own**	

Session 6	Contributed Papers--Upland Game/Waterfowl	CHE 210
	Chair: John Connelly, Idaho Department Fish and Game, Pocatello, Idaho	

Time	Abstract #	Title/Author
1:30p-1:50p	99	OXFORD SLOUGH DUCK NESTING STUDY: FINAL REPORT. Bradley B. Compton, Daryl Meints, and Carl Anderson, Idaho Department of Fish and Game, Pocatello, Idaho, Mike Johnson, US Fish and Wildlife Service, Pocatello, Idaho
1:50p-2:10p	100	SAGEGROUSE IN IDAHO: FORUM-94'. Samuel N. Mattise, Boise District, Bureau of Land Management, Boise, Idaho
2:10p-2:30p	101	ECOLOGY OF REINTRODUCED COLUMBIAN SHARP-TAILED GROUSE IN SOUTHERN IDAHO. Scott C. Gardner, Kerry P. Reese, University of Idaho, Moscow, Idaho, and John W. Connelly, Idaho Department of Fish and Game, Pocatello, Idaho
2:30p-2:50p	102	WINTER ECOLOGY OF COLUMBIAN SHARP-TAILED GROUSE IN SOUTHEASTERN IDAHO. Mark J. Ulliman, Kerry P. Reese, University of Idaho, Moscow, Idaho, and John W. Connelly, Idaho Department of Fish and Game, Pocatello, Idaho
2:50p-3:10p	Break	
3:10p-3:30p	103	DO COLUMBIAN SHARP-TAILED GROUSE SUBSTITUTE HARD SEEDS FOR GRIT IN WINTER? Kerry P. Reese, James W. Schneider, University of Idaho, Moscow, Idaho, and John W. Connelly, Idaho Department of Fish and Game, Pocatello, Idaho

3:30p-5:00p **Business Meeting, Idaho Chapter, The Wildlife Society**

6:00p-10:00p Social/Auction
Sponsored by Idaho Chapter, The Wildlife Society
Shilo Inn

The Northwest Lichen and Moss Guild Agenda

Thursday, March 9

AM--Attend contributed paper sessions of the NWSA and Idaho Chapter, The Wildlife Society.

PM--2-5p. Workshop on "How to Dye with Lichens" at the Idaho Falls campus of Idaho State University. This will be led by Karen Dillman and will cover how to prepare the lichen dye baths and the wool yarns for dyeing. Karen will demonstrate how the dying is done, and has examples of the finished product from several lichen species. Participants are encouraged to bring about 1/2 ounce of pure wool yarn and a small amount (a handful or two) of a particular lichen to experiment with. (For example, *Parmelia*, *Lobaria*, *Letharia*, and *Rhizoplaca* are good. Of course, collect conservatively for dyeing purposes!)

Friday, March 10

AM--9-11:30a. Workshop on "How to Process and Identify Microbiotic Crusts" at the Idaho Falls campus of ISU. This workshop will cover the identification, curation and labeling of microbiotic crust lichens. Roger Rosentreter and Bruce McCune will assist in the identification of the lichens and the use of light microscope techniques for spore dissections. Karen Dillman will demonstrate herbarium techniques including preparation and mounting of specimens. Ann DeBolt will discuss proper labeling and typing procedures for herbarium specimens. Participants are encouraged to bring specimens which they have collected to practice some of these procedures. Dissecting scopes, and othe basic materials will be provided. After the workshop and before lunch will be a good time to look at the *Umbilicaria* specimens and animal nests which individuals may have brought.

PM--1:30-5p. Contributed paper session at the Idaho Falls campus of ISU.

Saturday, March 11

AM--9:30-2:00p Field trip titled "The Role of Microbiotic Crusts in Sagebrush-Steppe Ecosystems". This adventure will take us west of Pocatello, where sagebrush covered hills support interesting and dynamic microhabitats for cryptogamic plants. We will meet at the College Market Coffee Shop on the corner of S. 8th St. and Halliday, one block north of the Pocatello ISU campus. We can car pool in private vehicles to the area, approximately 20 minutes from campus. Collecting will be encouraged and it will be a good time for experts like Roger Rosentreter, Ann DeBolt, and Bruce McCune to help in identification. These specimens can then be deposited in your local herbarium or used for future study. An ecologist from ISU will discuss the ecology of the sagebrush-steppe habitat, and Jane Belnap and Roger will help clarify the role of microbiotic crusts in this desert ecosystem. The BLM has a study site nearby that involves land which burned, and then was restored with native grasses in one area and exotic grasses in another. An ecologist from ISU will discuss this project as we explore near the study site. Lunch will be in the field and the trip will be over by 2:00p so people can begin heading home. For those who have the time after the field trip, a visit to the Ray J. Davis Herbarium at ISU is an option.

NWSA Symposium: Ecological Aspects of Waste Management

ECOLOGICAL ASPECTS OF WASTE MANAGEMENT. Randall C. Morris and Timothy D. Reynolds, Environmental Science and Research Foundation, Idaho Falls, ID.

Humans have been creating, and disposing of, sanitary and hazardous wastes for millenia. In the past 40 years, radioactive wastes have been added to the stream. While recent engineering designs for waste disposal have commonly considered ecological impacts of waste management systems, they have generally failed to consider ecological impacts on such systems. Thus, wastes have not been adequately protected from the environment and vice versa. This symposium includes papers which will discuss current waste management systems, potential ecological impacts on those systems which may degrade their effectiveness, and remedies to those impacts. Two approaches to dealing with potential ecological impacts will be discussed. One approach uses engineered barriers to prevent the impacts. The other approach uses principles of ecology to manage the impacts. We hope that symposium participants will come away with a renewed appreciation for the complexity of the watse management problem and new information with which to solve it.

1

THE PURPOSE OF WASTE ISOLATION: LEGAL REQUIREMENTS AND DESIGN CRITERIA. Catherine Massimino, U.S. Environmental Protection Agency Region 10.

Discussion of the federal requirements for design and operation of landfills for disposal of low-level radioactive and hazardous waste. Requirements addressed will include leachate collection and removal systems, landfill covers, bottom liner systems, and leak detection, collection and removal systems. These requirements will be reviewed in light of the overall major goals of assuring landfill long-term stability and minimization of future maintenance.

2

EXISTING LOW-LEVEL WASTE REPOSITORIES. W. J. Waugh, Environmental Sciences Laboratory, U.S. DOE Grand Junction Projects Office, Grand Junction, CO.

The U.S. Department of Energy (DOE) builds covers to isolate many types of waste both in place and in landfills. This paper reviews the designs and performance of existing covers and summarizes some lessons learned. Most covers built by DOE to date are for interim waste containment and require periodic if not continuous maintenance. Cover designs intended for long-term waste isolation rely on low-permeability, compacted soil layers to limit water infiltration and gaseous releases. Documented problems with these covers, such as soil cracking and biointrusion, stem from design approaches that inadequately address effects of ecological processes on soil hydraulic properties and water balance. A design and performance assessment paradigm that combines field tests, modeling, and natural analogs is recommended for the next generation of covers.

The U.S. Department of Energy Grand Junction Projects Office is operated by Rust Geotech under DOE Contract No. DE-AC04-94AL96907.

3

CHALLENGES TO WASTE REPOSITORIES: ANIMAL INTRUSION. Paul E. Blom, University of Idaho, Moscow, John W. Laundre', Idaho State University, Pocatello.

Burrowing animals, vertebrates as well as invertebrates, can impact the effectiveness of shallow, subsurface waste disposal areas to isolate the ambient environment from waste materials. Examples of small mammals bringing contaminated soils and other material to the surface have been recorded at many disposal sites. Similarly, invertebrate species such as ants have translocated contaminants from interrment. Besides the physical transportation of contaminants, burrowing can alter soil characteristics and thereby change soil moisture infiltration and evaporation regimes. Examples of changes in soil moisture patterns due to burrows have also been documented at many waste management sites. Invertebrates other than ants (e.g. cicadas and termites) in semi-arid habitats and elsewhere may also have an effect on changes in soil moisture movement and contaminant translocation. Studies are in progress at the INEL to assess the effectiveness of various barriers of natural materials to deter burrowing by small mammals and harvester ants.

4

CHALLENGES TO WASTE REPOSITORIES: PALEOCLIMATE. Kenneth L. Petersen, Pacific Northwest Laboratory[a], Richland, Washington.

The U.S. Department of Energy is developing an in-place disposal capability for low-level nuclear waste at the Hanford Site in southeastern Washington. Layered earthen and engineered barriers are being developed that will function in what is presently a semiarid environment (mean annual precipitation of 150 mm and temperature of 11.8°C) for at least 1,000 yr by limiting the infiltration of water through the waste. The Long-Term Climate Change Task is one of several key barrier tasks aimed at overcoming challenges to waste disposal. The Carp Lake Pollen Coring Project (subcontracted to the University of Oregon) found that over the last 75,000 yrs the Columbia Basin's long-term annual mean precipitation has ranged between 50% and 130% of modern levels while temperature have ranged from 10 degrees below to 2 degrees above. As compared to the present, the Columbia Basin had a colder and drier Ice Age climate between 75,000 and 10,000 yrs ago. Since 10,000 yrs ago, the climate has been both slightly warmer and/or wetter, with the last 2,000 yrs having been most like the present. Because of the cyclical nature of the past climate, these results provide several defensible analogs of potential future climates that are being used to both test and model barrier performance.

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[a]The Pacific Northwest Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76 RLO 1830.

5

CHALLENGES TO WASTE REPOSITORIES: PLANT BIOINTRUSION. Charles J. Burt and Mark L. Miller, Roy F. Weston Inc., Uranium Mill Tailings Remedial Action Project (UMTRA), 2155 Louisiana NE, Albuquerque, New Mexico 87110

Studies have shown that plants growing on disposal cells or on waste material can transport contaminants into the environment. Also, plants can facilitate the breakdown of engineered cover systems. A study of plant growth on six rock-covered UMTRA Project disposal cells from 1990 into 1993 showed that plants were rooted in the radon barriers of some of these cells. Root growth into the radon barriers may cause an increase in radon emanation and infiltration. If uncontrolled, roots will reach the tailings and have the potential to transport contaminants to the surface. To reduce these potential effects, some type of vegetation control is required at some of the rock-covered disposal cells. Vegetative covers, adequate rock depth, and/or frost protection layers are being used to reduce the potential for plants to compromise the cover systems used on the UMTRA Project.

6

COMBINED TREATMENT OF LOW-LEVEL AND MIXED WASTE WITH EXEMPLARY DISPOSAL. G. R. Darnell, Formerly with Lockheed Idaho Technologies Company, Idaho Falls.

Today's concepts for treatment and disposal of low-level radioactive waste (LLW) and radioactive hazardous LLW leave a high probability that recovery and remediation will be required. Disposal volumes are much too large. New thinking and environmental logic are required to develop sound concepts for waste treatment and disposal. Optionally, all three classes of LLW and mixed LLW are considered as a single waste and treated to the highest standards for both Class C LLW and mixed LLW. High-temperature treatment is essential to convert organic waste to inorganic waste. Disposal containers are one-cubic-meter steel containers with no appendages. They contain concreted inorganic waste and are stacked in an essentially voidless array in an abovegrade, earth-mounded concrete vault. Disposal uses an automated stacker with no operators required. The best of our waste treatment technologies are used to minimize the number of operators and the radiation exposure they receive. The public receives zero radiation for an estimated 12,000 years.

7

MEETING THE CHALLENGES: ECOLOGICAL SOLUTIONS. Jay E. Anderson, Idaho State University, Pocatello.

In arid and semiarid regions where potential evapotranspiration far exceeds precipitation, it is theoretically possible to keep water from reaching interred wastes by 1) providing a sufficiently deep cap of soil to store precipitation that falls while plants are dormant and 2) establishing plant cover that will deplete soil moisture during the growing season, thereby emptying the water storage reservoir in the soil. Research at the Idaho National Engineering Laboratory (INEL) has shown that 2 m of soil should be adequate to store moisture from snowmelt and spring rains while providing a margin of safety in case water accumulates in local areas as a result of subsidence or heavy snow accumulation. Our research has also shown that healthy stands of perennial grasses and shrubs adapted to the INEL climate will use all available soil moisture, even during a very wet growing season. However, it is possible that burrowing by small mammals or ants may result in failure of a soil cap. Intrusion barriers of gravel and cobble can be used to restrict burrowing, but the effects of such barriers on soil moisture storage and plant rooting depths are unknown. A replicated field experiment has been initiated to investigate those effects.

8

TECTONICS AND EVOLUTION OF THE YELLOWSTONE HOTSPOT. R. B. Smith, Dept. of Geology and Geophysics, Univ. of Utah, Salt Lake City, Ut., 84112, rbsmith@mines.utah.edu.

Signatures of the 16 Ma tectonic evolution of Yellowstone-Snake River Plain (YSRP) volcanic system include tectonic parabolas of earthquakes and concomitant topographic highs sweeping in two belts southwest from Yellowstone surrounding a progression the aseismic SRP. Plate modeling suggests a ~ 2 cm/yr. rate of motion of the N. American plate across a mantle heat source giving rise to the systematic progression of silicic centers across the SRP at ~4.5 cm/yr. including a component of Basin-Range extension. Active deformation of this dynamic system is marked by unprecedented uplift of the Yellowstone Plateau as large as 1 m from 1923 to 1984 followed by a rapid reversal to subsidence which began in ~1985 to 1993 up to 7 cm measured by GPS. Seismic velocity anomalies beneath Yellowstone were determined by tomographic inversion of P-wave data that revealed a 15 % P-wave decrease to depths of 14 km beneath the caldera and an additional 15% reduction beneath two resurgent domes. The seismic and GPS source models are consistent with a NE-elongate, sill-like hydrothermal fluid body underlain by magmas at 4 km to 14 km depth beneath the caldera though to be the principal source of the extremely high ~2000 mWm^{-2} heat flow. These data are consistent with a model for plume-plate interaction that produces asthenospheric flow southwesterly from the hotspot.

9

Upper Crustal Seismic and Geologic Structure of the Eastern Snake River Plain (ESRP): Evidence From Drill Holes and Regional Geophysics at the Idaho National Engineering Laboratory (INEL).
R P Smith, N E Josten , INEL, Idaho Falls, W R Hackett, WRH Associates, Salt Lake City.

Drill hole and surface geophysical data generated at the INEL, integrated with published regional investigations gives a clearer understanding of the upper crustal structure of the ESRP. V_p for ESRP basalts triples within the first 0.5km, producing a profile similar to that for oceanic crust. The steep profile is caused by filling of profuse primary fractures in the basalts with sediments and secondary minerals and closing of fractures under increasing lithologic load. The thickness of ash flows in deep boreholes and the magnitude of displacement on caldera faults imaged by seismic refraction surveys suggest that intra-caldera eruption volumes rival those of the outflow tuffs which outcrop adjacent to the Plain. Source plutons for the voluminous ash-flow eruptions and calderas may lie between 3 and ~8km depth, below the deepest borehole and above the mid-crustal high-density, high-velocity zone imaged by Sparlin and others (1982). 10-30 mgal gravity anomalies on the Plain can be explained by unsubsided blocks of Paleozoic carbonates between silicic calderas. Positioning of buried calderas based on this assumption satisfies geologic constraints. Other possible sources of gravity anomalies include basaltic dike swarms beneath volcanic rift zones and pre-volcanic structural or topographic relief.

10

CRUST-MANTLE STRUCTURE ALONG THE EASTERN SNAKE RIVER PLAIN
Ken Dueker, CIRES, Univ. of Colorado, Boulder, Co.; Eugene Humphreys, Dept. of Geology, Univ. of Oregon, Eugene, Or.

Understanding the correspondence between upper mantle flow and melt extraction along the Yellowstone Volcanic Track (YVT) and the surficial observables which define its wake (e.g., volcanism, seismicity, elevation) requires well-resolved images of the upper mantle isotropic and anisotropic velocity structure. To date, several USGS seismic experiments have been conducted along the YVT which has allowed construction of compressional wave velocity images of the upper 200-300 km of the upper mantle. These images show that the low-velocity anomaly located beneath the YVT extends to a depth of about 140 km beneath the Yellowstone Caldera and then deepens to about 180 km depth at the latitude of Pocatello. In addition, the width of the low-velocity body widens from 80 at the Caldera to 120 km at the latitude of Pocatello. Under certain assumptions, these observations are contrary to dynamic flow modeling of the YVT as the manifestation of a plume conduit rising beneath the present-day Caldera. In addition, a recent broad band PASSCAL experiment conducted in 1993 is providing images of the crustal structure from receiver function analysis and the upper mantle's anisotropic structure from shear wave splitting analysis.

11

VOLCANIC GEOLOGY OF THE EASTERN SNAKE RIVER PLAIN, IDAHO
William R. Hackett, WRH Associates, 2880 E Naniloa Circle, Salt Lake City, UT 84117-5523

An overview of ESRP regional geology is given, emphasizing magmatic processes. This area of eastern Idaho is part of the Yellowstone-Snake River Plain volcanic province, a low-lying, relatively aseismic structural and topographic depression that developed within the adjacent, seismically active Basin & Range province of eastern Idaho during the past 8 million years. An explanation for the aseismicity is that basaltic-dike intrusion accommodates crustal extension, supplants normal faulting, and keeps deviatoric stresses low within the upper crust of the ESRP. Early ESRP volcanism was explosive, silicic in composition, and caldera-related. Volcanism of the past 4 million years has been predominately basaltic, with dike intrusion, fissure eruptions, and the growth of small shield volcanoes and lava fields along numerous volcanic-rift zones. A volcanic-hazards assessment for the Idaho National Engineering Laboratory suggests recurrence intervals for ESRP rift-zone volcanism ranging from 2,000 yrs (Great Rift) to 125,000 yrs (other rift zones near INEL). Volcanism has created a scientifically important region. The ESRP has been intensively studied as a proxy for inaccessible planetary surfaces. Lava tubes and dike-induced fissures contain important paleontologic and archaeologic materials, and the fractured basaltic lava flows of the ESRP host a major aquifer.

12

GENESIS OF QUATERNARY RHYOLITE DOMES AND FLOWS OF THE EASTERN SNAKE RIVER PLAIN. Michael McCurry, Idaho State University, Pocatello, Karl P. Hayden, 3550 S. Kendall St., Denver, CO, William R. Hackett, WRH & Associates, Salt Lake City, UT.

Geochemically anomalous, highly evolved Quaternary volcanic rocks, including rhyolite domes and flows make up some of the most striking topographic features of the Eastern Snake River Plain. Detailed field, geochemical, isotopic and petrological studies of one of the anomalous volcanic centers, the ~400 Ka Cedar Butte volcano (CBV), evaluate why these highly evolved rocks occur within a region dominated by a long period of nearly homogeneous tholeiitic basalt volcanism. CBV spans a continuous compositional spectrum from basalt to rhyolite, 54-75 wt.% SiO_2. Variations in bulk chemical composition correlate closely with changes in intratelluric phenocryst assemblages in a pattern suggesting that the rhyolites were primarily derived by fractional crystallization of a basaltic parent magma. Sr-, Nd- and Pb-isotopic data support this interpretation. Sr- and Nd-isotopic data (e.g., ε_{Nd} varies from -4.1 to -4.7) limit Precambrian crustal contributions to less than 10%. Genesis of Quaternary rhyolites therefore appears to differ fundamentally from subjacent, more voluminous late Miocene and Pliocene rhyolite tuffs and flows, which were likely derived by large-scale partial melting of Precambrian continental crust.

13

AIR-FALL TUFFS AT TRAPPER CREEK, IDAHO: RECORD OF MIOCENE EXPLOSIVE VOLCANISM IN THE SNAKE RIVER PLAIN VOLCANIC PROVINCE. Michael E. Perkins, William P. Nash, and Francis H. Brown, University of Utah, Salt Lake City

The nature of volcanism in the Snake River Plain volcanic province (SRPVP) during its initial (Miocene) period of development is not well established. Air-fall tuffs exposed at Trapper Creek (TC), Idaho provide insight into the character of explosive silicic eruptions in the SRPVP during the middle to late Miocene. A sequence of 51 separate air-fall tuffs have been identified at TC. New age determinations show these tuffs were deposited in the period ~14 to 8.6 Ma. Chemical correlation shows that most of the air-fall tuffs came from coeval volcanic fields of the SRPVP. Frequency of major (>1.5 m thick) SRPVP ash-falls at TC was high, ~1 event per 175 k.y. SRPVP silicic magma erupted during this period was progressively hotter, culminating in the eruption of ~1000°C magma during the interval 11 – 9.5 Ma. Air-fall tuffs identical or similar to the TC tuffs are common in coeval strata located far as 1600 km from the Miocene SRPVP. Such widespread distribution attests to the large magnitude of many of the Miocene SRPVP eruptions. The sequence of tuffs at TC define a distinctive phase of SRPVP volcanism characterized by frequent, large magnitude, explosive eruptions with increasing eruption temperature.

14

DISTRIBUTION AND SOURCES OF LOESS IN SOUTHEASTERN IDAHO. Thomas V. Dechert and Paul A. McDaniel, University of Idaho, Moscow.

The eastern Snake River Plain (ESRP) of Idaho is surrounded by glaciated mountains to the north, east, and south. Foothills and valleys to the north of the ESRP exhibit little or no loess cover while similar landscape positions to the south and east of the ESRP have significant blankets of loess. In addition, loess generally thins from south to north across the ESRP. We developed a new model to explain the distribution of loess in southeastern Idaho. GIS-based data included: loess distribution, thickness and particle size; degree of soil development; location of glaciated mountains and their glacial outwash plains; glacial and modern climate circulation models; and recent basalt flow distribution. Previously it was thought that ESRP loess was distributed by WSW winds similar to those at present. We conclude that loess distribution reflects winds from the north which dominated as a result of different atmospheric circulation patterns during glaciation. During the Holocene, dominant WSW winds have redistributed some of the loess.

15

USE OF RADIOISOTOPIC TRACERS TO REFINE THE CONCEPTUAL MODEL OF GROUND-WATER MOVEMENT, SNAKE RIVER PLAIN AQUIFER, SOUTHEASTERN IDAHO

by Larry J. Mann
U. S. Geological Survey
Idaho Falls, Idaho

Radioisotopes are being used as tracers to quantitatively describe ground-water flow rates in the Snake River Plain aquifer. ^{36}Cl, ^{129}I, and ^{3}H are the chief radioisotopes being used because they: 1) are conservative solutes; 2) are both naturally and anthropogenically produced; 3) were released to the environment during the oceanic and atmospheric testing of thermonuclear weapons; 4) were discharged to the aquifer at the Idaho National Engineering Laboratory (INEL); and 5) can be detected at concentrations many orders of magnitude smaller than most inorganic and organic solutes, and other radioisotopes.

Preliminary analyses of data for ^{36}Cl ($t_{1/2}$ = 301,000 years) and ^{129}I ($t_{1/2}$ =15.7 million years) in water from wells at and near the INEL indicate that the velocity of ground-water movement in the aquifer is at least 6 feet per day. Data for ^{3}H ($t_{1/2}$ = 12.4 years) in flow from selected springs near Twin Falls suggests that the average residence time of ground water in an intermediate flow compartment of the regional flow system, in which excess applied-irrigation water is the main source of recharge, is about 25 years. These estimates support ground-water residence-time calculations by an advective-transport model. Residence times calculated by the model for ground water in 80 percent of the 10,800-square-mile area ranged from 25 to 400 years.

16

WOLF RECOVERY AND REINTRODUCTION IN CENTRAL IDAHO

Ted Koch, Alice Whitelaw, and Valpa Asher, U.S. Fish and Wildlife Service, Boise, Idaho.

Wolves occurred naturally in Idaho until exterminated by Europeans by the early 1930's. Since then, wolves have occurred in Idaho with increasing frequency. Wolves were protected under the federal Endangered Species Act of 1973. Wolves began naturally dispersing into Montana in the 1980's. In 1987, the Service developed the Northern Rocky Mountain Wolf Recovery Plan, which called for possible reintroduction into central Idaho and Yellowstone National Park if natural recovery did not proceed in a timely manner. In 1991, the U.S. Congress directed the Service to evaluate wolf reintroduction, with the Service deciding to reintroduce wolves into both areas as "experimental, non-essential" animals. Fifteen wolves were reintroduced to central Idaho in mid-January of this year. The recovery goal for wolves in the northern Rocky Mountains is a minimum of ten breeding parts of wolves in each of three recovery areas (Montana, Idaho, and Wyoming) for three consecutive years.

17

WOLF NATURAL HISTORY

Alice Whitelaw, Valpa Asher, and Ted Koch U.S. Fish and Wildlife Service, Boise, Idaho.

Wolves are highly social animals that depend on a core family unit, or pack, for survival. An alpha pair of wolves remains dominant in the pack and are the only pack members to breed. Other pack members support the pack by helping to provide food and protection. This dependency on a social unit makes wolf populations vulnerable to exploitation by humans. Wolves live for about twelve years in the wild, average from 32-55 kg (70-120 lbs.) in weight, and are about 90 cm (36 in.) high at the shoulder. In the northern Rocky Mountains wolves range in color from gray to black. Main prey items are wild ungulates including elk and deer. Prey species are selected by wolves relative to their abundance in a wolf pack home range. Wolves breed in February, and whelp an average of six pups per litter in late April. The pack will use rendezvous sites through the summer until the pups are able to travel with the adults in the fall.

18

WOLF CONTROL IN IDAHO

Layne Bangerter, U.S.Department of Agriculture., APSIS, Animal Damage Control, Boise, Idaho.

Animal Damage Control (ADC) activities in Idaho include the protection of livestock, private property, wildlife enhancement, and human health safety. ADC activities are conducted throughout the State on both private and public lands with an emphasis on the rural areas of Idaho. ADC plays an integral role in wolf recovery in the United States by using it expertise to control problem wolves, thereby minimizing the risk of take by those who suffer from livestock depredations. In the ten-year history of wolf recovery in northwestern Montana, only 19 cows and 12 sheep were confirmed by ADC as being killed by wolves. ADC, in conjunction with the USFWS, has been 100% successful at controlling wolves that kill livestock. Under this control program, the wolf population has grown at a rate of 20% per year. In Idaho, ADC may implement, with the OSSIFIES a control program modeled after the successful Montana program.

19

STATE PERSPECTIVE ON RECOVERY AND MANAGEMENT OF WOLVES IN IDAHO

Jon S. Rachael, Idaho Department of Fish and Game, Boise, Idaho

Wolf recovery is a highly controversial and political issue in Idaho. In 1988 the Idaho legislature restricted the Idaho Department of Fish and Game's (IDFG) ability to participate in wolf recovery by prohibiting the agency from expending funds on wolf-related activities unless expressly authorized by state statute. The IDFG participated in developing the U.S. Fish and Wildlife Service's (OSSIFIES) Environmental Impact Statement on the reintroduction of wolves, and supported the USFWS's proposal to reintroduce wolves under a "non-essential, experimental population" status. The state legislature authorized the IDFG in 1994 to work with a citizen's oversight committee to develop and implement a state wolf management plan that would allow the IDFG to receive funding from the OSSIFIES to assume many of the responsibilities for receiving and managing wolf populations in the state. The IDFG and the oversight committee subsequently produced a state wolf recovery and management plan that was acceptable to the OSSIFIES. The state legislature failed to accept that plan. I believe the Idaho wolf recovery and management plan would allow the IDFG to manage wolves in a way that would result in recovery of wolf populations in central Idaho, while minimizing impacts of wolves on other resource uses (e.g., hunting, cattle grazing, timber harvest, mining, etc.). However, without the approval of the state legislature, the IDFG is not authorized to enter into an agreement with the OSSIFIES to implement that plan.

20

NORTHERN ROCKY MOUNTAIN WOLF RECOVERY PLAN

Rod Evans, DVM, Custer County Farm Bureau President, Idaho Farm Bureau, Challis, Idaho.

The American Farm Bureau Federation, along with the Idaho, Wyoming, and Montana Farm Bureaus are opposed to the Northern Rocky Mountain Wolf Recovery Plan because the plan exceeds the limits of the Endangered Species Act, did not follow the Administrative Procedure Act, our members will face livestock losses, which are lawfully present in the affected areas, and they also face unknown land-use restrictions.

21

THE CONSERVATIONISTS PERSPECTIVE ON WOLF RECOVERY IN IDAHO

David Langhorst, Wolf Education and research Center, Ketchum, Idaho

The Wolf Education and Research Center (WERC) is an organization dedicated to providing factual, balanced information and research on gray wolves and other endangered species, and to finding workable ways for endangered species to coexist with the diverse people and cultures of the Northwest. WERC promotes communication between agencies and the public through cooperative programs like "Track a Wolf", which involves schools in the day to day monitoring of translocated wolves. WERC also raises money to fund wolf recovery through the Wolf Recovery Action Fund; in this way WERC helped enable the largest telemetry sweep for wolves ever in the Northern Rockies in early 1994, an effort to find naturally occurring wolves in Idaho before the reintroduction. In partnership with the Nez Perce Indian Tribe, the organization is building a public education center near Winchester, Idaho, scheduled to open later this year.

22

BIRD POPULATION RESPONSES TO RECOVERY OF WESTERN RIPARIAN HABITATS. Terry Rich, Bureau of Land Management, Boise, ID, Dave Krueper, Bureau of Land Management, Sierra Vista, AZ.

Although riparian systems cover less than 1% of the land area in the West, they are essential nesting and migration habitat for 70-90% of the region's bird species. Further, these habitats support the highest density of breeding birds (~1400 pairs/km^2) of any habitat in North America. Cattle grazing has severe impacts on western riparian vegetation and, hence, breeding bird populations. Data reveal that 8 species respond positively to grazing while 42 species respond negatively. Following removal of livestock in a southwestern cottonwood-willow riparian habitat, populations of nearly all species increased - many dramatically. For example, Common Yellowthroats increased from 8 to 84 individuals per 40 ha; Song Sparrows increased from 0 to 29; and Yellow Warblers increased from 35 to 123. These and other responses demonstrate that land managers can significantly increase bird populations if they have the will and political support.

23

RESTORATION AND MANAGEMENT OF RIPARIAN HABITATS AT HART MOUNTAIN NATIONAL ANTELOPE REFUGE, SOUTH-CENTRAL OREGON. Barry Reiswig, U.S. Fish and Wildlife Service, Southeast Idaho Complex, Pocatello, ID 83201, and W.H. Pyle, U.S. Fish and Wildlife Service, Sheldon-Hart Mountain Refuge Complex, Lakeview, OR 97630

This paper reports recent initiatives of riparian restoration and management at Hart Mountain National Antelope Refuge. A new management plan describes existing habitat conditions, establishes goals and objectives for future habitat conditions, and prescribes rest from livestock use, prescribed fire, and willow planting to restore and maintain wildlife habitat in riparian areas. Use of ecological inventory and monitoring data in conjunction with demonstration sites provided a framework for restoration and management initiatives, which collectively represent a significant departure in management of wildlife habitats in the Intermountain West. Future work will consist of implementation, monitoring, and evaluation of restoration actions prescribed by the management plan.

24

DEMONSTRATION OF TWO TECHNIQUES TO MEASURE VEGETATIVE CHANGE IN RIPARIAN HABITATS. Howard G. Hudak, USDA, Sawtooth National Forest.

The Integrated Riparian Evaluation Intermountain Region, March 1992 describes several sampling techniques for use in riparian habitats. Two of them are the Green Line Vegetation Composition and Woody Species Regeneration transects. The techniques will be demonstrated and the results of six years of change of species composition and woody species regeneration in riparian areas will be evaluated. The techniques can be used to determine ecological status and trend for riparian systems. Applicability and rational for usefulness of these quantitative techniques on riparian stream systems will be discussed.

Keywords are Green Line and Riparian Complex.

25

DECLINING RIPARIAN ECOSYSTEMS IN THE WESTERN UNITED STATES: CAUSES AND PROPOSED FIXES. Robert A. Obedzinski, and Charles G. Shaw, III, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Riparian areas in the West are critical systems that interface with an array of resource needs. There is substantial documentation that these keystone systems are in serious decline. Invasion by exotic species, stress-induced mortality, increases in insect and disease attack, drought, and anthropogenic activities such as agricultural development, creation of dams, and grazing are major factors involved in riparian declines. This paper discusses causes of decline in Western riparian systems, the potential for returning these systems to sustainability, and poses questions that need to be answered in order to develop and maintain sustainable riparian systems.

26

THE IMPORTANCE OF RIPARIAN HABITAT TO AMPHIBIANS AND OF AMPHIBIANS TO RIPARIAN ECOSYSTEMS. Charles R. Peterson, Idaho State University, Pocatello.

Riparian habitats are important to amphibians because they provide hibernacula, breeding and development sites, dispersal corridors, and foraging areas. Amphibians are important elements of biodiversity in riparian systems. For example, Idaho Giant Salamanders and Coeur d'Alene Salamanders are endemic to the northern Rockies. Western Toads and Northern Leopard Frogs are State Species of Special Concern because they have experienced unexplained declines in southern Idaho. Amphibians are important functional components of riprarian ecosystems. Because amphibians can be very abundant, they are important as both predators and prey, forming a critical link between invertebrate prey and many vertebrate predators. Their high biomass may store a large amount of energy and their biphasic life cycle may result in considerable nutrient transport between aquatic and terrestrial systems. Amphibians are potentially sensitive indicators of environmental change because of a unique combination of biological characteristics, such as their permeable skin, biphasic life cycles, and aquatic reproduction and development.

27

RIPARIAN ZONES AND BIG GAME. James M. Peek, Department of Fish and Wildlife Resources, University of Idaho, Moscow, ID 83844

Big game animals often key in on riparian zones, especially as forage elsewhere desiccates or becomes unavailable. The lower-elevation river bottoms provide permanent year-long habitat in some areas, while in others they are used primarily during winter. Higher elevation riparian communities may be important sources of forage and cover at other times of the year. Shiras moose appear to be tied to riparian communities in many parts of their range, and a review of the adaptations in habitat use by this species relative to the ecology of riparian systems is provided. Riparian zones are highly important habitats for big game and efforts to maintain them for their multiple values will benefit these species.

28

Endangered and Threatened plant species in Washington State: Planning and Partnerships
Ted Thomas USDI Fish and Wildlife Service, Olympia, Washington

The protection of endangered and threatened plant species in their native habitat should be adopted as the best method of ensuring a plant's survival and conserving our nation's natural heritage. Barring this option, plant species may be listed as endangered or threatened after review of the best scientific data and the status of each candidate species. The US Fish and Wildlife Service in Olympia, WA is responsible for taking action on twelve category 1 candidate plants found in Washington that were named in a lawsuit brought against the Service. Endangered or threatened status will be determined for each candidate species based on threats to the species and its habitat, overutilization, disease or predation, the inadequacy of existing regulations, and other natural or manmade causes affecting a plant's existence. Efforts to protect and conserve plant populations and biodiversity are supported by the cooperation of the Washington DNR Natural Heritage Program, federal land management agencies, and private parties that desire to develop conservation plans for plants.

29

A HOLOCENE VEGETATION AND DISTURBANCE HISTORY OF THE WILLAMETTE VALLEY, WESTERN OREGON, U.S.A. Christopher A. Pearl, Cathy Whitlock, Marc A. Worona, Peter K. Schoonmaker, University of Oregon, Eugene and Oregon State University, Corvallis.

Fossil pollen, charcoal fragments, and plant macrofossils document pre-settlement vegetation and disturbance in the central valley. Pollen stratigraphy from an 8 meter sediment core from Beaver Lake (elevation 65m.) suggests an early-Holocene characterized by Douglas-fir (Pseudotsuga menziesii), hazel (Corylus californica), red alder (Alnus rubra) and Oregon white oak (Quercus garryana). The late-Holocene record suggests high level of Douglas-fir, western red cedar (Thuja plicata), and western hemlock (Tsuga heterophylla), with oregon ash (Fraxinus latifolia) and grass (Poaceae) increasing in prominence. These vegetation types suggest a warmer, drier early-Holocene, and a cooler, moister late-Holocene. A significant decrease in the charcoal signal followed by a pronounced increase in grass pollen at Beaver Lake may reflect post-settlement (ca. 1850) fire suppression, and the subsequent agricultural conversion to grass seed production in the early-mid 20th century. The charcoal record also suggests the pre-settlement Willamette Valley was a region characterized by relatively frequent and significant burning.

30

POPULATION STUDIES OF *PRIMULA Alcalina* IN ITS VARIED HABITAT
Robert Fitts, Utah State University

The effects of habitat on plant growth and reproduction on *Primula alcalina*, a rare endemic of Idaho. The two major habitat types, flat stream bars and soil hummocks were studied. More plants stayed in the flowering stage over two seasons in the stream bar areas than in the hummock habitat, where most plants became scapeless rosettes the second year. Plants also had taller flower scapes and about one more flower in the bar habitat. *P. alcalina* is distylous. Pin and thrum plants were not randomly distributed on the landscape, but were more often associated with plants of the same flower morph. Reproductive allocation from the first year of the study did not seem to determine reproductive allocation the following year. Augmenting pollen increased seed set, while adding fertilizer did not increase either seed number or weight.

31

THE HISTORIC AND PRESENT DISTRIBUTION OF *Bromus tectorum* ON THE IDAHO NATIONAL ENGINEERING LABORATORY. Teresa D. Ratzlaff, Kaylie E. Rasmuson, Tracy R. Bowlin, Jay E. Anderson, Richard S. Inouye, Idaho State University, Pocatello.

Cheatgrass (*Bromus tectorum*) is an exotic annual grass that has converted many sagebrush steppe communities in the Intermountain West into annual grasslands. Its presence on the Idaho National Engineering Laboratory (INEL) in southeast Idaho was first documented in 1950, and a marked increase in its range at the INEL occurred between 1965-1975 in the absence of grazing, fire, and other major disturbances. Ordination of abundance scale data from 92 vegetation plots established in 1950 produced two distinct groups of plots. Cheatgrass was present at all the plots in one group and absent from all the plots in the second. Furthermore, the groups remained distinct when cheatgrass was removed from the data set; thus the ordering was a consequence of factors other than the presence of cheatgrass. Examination of soil characteristics from plots with and without cheatgrass showed a difference in soil texture, soil strength, and chemical parameters.

32

GROWTH AND PHYSIOLOGICAL RESPONSES OF *Bromus tectorum* TO INCREASING LEVELS OF SALINITY. Kaylie E. Rasmuson, Idaho State University, Pocatello.

Bromus tectorum is an aggressive alien grass in sagebrush steppe of western North America. Studies indicate that soil salinity may restrict its distribution. Plants grown in sand culture were irrigated with 0, 0.025M, 0.070M and .1M NaCl. Dry mass and area of roots and leaves were reduced by salinity ($P < 0.001$ in both cases). Photosynthesis (A) and conductance (g) declined with increasing salinity ($P < 0.001$ in all cases). Conductance was more tightly correlated with A as salt stress increased. This and a 36% decline in intercellular CO_2 (c_i) indicate that reduced A was primarily due to reduced g. Carbon isotope discrimination (Δ) was negatively correlated with increasing salinity ($r = 0.85$, $P < 0.001$). A 4.2 $^{o}/_{oo}$ difference in Δ between the control versus the high salinity treatment indicated a 60 $\mu L\ L^{-1}$ difference in time-averaged c_i. Δ was 2.2$^{o}/_{oo}$ lower in the control than in low salinity plants; thus g was affected by low levels of salinity. Reduction of growth in *B. tectorum* associated with salt stress was due to effects on plant water status, gas exchange and biomass production and allocation.

33

THE EFFECTS OF SEED-PRIMING ON THE GROWTH OF Elymus lanceolatus IN COMPETITION WITH Bromus tectorum. W. Eric Limbach, Idaho State University, Pocatello, Stuart P. Hardegree, Northwest Watershed Research Laboratory, Boise.

Primed seeds germinate earlier than unprimed seeds in growth chambers. We investigated the effects of seed-priming on emergence and shoot production of Elymus lanceolatus (≡Agropyron dasystachyum) (ELLA), growing with Bromus tectorum (BRTE). Seeds of ELLA, unprimed (UE) and primed (PE), were sown at 8, 16, and 32 seeds per pot, alone and in combination, with BRTE seeds sown at the same densities; BRTE with unprimed-(BUE) and primed-(BPE) ELLA seeds. Plants were harvested after seven months and competitive interactions analyzed. Median emergence time was significantly shorter ($F_{3,15}=32.39$, $P=<0.0001$) for PE (24.4 d) than for UE (29.5 d), BUE (25.5 d), or BPA (26.1 d). ANOVA, however, did not indicate any significant effect of priming on shoot weights. Substitution rates ranged from 1.31-1.48 for UE, 1.46-1.73 for PE, 0.48-0.35 for BUE, and 0.38-0.25 for BPE. Perceived densities ranged from 18.48-79.30 for UE, 19.64-87.20 for PE, 11.82-43.14 for BUE, and 11.05-40.00 for BPE. Priming enhanced emergence of ELLA but not competitive ability with BRTE.

34

DISTINGUISHING BETWEEN *ELYMUS LANCEOLATUS* AND *PASCOPYRUM SMITHII* (GRAMINEAE: TRITICEAE). Mary E. Barkworth and C.A.B. Gilbert, Intermountain Herbarium, Department of Biology, Utah State University, Logan, Utah 84322-5305 and K.H. Asay, U.S.D.A.-A.R.S., Logan, Utah 84322-6300

Elymus lanceolatus (thickspike wheatgrass) and *Pascopyrum smithii* (western wheatgrass) are cytologically distinct, *E. lanceolatus* being an allotetraploid and *P. smithii* octoploid with at least one different genome. Despite this cytological distinction, the two species are often confused. Discriminant function analyses of data from 197 cytological vouchers deposited in DAO By W.M. Bowden were used to evaluate the effectiveness of 24 morphological characters in distinguishing between the two species. The findings were tested by applying them to an additional 300 specimens. No single character or combination of characters was completely reliable for distinguishing the two taxa. The most reliable were curvature of the first glume, the difference in width of the first glume at 1/4 and 3/4 length, and the rachilla width just below the second floret. *Elymus lanceolatus* tends to have straighter glumes with less difference in width from bottom to top and a narrower rachilla than *P. smithii*.

35

FLORA AND PLANT COMMUNITIES OF THE DARLINGTONIA WAYSIDE STATE PARK, LANE COUNTY, OREGON. Marie J. James, Washington State University, Pullman, and Ralph L. Thompson, Berea College, Berea, KY.

Darlingtonia Botanical Wayside State Park, Lane County, Oregon, was established in 1946 to preserve a population of the insectivorous plant, Darlingtonia californica (cobra-lily). The 7.3 ha park is located 8.9 km north of Florence, Oregon, on U.S. 101, at the junction with Mercer Lake Road. It is under the management of the Oregon Department of Transportation, Honeyman State Park District. The geographic range of this endemic includes Pacific coastal bogs and mountain slopes from Oregon to northern California. A descriptive study of the vascular plants was conducted during June-August 1991, June 1992, March 1994, and September 1994. Five plant communities are designated on the basis of habitat, indicator species, and presence of Darlingtonia californica (DACA): 1) bog: DACA, 2) seasonally wet swales and stream banks: DACA, 3) dense coniferous forest: DACA, 4) dense coniferous forest: no DACA, and 5) mowed park yard. The annotated list of vascular plants is comprised of 65 species in 54 genera from 32 families. Species consist of five Pteridophyta, five Pinophyta, and 52 Magnoliophyta.

36

37 EVALUATING SNOWMELT EROSION FROM SIMULATED WASTE BURIAL TRENCH CAPS. Eric K. Duffin, Utah State University, Logan, James P. Dobrowolski, Utah State University, Logan.

Erosion from snowmelt runoff is significantly affected by environmental variables such as extreme snow depths, rapid snowmelt from rain-on-snow events, and the presence of soil frost. A fully automated study site has been established at the INEL to define native conditions contributing to snowmelt erosion on 9 simulated waste burial trench caps (SWBTC) maintaining 3 different surface cover treatments. In order to create a worse-case scenario, simulated rain and snow were used in a small plot (254 mm x 254 mm) study utilizing two levels of water temperature. Runoff samples were collected at 5 minute intervals and analyzed for sediment content. The extent of soil frost was monitored during the experiment with TDR probes. Results from natural snowmelt runoff generated from SWBTC provide evidence for greater amounts of sediment carried from bare and sodgrass-covered plots than bunchgrass-covered plots.

38 GRAVITROPISM AND W-WAVE VELOCITIES O.E. Wagner. Wagner Research Lab., Rogue River, OR 97537.

I reported W-Waves in plants in NWS in '88, '89, and '90. Last year I found that the velocities of W-waves in plants appear to be different depending on whether they are traveling vertically or horizontally. This seems to produce gravitropism. I first found, by using different methods of introducing a pulse, that I was able to produce several W-wave velocities in plants which appear to be integral multiples of 96 cm/s. I then took averages of thousands of reciprocals of both vertical and horizontal internodal spacings from different trees. I took ratios of the vertical to the horizontal averages and found a set of distinct repeating ratios such as 1.50 (288/192) in several conifers (by comparing the averages of needle spacings rather than reciprocals). 1.50, 1.66, 1.25, 3.0, 1.33, and others were found in other species. These ratios are just the ratios that I found earlier by direct velocity measurement. The larger vertical velocities produce larger average internodal spacings.

FIRST-YEAR PERFORMANCE OF CONIFERS AND HARDWOODS PLANTED IN COMMERCIALLY THINNED DOUGLAS-FIR STANDS. Kathleen Maas, and W.H. Emmingham, Adaptive COPE, Oregon State University, Newport.

Douglas-fir stands in the Oregon Coast Range were thinned and underplanted to increase structural diversity. Three stands were thinned. Thinning densities were 30, 60, and 100 trees per acre. Unthinned control densities were 225 TPA. Seedlings of five conifers and two hardwood species were planted in separate trials after logging. Conifers planted were Douglas-fir, western redcedar, western hemlock, Sitka spruce, and grand fir. Growth and survival was determined after the first growing season. Survival in the control was 33% and increased up to 92-97 percent in the thinned stands. Hemlock had the highest survival (89%); Douglas-fir the poorest (70%). Hardwoods planted were big leaf maple and red alder. Survival in the control was 23%, thinning increased survival to 97% and higher in each density. Big leaf maple survival was 85%; red alder was 74 percent.

39

FIRE HISTORY AND SUCCESSIONAL PROCESSES WITHIN THE PONDEROSA PINE DOUGLAS-FIR/BEARDLESS BLUEBUNCH WHEATGRASS PLANT ASSOCIATION WITHIN THE OKANOGAN NATIONAL FOREST. Therese H. Ohlson, Okanogan National Forest, Winthrop. Benjamin A. Zamora, Washington State University, Pullman.

To understand how structural and compositional changes have occurred since exclusion of fire, three unmanaged stands of 10.5 ha minimum size were selected in the Methow River drainage for the fire history studies. All three stands represent the *Pinus ponderosa - Pseudotsuga menziesii / Agropyron spicatum var. inerme* plant association of this area. At each site, thirty plots were sampled within a randomly placed, systematic grid. Stand age, structure, species composition, and site factors. Ten fire scarred trees were sampled at each site to estimate fire return intervals. Fire return intervals were examined for linkage to stand development sequences within and between study sites. This research has been cooperatively funded by Region Six of the Forest Service, the Okanogan NF, and the Wenatchee Range and Forest Experiment Station.

40

WATERSHED ANALYSIS FOR FOREST VEGETATION. Richy J. Harrod and William E. Hartl U.S.D.A Forest Service, Leavenworth, WA.

Watershed analysis methods for forest vegetation are still in the developmental stage. We present a method of analyzing forest vegetation in 5th or 6th order watersheds. The goal of the process is to compare existing disturbance regimes and vegetation structure and composition with the best estimate of a range of conditions that would have existed prior to European settlement. The steps in this analysis are as follows: 1) stratify the watershed into vegetative groups (an important aspect is to incorporate disturbance regimes); 2) identify "species of concern" and their distribution within the watershed; 3) determine the current landscape pattern and structure of vegetative groups by ecology plot data, aerial photo interpetation, satellite imagery, and local knowledge; and 4) determine past landscape pattern and structure of vegetative groups by old photos, structure of the oldest present day canopy layer, enviromental and physical site characteristics, and existing literature. This process allows for estimating the effects of past management activities and identifying restoration projects. The Mission Creek Watershed will be presented as an example of this suggested approach.

41

SOIL AND AIR TEMPERATURE RELATIONS IN FORESTED HABITATS IN WESTERN WASHINGTON. Jan A. Henderson and David H. Peter, USDA Forest Service. Mountlake Terrace WA.

Temperature recorders were placed at 12 locations on the Olympic and Mt. Baker-Snoqualmie National Forests between 1989 and 1991. Soil and air temperature plus other environmental variables were recorded and stored on a computer chip every 3 hours for the duration of the study. Data were downloaded and fresh batteries were installed once a year. Results show the temperature profile at different seasons at each location. Winter temperatures below the snow pack rarely exceeded freezing. An abrupt change in soil temperature in the Silver Fir and Mtn. Hemlock Zones marked the melting of the snowpack in the spring. Mean annual temperature and mean seasonal temperature fluctuations were used to estimate the soil temperature regime using SCS standards. Regressions of mean annual temperature and elevation were used to generate the temperature lapse rates for this area. The data are being used to help generate a temperature model for forested sites in this area. This model will be used to estimate temperature relations for different types of potential natural vegetation.

42

EFFECTS OF POSTFIRE ENVIRONMENT AND COMPETITION ON GROWTH OF LODGEPOLE PINE SEEDLINGS IN YELLOWSTONE NATIONAL PARK. Jay E. Anderson, Idaho State University, Pocatello.

Initial postfire densities of lodgepole pine (*Pinus contorta*) seedlings at sites burned by the 1988 Yellowstone fires varied by four orders of magnitude, approaching 200 m^{-2} at one study site. Densities were positively correlated with the proportion of serotinous trees in the stand that burned and were consistently higher in areas that burned at moderate severity than in adjacent areas subjected to a severe crown fire. Because substantial differences in sizes of seedlings were apparent within two years, we initiated studies to assess the effects of competition and other factors on seedling growth. At three sites, we manipulated densities of intraspecific and/or interspecific competitors of target lodgepole seedlings. Growth of target seedlings was reduced substantially by intraspecific competitors, whereas interspecific competition was less important at all three sites and had little effect on seedling growth at two of the three sites. Seedlings were larger in areas burned by severe crown fires than in adjacent sites burned by fires of moderate severity. Competition may contribute to such differences where seedling densities are high, but site factors such as temperature and light availability are important as well.

43

VEGETATION CHARACTERISTICS OF SPOTTED OWL SITES IN THE NORTHWEST WASHINGTON CASCADES. Wayne F. Iverson, Seattle Central Community College.

Vegetation characteristics of spotted owl (*Strix occidentalis*) sites in the Mount Baker Snoqualmie National Forest were compared in order to discern possible differences between reproductive and non-reproductive spotted owl activity centers (n = 10). Results from three nested plots at each site were averaged. Cover class percentages were determined for shrubs and herbaceous plants within 0.004 ha and 0.0004 ha plots. Tree species were measured for density and basal area within 0.04 ha plots. Western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) were the dominant tree species. The shrubs and herbs with the highest average cover were Alaska huckleberry (*Vaccinium alaskaense*), sword fern (*Polystichum munitum*), and foamflower (*Tiarella unifoliata*). Deer fern (*Blechnum spicant*) and twin flower (*Linnea borealis*) both had significantly higher percent cover in the sites with successful owls. These results suggest that spotted owls in this area prefer moist sites of moderate to high timber productivity. Abundance of deer fern and twinflower in the forest understory may be indicative of the soil moisture, organic material, and canopy openings necessary to support the prey abundance and availability required by reproductive spotted owls in the northwest Washington Cascades.

44

ECOSYSTEM METABOLISM AND CARBON SPIRALING IN AN IMPOUNDED, COLD WATER RIVER SYSTEM. **Eric B. Snyder, G. Wayne Minshall, Idaho State University, Pocatello.**

The Kootenai River is an impounded, clear, cold-water system. Estimates of community metabolism were conducted in three physically different reaches downstream of the dam to document longitudinal trends and obtain an accurate representation of ecosystem metabolism and carbon spiraling. The river was characterized by long carbon spiraling distances on the order of kilometers, and as heterotrophic based on open system and closed chamber metabolism measurements. The long carbon spiraling distances are believed to be indicative of a lack of retention devices such as large woody debris, and because the river has a restricted flood plain due to natural canyon geomorphology and anthropogenic levying. Metabolism parameters, based on open system techniques, were spatially and temporally variable: Community Respiration (CR_{24hr}) and Gross Primary Productivity (GPP_{day}) ranged from 0.02 to 5.52 g O_2/m^2 and from 0.02 to 5.08 g O_2/m^2, respectively; Net Daily Metabolism (NDM_{24hr}) ranged from 1.11 to -6.2 g O_2/m^2. Carbon spiraling distance and metabolism measures in the Kootenai River were comparable to the pristine Salmon River, though metabolism values were slightly higher. In contrast, the eutrophic Middle Reach of the Snake River had much shorter spiraling distances and greater rates of respiration and productivity.

45

CARBON SPIRALING IN THE MIDDLE REACH OF THE SNAKE RIVER, IDAHO. Steven A. Thomas and G. Wayne Minshall., Stream Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, ID 83209.

Indices of carbon spiraling were determined at four locations in the Middle Reach of the Snake River, a sixth order segment influenced by sediment and nutrient enrichment and several upstream impoundments. Transported and benthic organic carbon (OC), community respiration, and several physical variables were used to determine the mean velocity of OC (**V**), the rate of OC recycling (**K'**), the turnover length of OC(**S**), the OC turnover time (**TT**), and the index of retentiveness (**IR**) for each experimental location and date. All spiraling parameters varied spatially and temporally. **V** ranged from 1.2 to 29.2 m/day, **K'** from 0.3 % C/day to 2.4 % C/day, **S** from 0.16 km to 6.03 km, **TT** from 42 days to 352 days, and **IR** from 578 to 9250. As composite indices several other variables (e.g. discharge) can also strongly influence these parameters under specific conditions suggesting these estimates provide unique information regarding the movement and cycling of organic carbon in the Middle Reach of the Snake River.

46

DIATOM COMMUNITY STRUCTURE IN RELATION TO HABITAT HETEROGENEITY FOLLOWING WILDFIRE. T.V. Royer, C.T. Robinson, G.W. Minshall, Idaho State Univ., and S.R. Rushforth, Brigham Young Univ.

Habitat heterogeneity, a major factor structuring diatom communities in stream ecosystems, is influenced by landscape disturbances such as wildfire. In the present study, diatoms were sampled, and habitat chacteristics measured, from 15 streams in central Idaho which varied in the amount of time since they last experienced major wildfire. Habitat heterogeneity varied between the streams, generally reflecting the time since last major disturbance. The relative abundance of individual species also varied greatly between streams. In particular, the abundance of *Achnanthes minutissima*, *Cocconeis placentula* var. *lineata*, and *Rhoicosphenia curvata* was quite distinct between streams. Diatom species richness ranged from 17-33, while Simpson's Dominance Index ranged from 0.15-0.75. Typically the communities were dominated by a single taxa. The results suggest diatom communities are directly influenced by benthic habitat heterogeneity, which in turn is altered by wildfire.

47

THERMAL STRESS RESPONSE OF A STONEFLY (PLECOPTERA: *Hesperoperla pacifica*). **Jason Nelson, Stream Ecology Center, Idaho State University, Pocatello, Idaho 83209.**

Response to disturbance, an acute thermal stress, was investigated for *H. pacifica* populations from two adjacent Idaho streams that differed in degree of habitat heterogeneity (LOW vs. HIGH). Seasonal experiments were conducted in aquarium microcosms with water temperatures maintained at average ambient stream levels. Stress consisted of an acute thermal pulse exceeding ambient temperature by 19.5°C for 1-hr during each day of a five day experiment. Mortality was recorded daily during each experiment. *H. pacifica* mortality was more variable in HIGH (CV=0.87) than in LOW (CV=0.43) in spring, but were comparable between streams during summer (>95%) and autumn (<10%). Water deoxygenation stress, associated with a thermal pulse, was determined in a separate experiment under which thermally stressed microcosms were oxygen supersaturated (150%). Mortality was greater in thermal trials without oxygen amendments, indicating deoxygenation as being a more significant mechanism producing mortality then actual temperature increases. The results suggest a distinct population response to thermal stress, reflecting an organism's generation time and genetic composition interacting with degree of habitat heterogeneity.

48

LOTIC ECOSYSTEM FUNCTION: COMPARISON OF TWO HEADWATER STREAMS THAT DIFFER IN ASPECT.
Scott E. Relyea, Chris T. Robinson, and G. Wayne Minshall, Stream Ecology Center, Department of Biological Sciences, Idaho State University, Pocatello, Idaho 83209.

Estimates of functional properties are inherent in understanding ecosystem level processes and dynamics. This study assessed the role of stream aspect (north-:NFA, or south-facing:SFA) on ecosystem function. Both streams are 2nd order, closed canopied, high gradient with boulder-cobble substrata. SFA was spring snowmelt controlled and accumulated 200 more degree days than the flow-constant NFA. Total organic matter (TOM) displayed a seasonal pulse (3-4X higher during spring runoff) in SFA that was not evident in NFA. Decomposition rates of leaf packs differed seasonally, however they were comparable between streams. Secondary production was greater in SFA than in NFA, although structural properties were similar between streams. The higher secondary production in SFA was primarily caused by the predominance of *Drunella doddsi*, which accounted for 25-30% of the macroinvertebrate biomass in SFA. The results suggest that drainage basin aspect plays an important role in stream ecosystem function through its influence on timing and magnitude of spring runoff and total heat energy budget.

49

COASTAL OREGON PRODUCTIVITY ENHANCEMENT ADAPTIVE COPE PROGRAM: A FOREST RESOURCE RESEARCH AND TECHNOLOGY TRANSFER PROGRAM.
Liz Dent, Kathleen Maas, John P. Hayes, Michael D. Adam, Coastal Oregon Productivity Enhancement, Hatfield Marine Science Center, Newport, OR 97365.

The Adaptive COPE Program was established to address information needs concerning upslope and riparian zone ecology and management in the Oregon Coast Range. Research studies address management of fish, timber, water, and wildlife. This poster presents and overview of a selection of Adaptive COPE studies. An active riparian zone management project has been implemented on three streams in the Oregon Coast Range. The project components being researched include: costs of stream restoration, the influence of management on channel morphology, stream temperature, and responses of bat and insect populations. In a separate study, Adaptive COPE installed woody debris structures of various diameters in two streams. Responses of fish population dynamics and channel morphology to the structures are being studied. Two riparian silviculture studies are underway to examine strategies for converting hardwood-dominated riparian areas to conifers. Upslope, we are examining techniques for promoting structural diversity in second growth Douglas-fir stands through commercial thinning and planting of hardwoods and conifers. In a separate study, Adaptive COPE is examining the effects of thinning young forest stands on wildlife populations and on vegetation dynamics and seedling establishment.

50

GEOSTATISTICAL ESTIMATION OF REGIONAL HYDRAULIC CONDUCTIVITY VARIATIONS AT THE IDAHO NATIONAL ENGINEERING LABORATORY, John A. Welhan, Idaho Geological Survey, Pocatello, Michael F. Reed, Idaho State University, Pocatello.

Two-dimensional geostatistical techniques were used to estimate the regional spatial distribution of hydraulic conductivity in the fractured basalt aquifer at the Idaho Engineering Laboratory (INEL). Preliminary indications are that the underlying statistical variation of lnK in the aquifer can be described by an isotropic exponential variogram model. Kriged estimates of lnK over a 22.4 mi^2 (58 km^2) area are consistent with the premise that a region of low hydraulic conductivity exists just south of the Idaho Chemical Processing Plant (ICPP). Such a regional feature could affect the migration of the waste disposal plume produced by past operation of the ICPP deep disposal well. The existence of anisotropy and "hole" effect at a separation scale of ca. 100,000 ft. (30.48 km) suggest that underlying geologic structural controls may be represented in the hydraulic conductivity data.

51

GEOCHEMICAL CORRELATION OF BASALT LAVA FLOWS BENEATH THE IDAHO CHEMICAL PROCESSING PLANT (ICPP), IDAHO NATIONAL ENGINEERING LABORATORY. Scott S. Hughes and Michael F. Reed, Idaho State University, Pocatello

Evolution of basaltic volcanics that comprise the upper 1- 2 km of eastern Snake River Plain (ESRP) requires knowledge of detailed stratigraphy of local eruptive systems. Chemical signatures of lava flows beneath the ICPP was established using samples collected from the cores of ~230 m deep wells #121 and #123 located ~1.8 km apart on opposite sides of the Big Lost River. Elemental analyses indicate three principal chemical types, two of which are each represented by a single flow unit and the third which includes a wide range of chemical subtypes involving several flows ~3-20 m thick. Distinction between flows within the third group by hierarchical K-cluster analysis of 14 representative elements (Fe, Ca, Na, K, Co, Sc, La, Ce, Sm, Eu, Yb, Hf, Ta and Th) yields positive correlation of lava flows at depths of 39 m, 127 m, 133 m, and 189 m. Good correlations are also established between at least 7 flows in the remainder of the sequence. Several flows are present in one location and not in the other, thus reflecting possible influence by the Big Lost River channel. Chemical correlation of flows on a local scale demonstrates the utility for unraveling the regional stratigraphy of ESRP lavas and eruptive centers.

52

THE PLIOCENE SNAKE RIVER FLOWED NORTH AT HAGERMAN FOSSIL BEDS NATIONAL MONUMENT, IDAHO. Dana E. Lee and Paul Karl Link, Department of Geology, Idaho State University, Pocatello

Sandstone petrology from the Glenns Ferry Formation (ca 5 to 3 Ma) in the Hagerman, Idaho area reveals that rhyolitic lithic detritus comprises the greatest percentage of sand grains, suggesting that the Pliocene Snake River flowed northward, draining volcanic highlands in southernmost Idaho and northern Nevada. Fine-to coarse-grained sandstones are volcanic litharenites, averaging 49% rhyolitic lithics and 11% basaltic lithics, with only 9% monocrystalline quartz, 4% polycrystalline quartz, 9% feldspar, 13% Paleozoic sedimentary rock fragments and chert, and 4% intrabasinal sedimentary (Snake River Plain-derived) rock fragments. These rhyolitic sands plus sparse paleocurrent information suggest the Glenns Ferry Formation was fed by a north-flowing meandering river and flood plain system with similar course to the modern Salmon Falls Creek, and which drained into Lake Idaho to the west. The low amounts of Paleozoic sedimentary rock fragments, polycrystalline quartz and chert suggest that the Hagerman area was not fed by a river draining the thrust faulted southeast Idaho uplands to the east. Further study of provenance of Neogene Snake River Plain sands will allow tracking of drainage reversal in the wake of the migrating hot spot.

53

ORIGIN OF MCLAUGHLIN CAVES, WASHINGTON, PRELIMINARY REPORT. Eugene P. Kiver, John P. Buchanan, Michael Alcorn, Steven Harris, Mark Schuler, Eastern Washington University, Cheney.

The origin of a cave and open trench system over 1128 m long near Tonasket in north-central Washington was investigated by a faculty-student research team as a requirement for a field research class. The system is in the late Mesozoic Tonasket Gneiss and lies on the east side of the Okanogan River valley in a 1 x 0.4 km slump block developed on a glacially-scoured ridge just north of the McLoughlin Canyon ridge. The gneiss lies on the west flank of the Okanogan Gneiss Dome. Oversteepening by glaciers and a shallow ice marginal valley at the base of the ridge initiated slump block movement and enabled joint blocks to separate and creep westward and northward. A box-like maze pattern of caves and open trenches formed along the opening joints. Lower slopes consist of block rubble with mid slopes containing intact joint blocks toppling westward. A distinct trough marks the upper edge of the slump block. Slippage along mylonitic zones that dip 20 to 28° to the northwest accounts for roofing of opening joints. Roofs on cave passages over 2.5 m wide become unstable and tend to collapse. Mazama ash (?) occurs locally on the glacially-scoured bedrock surface but none was found in the open trenches. Thus, the open trenches and likely the cave system is less than 6800 years old.

54

BETTER INFORMATION TRANSFER BY MAKING INTERESTING LANDSCAPES AVAILABLE TO YOUNG MINDS. Nancy B. Hultquist, Central Washington University, Ellensburg.

Teachers in elementary and high schools need materials to present science to their students. A project is underway in the National Council for Geographic Education, called the Pathways Series, to satisfy this need. There are other efforts as well. The National Geographic Society sponsors projects. I have used a 1972 LANDSAT color image along with larger scale topographic maps to explore the landscape of the Eastern Snake River Plain. I present issues of providing such materials to teachers. Herein I will show how the material was initially presented, the visuals offered in the package, and the different ways which have been used in the field to introduce knowledge to teachers and teachers-in-training. I address the problems of making such materials accessible to teachers, the costs, the what-to-do's, and what-not-to-do's in presenting graphic information usable for the classroom, and the challenge of educating the teachers.

55

CHANGES IN GLACIER RUNOFF IN CLE ELUM RIVER, NORTH CASCADES. Mauri Pelto, Nichols College, Dudley, MA, Bill Prater, Twin Falls, Idaho

Glaciers are an important late summer (July-Sept) runoff source in the North Cascades, a low flow period in alpine streams. As glacier's retreat there is less snow and ice area exposed for melting, and than less runoff. The North Cascade Glacier Climate Project has monitored 4 glaciers in Cle Elum River Basin since 1984. In this basin there has been a rapid retreat of Ice Worm, Daniels, Chimney Rock and Lemah glaciers. Glacier area in the Cle Elum River Basin was 3.2 km in 1933 when Cle Elum Reservoir was completed, 2.5 km in 1958, 2.0 km in 1986, and 1.5 km in 1994. In August 1994, with the Cle Elum River system far short of meeting the desired flow rate for irrigation districts, Daniels and Ice Worm Glacier yielded 4.5 million gallons/day of runoff compared to 6.5 million gallons/day in the equallly dry August's of 1986 and 1987. Rapid glacier retreat is causing a decline in late summer glacier runoff and alpine streamflow. Glacier's are a significant, but not principal water source in this basin and must be considered for intelligent water resource planning.

56

MOUNDED MICRORELIEF ON THE EASTERN SNAKE RIVER PLAIN (ESRP), IDAHO Julie A. Tullis, Idaho State University

Earth mounds on the ESRP apparently formed by the heaving of fine-grained sediments during the growth of ice lenses. Mound development occurred during the Late Pleistocene, after glacial outburst flooding ca. 20 ka, but prior to Holocene pedogenesis. Bioturbation, intermound erosion, and eolian deposition have maintained or increased mound height. Mounds are consistently less than a half meter in height, round or oblong in plan view, and 8-14 meters in diameter. Differences in mound versus intermound vegetation enhance mound identification Mounds formed in multiple sedimentary environments, but typically within a one to two meter thick deposit of fine-grained sediment overlying a basalt or coarse-grained sedimentary floor. Mound floors are commonly concave upward on one or both sides of the mound, but represent paleosurfaces rather than mound-building processes. These paleosurface concavities were optimal for the growth of ice lenses in discrete open systems. Differences in hydraulic conductivity between the basement and the overlying sediments contributed to the availability of moisture for migration toward the freezing front. Buried and surface soils are continuous across the mound/intermound boundaries, and surface soils show no disruption from mound-building processes. Involutions and wedges in paleosols, and frost-heaved basalt clasts and gravels are present.

57

BUSINESS AND THE ENVIRONMENT: CAN THEY CO-EXIST? Steven C. Dunn and Robert Picard, Idaho State University, Pocatello.

As we head into the 21st century, environmentally-based issues promise to grow in importance to business managers due to increasing public awareness and concern over causation. The call to be more "environmentally oriented" results directly from dramatic incidents involving corporations such as the Exxon Valdez, Union Carbide and Bhopal, etc. As corporate groups struggle to maintain their legitimacy in the face of more stringent public demands, business educators must provide the next generation of managers the opportunity to develop skills necessary to cope with the demands of this new environmentalism.[1] This presentation will: 1) review the history of this movement in business management; 2) explain how the environment crosses each functional area of a business; and 3) raise the issue of co-existence.

[1] Smith, Denis. Business and the Environment: Implications of the New Environmentalism, New York: St. Martens: 1993, p. 1.

58

DRIFTING AND HIVE FIDELITY IN HONEYBEES DURING AUTUMN. Margo M. Kanz, Western Washington University, Bellingham.

Drifting of honeybees (Apis millifera) was examined within the context of modern beekeeping concerns, particularly the threat to commercial beekeeping from the spread of parasitic mites. Previous research on drifting in summer bees (those maturing in spring/ summer) was outlined, and an experiment to test the validity for assumptions of non-drifting behaviors for winter bees (those maturing in autumn) was presented. Circumstances within the apiary were arranged to facilitate either drifting or hive fidelity, depending on which of two feeding stations the individual, marked bee visited. After five days, it was observed that the target hive was depopulated and all the marked bees had joined the existing viable colony in the hive directly south and adjacent to the target hive. According to present knowledge based on summer bee research, this behavior should have been impossible. We conclude that this unusual event suggests a need for further research of winter bee behaviors to determine whether drifting is an adaptation to human interference; a result of season-specific, biological determination and physiological changes; or a combination of these or other factors as yet unknown.

Author acknowledges the invaluable assistance of Earl W. Kanz, K & G Bee Wranglers, Bellingham.

59

ECOLOGICAL COMPLIANCE ASSESSMENT ON THE HANFORD SITE. Charles A. Brandt, Pacific Northwest Laboratory*, Richland, Gretchen L. Fortner, ASci Corporation, Richland, Rhett K. Zufelt, ASci Corporation, Richland.

The U.S. Department of Energy (DOE) is required by federal laws, regulations, and DOE orders to protect valuable ecological resources within the range of its land and resource management responsibilities. Protection includes evaluating the potential for these resources to be adversely affected by DOE activities and conducting its activities in a manner that ensures the long-term maintenance and enhancement of ecological resources. To help meet these goals at the Hanford Site, the DOE Richland Operations Office (RL) established the Ecological Compliance Assessment Project (ECAP). The purpose of the ECAP is to assist RL in assessing and minimizing impacts to species and habitats of concern. The objectives of the ECAP are to identify changes to Site projects that will reduce impacts, identify mitigation requirements, and annually compile cumulative impacts to ecological resources as a result of Hanford Site activities. These efforts are facilitated by a baseline survey approach in which the status of species and habitats of concern is determined on an annual basis within anticipated activity zones. Survey results are entered into a computer database linked with a GIS interface that is used to map projects, habitats, and species, as well as track species status in regard to federal and state species protection laws.

60

WILDLIFE POPULATION TRENDS ON THE DOE HANFORD SITE, SOUTH-CENTRAL WASHINGTON STATE. L.L. Cadwell, B.L. Tiller, D.D. Dauble, M.A. Simmons, J.L. Downs, W.H. Rickard, Pacific Northwest Laboratory, Richland WA, and Rosemary Mazaika, Pacific Northwest Laboratory(a), Portland OR.

The Wildlife Resources Monitoring Project purpose is to track trends in wildlife populations and to identify impacts resulting from Site operations on natural plant and animal populations. The project further conducts surveys to identify, record, and map populations of threatened, endangered and sensitive species. Fall chinook salmon redd counts and bald eagle numbers have both increased over the period from about 1960 until 1990. A vegetation cover map was recently produced for the Hanford Site and is being used for land use planning, impact mitigation and Site management decisions. A local population of Rocky Mountain elk has grown from about 20 animals in 1980 to more than 300 in 1994. A special study of mule deer is being conducted to identify a possible cause for observed abnormalities in bucks that include irregularly-shaped antlers that remain permanently in velvet and atrophied testicles. Affected animals are predominantly the older bucks which are abundant at Hanford because of the lack of hunting for more than fifty years.

(a) The Pacific Northwest Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RLO 1830

61

THE EFFECTS OF HABITAT FRAGMENTATION ON THE DEMOGRAPHY AND SOCIAL STRUCTURE OF THE GRAY-TAILED VOLE.
Jerry O.Wolff, Eric M. Schauber, and W. Daniel Edge, Department of Fisheries and Wildlife, Oregon State University, Corvallis, Oregon 97331 USA

We monitored the demographic and behavioral responses of gray-tailed voles, *Microtus canicaudus*, to fragmentation in 12 0.2 ha enclosures planted with alfalfa. A 70% reduction in habitat did not adversely affect reproduction, survival, juvenile recruitment, or population size of voles in one large continuous fragment (625 m^2), or a mosaic of 25 small fragments (each 25 m^2). Peak density estimates based on the amount of habitat in each enclosure were 545 animals/ha in control, 1,056 in large fragment, and 2,880 in small fragment enclosures. In small fragments 6% of females and 15% of males moved among fragments within a week compared to approximately 50% in large fragment and control enclosures. We conclude that at the time of fragmentation, population sizes were low enough to accommodate a 70% reduction in habitat and still continue to increase in numbers. The social system of gray-tailed voles was sufficiently flexible to accommodate an influx of animals and to withstand densities in excess of 1,000 voles/ha.

62

SIMPLE HORIZONTAL TRANSFER MODELS.
Harry Oxley and Patrick Lang, Idaho State University, Pocatello.

The transmission of genetic material from one sexually reproducing generation to the next is commonly referred to as vertical transfer. Until recently, barring genetic drift, selection, and mutation considerations, this transfer method was believed to be the only mechanism that accounted for the the genetic makeup of new generation members. Today, evidence suggests genetic material is able to 'jump' between individuals of the same generation and even between non-interbreeding species. This speculated form of genetic material movement is known as horizontal transfer. It has been suggested that horizontal transfer may account for the sudden appearance of fully developed characteristics acquired by some species, where such characteristics would have taken selection and other evolutionary forces many generations to develop through the vertical transfer process. This suggestion is investigated. In particular, two simple mathematical horizontal transfer models are developed and used to determine the effect this transfer method has on the genetic makeup of successive generations. These simple models show horizontal transfer can cause extinction of dominant genotypes. This change can be rapid or slow. In the first model rapid change occurs when the transfer rate is high and in the second, a rapid change occurs when there are a large number of transfer agents acting on the studied population. Slow, almost undetectable, changes occur when either transfer rates are small or the number of agents is minimal. Both models suggest that horizontal genetic material transfer may often play a role in evolutionary change, but that its effects are typically not noticed due to small transfer rates or low numbers of transfer agents.

63

EFFECTS OF ADRENALECTOMY AND ANDROGENIC HORMONE REPLACEMENT ON WINTER FUR GROWTH IN MINK.
Michael D. Kennedy, Brady K. Cottle, Bruce Eshelman and Jack Rose. Idaho State University, Pocatello

Adrenalectomy (ADX) of mink during July induces early onset of winter fur growth, suggesting that adrenal hormones inhibit the initiation of the winter hair growth cycle. The objective of this study was to determine if the effects of ADX on hair growth could be overridden by exogenous testosterone (TEST) or dihydrotestosterone (DHT). Mink that were ADX began growing the winter fur 5 weeks earlier than controls ($P < 0.01$). Neither TEST nor DHT changed the time at which winter fur growth began subsequent to ADX. Interestingly, the second spontaneous hair growth cycle following ADX appeared to occur earlier in those mink treated with TEST than ADX mink treated with or without DHT. The differential effects of the steroids at this time may reflect changes in serum levels of other hormones that effect hair growth, such as prolactin, or the sensitivity of the skin to them.
(Support: American Mink Farm. Res. Found.).

64

THE USE OF SHEEP GRAZING TO CONTROL POCKET GOPHERS ON FORESTED RANGELANDS OF SOUTH CENTRAL WASHINGTON.
Anna M. Owsiak, Washington State University, Pullman, Gary W. Witmer, USDA/APHIS/DWRC, Pullman, Washington.

Intensive sheep grazing to reduce competing vegetation on reforested units may also control pocket gopher (Thomomys talpoides) populations. Gophers damage planted seedlings in many areas of the inland Pacific Northwest. We compared sheep-, cattle- and non-grazed units to determine the effects of grazing on gopher densities, food habits and above ground vegetation cover and below ground vegetation biomass. Gopher densities were 9 per acre where no grazing or cattle grazing occurred and 3 per acre where intensive sheep grazing occurred. Forb (preferred food) consumption by gophers was highest and grass lowest on non-grazed units. Root biomass was about 50% lower on sheep-grazed units than cattle-grazed units. Sheep removed much of the above ground vegetation, decreasing the available food for gophers. This plus other factors appear to lower gopher densities, thereby decreasing the potential for gopher damage to seedlings in these units.

65

66 **UTILIZATION OF SUMMER THERMAL ENVIRONMENTS BY FRESHWATER WESTERN PAINTED TURTLES CHRYSEMYS PICTA IN LAKE DEPUDDLE, PULLMAN, WASHINGTON.** **Peg Bartels and Ken Kardong, Washington State University, Pullman.**

Model L minimitter telemetry units powered by a 3.4 lithium battery (Minimitter, Co., Sun River, Oregon) were implanted in five western painted turtles to monitor internal temperatures from April 1984 to August 1985. Daily turtle internal temperatures (TI) and external environmental temperatures (TE) curves were compared with: 1). morning basking behavior, 2). peak TI behavior and 3). aquatic and float basking behavior. Observations were recorded on population structure, unimodal and bimodal basking and large, medium and small turtle basking patterns. At the end of basking, TI is significantly higher than other times. A strategy of large western painted turtles may be to increase TI quickly in early mornings and maximize metabolism prior to foraging.

67 A COMPARISON OF THE DISTRIBUTION AND ABUNDANCE OF THE HERPETOFAUNA OF THE IDAHO NATIONAL ENGINEERING LABORATORY: 1975 AND 1994. Sarah L. Cooper, Charles R. Peterson, Idaho State University, Pocatello.

To determine changes in the distribution and abundance of amphibians and reptiles in southeastern Idaho, we repeated a survey of the herpetofauna of the Idaho National Engineering Laboratory (INEL) conducted in 1975 by Sehman and Linder. They performed visual searches and recorded the numbers of species and individuals observed at each site. Our comparison used 43 temporally-matched visits to spatially-paired sites. The biggest difference between the two surveys was the absence of Great Basin Spadefoots (*Spea intermontana*) and Western Terrestrial Garter Snakes (*Thamnophis elegans*) from former wetland sites now dry because of drought and the diversion of the Big Lost River. All four species of lizards are still present; however, these species were found at fewer sites and were less abundant, especially Short-horned Lizards (*Phrynosoma douglassii*). The snake species found in 1994 had comparable distributions and abundances to 1975. To augment the 1994 survey, we used drift fences and funnel traps to monitor snake populations at three denning locations and detected a new species for the INEL, the Racer (*Coluber constrictor*).

68 BREEDING BIOLOGY AND NESTING HABITAT OF NORTHERN GOSHAWK AND GREAT GRAY OWL IN EASTERN IDAHO. Susan M. Patla and Dr. C. Trost, Idaho State University, Pocatello.

Between 1989 and 1993, we identified 69 occupied northern goshawk (*Accipiter gentilis*) nest sites (32 territories), and 67 great gray owl (*Strix nebulosa*) nest sites in mature and old growth conifer and mixed conifer/aspen (*Populus tremuloides*) habitat on the Targhee National Forest. Production at successful goshawk nests averaged 1.94 young/nest (range 1.54-2.26). Productivity was significantly lower in pure lodgepole pine (*Pinus contorta*) compared to Douglas fir (Pseudotsuga menzesii) and mixed conifer habitat. Mean fledging date was July 13 (range July 1-July 30). Occupancy of previously identified nest trees was uncommon (4-11%/year). Occupancy of nesting areas which contained more than one alternate nest tree averaged 61% over the five year period. For great gray owl, mean annual productivity ranged from 2.0-2.4 young/nest. Great gray owls fledged from late-May to early July. Fifty-eight percent of nests found (n=30) were in alternate goshawk stick nests. Twenty meter radius plots (0.064 ha) were measured to describe nest stand structure.

69 DISTRIBUTION, RELATIVE ABUNDANCE AND HABITAT ASSOCIATIONS OF AMPHIBIANS AND REPTILES ON THE CRAIG MOUNTAIN WILDLIFE MITIGATION AREA (CMWMA). Robin Llewellyn, and Charles R. Peterson, Idaho State University, Pocatello, ID

The primary objective of this project was to survey the amphibians and reptiles of the CMWMA to provide information for appropriate management of these species. This study is important because little was known about this area and the concern about the declines in amphibian populations. Because of the ecological diversity of the species, I used a variety of sampling techniques, of which visual searching was the most effective. One salamander, six anuran, two lizard, and eight snake species were found. The CMWMA topography has a high elevation coniferous and meadow "plateau" (5000-ft.) with steep elevational breaks down to the Snake and Salmon River (800-ft.). Five species such as the Spotted Frog and the Common Garter Snake, were found at the cooler and moister high elevation sites. Seven species such as the Great Basin Spadefoot and Western Rattlesnake were found at the warmer and dryer lower elevation sites. Some species, such as the Western Toad and Rubber Boa, were found at both elevations. Species of special concern that were found included: Tailed Frog (C2) Ringneck Snake (SSC C) and Nightsnake (range extension).

70 THE EFFECTS OF HABITAT MODIFICATIONS ON A SPOTTED FROG POPULATION IN YELLOWSTONE NATIONAL PARK.

Debra A. Patla and Charles R. Peterson, Idaho State University, Pocatello.

Many species of amphibians are undergoing apparent population declines. An understanding of how human disturbances affect amphibian populations is critical for their conservation. The goal of this project is to determine how specific habitat modifications may have contributed to local changes in the abundance and distribution of spotted frogs (*Rana pretiosa*). Our approach is to compare the results of a baseline ecological study (1953-1955) with a similar study (1991-1994) of a frog population in Yellowstone Park at a site where habitat modifications have occurred. We are investigating changes in the population's demographic characteristics, habitat use, and movement patterns. Population size has declined by approximately 80%. There are changes in the proportion of the population using and dispersing among various habitat features within the study area. The most probable causes of these changes are road construction and water developments. In an adjacent area less affected by these disturbances, the abundance of spotted frogs does not appear to have changed significantly over the same 40-year period.

71 GEOGRAPHIC INFORMATION SYSTEM: FROM SIMPLE MAPPING TO CRITICAL HABITAT ANALYSIS

L.L. Cadwell, W.H. Reid, Pacific Northwest Laboratory[a], Richland WA, K.D. Hand, AScI Corporation, McLean, VA, and J.J. Nugent, University of Montana, Missoula

Habitat quality determination at the landscape or regional scale is a critical need as land managers seek to impliment the concept of ecosystems management. Pacific Northwest Laboratory is using a geographic information system-based approach to habitat evaluation. The method relies on integration of remotely sensed geographical data and specific location (coordinate) data to evaluate the character of local habitat features used by sensitive populations. This display identifies several of the legal drivers that give rise to the need for landscape level GIS analyses, shows the steps involved in the process and provides examples of applications to current land management decisions. The ferruginous hawk, a Washington State threatened species, is used as the model example in this display.

(a) The Pacific Northwest Laboratory is operated for th U.S. Department of Energy by Battelle Memorial Institute under Contract DE-AC06-76RLO 1830

THE EFFECTS OF POST-FIRE RANGELAND REHABILITATION ON THE RECOVERY OF MICROBIOTIC SOIL CRUSTS ON THE WESTERN SNAKE RIVER PLAIN. Julie Kaltenecker and Marcia Wicklow-Howard, Boise State University, Boise.

Fifty-four permanent transects were established during the spring of 1994 to study the recovery of microbiotic soil crusts following fire and subsequent rangeland rehabilitation. Coverage of lichen and moss crust components and vascular vegetation were measured in unburned stands of Wyoming big sagebrush (*Artemisia tridentata* ssp.*wyomingensis*) and adjacent areas which had burned approximately 10 years earlier, part of which were seeded to perennial grasses during the fall following the fire. Over a decade following treatment, microbiotic crusts in areas seeded with perennial grasses were in early to mid-seral successional stages. Areas that were burned but not rehabilitated were dominated by annual grasses and forbs, and lacked the development of the climax microbiotic crust components, particularly lichens, found in the seeded and unburned areas. Results of this study suggest that restoration of vascular vegetation and recovery of microbiotic soil crusts in burned areas are closely tied.

72

MICROBIOTIC SOIL CRUST COMPOSITION OF A HIGH DESERT JUNIPER SAVANNA IN OREGON. Jeanne Ponzetti, Bruce McCune, Oregon State University, Corvallis.

Despite increasing interest in the ecological roles of microbiotic soil crusts, surprisingly little is known about their community composition and response to disturbance in Oregon's shrub-steppe region. We assessed soil crust communities at the Horse Ridge RNA/ACEC, a *Juniperus occidentalis - Artemisia tridentata - Carex filifolia* community that has been fenced from cattle grazing for 19 years. The site's sandy textured soils are derived from aerially deposited pumice. Vascular and nonvascular species were compared between the exclosure and an adjacent grazed parcel. Soil crust composition differed between the fenced and grazed parcels (MRPP; $p < 0.0001$). Average species richness per quadrat and overall cover and frequency was higher for soil crust species inside the fence. Cover of *Aspicilia reptans*, *Caloplaca tominii*, and *Psora cerebriformis* was significantly greater in the exclosure, while cover of *Encalypta rhaptocarpa* was greater in the grazed parcel (univariate F-test; $p \leq 0.01$). The dominant compositional trend within the site was a negative correlation between *Tortula ruralis* and the lichens *A. reptans*, *Ochrolechia upsaliensis*, *C. tominii*, and *P. cerebriformis* (ordination analysis). Future studies will include replications at other Columbia Plateau sites to determine if grazing has created fenceline differences in our region's microbiotic soil crust communities.

73

EFFECT OF MICROBIOTIC CRUSTS ON THE GERMINATION AND ESTABLISHMENT OF THREE GREAT BASIN GRASSES. Kelly D. Larsen, Boise State University, Boise, Idaho, Marcia Wicklow-Howard, Boise State University, Boise, Idaho.

The effects of microbiotic crusts on soil moisture, soil nutrients, and germination and establishment of *Stipa thurberiana*, *S. comata*, and *Bromus tectorum* were studied on the Snake River Plain near Boise, Idaho. Three treatments of microbiotic crusts (scalped, intact, and macerated) were examined. Germination of the grasses was recorded in May 1994, nutrients were analyzed from soil collected in June 1994, and soil moisture was collected monthly from August 1994 to April 1995. Multivariate analysis of variance was utilized to detect significant differences among microbiotic crusts treatments with respect to these variables. The germination rate of *B. tectorum* was higher in the plots receiving the macerated treatments ($F=25.44$, $P=0.0001$). The macerated plots also contained higher levels of nitrate ($F=31.23$, $P=0.0001$) and ammonium ($F=63.65$, $P=0.0001$). There were no significant differences among treatments with respect to soil moisture and *Stipa* spp. germination. Therefore, disturbance to the microbiotic crust, in this area, lends itself to invasion by *B. tectorum*.

74

ECOLOGY OF VAGRANT LICHENS IN ARID STEPPE COMMUNITIES. Rosentreter, Roger. Bureau of Land Management, 3380 Americana Terrace, Boise, Idaho 83706.

Vagrant lichens are unattached to a substrate. They can move about with the wind like a tumbleweed. Vagrant lichens are most common in wind-swept arid environments around the world. They appear to be associated with sites where water is ephemerally ponded during the cool season. Sites where vagrant lichens occur lack an accumulation of plant litter. Vagrant lichen taxa are presently recognized in several different genera. The genus Xanthoparmelia, commonly known as range lichen, contains the largest number of vagrant taxa and is the most widely distributed geographically. The genus Aspicilia has the second largest number of vagrant taxa worldwide. Reproduction in vagrant lichens is typically by large unspecialized vegetative fragments. Due to wide scale land disturbances, intensive alien livestock grazing, and the dispersal strategies of vagrant lichens, some of these taxa are so fragmented in their distribution that they may become extinct.

75

LICHEN COMMUNITIES IN FOREST HEALTH MONITORING AND POSSIBLE EXTENSIONS TO ARID ECOSYSTEMS. Bruce McCune, Oregon State University, Corvallis.

Lichen communities are being sampled in forests on a national grid of permanent plots, along with other indicators of forest condition. A standardized method for sampling epiphytic lichens has been applied to states in the Southeast, Northeast, and in California, Colorado, and the Pacific Northwest. Several years of results are available from the Southeast. Gradient analysis revealed two major gradients in lichen communities: a macroclimatic gradient from the coast to the Piedmont to the Appalachian Mountains and a gradient in air quality, with pollution-tolerant species and lower species richness at one end of the gradient, and pollution-sensitive species and high species richness at the other end of the gradient. The method could be extended across the forest - arid lands transition by sampling epiphytes sampling in pinyon-juniper and in shrub steppe. From both functional and biodiversity perspectives on ecosystem health, we should also sample integrity, cover, and composition of the biotic soil crust on the national grid. Repeated sampling of the biotic crust would require plots separated from other indicators to avoid trampling by field crews and a plot design that would not require entry onto the plot.

76

LICHENS AS AIR QUALITY INDICATORS IN SOUTHWESTERN MONTANA. Lisa Schubloom, Montana State University, Bozeman.

Long distance transport of pollutants could potentially influence pristine wilderness areas. To predict what biological effects might be observed with changes in air quality, baseline data must be collected. Lichens are recognized as bioindicators of air pollution. Air chemistry can be reflected through element analysis of lichen thalli. A species list, in addition, offers basic information primary to the understanding of ecological systems. In Montana, very little taxonomic or elemental analysis of lichens has been performed. This project uses lichens to evaluate the current air quality of three areas in southwestern Montana through element analysis and expands our present knowledge of lichen distribution in Montana with species lists. The three areas were selected for their relationship to past and present mining and smelting activities. Preliminary results indicate low levels of contaminants in all three areas, but show differences within and among the three areas. Floristic collection has revealed differences in biodiversity of the three areas due to a southwest to northeast climatic gradient.

77

LEAD CONCENTRATIONS IN THE LICHEN PARMELIA SULCATA ADJACENT TO A MAJOR HIGHWAY. Scott Rash, Kris Rhode, Paul Przybylowicz, The Evergreen State College, Olympia.

Patterns of lead deposition adjacent to a major highway were investigated using the lichen *Parmelia sulcata*. Lichen samples were collected from Oregon white oaks (*Quercus garryana*) on an east-west transect perpendicular to the highway. The lichen thalli were analyzed for lead contamination using flame atomic absorption spectroscopy. High concentrations of lead were found in samples from both sides (east and west) of the highway. Lead concentrations downwind of prevailing westerly winds (east of highway) correlated strongly with distance from the highway, while concentrations on the west side did not. These distribution patterns suggest a strong influence by local winds.

78

LICHEN COMMUNITIES IN *PINUS CONTORTA* PEATLANDS IN SOUTHEAST ALASKA. Chiska C. Derr & Bruce McCune, Oregon State University, Corvallis.

As part of an Air Quality Biomonitoring Program on the Tongass National Forest, lichen communities were sampled on 50 *Pinus contorta* peatlands in southeast Alaska. A total of 100 lichen species were encountered during whole-plot ocular surveys of all substrates on each plot. Ordination of 29 epiphytic lichen species occurring on *Pinus contorta* branches revealed what appears to be a successional gradient represented by high cover of *Bryoria* species at older sites and high cover of *Platismatia norvegica*, *P. glauca*, *Hypogymnia enteromorpha* and *H. inactiva* at younger sites. A second pattern revealed by ordination analysis appears to be a climatic gradient with high *Alectoria sarmentosa* cover on moister, warmer sites and high cover of *Bryoria* species on drier, colder sites. The first two gradients contained 35% and 21%, respectively, of the information in the analytical data set (cumulative r^2 = 56%).

79

ABUNDANCE AND DISTRIBUTION OF LICHENS IN PACIFIC SILVER FIR CROWNS AT FINDLEY LAKE, WASHINGTON CASCADES. Robin D. Lesher and Jan A. Henderson, USDA Forest Service. Mountlake Terrace WA.

Lichens were sampled in the crowns of Pacific silver fir to determine presence, abundance and distribution of species along vertical and horizontal gradients within the crowns. Three codominant trees were sampled in a stand approximately 250 years old. Generally, every seventh branch in each crown was sampled. Area of individual species was measured within 1 foot segments along the branch axis. Samples were collected from each branch to determine the empirical relationship between lichen area and biomass. Lichen species diversity was relatively low; preliminary identification recorded 18 species. No bryophytes or cyanolichens were encountered in the sample. *Alectoria sarmentosa*, *Bryoria* spp., *Hypogymnia enteromorpha* and *Platismatia glauca* were the most common and abundant species present. These lichens were generally distributed throughout the crown, but differed in their abundance vertically, and from the trunk to the outer parts of the branches. *Alectoria sarmentosa* was the most abundant species. It was most common on the mid to outer branch segments in the mid crown. *Bryoria* spp. were most abundant in the upper to mid crown on the outer branch segments. *Platismatia glauca* and *Hypogymnia* species were more uniform in their distribution both vertically and horizontally.

80

DYES FROM UMBILICARIACEAE SPECIES AND CHEMOTYPES. Sherman G. Brough, 8015 S. Danish Oaks Drive, Sandy, UT.

Most species in Umbilicariaceae produce characteristic purple or red-purple (orchil) dyes. Modifications of dye values, intensities, and hues were made by changing fermentation times, dyeing times or temperatures, pH, exposure to sunlight, and use of previous dye-exhausts. When the above conditions were standardized, results could be highly variable, especially when different collections of the same species were used. These latter inconsistencies are attributed to lichen chemotypes, and these chemotypes may account for the formulation of many unusual lichen dyeing recipes reported.

81

DISTRIBUTION OF EPIPHYTIC PLANT FORMS ON TREE TRUNKS IN THE TILARÁN MOUNTAINS NEAR MONTEVERDE, COSTA RICA. Karen L. Dillman, Idaho State University, Pocatello, Margot S. Bass, Princeton University, Princeton.

Geophysical interactions between the Atlantic Trade Winds and the mountains around Monteverde, Costa Rica cause dramatic local differences in the amounts of precipitation, wind, and solar radiation received within the nearby cloud forest. This study investigated the changes in epiphytic plant forms on tree trunks in forests along altitudinal gradients on the Atlantic and Pacific slopes of the Cordillera de Tilerán. In July, 1994, a total of 122 tree trunks were surveyed at DBH at six Atlantic elevations, five Pacific elevations, and one elevation on the Continental Divide. Percent cover was determined for each of the different epiphytic plant forms found. Regression analyses revealed that changes in epiphytic plant forms are more marked on the Pacific slope than on the Atlantic. On the Pacific slope, the percent cover of crustose lichens and exposed bark decreased, while filmy ferns, non-appressed liverworts, flowering plants, roots and stems, and soil and litter all increased with increasing elevation. On the Atlantic slope, non-appressed mosses, and roots and stems decreased as elevation increased. The differences between the two slopes indicate that understorey microclimate does not change dramatically along an altitudinal gradient on the Atlantic slope of this tropical cloud forest, while on the Pacific slope, it does.

82

ELEMENTAL ANALYSIS OF THE LICHEN RHIZOPLACA MELANOPHTHALMA IN RELATION TO PHOSPHATE REFINERIES NEAR POCATELLO, IDAHO. Karen L. Dillman, Idaho State University, Pocatello.

Lichens are reliable bioindicators of air pollution because they lack a protective cuticle and thus readily accumulate elements present in their abiotic environment. Phosphate refineries are local point sources for substantial quantities of atmospheric Cr, Cd, Zn, and P, so the concentrations of these elements in nearby lichen populations are of particular interest. Concentrations of these and other elements were determined in the lichen *Rhizoplaca melanophthalma* (Ram.) Leuck. & Poelt in relation to distance and direction from phosphate refineries northwest of Pocatello, Idaho. Lichens were collected from basalt substrates at various distances from the refineries along four separate transects. Elemental concentrations in the lichens were determined by a multi-element inductively coupled plasma atomic emission spectrometer (ICP-AES). Analysis of covariance indicated significant differences in elemental concentrations in lichens as a function of distance and direction from the pollution source; concentrations of Cd, Cr, Zn, and P all increased with decreasing distance and were higher downwind from the refineries. These results indicate that lichens may be used to map local deposition patterns of air pollutants to help designate high risk areas to human or ecosystem health, and to monitor future changes in Pocatello's air quality.

83

HABITAT SELECTION IN DRY VS. VERY DRY SAGE STEPPE IN SUMMER BY MULE DEER. Gregory B. Milner and Clint J. Gray, Montana State University, Bozeman.

Parallel studies on mule deer (Odocoileus hemionus) habitat use were conducted in the Bennett Hills and Owyhee Mountains of southwestern Idaho from June 1993 to November 1994. Radio-collared deer from each study area were intensively ground-tracked to monitor habitat use throughout two summer/fall field seasons. Both areas are sage steppe environs, but the Owyhees are much drier than the Bennetts. We compared measurable aspects of habitat use between female deer in the two areas. In 1993, average summer home range size for Owyhee does was 21.30 km^2 and for Bennett Hills does was 3.86 km^2, calculated with the 95% harmonic mean method. Data from 1994 remain to be analyzed. Both study areas received significantly higher than average levels of precipitation in 1993 and less than average in 1994. The Owyhee deer responded to the drier year by shifting to areas nearer perennial water sources, whereas Bennett deer did not seem to alter their areas of use between years. Habitat use appeared to differ significantly between the dry and very dry study areas.

84

STRONTIUM-90 CONCENTRATIONS IN DEER ANTLERS IN RELATION TO DEER MOVEMENTS ON THE HANFORD SITE. B.L. Tiller, L.E. Eberhardt, and T.M. Poston, Pacific Northwest Laboratory, Richland, WA.

This study was initiated to evaluate deer antlers as indicators of animal exposure to localized strontium-90 contamination. We examined levels of strontium-90 in antlers of Rocky Mt. mule deer (*Odocoileus hemionus hemionus*) residing near and distant from previously active reactor sites and also examined animal movements in relation to the observed ^{90}Sr concentrations. From 1991 to 1994, 38 deer antler samples were collected and analyzed for ^{90}Sr contamination. Antler samples were collected from several bucks that were fitted with radio-transmitters and their movements were monitored. A significant difference ($P < 0.001$) in ^{90}Sr concentrations was observed between two onsite locations and a reference site in central Oregon. Animal movements and home ranges plotted on a GIS confirmed little to no intermixing between two onsite sub-populations. We have concluded that antlers can be used as a non-destructive tool for detecting localized contamination.

85

THE STATUS AND MANAGEMENT OF MOOSE IN IDAHO. Bradley B. Compton, Idaho Department of Fish and Game, Pocatello, Lloyd E. Oldenburg, Idaho Department of Fish and Game, Boise.

A review of historical accounts, field observations, harvest information, and limited aerial survey data indicate that Idaho's moose (Alces alces shirasi) population has increased substantially over the past 150 years. Hunting was allowed from 1893-98, prohibited from 1899 through 1945, and resumed in 1946 with controlled permits. Currently, 44% of game management units offer hunting opportunity primarily for antlered animals with a limited number of antlerless permits. Annual harvest has increased 1,950% since 1946. Five-year plans are developed to guide management direction. Field observations, aerial surveys, hunter success rates, and antler measurements of harvested bulls are used to establish harvest regulations. Moose populations are expected to continue increasing in the future. Maintaining suitable habitat; mitigating for impacts from an increasing human population, timber management, road building, livestock grazing, and mining will require additional efforts in the future along with better population information.

86

EFFECTS OF PRESCRIBED BURNING AND HARVESTING ON SURVIVAL AND VIGOR OF BITTERBRUSH AND WILLOW IN WESTERN MONTANA. Dayna Ayers and Don Bedunah, University of Montana, Missoula.

Under the directive of Ecosystem Management, research on silvicultural techniques for enhancing wildlife habitat was conducted in the Bitterroot Mountains, Montana. A shelterwood harvest and a prescribed burn were tested for their utility for enhancing the browse of antelope bitterbrush (*Purshia tridentata*) and Scouler's willow (*Salix scouleriana*) in a Douglas Fir/Ponderosa Pine stand. In 1992, a control, a shelterwood harvest and a harvest/prescribed burn were established as treatments on a 50 ha unit. Over 2000 bitterbrush and 1000 willow were identified prior to treatment and monitored for two years. Treatments reduced the number of bitterbrush by 66% and willow by 20%. Plants that survived showed an increase in vigor of 53-59% relative to controls. Burn severity and post-treatment browsing affected survival and vigor significantly. Bitterbrush vigor and use were highest in the harvested units, whereas willow vigor and use were highest in the harvest/burn units.

87

YOUNG STAND THINNING AND DIVERSITY IN THE CENTRAL OREGON CASCADES: AN ANALYSIS OF PRETREATMENT VEGETATION AND WILDLIFE HABITAT.

Gabriel F. Tucker & Joan C. Hagar, Oregon State University, Corvallis.

Commercial thinning treatments including light and heavy thinning, light thinning with gaps, and an uncut control are being installed in four different sites to investigate the potential for enhancing wildlife habitat in 40-year-old Douglas-fir stands which are 35 to 90 acres in size. An analysis of variance of cover and tally estimates of over 45 vegetation species and habitat structures shows a pronounced amount of variation between, as opposed to within, treatment blocks particularly for several key features. Pretreatment sampling provides data with replication of the control condition at each site which is not otherwise obtainable. Results demonstrate the importance of pretreatment analysis for illustrating the effects of site, as opposed to treatment, in wildlife habitat management.

88

YOUNG STAND THINNING AND DIVERSITY IN THE CENTRAL OREGON CASCADES: AN ANALYSIS OF PRETREATMENT WILDLIFE ABUNDANCE.

Joan C. Hagar, Gabriel F. Tucker, & William C. McComb, Oregon State University, Corvallis.

Commercial thinning treatments including light and heavy thinning, light thinning with gaps, and an uncut control are being installed in four blocks in the central Oregon Cascades to investigate the potential for enhancing wildlife habitat in 40-year-old Douglas-fir stands which are 35 to 90 acres in size. Small mammals were trapped in fall, 1991 and 1992, and diurnal songbirds were surveyed in May and June, 1992 and 1993, prior to application of treatments. Six bird species showed an effect of annual variation, indicating the value of collecting more than one year of pretreatment data. Based on multiple regression relationships between bird and mammal abundance and vegetation characteristics, we predicted how each species might respond to thinning.

89

4-H WILDLIFE HABITAT EVALUATION PROGRAM: A NEW WILDLIFE OUTREACH OPPORTUNITY.

Dean Rose, Idaho Department of Fish & Game, Pocatello, Steve Bouffard, U.S. Fish & Wildlife Service, Pocatello.

The 4-H Wildlife Habitat Evaluation Program is a method to teach wildlife management to youths. The nationwide program began in 1989 with support from governmental agencies, NGO's and corporations. Youths learn basic concepts and practices of wildlife management, focusing on wildlife habitat. State and national competitions require application of knowledge to real field situations. Youths must defend their recommendations verbally and in writing, learning to think and write concisely and logically. At the same time, they learn to consider landowner goals while applying habitat management practices for targeted wildlife species. Idaho began in 1992 with six counties participating. Presently, 22 counties are involved at some level. Team coaches and contest judges are all volunteers. Funding is donated by: Idaho TWS, IDF&G, Pheasants Forever, McDonald's, and Basic American Foods. The program is an excellent outreach vehicle to teach our future constiuency appreciation of wildlife and the value of habitat conservation. Volunteers who help youth education produce positive benefits for wildlife resources and for their conservation agency.

90

WILDLIFE HABITAT MITIGATION FOR FEDERAL HYDROPOWER PROJECTS IN IDAHO.

H.Jerome Hansen, S.H.Stovall, M.Beucler, and K.E.Ragotzkie, Idaho Department of Fish and Game, Boise, ID.

The Northwest Power Act of 1980 mandated the development of programs to protect, mitigate, and enhance fish and wildlife habitat affected by dams on the Columbia River system. The Idaho Department of Fish and Game, in cooperation with Bonneville Power Administration and interagency/tribal work groups, is using Habitat Evaluation Procedures to evaluate pre- and post-construction habitat conditions at numerous hydro facilities throughout Idaho. Mitigation and enhancement plans have been completed for six projects. Mitigation activities in progress for Dworshak Dam involve protection of old growth habitat in Buck Creek and the Craig Mountain Wildlife Mitigation Area. The advance design phase of implementation is underway for projects which would partially mitigate for losses associated with hydro development at Albeni Falls (Pack River/Clark Fork Delta project), Anderson Ranch (Camas Prairie project), Palisades (South Fork Snake River and Sand Creek projects).

91

STATUS OF NEOTROPICAL MIGRATORY BIRDS AND PARTNERS IN FLIGHT ACTIVITIES IN IDAHO. Sharon A. Ritter, Idaho Department of Fish and Game.

Neotropical migratory land birds were ranked in order of priority for management, monitoring, and research. Ranks were based on importance of Idaho in each bird's range, abundance, threats to breeding and wintering habitat, breeding and wintering distribution, and the 26-year BBS population trend. Species using grasslands, juniper, low elevation coniferous, riparian, and sagebrush habitats ranked highest, with riparian habitat represented by the most species. The highest ranking species were the olive-sided flycatcher, gray flycatcher, and black swift. Of the top 20 species, the olive-sided flycatcher, MacGillivray's warbler, Brewer's sparrow, yellow-headed blackbird, red-naped sapsucker, and solitary vireo showed population declines in Idaho according to the BBS data. However, lack of adequate trend data in Idaho is a concern. In 1994, about 40 monitoring or research projects in Idaho focused on Neotropical migrants. Unfortunately, only a few of these measured productivity and those only covered a small percentage of the species in the state. Locating source populations is a high priority for conservation planning for these species. Idaho Partners in Flight was established to coordinate monitoring, research, I&E, and management for Neotropical migrants throughout the state.

92

PREDICTING NEST-HABITAT FOR BUTEO *spp.* HAWKS USING A MULTIVARIATE MODEL AND A GEOGRAPHIC INFORMATION SYSTEM. John J. Nugent, University of Montana, Missoula, Larry L. Cadwell, Pacific Northwest Laboratory, Richland, WA.

Ferruginous (*Buteo regalis*), Swainson's (*Buteo swainsoni*), and red-tailed (*Buteo jamaicensis*) hawks nest sympatrically on the U.S. Department of Energy's Hanford Site in southeastern Washington. These buteos coexist in grassland and shrub-steppe habitats of western North America and occupy similar ecological niches. Ecological segregation of these species appears greatest along nest-site and habitat dimensions. We characterized nest-site and habitat selection of these species in southeastern Washington on a micro- and macro-habitat scale. A model that combines the Mahalanobis distance statistic, a Geographic Information System, remote sensing data, and survey data was used to create detailed maps of habitat suitability on the Hanford Site for each species. The model produces a map displaying Mahalanobis distance values for each of 882,531 cells in a 50 x 50 m grid. This information can be used to aid in identifying nest-habitat and for habitat-related mitigation and/or restoration planning.

93

AN INVESTIGATION OF CLIFF-NESTING RAPTORS IN THE HAGERMAN STUDY AREA. Von R. Pope and Anthonie M. A. Holthuijzen, Idaho Power Co., Boise, ID 83707.

During late March and early April, 1990, a survey of cliff-nesting raptors was conducted in the Hagerman Valley of southwestern Idaho. Occupancy of traditional and new nesting territories was determined using point counts. Fifty-two occupied nesting territories of diurnal raptors and common ravens (Corvus corax) were found. Common ravens occupied 14 nesting territories, followed by the red-tailed hawk (Buteo jamaicensis), American kestrel (Falco sparverius), golden eagle (Aquila chrysaetos), and prairie falcon (F. mexicanus), with 13, 12, 9, and 4 nesting territories respectively. A comparison was made of cliff nesters reported, between Bancroft Springs and Lower Salmon Falls Dam, by comparing data collected 1990 and 1976-1978 (BLM). An average of 29 diurnal raptor nesting territories was recorded by the BLM compared to 36 by in 1990. Thus, raptor population appeared to be remarkably stable over the past 17-19 years, although changes in raptor population composition were noted.

94

SMALL MAMMAL COMMUNITIES IN THE HAGERMAN VALLEY, SOUTHWESTERN IDAHO. Anthonie M.A. Holthuijzen and Kelly D. Wilde, Idaho Power Co., Boise, ID 83707

Small mammal communities were sampled at 14 sites in May-July, 1987-1990. Nine sites were in riparian- and five in upland habitat. Sites were prebaited for two days and trapped for three consecutive days with a combination of Victor snap traps, Sherman live traps, McGill rat traps, and pit traps. Vegetation structure, species composition, cover, density and diversity were measured at most sites. The most commonly trapped species was the deer mouse (Peromyscus maniculatus), followed by the Great Basin pocket mouse (Perognathus parvus), western harvest mouse (Reithrodontomys megalotis), and montane vole (Microtus montanus). Relative abundance was similar, but diversity was higher in riparian than upland habitats. Deer mice comprised a relative high proportion of the small mammal community, suggesting that the sampled sites were moderately degraded.

95

SPECIAL PLANT COMMUNITIES IN THE HAGERMAN VALLEY: FLORAL AND FAUNAL CHARACTERISTICS. Kelly D. Wilde and Anthonie M. A. Holthuijzen, Idaho Power Co., Boise, ID 83707

Two special plant communities are known to occur in the Hagerman Valley: sites dominated by netleaf hackberry (Celtis reticulata) and waterbirch (Betula occidentalis). Our objective was to characterize the floristic and faunal communities within these special habitats. Avian and small mammal data were collected during 1987-1992 to characterize these and other riparian communities in the valley. Average age-class at one sampled hackberry stand was 32 $\pm$ 8 years (range 13-53) and one waterbirch stand was 35 $\pm$ 8 years (range 15-61). Bird diversity and abundance were low compared to other riparian communities, but not considered unique. The small mammal population was unique at the waterbirch site, due to relatively high abundance of shrews. Results of this and other investigations will be used to determine critical factors influencing the occurrence of these special plant communities in the valley.

96

ROOST SELECTION IN A PLEISTOCENE RELICT-PLECOTUS TOWNSENDII. J. Mark Perkins, J. R. Peterson and A. J. Perkins, PNW Bat Research Team- 5130 SW Idaho, Portland, OR 97221. We surveyed over 1,000 caves and mines located in OR, WA and northern CA for roosting bats. We noted that preferred winter roost sites were: 1) in caves or mines with discernible air flow (usually the result of multiple entrances); 2) range of preferred roost height when bats were undisturbed was <3 m; 3) roost temperatures were highly variable, but most bats were situated in cave or mine tunnels where temperature centered around 1-2 deg. C; and summer roosts were: 1) near entrances in twilight zones; 2) on cave or mine walls; and 3) of relatively low ambient temperatures. Each of these characters indicate that the bats are likely late invaders in use of caves as roost sites as noted by Humphrey and Kunz.

97

CARNIVORES IN A TROPICAL DRY FOREST OF WESTERN MEXICO: TEST OF METHODS. Carlos A. López González, John W. Laundré, Kelly Altendorf, Idaho State University, Pocatello, Alberto González Romero, Instituto de Ecología, Xalapa, Mexico.

Tropical dry forests are considered the most threatened forested ecosystem of the world. If we are to understand the role of the mammalian carnivores within this complex we need to be able to document and capture this elusive group of species. We tested, during October-November of 1994, camera-traps, live-baited box traps, leghold traps and scent stations in the Chamela Biological Station. Results from box trapping were the capture of an endangered species, the ocelot (Felis pardalis) and a threatened one, the pygmy spotted skunk (Spilogale pygmaea). Also captured were the gray fox (Urocyon cinereoargenteus) and coatimundi (Nasua nasua). Camera traps recorded the presence of coyotes and ocelots; humidity restrained optimal performance. Leg hold traps were set with a tranquilizer tab to minimize damage to animals. An endangered jaguar (Panthera onca) was captured with this method. Preliminary conclusions are that the methods are not exclusive but complimentary.

98

OXFORD SLOUGH DUCK NESTING STUDY: FINAL REPORT. Bradley B. Compton, Idaho Department of Fish and Game, Pocatello, Mike Johnson, U.S. Fish and Wildlife Service, Pocatello, Daryl Meints, Idaho Department of Fish and Game, Pocatello, Carl Anderson, Idaho Department of Fish and Game, Pocatello.

We studied nest success of upland ducks at the Oxford Slough Waterfowl Production Area (OSWPA) in southeastern Idaho during 1993 and 1994. Our objective was to gather baseline information and provide a comparable data set to a similar study being conducted at the Sterling Wildlife Management Area approximately 100 km northwest of OSWPA. The Oxford area was chosen for its lack of Russian olives (Elaeagnus angustifolia) and apparent low population of black-billed magpies (Pica pica). Detectable nest density was 0.19/ha and 0.17/ha in 1993 and 1994, respectively. Mayfield nest success was 0.48 in 1993 (27 nests) and 0.57 in 1994 (42 nests). Predation accounted for 81% of all unsuccessful attempts. Mallards (Anas platyrhyncos), shovelers (A. clypeata), and teal (A. cyanoptera or discors) were the most common upland nesting waterfowl, and accounted for 75% of the detected nests.

99

SAGEGROUSE IN IDAHO: FORUM - 94'

Samuel N. Mattise, Boise District Bureau of Land Management Boise, Idaho

There has been an increasing concern regarding the decline of the sagegrouse populations in Idaho. In the fall of 1994, twenty-six professionals representing four agencies discussed problems associated with managing sagegrouse habitat and populations. Participants reported on habitat condition and problems relating to the loss and conversion of sagebrush ranges due to wildfire, mechanical, spraying and other techniques. They discussed population dynamics and the effects of variables such as predation, hunting, drought, and poor weather conditions during nesting and brood rearing periods. Two major problems were recognized, habitat fragmentation and habitat conversion. Two strategies that were identified were to develop a policy on prescribed burns relating to sagegrouse habitat and to standardize habitat and population monitoring techniques.

100

ECOLOGY OF REINTRODUCED COLUMBIAN SHARP-TAILED GROUSE IN SOUTHERN IDAHO Scott C. Gardner and Kerry P. Reese, University of Idaho, Moscow, John W. Connelly, Idaho Dep. Fish and Game, Pocatello.

We reintroduced 104 Columbian sharp-tailed grouse (Tympanuchus phasianellus columbianus) into former range in Idaho between 1992 and 1994. We estimated movements, home ranges, survival, and productivity for the first 20 weeks following release. Birds were held captive in 1992 and 1993 for 1-12 days, but were released daily in 1994. Kaplan-Meier survival functions were lower in 1993 (0.30) than 1994 (0.67), with survival of 0.49 in 1992. We examined the relationship between survival and percent weight loss during captivity, movements, home ranges, sex, and age classes. Post-release survival was related to percent weight loss in both 1992 and 1993. The winter just prior to the 1993 releases was hard and birds were in poorer condition when trapped, which may also have contributed to high early mortality that year. Two nests were depredated during incubation in 1992 and 2 hens successfully hatched broods in 1994. Five of 6 hens died within 3 weeks following release in 1993. Stresses resulting from hard winters and translocation may lower survival and productivity in reintroduced populations.

101

WINTER ECOLOGY OF COLUMBIAN SHARP-TAILED GROUSE IN SOUTHEASTERN IDAHO. Mark J. Ulliman and Kerry P. Reese, University of Idaho, Moscow, John W. Connelly, Idaho Dep. Fish and Game, Pocatello.

A comprehensive knowledge of a species seasonal habitat requirements is essential for the effective management of that species. Although the Columbian sharp-tailed grouse (Tympanuchus phasianellus columbianus) has been widely researched, few studies have addressed their winter habitat requirements. Our study sought to quantify habitat selection, the variables that influence selection, and movements and home ranges of radio-marked grouse during the winters of 1992 and 1993. In 1992, grouse used CRP and sagebrush more than expected, while in 1993, riparian shrubs were used more than expected. Sites selected by grouse had more residual cover and food than found at random sites. Ungulate use, winter severity, and distances to topographic features, cover-types, and leks had no measurable influence on habitat selection. Females moved farther than males to winter habitat during both years, however, home ranges and daily movements did not differ. Management efforts should focus on protecting and enhancing existing shrub-steppe, in particular riparian shrubs, and ensuring that these habitats provide a diversity of cover and food throughout the year.

102

DO COLUMBIAN SHARP-TAILED GROUSE SUBSTITUTE HARD SEEDS FOR GRIT IN WINTER? Kerry P. Reese, James W. Schneider, University of Idaho, Moscow, John W. Connelly, Idaho Department of Fish and Game, Pocatello.

Researchers have hypothesized that galliforms, when deprived of grit due to snowfall, may conserve grit in their gizzard or substitute hard seeds for grit. Our study documents the use of grit by Columbian sharp-tailed grouse (Tympanuchus phasianellus columbianus) during winter and examines whether the birds conserve grit or substitute hard seeds when grit is limited. We collected birds in southeastern Idaho during the winters of 1992 and 1993. Gizzard contents were washed to separate seeds and grit from food materials. Stones were present in 86% of 49 gizzards. Chokecherry and serviceberry seeds were hard enough to function as grit, and were present in 72 and 41% of gizzards, respectively. More stones and serviceberry seeds were present in gizzards of birds collected in 1992 than in 1993. There were more chokecherry seeds in gizzards during 1993 than in 1992. The number of chokecherry seeds was negatively correlated with number of stones per gizzard, while serviceberry seeds were not. Columbian sharp-tailed grouse were retaining chokecherry seeds during periods of low stone availability.

103

Alphabetical Listing of Keywords for Abstracts

(S=Symposium, C=Contributed Papers)

keyword	abstract #	program page	abstract page	session
Abovegrade	7	1	2	S-Waste Management
Administrative Procedure Act	21	8	6	S-Wolf Recovery
Air temperature	42	3	12	C-Forestry
Air pollution	77, 78	7,7	23,23	C-Lichen/Mosses
Altitudinal gradient	82	7	24	C-Lichen/Mosses
American Farm Bureau Fed	21	8	6	S-Wolf Recovery
Amphibian	69	6	20	C-Ecology/Zoology
Amphibian decline	70	6	21	C-Ecology/Zoology
Amphibians	27	10	8	S-Riparian Management
Animal Damage Control	19	8	5	S-Wolf Recovery
Aquatic	46	3	14	C-Aquatic Ecology
Basalt	52	5	16	C-Geology/Geography
Basking	66	6	20	C-Ecology/Zoology
Bats	97	9	28	C-Nongame Species
Big game	28	10	8	S-Riparian Management
Biointrusion	6	1	2	S-Waste Management
Biomonitoring	83	7	23	C-Lichen/Mosses
Birds	23	10	7	S-Riparian Management
Birds of Prey	94	9	27	C-Nongame Species
Bromus tectorum	32,33	2,2	9,10	C-Botany
Browse	87	9	25	C-Wildlife Management
Business	58	5	18	C-Ecology/Zoology
Buteo Hawks	93	9	27	C-Nongame Species
Carnivores	98	9	28	C-Nongame Species
Caves	54	5	16	C-Geology/Geography
Chemotypes	81	7	24	C-Lichen/Mosses
Chrysemys picta	66	6	20	C-Ecology/Zoology
Cobra-lily; bog	36	2	10	C-Botany
Columbian sharp-tailed grouse	101,102,103	11,11,11	29,29,30	C-Upland Game/Wtrfowl
Commercial thinning	39	2	12	C-Forestry
Community metabolism	45	3	14	C-Aquatic Ecology
Community composition	95,96	9,9	27,28	C-Nongame Species
Competition	34	2	10	C-Botany
Complex	25	10	7	S-Riparian Management
Conservation	92	9	27	C-Nongame Species
Crustal structure	10	4	3	S-Geology
Darlingtonia californica	36	2	10	C-Botany
Decline	26	10	7	S-Riparian Management
Demonstration sites	24	10	7	S-Riparian Management
Distribution	15	4	4	S-Geology
Disturbance	47	3	14	C-Aquatic Ecology
Douglas fir	39	2	12	C-Forestry
Drainage reversal	53	5	16	C-Geology/Geography
Drifting	59	5	18	C-Ecology/Zoology
Eastern Snake River Plain	55	5	17	C-Geology/Geography
Ecological compliance	60	6	18	C-Ecology/Zoology
Ecological concepts	1	1	1	S-Riparian Management
Ecology	46	3	14	C-Aquatic Ecology
Ecology	75,79	7,7	22,23	C-Lichen/Mosses

keyword	abstract #	program page	abstract page	session
Ecosystem function	49	3	15	C-Aquatic Ecology
Ecosystem health	76	7	23	C-Lichen/Mosses
Ecosystem management	87	9	25	C-Wildlife Management
Education	90	9	26	C-Wildlife Management
Endangered	29	2	9	C-Botany
Endangered species	22	8	6	S-Wolf Recovery
Engineered covers	3	1	1	S-Waste Management
Epiphytes	82	7	24	C-Lichen/Mosses
Evapotranspiration	8	1	2	S-Waste Management
Exemplary	7	1	2	S-Waste Management
Faunal intrusion	4	1	1	S-Waste Management
Fire	43	3	13	C-Forestry
Fire history	40	2	12	C-Forestry
Fire history	30	2	9	C-Botany
Forest succession	40	2	12	C-Forestry
Forest wildlife	89	9	26	C-Wildlife Management
Forum	100	11	29	C-Upland Game/Wtrfowl
Fur	64	6	19	C-Ecology/Zoology
Fragmentation	62	6	19	C-Ecology/Zoology
Geographical Information System (GIS)	71	6	21	C-Ecology/Zoology
GIS	93	9	27	C-Nongame Species
Geology	12,13	4,4	3,4	S-Geology
Geomorphology	57	5	17	C-Geology/Geography
Geophysics	11	4	3	S-Geology
Glaciers	56	5	17	C-Geology/Geography
Glenn's Ferry formation	53	5	16	C-Geology/Geography
Gramineae	35	2	10	C-Botany
Gravitropism	38	2	11	C-Botany
Grazing	65	6	19	C-Ecology/Zoology
Green line	25	10	7	S-Riparian Management
Grit	103	11	30	C-Upland Game/Wtrfowl
Ground water flow	16	4	4	S-Geology
Ground water tracers	16	4	4	S-Geology
Habitat	31	2	9	C-Botany
Habitat evaluation procedures	91	9	26	C-Wildlife Management
Habitat management	89	9	26	C-Wildlife Management
Habitat modification	70	6	21	C-Ecology/Zoology
Habitat quality	71	6	21	C-Ecology/Zoology
Hanford Site	60	6	18	C-Ecology//Zoology
Hazardous wastes	8	1	2	S-Waste Management
Herpetofawna	67	6	20	C-Ecology/Zoology
Holocene vegetation	30	2	9	C-Botany
Home range	84	8	25	C-Wildife Management
Honeybee	59	5	18	C-Ecology/Zoology
Horizontal transfer	63	6	19	C-Ecology/Zoology
Hydrology	51	5	16	C-Geology/Geography
Ice age	5	1	2	S-Waste Management
Joints	54	5	16	C-Geology/Geography
Landfills	2	1	1	S-Waste Management
Lichen	75,76,77,78,79,80,83	7	22,23,23,23,23,24,24	C-Lichen/Mosses
Lichen dyes	81	7	24	C-Lichen/Mosses
Linear	2	1	1	S-Waste Management

keyword	abstract #	program page	abstract page	session
Lodgepole pine	43	3	13	C-Forestry
Loess	15	4	4	S-Geology
Management	58	5	18	C-Ecology/Zoology
Management	86	9	25	C-Wildlife Management
Management	20	8	5	S-Wolf Recovery
Microbiotic	73	7	22	C-Lichen/Mosses
Microbiotic crusts	74	7	22	C-Lichen/Mosses
Microbiotic soil crust	72	7	22	C-Lichen/Mosses
Microhabitat selection	84	8	25	C-Wildlife Management
Mink	64	6	19	C-Ecology/Zoology
Miocene	14	4	4	S-Geology
Mitigation	91	9	26	C-Wildlife Management
Moose	86	9	25	C-Wildlife Management
Muledeer	85	8	25	C-Wildlife Management
Neotropical	92	9	27	C-Nongame Species
Nesting	94	9	27	C-Nongame Species
Nesting	99	11	29	C-Upland Game/Wtrfowl
Nesting ecology	68	6	20	C-Ecology/Zoology
Pack	18	8	5	S-Wolf Recovery
Paleoecology	5	1	2	S-Waste Management
Pedogenesis	57	5	17	C-Geology/Geography
Plants	29	2	9	C-Botany
Plecoptera	48	3	14	C-Aquatic Ecology
Pocket Gopher	65	6	19	C-Ecology/Zoology
Population genetics	63	6	19	C-Ecology/Zoology
Primula	31	2	9	C-Botany
Population trends	61	6	18	C-Ecology/Zoology
Ordination	32	2	9	C-Botany
Owls	44	3	13	C-Forestry
Rangeland rehabilitation	72	7	22	C-Lichen/Mosses
Raptor	68	6	20	C-Ecology/Zoology
Reintroduction	101	11	29	C-Upland Game/Wtrfowl
Reintroduction	17	8	5	S-Wolf Recovery
Riparian	23,26	10,10	7,7	S-Riparian Management
Riparian communities	28	10	8	S-Riparian Management
Riparian habitat	27	10	8	S-Riparian Management
Riparian restoration	24	10	7	S-Riparian Management
Riparian zone management	50	3	15	C-Aquatic Ecology
Reptile	69	6	20	C-Ecology/Zoology
Roosting	97	9	28	C-Nongame Species
Runoff	56	5	17	C-Geology/Geography
Sagegrouse	100	11	29	C-Upland Game/Wtrfowl
Salinity	33	2	10	C-Botany
Science Education	55	5	17	C-Geology/Geography
Secondary production	49	3	15	C-Aquatic Ecology
Seed germination	74	7	22	C-Lichen/Mosses
Seedling	34	2	10	C-Botany
Silver fir canopies	80	7	24	C-Lichen/Mosses
Small mammals	95	9	27	C-Nongame Species
Snake River Plain	9,10	4,4	3,3	S-Geology
Snowmelt erosion	37	2	11	C-Botany
Soil crust	73	7	22	C-Lichen/Mosses

keyword	abstract #	program page	abstract page	session
Soil temperature	42	3	12	C-Forestry
Special communities	96	9	28	C-Nongame Species
Stratigraphy	52	5	16	C-Geology/Geography
Statistic	51	5	16	C-Geology/Geography
Streams	47	3	14	C-Aquatic Ecology
Stream ecosystems	45	3	14	C-Aquatic Ecology
Strontium-90	85	8	25	C-Wildlife Management
Survey	67	6	20	C-Ecology/Zoology
Taxonomy	35	2	10	C-Botany
Thermal stress	48	3	15	C-Aquatic Ecology
Tropics	98	9	28	C-Nongame Species
Upslope ecology	50	3	15	C-Aquatic Ecology
Vegetation	6	1	2	S-Waste Management
Vegetation	41,44	2,3	12,13	C-Forestry
Vegetation analysis	88	9	26	C-Wildlife Management
Volcanism	12,14	4,4	3,4	S-Geology
Volcanology	13	4	4	S-Geology
Vole	62	6	19	C-Ecology/Zoology
Waste management	1,3,4	1,1,1	1,1,1	S-Waste Management
Waste management	37	2	11	C-Botany
Waterfowl	99	11	29	C-Upland Game/Wtrfowl
Watershed	41	2	12	C-Forestry
Wildlife	90	9	26	C-Wildlife Management
Wildlife habitat	88	9	26	C-Wildlife Management
Wildlife monitoring	61	6	18	C-Ecology/Zoology
Winter ecology	102	11	29	C-Upland Game/Wtrfowl
Wolf recovery	17,22	8,8	5,6	S-Wolf Recovery
Wolves	18,19,20	8,8,8	5,5,5	S-Wolf Recovery
W-Wave velocities	38	2	11	C-Botany
Yellowstone	9	4	3	S-Geology

Alphabetical Listing of Senior Authors
(if different from presenter then presenter is also listed)

Author	Abstract #	Program Page	Abstract Page	Session
Adam, Michael D.	50	3	15	C-Aquatic Ecology
Altendorf, Kelly	98	9	28	C-Nongame Species
Anderson, Jay E.	8,43	1,3	2,13	S-Waste Mgmt, Forestry
Ayers, Dayna	87	9	25	C-Wildlife Management
Bangerter, Layne	19	8	5	S-Wolf Recovery
Barkworth, Mary E.	35	2	10	C-Botany
Bartels, Peg	66	6	20	C-Ecology/Zoology
Blom, Paul E.	4	1	1	S-Waste Management
Brandt, Charles A.	60	6	18	C-Ecology/Zoology
Brough, Sherman G.	81	7	24	C-Lichen/Mosses
Burt, Charles	6	1	2	S-Waste Management
Cadwell, Larry L.	61,71	6,6	18,21	C-Ecology/Zoology
Compton, Bradley B.	86,99	9,11	25,29	C-Wildlife Mgmt,Upland Game
Cooper, Sarah L.	67	6	20	C-Ecology/Zoology
Darnell, G. Ross	7	1	2	S-Waste Management
Dechert, Thomas V.	15	4	4	S-Geology
Dent, Liz	50	3	15	C-Aquatic Ecology
Derr, Chiska C.	79	7	23	C-Lichen/Mosses
Dillman, Karen L.	82,83	7,7	24,24	C-Lichen/Mosses
Dueker, Ken	11	4	3	S-Geology
Duffin, Eric K.	37	2	11	C-Botany
Dunn, Steven C.	58	5	18	C-Ecology/Zoology
Evans, Rod	21	8	6	S-Wolf Recovery
Fitts, Robert	31	2	9	C-Botany
Gardner, Scott C.	101	11	29	C-Upland Game/Wtrfowl
Gonzalez, Carlos A. Lopez	98	9	28	C-Nongame Species
Hackett, William R.	12	4	3	S-Geology
Hagar, Joan C.	89	9	26	C-Wildlife Management
Hansen, H. Jerome	91	9	26	C-Wildlife Management
Harrod, Richy J.	41	2	12	C-Forestry
Henderson, Jan A.	42	3	12	C-Forestry
Holthuijzen, Anthonie M.A.	95	9	27	C-Nongame Species
Hudak, Howard G.	25	10	7	S-Riparian Management
Hughes, Scott S.	52	5	16	C-Geology/Geography
Hultquist, Nancy B.	55	5	17	C-Geology/Geography
Iverson, Wayne F.	44	3	13	C-Forestry
James, Marie J.	36	2	10	C-Botany
Kaltenecker, Julie	72	7	22	C-Lichen/Mosses
Kanz, Margo	59	5	18	C-Ecology/Zoology
Kennedy, Michael D.	64	6	19	C-Ecology/Zoology
Kiver, Eugene P.	54	5	16	C-Geology/Geography
Koch, Ted	17	8	5	S-Wolf Recovery
Langhorst, David	22	8	6	S-Wolf Recovery
Larsen, Kelly D.	74	7	22	C-Lichen/Mosses
Lee, Dana E.	53	5	16	C-Geology/Geography
Lesher, Robin D.	80	7	24	C-Lichen/Mosses
Limbach, W. Eric	34	2	10	C-Botany
Link, Paul Karl	53	5	16	C-Geology/Geography
Llewellyn, Robin	69	6	20	C-Ecology/Zoology
Maas, Kathleen	39	2	12	C-Forestry
Mann, Larry	16	4	4	S-Geology
Massimino, Catherine	2	1	1	S-Waste Management
Mattise, Samuel N.	100	11	29	C-Upland Game/Wtrfowl
McCune, Bruce	76	7	23	C-Lichen/Mosses
McCurry, Michael	13	4	4	S-Geology

Author	Abstract #	Program Page	Abstract Page	Session
Meints, Daryl	99	11	29	C-Upland Game/Wtrfowl
Milner, Gregory B.	84	8	25	C-Wildlife Management
Morris, Randall C.	1	1	1	S-Waste Management
Nelson, Jason	48	3	14	C-Aquatic Ecology
Nugent, John J.	93	9	27	C-Nongame Species
Obedzinski, Robert A.	26	10	7	S-Riparian Management
Ohlson, Therese H.	40	2	12	C-Forestry
Owsiak, Anna M.	65	6	19	C-Ecology/Zoology
Oxley, Harry	63	6	19	C-Ecology/Zoology
Patla, Debra	70	6	21	C-Ecology/Zoology
Patla, Susan M.	68	6	20	C-Ecology/Zoology
Pearl, Christopher A.	30	2	9	C-Botany
Peek, James M.	28	10	8	S-Riparian Management
Pelto, Mauri	56	5	17	C-Geology/Geography
Perkins, J. Marl	97	9	28	C-Nongame Species
Perkins, Michael E.	14	4	4	S-Geology
Petersen, Kenneth L.	5	1	2	S-Waste Management
Peterson, Charles R.	27,69	10,6	8,20	S-Rip. Mgmt- Ecol/Zool
Picard, Robert	58	5	18	C-Ecology/Zoology
Ponzetti, Jeanne	73	7	22	C-Lichen/Mosses
Pope, Von R.	94	9	27	C-Nongame Species
Prater, Bill	56	5	17	C-Geology/Geography
Rachael, Jon S.	20	8	5	S-Wolf Recovery
Rash, Scott	78	7	23	C-Lichen/Mosses
Rasmuson, Kaylie E.	33	2	10	C-Botany
Ratzlaff, Teresa	32	2	9	C-Botany
Reese, Kerry P.	103	11	30	C-Upland Game/Wtrfowl
Reiswig, Barry	24	10	7	S-Riparian Management
Relyea, Scott E.	49	3	15	C-Aquatic Ecology
Reynolds, Timothy D.	1	1	1	S-Waste Management
Rich, Terry	23	10	7	S-Riparian Management
Ritter, Sharon A.	92	9	27	C-Nongame Species
Rose, Dean	90	9	26	C-Wildlife Management
Rosentreter, Roger	75	7	22	C-Lichen/Mosses
Royer, Todd V.	47	3	14	C-Aquatic Ecology
Schubloom, Lisa	77	7	23	C-Lichen/Mosses
Smith, Richard P.	10	4	3	S-Geology
Smith, Robert B.	9	4	3	S-Geology
Snyder, Eric B.	45	3	14	C-Aquatic Ecology
Thomas, Steven A.	46	3	14	C-Aquatic Ecology
Thomas, Ted	29	2	9	C-Botany
Tiller, Brett L.	85	8	25	C-Wildlife Management
Tucker, Gabriel F.	88	9	26	C-Wildlife Management
Tullis, Julie A.	57	5	17	C-Geology/Geography
Ulliman, Mark J.	102	11	29	C-Upland Game/Wtrfowl
Wagner, Orvin E.	38	2	11	C-Botany
Waugh, W. J.	3	1	1	S-Waste Management
Welhan, John	51	5	16	C-Geology/Geography
Whitelaw, Alice	18	8	5	S-Wolf Recovery
Wilde, Kelly D.	96	9	28	C-Nongame Species
Wolff, Jerry O.	62	6	19	C-Ecology/Zoology

SAMPLE ABSTRACT
(Measures 3 1/2" X 5 1/2")

SENSITIVITY OF POPULATION GROWTH RATES TO LIFE HISTORY COMPONENTS FOR MEDIUM- SIZED MAMMALS. James G. Hallett, Washington State University, Pullman, Margaret A. O'Connell, Eastern Washington University, Cheney.

Identification of the demographic components that most strongly influence animal population dynamics is essential for understanding life-history evolution and for conservation and management. We compared aspects of the population dynamics of two species with similar food requirements, but very different life histories: Virginia opossum (Didelphis virginiana) and raccoon (Procyon lotor). These species were studied by monthly live-trapping and radio-tracking from June 1980 to December 1984 in a small watershed at the Conservation and Research Center, National Zoological Park, Front Royal, Virginia. Population structure and dynamics were examined by constructing age- and stage-classified matrix models for each species. The elements of these matrices were the fertilities and survival probabilities of females in each age or stage class. The matrices were analyzed to determine the relative importance of fertility versus survival on population growth. For opossums, first year survival and reproduction had the greatest effect on population growth. Survival of adults was generally most important for raccoons. Changes in demography were attributable to a rabies epidemic that affected only raccoons.

- Abstract SHOULD NOT be surrounded by lines.
- Photocopy Ready
- 12 Pitch, CG Times Fonts
- Send Author's biography with abstract

Program contact: James W. Unsworth
(208) 465-8465

SUBMITTING AND TYPING ABSTRACTS FOR IDAHO CHAPTER, THE WILDLIFE SOCIETY

Deadline for receipt of abstracts is February 1, 1995.

Abstracts are required from persons presenting contributed papers, invited papers, posters or displays.

Abstracts should be of the informative type, containing:

1. A sentence statement of the study's specific objective, unless this is given by the title.
2. A brief statement of methods, if pertinent.
3. A summary of the results obtained.
4. A statement of the conclusions. It is not satisfactory to state "results will be discussed."
5. Follow ALL instructions for typing abstracts precisely.
6. Submit an original and one copy of the abstract.

TYPING ABSTRACTS

Abstracts must be photocopy ready. Dot matrix print is not acceptable. The abstract will be photographed ***just as you prepare and submit it.***

Type the abstract to fit within a 3 1/2" wide X 5 1/2" long rectangle. The submitted abstract should ***not*** be surrounded by lines. A line made by a non-photographing light blue pencil is acceptable. Your entire abstract, including

- title
- author(s)
- location
- text, and
- acknowledgements

must be within the 3 1/2" X 5 1/2" space. Leave no top margins. Characters outside the rectangle will not be printed.

Single-space all typing. Place the entire abstract within one paragraph, starting with a three-space indentation. Hand print in black all Greek letters and symbols not on your word processor. Type the title of the paper in all capital letters. Underline names and initials of the author(s).

The author must designate a primary and secondary keyword for the abstract for use in preparing a subject index.

DO NOT FOLD, CUT OUT, STAPLE, OR TAPE THE ABSTRACT.

Closest Airport
Idaho Falls

Meeting Location
Center for Higher Education
University Place, Idaho Falls

Lodging

Conference Hotel:
Shilo Inn, 780 Lindsay Boulevard
800-222-2244
This is the only facility with a shuttle to the conference location (CHE). Ask for one of the rooms in our reserved block.
1270-3395 $59/night

Alternate Lodging:

Ameritel Inn Best Western
900 Lindsay Boulevard; 523-6000

Comfort Inn
195 South Colorado Avenue
528-2804

Driftwood Falls View Motel
575 River Parkway; 524-9093

Motel 6
1448 West Broadway; 522-0112

Motel West
1540 West Broadway; 522-1122

Stardust Motor Lodge
700 Lindsay Boulevard
522-2910

Super 8 Motel
701 Lindsay Boulevard
522-8880

Westbank Inn at the Falls
475 River Parkway
523-8000

ABSTRACT SUBMITTAL FORM
1995 Annual Meeting
Idaho Chapter, The Wildlife Society

Type of Presentation: _____ Paper _____ Poster _____ Display

Preferred Section/Subject for Contributed Papers
If more than one is possible, list in order of preference (1, 2, 3)

_____ Big Game Species
_____ Nongame Species
_____ Wildlife Management
_____ Upland Game/Waterfowl
_____ Other _____

Name _____ Phone _____

Mailng Address _____ FAX _____

City, State, Zip _____

If first author is not presenter, name presenter: _____

Primary Keyword _____ Secondary Keyword _____

*Abstracts are required from persons presenting contributed papers, invited papers, posters or displays. The time limit for contributed papers is twenty minutes, including questions.

Send original plus one copy of the abstract with this form to:
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Telephone numbers: 800-753-4781 ◆ 208-236-3155 ◆ FAX: 208-236-4600

For program information, contact: James W. Unsworth 208-465-8465

THE DEADLINE FOR ABSTRACTS IS FEBRUARY 1, 1995

Idaho Chapter, The Wildlife Society

Wednesday, March 8
7:00 p.m. - 9:00 p.m. Reception - Registration (Shilo Inn)
8:00 p.m. - 9:00 p.m. NWSA Board and ICTWS Board Meetings

Thursday, March 9
8:00 a.m. - 8:15 a.m. **Welcome - Center for Higher Education (*"CHE"*)**
8:30 a.m. - 5:00 p.m. **Contributed Papers** (*CHE*)
8:30 a.m. - Noon ***Symposium: Wolf Reintroduction*** (*CHE*), Ted Koch, Program Chair
10:00 a.m. - 10:30 a.m. **Break**
12:15 p.m. - 1:30 p.m. **Lunch on your own**
6:30 p.m. - 9:00 p.m. **NWSA/ICTWS Banquet** (separate cost, prepayment required)
Keynote Speaker: G. Wayne Minshall, Ph.D., recipient of the NWSA Outstanding Scientist Award in 1993
"Stream Ecosystem Integrity: A Temporal Perspective of Disturbance in the Pacific Northwest."

Friday, March 10
8:30 a.m. - 5:00 p.m. **Contributed Papers** (CHE)
8:00 a.m. - Noon ***Symposium: Riparian Management*** (*CHE*), Kirk Lohman,Program Chair
10:00 a.m. - 10:30 a.m. **Break**
Noon - 1:30 p.m. **Lunch on your own**
7:30 p.m. - 9:00 p.m. **Social/Auction Sponsored by Idaho Chapter, The Wildlife Society**--Shilo Inn

Saturday, March 10
8:30 a.m. - Noon **Contributed Papers** (CHE)

See registration form for optional field trips.

NOTE: The Wildlife Society registration fee will be collected on-site. However, to participate in the banquet prepayment is required.

SAMPLE ABSTRACT
(Measures 3 1/2" X 5 1/2")

SENSITIVITY OF POPULATION GROWTH RATES TO LIFE HISTORY COMPONENTS FOR MEDIUM- SIZED MAMMALS. James G. Hallett, Washington State University, Pullman, Margaret A. O'Connell, Eastern Washington University, Cheney.

Identification of the demographic components that most strongly influence animal population dynamics is essential for understanding life-history evolution and for conservation and management. We compared aspects of the population dynamics of two species with similar food requirements, but very different life histories: Virginia opossum (Didelphis virginiana) and raccoon (Procyon lotor). These species were studied by monthly live-trapping and radio-tracking from June 1980 to December 1984 in a small watershed at the Conservation and Research Center, National Zoological Park, Front Royal, Virginia. Population structure and dynamics were examined by constructing age- and stage-classified matrix models for each species. The elements of these matrices were the fertilities and survival probabilities of females in each age or stage class. The matrices were analyzed to determine the relative importance of fertility versus survival on population growth. For opossums, first year survival and reproduction had the greatest effect on population growth. Survival of adults was generally most important for raccoons. Changes in demography were attributable to a rabies epidemic that affected only raccoons.

- Abstract SHOULD NOT be surrounded by lines.
- Photocopy Ready
- 12 Pitch, CG Times Fonts
- Send Author's biography with abstract

Program contact: Barry L. Keller
(208) 236-3207

SUBMITTING AND TYPING ABSTRACTS FOR NORTHWEST SCIENTIFIC ASSOCIATION

Deadline for receipt of abstracts is February 1, 1995.

Abstracts are required from persons presenting contributed papers, invited papers, posters or displays.

Abstracts should be of the informative type, containing:

1. A sentence statement of the study's specific objective, unless this is given by the title.
2. A brief statement of methods, if pertinent.
3. A summary of the results obtained.
4. A statement of the conclusions. It is not satisfactory to state "results will be discussed."
5. Follow ALL instructions for typing abstracts precisely.
6. Submit an original and one copy of the abstract.

TYPING ABSTRACTS

Abstracts must be photocopy ready. Dot matrix print is not acceptable. The abstract will be photographed ***just as you prepare and submit it.***

Type the abstract to fit within a 3 1/2" wide X 5 1/2" long rectangle. The submitted abstract should ***not*** be surrounded by lines. A line made by a non-photographing light blue pencil is acceptable. Your entire abstract, including

- title
- author(s)
- location
- text, and
- acknowledgements

must be within the 3 1/2" X 5 1/2" space. Leave no top margins. Characters outside the rectangle will not be printed.

Single-space all typing. Place the entire abstract within one paragraph, starting with a three-space indentation. Hand print in black all Greek letters and symbols not on your word processor. Type the title of the paper in all capital letters. Underline names and initials of the author(s).

The author must designate a primary and secondary keyword for the abstract for use in preparing a subject index.

DO NOT FOLD, CUT OUT, STAPLE, OR TAPE THE ABSTRACT.

Closest Airport
Idaho Falls

Meeting Location
Center for Higher Education
University Place, Idaho Falls

Lodging

Conference Hotel:
Shilo Inn, 780 Lindsay Boulevard
800-222-2244
This is the only facility with a shuttle to the conference location (CHE). Ask for one of the rooms in our reserved block.

Alternate Lodging:

Ameritel Inn Best Western
900 Lindsay Boulevard; 523-6000

Comfort Inn
195 South Colorado Avenue
528-2804

Driftwood Falls View Motel
575 River Parkway; 524-9093

Motel 6
1448 West Broadway; 522-0112

Motel West
1540 West Broadway; 522-1122

Stardust Motor Lodge
700 Lindsay Boulevard
522-2910

Super 8 Motel
701 Lindsay Boulevard
522-8880

Westbank Inn at the Falls
475 River Parkway
523-8000

ABSTRACT SUBMITTAL FORM
1995 Annual Meeting
Northwest Scientific Association

Type of Presentation: _____ Paper _____ Poster _____ Display

Preferred Section/Subject for Contributed Papers
If more than one is possible, list in order of preference (1, 2, 3)

_____ Botany
_____ Forestry
_____ Molecular Biology
_____ Invited Papers
_____ Ecology
_____ Other _____

_____ Geology/Geography
_____ Invertebrate Zoology
_____ Vertebrate Zoology
_____ Water/Aquatic Biology
_____ Lichens/Mosses

_____ Chemistry/Physics
_____ Mathematics
_____ Other: List:
_____
_____

Name _____ Phone _____

Mailng Address _____ FAX _____

City, State, Zip _____

If first author is not presenter, name presenter: _____

Primary Keyword _____ Secondary Keyword _____

*Abstracts are required from persons presenting contributed papers, invited papers, posters or displays. The time limit for contributed papers is twenty minutes, including questions.

Send original plus one copy of the abstract with this form to:
Gail L. Whitney, Idaho State University, Office of Continuing Education, Campus Box 8062, Pocatello, ID 83209-8062
Telephone numbers: 800-753-4781 ◆ 208-236-3155 ◆ FAX: 208-236-4600

For program information, contact: Barry Keller at 208-236-3207

THE DEADLINE FOR ABSTRACTS IS FEBRUARY 1, 1995

Friday, March 10

8:00 a.m. - 12:00 Noon — **Registration** (*CHE*)

8:30 a.m. - 5:00 p.m. — **Contributed Papers** (*CHE*)

Symposium: Geology of the Eastern Snake River Plain (*CHE*)

8:30 a.m. - 9:00 a.m — **Seismotectonics of the Snake River Plain - Yellowstone Region**
R.B. Smith, University of Utah

9:00 a.m. - 9:20 a.m. — **Upper Crustal Seismic and Geologic Structure of the Eastern Snake River Plain Based Upon Deep Drill Hole Information and Regional Geophysics,** R. Smith, Lockheed Idaho Technologies Company

9:20 a.m. - 9:40 a.m. — **Overview of Eastern Snake River Plain Volcanic Geology**
W.R. Hackett, WRH Associates

9:40 a.m. - 10:00 a.m. — **Genesis of Rhyolite Domes and Flows of the Eastern Snake River Plain,** M. McCurry, K. Hayden and W.R. Hackett, Idaho State University

10:00 a.m. - 10:30 a.m. — Break

10:30 a.m. - 10:50 a.m. — **Upper Mantle Structure Along the Snake River Plain**
K. Deuker, University of Colorado

10:50 a.m. - 11:10 a.m. — **Tuffs of Trapper Creek, Idaho: A Record of Miocene Explosive Volcanism in the Snake River Plain Volcanic Province**
M.E. Perkins, W.P. Nash, and F.H. Brown, University of Utah

11:10 a.m. - 11:30 a.m. — **Loess Distribution and Sources of Southeastern Idaho**
T. Decker, University of Idaho

11:30 a.m. - Noon — **Use of Radioisotopic Tracers to Refine the Conceptual Model of Ground-Water Movement, Snake River Plain Aquifer, Southeastern Idaho,** L. Mann, U.S. Geological Survey

Noon - 1:30 p.m. — **Lunch on your own**

1:30 p.m. - 4:00 p.m. — *Symposium: Distance Education: The New Frontier* (*CHE*)
Programs in Other States
What is New in Educational Technology--Hardware vs. Software
Overcoming Challenges

7:30 p.m. - 9:00 p.m. — **Social/Auction Sponsored by Idaho Chapter, The Wildlife Society--**
Shilo Inn

1995 Annual Meeting of the Northwest Scientific Association

Tentative Program

Wednesday, March 8	
7:00 p.m. - 9:00 p.m.	Reception - Registration (Shilo Inn)
8:00 p.m. - 9:00 p.m.	NWSA Board and ICTWS Board Meetings
Thursday, March 9	
7:30 a.m. - 12 Noon	Registration -- Center for Higher Education (*"CHE"*)
8:00 a.m. - 8:30 a.m.	Plenary Session Welcome
8:30 a.m. - 5:00 p.m.	**Contributed Papers**
	Symposium: Ecological Aspects of Waste Management *(CHE)*
8:30 a.m. - 8:40 a.m.	**Introduction to Symposium:** Randall Morris and Tim Reynolds, Environmental Science and Research Foundation, Idaho Falls
8:40 a.m. - 9:05 a.m.	**The Purpose of Waste Isolation: Legal Requirements and Design Criteria**--Speaker to be announced
9:05 a.m. - 9:30 a.m.	**Existing Low-Level Waste Repositories** Speaker to be announced
9:30 a.m. - 9:55 a.m.	**Challenges to Waste Repositories: Animal Intrusion** Paul Blom, University of Idaho
10:00 a.m. - 10:20 a.m.	**Break**
10:20 a.m. - 10:45 a.m.	**Challenges to Waste Repositories: Paleoclimate** Ken Petersen, Pacific Northwest Laboratory
10:45 a.m. - 11:10 a.m.	**Challenges to Waste Repositories: Plants and Water** Mark Miller, Jacobs Engineering Associates
11:10 a.m. - 11:35 a.m.	**Meeting the Challenges: Engineered Designs** G. Ross Darnell, Lockheed Idaho Technologies Company
11:35 a.m. - Noon	**Meeting the Challenges: Ecological Solutions** Jay Anderson, Idaho State University
12:15 p.m. - 1:30 p.m.	**Business Luncheon** (NWSA luncheon included in registration fee)
6:30 p.m. - 9:00 p.m.	**NWSA/ICTWS Banquet** Keynote Speaker: G. Wayne Minshall, Ph.D., recipient of the NWSA Outstanding Scientist Award in 1993; "Stream Ecosystem Integrity: A Temporal Perspective of Disturbance in the Pacific Northwest."
8:00 a.m. - 6:00 p.m.	**Poster Session/Displays** *(Thursday and Friday)*

REGISTRATION FORM
1995 Annual Meeting
Northwest Scientific Association, and Idaho Chapter, The Wildlife Society

Name _____

Address _____ Phone _____

University, Agency, Etc. _____

Membership ____ NWSA, ____ ICTWS Check here if you are an invited symposium speaker ____

NWSA Registration		*Before 2/1/95*	*After*
____	Professional	$32.00	$36.00
____	Student	$20.00	$25.00
____	One-Day Professional	$22.00	$29.00
____	One-Day Student	$14.00	$21.00

***ICTWS Registration* is independent of NWSA registration and will be collected at the meeting. The only things for which ICTWS members prepay are the Thursday banquet and field trips.**

Banquet and Socials

____	NWSA Social, Wednesday	$4.00
____	NWSA Banquet, Thursday	$14.00
____	Social/Auction, Friday	$ 5.00
____	Combined Social, Banquet, Social/Auction	$20.00
____	SUB TOTAL FOR THIS SIDE OF THE PAGE	

Make checks payable to: Idaho State University
Send to:
Gail L. Whitney, Idaho State University
Office of Continuing Education, Campus Box 8062
Pocatello, ID 83209-8062

Field Trips

Field trip attendance may be limited. Fees include transportation and fees. Trips usually last the entire day on Saturday, March 11.

Lava Hot Springs: 8a-5p; bring swim suit; lunch on own. Includes visit to Idaho Museum of Natural History, Pocatello.

INEL - Ecological Research, Craters of the Moon: Volcanism Talk: 8a-5p; lunch included; bring warm clothes.

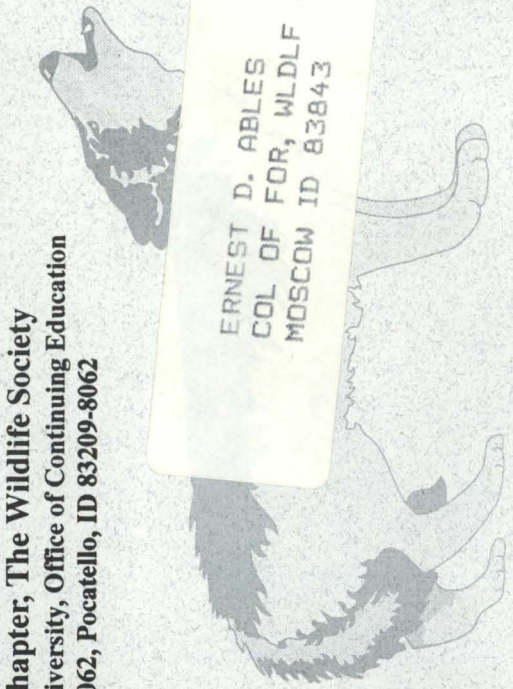
Sun Valley Ski: 5a - 10p; lunch and dinner on own; lift tickets included; rentals available.

Birding: 6a - Noon; lunch included; bring warm clothes.

Lava Hot Springs ($25)	$____
INEL and Craters of the Moon ($30)	$____
Sun Valley Alpine Ski Trip ($77)	$____
Sun Valley XC Ski Trip ($41)	$____
Birding ($25)	$____
SUB TOTAL THIS COLUMN	____
SUB TOTAL FROM LEFT-HAND COLUMN	____
TOTAL AMOUNT ENCLOSED	____

EEO/AA/TITLE IX INSTITUTION

68th Annual Meeting of the Northwest Scientific Association
and Idaho Chapter, The Wildlife Society
Idaho State University, Office of Continuing Education
Campus Box 8062, Pocatello, ID 83209-8062



DATED MATERIAL: MEETING ABSTRACT DUE.

Summary
NWSA complete grey abstract and registration grey form.
ICTWS complete mocha abstract and mocha registration form.

CALL FOR PAPERS

1995
ANNUAL MEETING
March 9, 10, 11, 1995

Northwest Scientific Association

and

Idaho Chapter, The Wildlife Society

Idaho State University *at the*
Idaho State University/University of Idaho
Center for Higher Education
Idaho Falls, Idaho