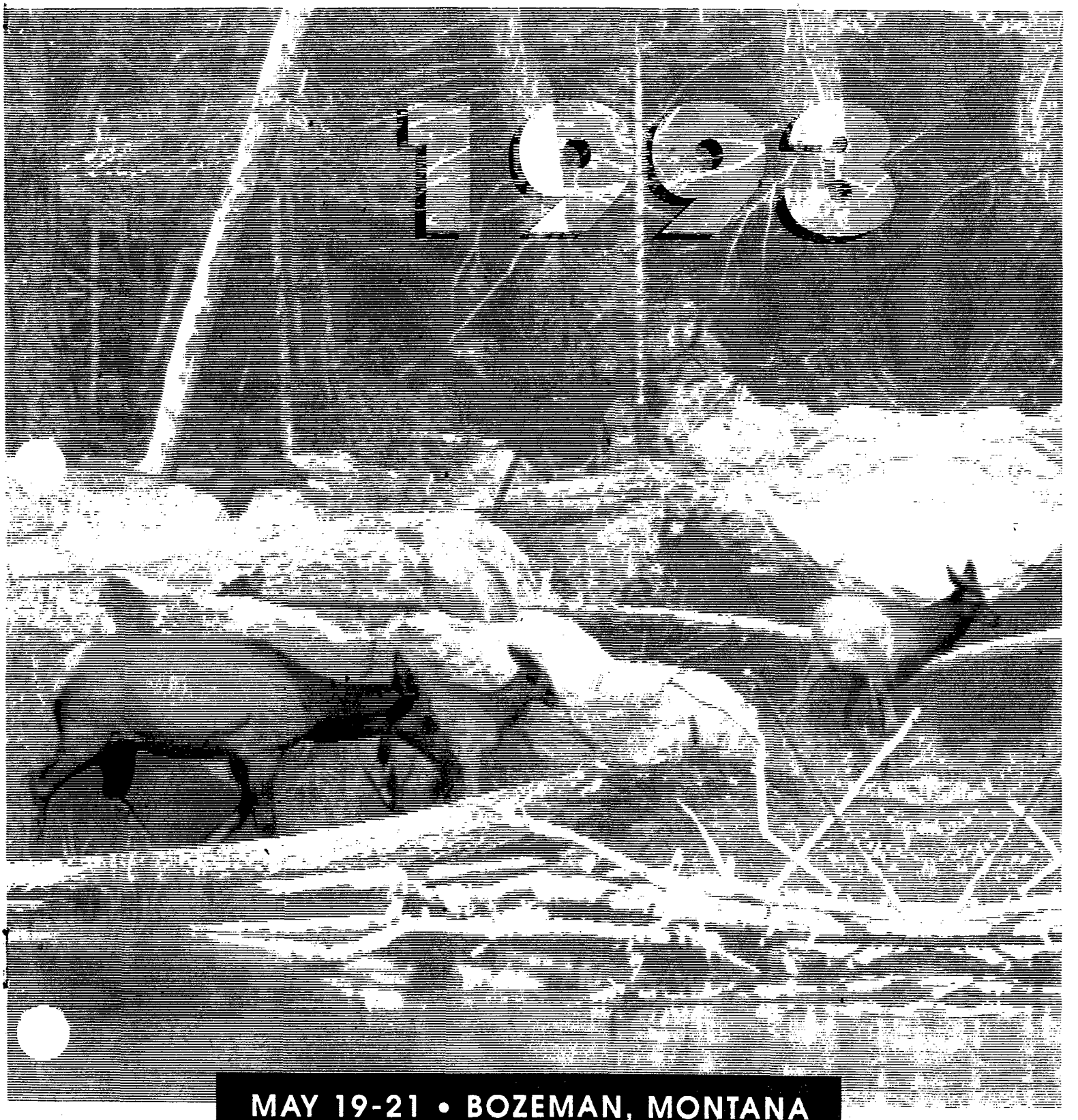
WESTERN STATES AND PROVINCES

ELK WORKSHOP

1993 § Bozeman, Montana

PROCEEDINGS OF THE WESTERN STATES & PROVINCES ELK WORKSHOP



MAY 19-21 • BOZEMAN, MONTANA

FORWARD

Elk management will continue to be more complex and difficult as a result of:

- Elk numbers being at twentieth century highs in most areas of the west,
- Increasing demands from both sporting and non sporting publics,
- Major concerns expressed by agriculturists about competition and game damage and,
- High values of elk from commercial hunting (outfitting) and game farms.

Management of the western states and provinces elk resource is being tugged at from many legitimate directions. In many areas there are more elk on private lands than is tolerable, but on the other hand, elk on public lands are sometimes negatively influenced by the presence of domestic animals. There is a wide range of preferences by sportsmen as to what type of elk hunting opportunities agencies should manage for. A consensus has not been reached on how many bulls are biologically necessary to maintain productive elk populations. There is a growing number of people who are not interested in hunting but just want to enjoy wildlife from a non consumptive aspect and/or who oppose public hunting. Outfitting in some areas competes with public hunting. Game farms and wildlife ranching are a potential hazard to wild elk populations from both a disease and genetic dilution standpoint.

There are many unknowns regarding the future of elk management, but one thing is certain: if these issues are not successfully addressed now, they will be more difficult to face in the future and likely some unrecoverable losses will take place. If there are solutions to these issues they will not be best derived by people working in isolation, but by joining together, working cooperatively, sharing knowledge (successes and failures), and developing compatible management strategies. This was a management and participatory oriented workshop. Attendance and participation from sportsmen as well as agency managers was encouraged.

Acknowledgements

A hearty thanks to the chairpersons; John Firebaugh (MDFWP), Lynn Irby (MSU), Mike Frisina (MDFWP), Len Carpenter (Colo. Div. of Wildlife) and to the Banquet Speaker - James I. S. Innes, Helicopter Wildlife Management. Also a special thank you to the management and staff of the Holiday Inn, Bozeman, Montana for their excellent service.

Workshop Proceedings Availability

Copies of these proceedings are available at $10.00 each. Send requests to:

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May 19-21, 1993 • Bozeman, Montana

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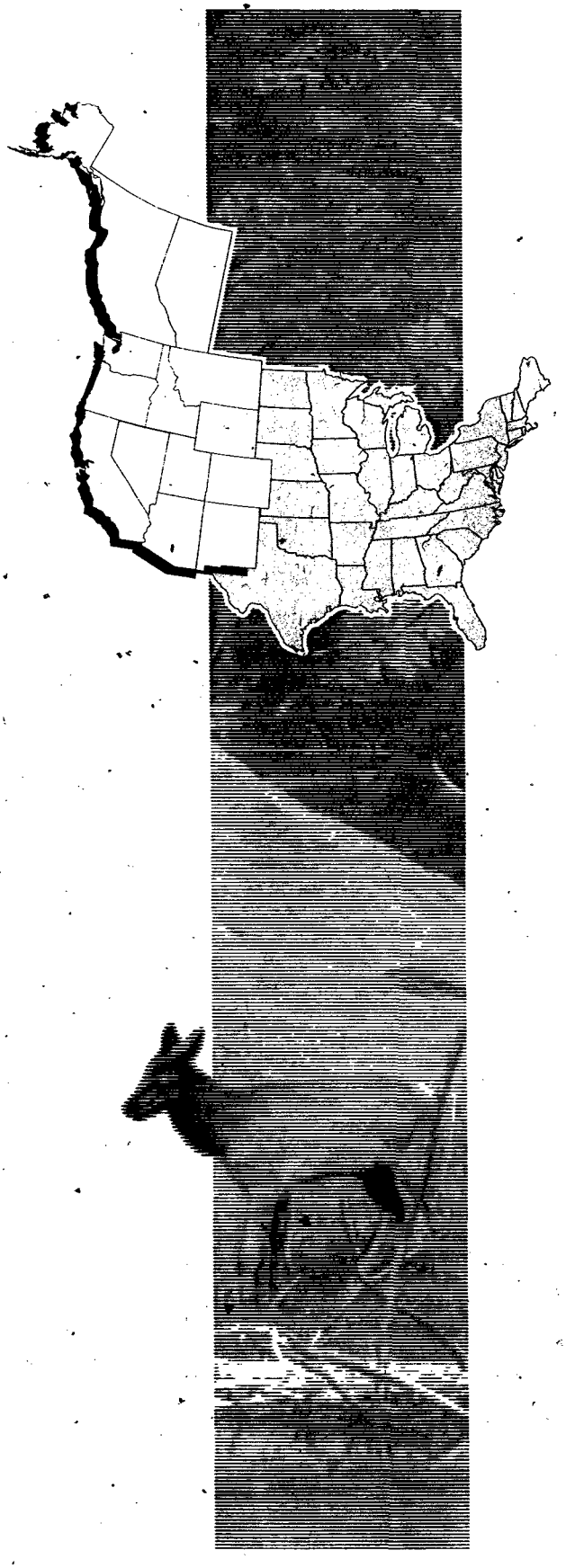
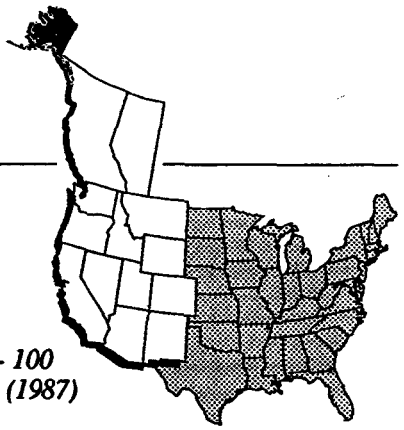
CONTENTS

STATUS REPORTS of the Western States & Provinces



CHAIR: JOHN FIREBAUGH Montana Department of Fish, Wildlife & Parks

ELK STATUS REPORT - *ALASKA*



PREPARED BY: *Roger B. Smith*

NUMBER OF WINTERING ELK: *850 - 950*
COMMENT: *750 - 850 Roosevelt elk on Afognak /Raspberry Islands; 75- 100 Roosevelt and Rocky Mtn. elk on or near Etolin Island from recent transplant (1987)*

BULLS/100 COWS: **PRE-SEASON:** *10* **RANGE:** *5-15*
WINTER: *<10*
COMMENT: *Some bias because bull:cow ratios based on August aerial surveys and some smaller bulls counted as cows.*

CALVES/100 COWS: **SUMMER:** *37 average* **RANGE:** *35-50*
COMMENT: *Biased because some yearling males are indistinguishable from cows in aerial surveys*

RESIDENT TAGS: **TOTAL:** *540 (resident hunters afield)*

NONRESIDENT TAGS: **TOTAL:** *30 (non-resident hunters afield)*
GRAND TOTAL: *570 (hunters afield)*
COMMENT: *1991 data. Non-residents participate equally with residents in drawing hunts*

TAKE OF BULLS: **TOTAL:** *30-35*
TAKE OF ANTLERLESS BULLS: **TOTAL:** *35-40*
COMMENT: *No data on weapons* **GRAND TOTAL:** *65-75*

TOTAL HUNTER SUCCESS: *19%*

HOW ARE HARVEST DATA OBTAINED?
Mandatory hunter report cards from all hunters

WHAT CENSUS METHOD USED?
Summer aerial composition surveys, radio-tracking; 1992 sample size for summer counts on Afognak , Raspberry was 633

PERCENT OF HUNTING BY DRAWING: *25%*

MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
Evaluation and monitoring of Etolin Island Transplant
Distribution and movement of elk herds on Afognak Island (1986 Present - documenting ranges of 8 elk herds using aerial telemetry and monitoring population trends)

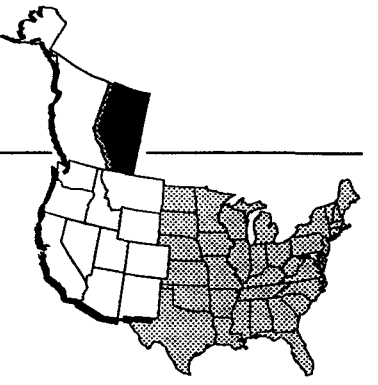
RECENT ELK PUBLICATIONS:
Federal Aid in Wildlife Restoration - Annual Performance Report of Survey - Inventory Activities. Vol. XXIII, Part III, Project W-23-5, Study 13.0. S.M. Abbott ed. Nov. 1992. Alaska Dept. Fish and Game, Juneau. 3 pp.

MAJOR MANAGEMENT ISSUES OF CONCERN:
1. *Clearcut logging of old growth Sitka spruce and road construction influencing harvest rates by improved access; impacts of logging on elk habitat on Afognak Island.*
2. *Proposed additional elk transplants into Sitka black-tailed deer habitat in SE Alaska and impacts on deer populations.*

CONTACT PERSON FOR MANAGEMENT / RESEARCH INFORMATION:
Roger B. Smith, Alaska Dept. Fish and Game
211 Mission Road, Kodiak, AK 99615

COMMENTS: *Afognak population in a decline associated with severe winters since 1989.*

ELK STATUS REPORT - *ALBERTA*



ATTENDING REPRESENTATIVE: *W. M. Glasgow*

NUMBER OF ELK: (Winter) *15,000*

SPECIES: *Two subspecies, C.e. nelsonii & C.e. manitobensis, data not kept separate*

BULLS/100 COWS:
Winter: **Range:** *5 - 40*
Comment: *Difficult to get accurate bull counts; bull distribution very different than cow/calf herd*

CALVES/100 COWS:
Winter: **Range:** *23 - 46*
Comment: *Range likely due to different rates of predation on neonates/young calves.*

RESIDENT TAGS (includes muzzleloader):
Rifle: *19,394* **Bow:** *3,752* **Total:** *23,146*

NONRESIDENT TAGS (includes muzzleloader):
Rifle: *275* **Bow:** *N/A* **Total:** *275*
Grand Total: *23,421*

Comment: *Bow hunters require same license as rifle hunters, so bow tag is just an estimate of how many licensed elk hunters use a bow.*

TAKE OF BULLS:
Rifle: *1,264* **Bow:** *83* **Total:** *1,347*

TAKE OF ANTLERLESS:
Rifle: *650* **Bow:** *33* **Total:** *683*
Grand Total: *2,030*

COMMENT: *The bull harvest was down from the previous year with more restrictive regulations in some areas, cow harvest up slightly (depredation complaints).*

BULL HUNTER SUCCESS: *6%* **TOTAL HUNTER SUCCESS:** *12%*

HOW ARE HARVEST DATA OBTAINED? *Compulsory registration and telephone harvest questionnaire.*

WHAT CENSUS METHOD USED (sample size)?
Primarily aerial survey using winter range, stratified blocks and transects. Sample size would vary from close to 100% on some winter ranges to less than 10% in forested blocks.

PERCENT OF HUNTING BY DRAWING: *15%*

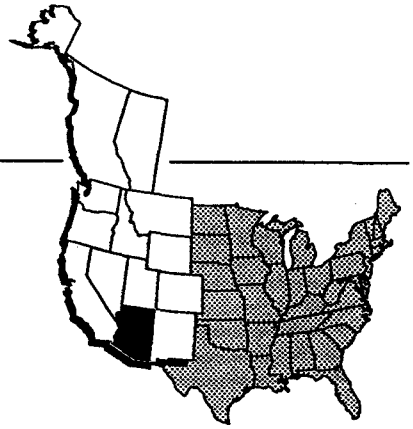
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
Study of movements, distribution and habitat preference in Southwestern Alberta to be used in access management plans and industrial EIAs. Study of seasonal habitat use, distribution and movements in relation to timber harvesting as well as assessing the current HSI (habitat suitability index)) for elk.

RECENT ELK PUBLICATIONS:
Alberta Fish and Wildlife Division. Management plan for elk in Alberta. Currently in draft form with expected completion in 1993/1994.

MAJOR MANAGEMENT ISSUES OF CONCERN:
Development on elk winter range, summer range and movement corridors, crop depredation, securing winter range on private land, access to private for recreational harvest, allocation for non-residents, 6-point trophy draw area, competition with livestock on public land in some areas and elk transplanting.

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Harold Carr for provincial management, Luigi Morgantini for the top research outlined above and Kirby Smith for the bottom research study mentioned above.

ELK STATUS REPORT - *ARIZONA*



NUMBER OF ELK: (Year-round) *30,000 (±5,000)*
SPECIES *Rocky Mtn*

BULLS/100 COWS:
PRE-SEASON (Includes spike bulls): *30/100 5-year average*

CALVES/100 COWS (5 year average):
PRE-SEASON: *51/100*

RESIDENT AND NONRESIDENT TAGS (RIFLE)
BULL: 6,255 **ANTLERLESS:** *4,645* **TOTAL:** *10,900*

RESIDENT AND NONRESIDENT TAGS (BOW)
BULL: *3,120* **ANTLERLESS:** *2,195* **TOTAL:** *5,315*
COMMENT:
Tags are issued to residents and nonresidents with the same schedule and system except there is a 10% cap on non-resident bull tags per hunt.

Non-resident tags: No more than 10% of issued tags for each bull hunt may be non-resident. 1933 non-resident participation for all hunts, bull and cow, was less than 5%.

TAKE OF BULLS :

RIFLE: *2,074 bulls*	**BOW:** *675 bulls*	**TOTAL:**	*2,749*
1,359 spikes	*1,78 spikes*	**TOTAL:**	*1,537*
		GRAND TOTAL:	*4,286*

TAKE OF ANTLERLESS: :

RIFLE *2,218 cows*	**BOW:** *459 cows*	**TOTAL:**	*2,677*
279 calves	*46 calves*	**TOTAL:**	*325*
		GRAND TOTAL:	*3,002*

BULL HUNTER SUCCESS:

BUGLE RIFLE SEASON:	*94%*
BUGLE MUZZLELOADER SEASON:	*82%*
NOV. OR DEC. RIFLE SEASON	*54%*

TOTAL HUNTER SUCCESS: **RIFLE:** *56%* **BOW:** *26%*

HOW ARE HARVEST DATA OBTAINED? *Mailed questionnaire to hunters.*

WHAT CENSUS METHOD USED (Sample size)?
All elk hunters are mailed a hunt questionnaire. Return rate is 60-65%. Herd composition census data are collected pre-hunt and sample sizes are determined to yield bull:100 cow:calf ratios at ±5 at the 90% confidence level.

PERCENT OF HUNTING BY DRAWING: *100%*

MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
1. *The effect of timber management practices on elk*
2. *Survival rates of adult female elk*
3. *Elk seasonal range and migrations between Pine and Show Low*

RECENT ELK PUBLICATIONS:
Brown, R.L. 1988. Effects of a Savory Grazing Method on Big Game. Arizona Game and Fish Department Interim Research Report. 17pp.
Brown, R. L. 1990. Elk Seasonal Ranges and Migrations. Arizona Game and Fish Department Technical Report No. 1 68pp.
Arizona Elk Operational Plan (Public Review Draft) January, 1993

MAJOR MANAGEMENT ISSUES OF CONCERN:
Elk and livestock grazing use on public lands.
Elk browsing of aspen and willow seedlings/saplings
Riparian habitat protection and elk and livestock impacts on these habitats.
High hunter demand for limited elk permits.

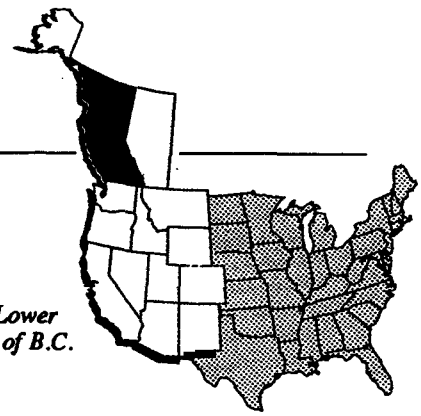
SUCCESSFUL PROGRAMS:
Permit drawing system
Sub-unit antlerless hunt management (herd unit management)
Habitat improvement projects in partnership with USFS and RMEF.

PROGRAMS TOO NEW TO EVALUATE:
- *CRM (Coordinated Resource Management)*
- *Ecosystem Management*
- *Stewardship Program*
- *Statewide Elk Plan*

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Tice Supplee, Game Management Chief and Ray Lee, Big Game Supervisor
Game Branch, 2221 W. Greenway Rd., Phoenix, AZ (602) 789-3349

CONTACT PERSON FOR RESEARCH INFORMATION:
Richard Brown, Research Biologist and Ray Schweinsberg, Research Field Supervisor.
Research Branch, 2221 W. Greenway Rd., Phoenix, AZ (602) 789-3246

ELK STATUS REPORT - *BRITISH COLUMBIA*



ATTENDING REPRESENTATIVE: *Guy Woods*

NUMBER OF ELK: (Winter)
SPECIES: *Rocky Mtn .and Roosevelt*
COMMENT: *British Columbia supports Roosevelt elk on Vancouver Island and Lower Mainland while Rocky Mtn. elk are found in varying numbers throughout most areas of B.C.*

BULLS/100 COWS:
WINTER: **RANGE:** *20-80*
COMMENT: *A variety of hunting strategies and goals are applied across the province, from intensive open bull seasons to highly regulated bull permit seasons on newly established herds.*

CALVES/100 COWS:
WINTER: **RANGE:** *15-60*
COMMENT: *High predation and calf only seasons are resulting in low calf survival in some areas while in other areas populations are growing rapidly, predation is light and calves are not hunted.*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *14,500* **BOW:** *No special tag* **TOTAL:** *14,500*

NONRESIDENT TAGS (includes muzzleloader)
RIFLE: *770* **BOW:** *No special tag* **TOTAL:** *770*
GRAND TOTAL: *15,270*

COMMENT:
Resident hunter numbers are allocated through a lottery system in most areas of the province due to high demand. Non-resident hunters must hunt with a guide and guides are limited by quotas in some areas while in other areas they are not.

TAKE OF BULLS:
RIFLE: *Not Reported* **BOW:** *Unknown* **TOTAL:** *2,729*

TAKE OF ANTLERLESS:
RIFLE: *Not Reported* **BOW:** *Unknown* **TOTAL:** *553*
GRAND TOTAL: *3,282*

COMMENT:
Calf only Limited Entry Hunting resulted in a harvest of 329 juveniles in 1992, a drop of 600 from 1991, as a result of calf harvest plan changes in the Kootenay Region

TOTAL HUNTER SUCCESS: *25% kills/hunter, 34 hunter days/kill*

HOW ARE HARVEST DATA OBTAINED?
Some areas require elk to be inspected. Most is collected through mail surveys of successful Limited Entry hunt participants or mail surveys of elk license holders.

WHAT CENSUS METHOD USED (sample size)?
All elk license holders are surveyed at least once and some may be contacted twice. About 80% surveyed respond.

PERCENT OF HUNTING BY DRAWING: *58%*

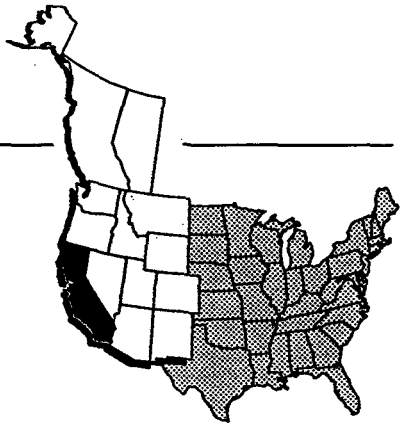
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
The second year of a program to determine elk populations in 2 Kootenay management units using Idaho survey techniques was completed in 1993. B.C. Ministry of Forests is undertaking cattle/elk forage utilization trials and are in year 3 of this work. Movement monitoring and population dynamic work in Trench.

RECENT ELK PUBLICATIONS:
Brunt, K.R. 1990. Ecology of Roosevelt Elk in B.C, Min Forests Spec. Rpt. Sec. 5.; Demarchi, R.A. and A.W. Wolterson, 1991. Results of special calf only hunting seasons in E. Koot. Region of B.C. In elk Vulnerability Symposium. Montana State U., Bozeman, MT.

MAJOR MANAGEMENT ISSUES OF CONCERN:
Forest ingrowth on winter ranges.
Calf and cow elk hunting and a perception of declining populations
Elk competition with livestock on Crown range.
Elk damage to agricultural crops.
Game farming and concerns over the spread of disease.

CONTACT PERSON FOR MANAGEMENT INFORMATION:
D. Blower, I. Hatter, MOELP, Wildlife Branch,. Victoria
A. Wolterson, MOELP, Wildlife Branch, Cranbrook
D. Janz, MOELP, Wildlife Branch,.Nanaimo.
G. Woods, MOELP, Wildlife Branch,.Nelson

ELK STATUS REPORT - *CALIFORNIA*



ATTENDING REPRESENTATIVE: *Jon K. Fischer*

NUMBER OF ELK-WINTER: *2,500-2,900 Tule elk*
1,000-1,500 Rocky Mtn. elk
3,500 Roosevelt elk

BULLS/100 COWS:

PRE-SEASON: **RANGE** *32-129*

WINTER: **RANGE:** *30-100*

CALVES/100 COWS:
WINTER: **RANGE:** *7-66*

RESIDENT TAGS (includes muzzleloader): **TOTAL:** *1,110 (public)*

COMMENT: *(Quota for 1993) Authorized methods of take include rifle or archery equipment. There is no special archery season. Approximately 35 additional tags are available through the Private Lands Wildlife Management Area (PLM) Program. Non-residents may hunt elk by purchasing one of three special fund-raising tags or through the PLM Program. Otherwise, the public hunting program is restricted to residents.*

TAKE OF BULLS: **TOTAL:** *27 public*

TAKE OF ANTLERLESS: **TOTAL:** *43 public*

GRAND TOTAL: *70 public*

COMMENT: *Based on 1992 tag quota of 100 tags via public drawing. An additional 21 elk were taken through the PLM Program.*

TOTAL HUNTER SUCCESS: *70%*

HOW ARE HARVEST DATA OBTAINED?
Mandatory tag return.

WHAT CENSUS METHOD USED (sample size)?
Air surveys using helicopter and fixed-wing aircraft.

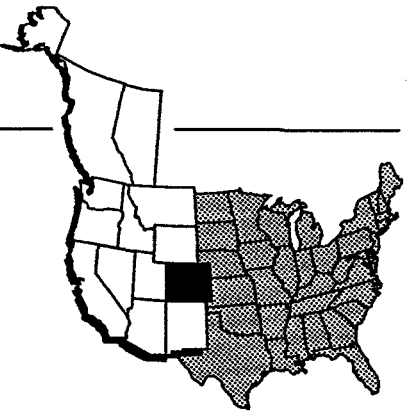
PERCENT OF HUNTING BY DRAWING: *Almost 100%. Three fund-raising tags are sold at banquets or other fund-raising events.*

MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
A sightability study involving Tule elk in the Owens Valley began last fall (1992)
The Department is testing elk for Johne's Disease.
The Department is examining antler composition of Tule elk at Grizzly Island and in the Owens Valley.

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Terry Mansfield

OTHER COMMENTS: *The Department is continuing to translocate Roosevelt and Tule elk to suitable historic habitat. Suitable, unoccupied habitat for Roosevelt elk exists in the state. However, finding such habitat for Tule elk is increasingly difficult. During the last few years, a small group of elk has become established in the Warner Mountains of northeastern California. These are presumed to be Rocky Mountain elk. The Department did not introduce elk to the area; these elk presumably immigrated from southern Oregon.*

ELK STATUS REPORT - *COLORADO*



ATTENDING REPRESENTATIVE: *Rick Kahn/Len Carpenter*

NUMBER OF ELK: (Winter) *215,000*
SPECIES: *C. e. nelsonii*
COMMENT: *Long term objective - 175,000*

BULLS/100 COWS:
PRE-SEASON: *45* **RANGE:** *25-78*
WINTER: *19* **RANGE:** *3 - 63*

CALVES/100 COWS:
WINTER: *58* **RANGE:** *38-65*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *109,510* **BOW:** *10,374* **TOTAL:** *119,884*

NONRESIDENT TAGS (includes muzzleloader):
RIFLE: *74,995* **BOW:** *12,299* **TOTAL:** *87,294*
GRAND TOTAL: *207,178*
COMMENT: *Cow license numbers will increase in 1993. Cow success state wide - 48%*

TAKE OF BULLS (includes muzzleloader):
RIFLE: *24,958* **BOW:** *3,493* **TOTAL:** *28,451*

TAKE OF ANTLERLESS (includes muzzleloader):
RIFLE: *21,683* **BOW:** *1,326* **TOTAL:** *23,009*
GRAND TOTAL: *51,460*
COMMENT: *Cow success is down the past 2 years; harvest has averaged about 48,000 for the past 3 years; 1993 harvest objective is 57,000-60,000 elk.*

BULL HUNTER SUCCESS: *20%* **TOTAL HUNTER SUCCESS:** *24%*

HOW ARE HARVEST DATA OBTAINED?
Random phone survey of unlimited licenses (40,000); mail survey of all limited licenses (70,000).

WHAT CENSUS METHOD USED (sample size)?
Post-season (Dec-Feb) helicopter sex and age classification counts (75,000 elk counted statewide). Pop 2 model used in conjunction with sex and age ratios on a Data Analysis (Herd) Unit basis.

PERCENT OF HUNTING BY DRAWING: *52%*

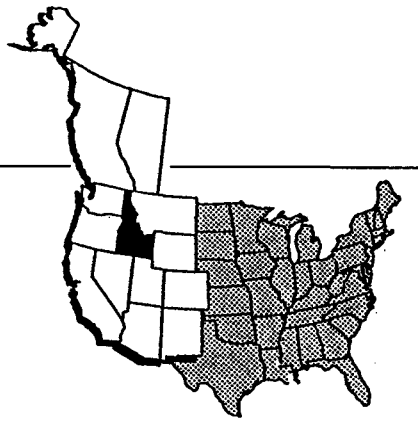
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
G. Bear - early season elk movements in the White River N.F.
D. Freddy - elk survival (calves and cows) and population estimation (sighting bias and mark/resight on sampled search quadrants), Grand Mesa

RECENT ELK PUBLICATIONS:
Hobbs, N.T. and D. L. Baker. 1993. Impacts of elk winter grazing on livestock production(in press).

MAJOR MANAGEMENT ISSUES OF CONCERN:
Accurate estimation of populations; another reference point needed.
Inability to harvest an ever-increasing segment of the elk pop. due to private land conflicts; in some units >50% of the elk are unavailable
Game damage; specifically forage loss and fence damage
Watchable wildlife vs. hunting conflicts

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Rick Kahn (303) 291-7349 - Management
Bruce Gill (303) 484-2836 - Research

ELK STATUS REPORT - *IDAHO*



ATTENDING REPRESENTATIVE: *Lonn Kuck*

NUMBER OF WINTERING ELK: *N/A*
SPECIES: *C.e. nelsonii*

COMMENT: *No estimate*

BULLS/100 COWS: **WINTER:** *20* **RANGE:** *12 to 68*

COMMENT: *Excellent - response to spike only seasons in eastern Idaho, statewide - goal 15, 20 & 25 bulls:100 cows*

CALVES/100 COWS: **WINTER** *30* **RANGE:** *15 to 50*

RESIDENT TAGS: **RIFLE:** *94,000* **TOTAL:** *94,000*

NONRESIDENT TAGS **RIFLE:** *13,000* **TOTAL:** *13,000*
GRAND TOTAL: *107,000*

COMMENT: *Rifle and archery hunters utilize same tags.*

TAKE OF BULLS: *15,300* **BOW:** *1,400* **TOTAL:** *16,700*

TAKE OF ANTLERLESS BULLS, RIFLE: *8,700* **TOTAL:** *9,900*
GRAND TOTAL: *26,600*

BULL HUNTER SUCCESS: **General:** *46%* **Control:** *69%* **TOTAL:** *57%*

HOW ARE HARVEST DATA OBTAINED? *Telephone random survey.*

WHAT CENSUS METHOD USED? *Sightability*

PERCENT OF HUNTING BY DRAWING: *38%*

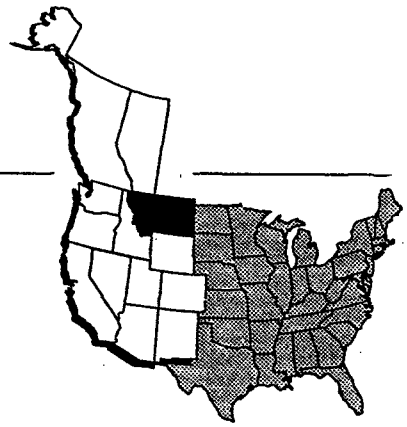
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
1. Assessment of access on bull mortality.
2. Evaluation of road closures or bull escapement.
3. Effects of antlerless harvest on population dynamics.
4. Elk sightability development.

RECENT ELK PUBLICATIONS:
Unsworth. J.W., L. Kuck. M.D. Scott, E.O. Garton. 1993. Elk mortality in the Clearwater Drainage of Northeastern Idaho JWM (in press).
Gratson, M.W., J.W. Unsworth. P. Zager. and L. Kuck. 1993. Trans. North Am. Wildlife and Natural Resource Conference (in press)
Unsworth. J.W., F.A. Lebon. G.A. Sargent. E.O. Garton and J.R. Pope. 1991. Aerial survey 31: User's Manual. Idaho Dept. of Fish & Game. 46 pp.

MAJOR MANAGEMENT ISSUES OF CONCERN:
Access development associated with timber harvest.
Depredations associated with herd expansion.
Achievement of bull:cow ratio objectives as hunting demand exceeds supply.
Conflict with livestock and elk on public lands.

CONTACT PERSON FOR MANAGEMENT / RESEARCH INFORMATION:
Lonn Kuck, 600 S. Walnut, Boise, ID 83707

ELK STATUS REPORT - *MONTANA*



ATTENDING REPRESENTATIVE: *John Firebaugh*

NUMBER OF ELK: (Winter) *100,000+*
Species: *c.e. nelsonii*
Comment: *Population is at 20th century high.*

BULLS/100 COWS:
Pre-season: **Range:** *20-40*
Winter: *5-15* **Range:** *5-30*
Comment: *Varies considerable across the state depending upon security and management goals.*

CALVES/100 COWS:
Winter: *35-45* **Range:** *20-60*
Comment: *Varies depending upon winter range habitat, winter severity, etc. Typically, NW Montana has the lowest ratios while SW and central Montana have the highest ratios.*

RESIDENT TAGS (includes muzzleloader):
Rifle: *85,768* **Bow:** *26,500* **Total:** *112,268*

NONRESIDENT TAGS (includes muzzleloader):
Rifle: *17,000* **Bow:** * **Total:** *17,000*
Grand Total: *129,268*

COMMENT:
** Nonresident archery licenses are not separated but are included in the resident total. A maximum of 17,000 nonresident elk licensed may be sold due to legislation.*

TAKE OF BULLS: **Total:** *12,964*

TAKE OF ANTLERLESS: **Total:** *14,540*
Grand Total: *27,529**

COMMENT:
** 1992 harvest - includes 25 unknown elk; 1992 archery harvest is included in totals, but not yet broken out. 1992 was the 2nd highest total elk harvest and the highest antlerless harvest on record.*

BULL HUNTER SUCCESS: *12%* **TOTAL HUNTER SUCCESS:** *25%*

HOW ARE HARVEST DATA OBTAINED?
Resident hunters are randomly sampled through a phone survey. Nonresidents are randomly sampled through a mail survey.

WHAT CENSUS METHOD USED (sample size)?
Winter, early spring helicopter and fixed-wing aircraft surveys of winter ranges to determine sex-age ratios and population trends. Some sightability used in western Montana

PERCENT OF HUNTING BY DRAWING: *27%*

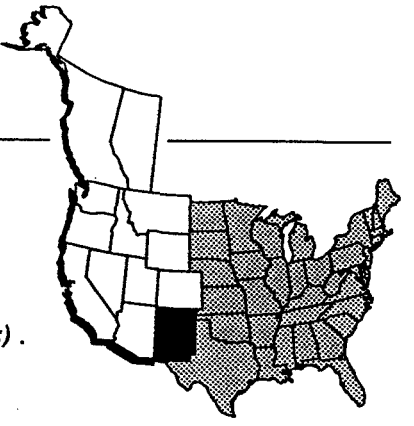
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
- *Elk population Dynamics and Breeding Biology Study*
- *Resource Partitioning by Sympatric Elk, Mule Deer and White-tailed Deer Populations on a Forested Winter Range in Western Montana*
- *Evaluation of Three Different Elk Hunting Regulations in the Elkhorn Mountains*
- *Hungry Horse Elk Mitigation*
- *Lower Clark Fork Elk Study*

RECENT ELK PUBLICATIONS:
Montana Elk Management Plan, 1992

MAJOR MANAGEMENT ISSUES OF CONCERN:
- *Loss of security on public and private timber corporation lands.*
- *Impacts of increasing subdivision and loss of open space on winter ranges.*
- *Implications of game farms*
- *Increasing crop depredations by elk on private lands*
- *Fee hunting and leasing of hunting rights on private land where public use is excluded.*
- *Opposition from certain groups to habitat acquisition.*

CONTACT PERSON FOR RESEARCH INFORMATION:
Ken Hamlin, Montana Dept. of Fish, Wildlife & Parks, 1400 S. 19th, Bozeman, MT 59715
CONTACT FOR MANAGEMENT INFORMATION:
Glenn Erickson, Montana Dept. of Fish, Wildlife and Parks, 1420 E. Sixth Ave., Helena, MT 59620

ELK STATUS REPORT - *NEW MEXICO*



ATTENDING REPRESENTATIVE: *Larry Edwards*

NUMBER OF ELK: (Winter) *40,000-50,000*
SPECIES: *Rocky Mtn.*
COMMENT: *Counted 17,692 in winter 1991; 17,267 in 1992- (165 hours) . We do not survey preseason*

BULLS/100 COWS:
WINTER: *41* **RANGE:***11-63*

CALVES/100 COWS:
WINTER: *47* **RANGE:***14-78*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *113,485* **BOW:** *4,654* **TOTAL:** *18,139*

NONRESIDENT TAGS (includes muzzleloader):
RIFLE: *3,733* **BOW:** *1,805* **TOTAL:** *5,538*
GRAND TOTAL: *23,677*
COMMENT: *These figures are for both public and private hunts for 1991-1992 license year.*

TAKE OF BULLS:
RIFLE: *4,230* **BOW:** *1,065* **TOTAL:** *5,295*
TAKE OF ANTLERLESS:
RIFLE: *2,115* **BOW:** *416* **TOTAL:** *2,531*
GRAND TOTAL: *7,826*

COMMENT: *These figures are for both public and private hunts for the 1991-1992 license year.*

BULL HUNTER SUCCESS:*Not available* **TOTAL HUNTER SUCCESS:** *34%*

HOW ARE HARVEST DATA OBTAINED?
Harvest questionnaires are given to hunters with licenses. A business reply envelope is supplied.

WHAT CENSUS METHOD USED (sample size)?
All hunters ; 100% sample.

PERCENT OF HUNTING BY DRAWING: *Public hunts - 100%*
Private hunts - 0%

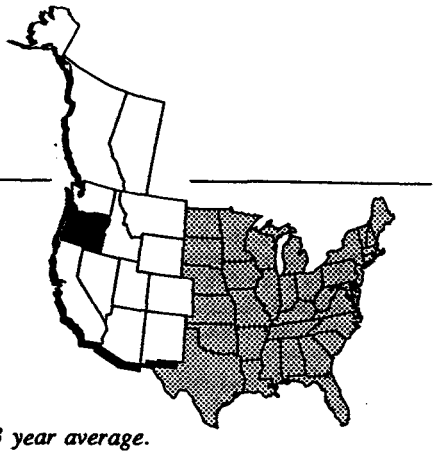
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
Only research currently in place is a small study on the Valle Vidal. This is a high quality hunt area that is closely monitored for impacts from public and Forest Service sources. Pupose of project is to Track movements, production, habitat use, population structure and hunter harvest and injury information.

RECENT ELK PUBLICATIONS: *None*

MAJOR MANAGEMENT ISSUES OF CONCERN:
1. *Elk - livestock issues (forage competition, season of use, permittee rights and obligations, landowners rights and obligations, public rights and obligations)*
2. *Accurate methodology to sample population parameters*
3. *Useful model to predict and track population numbers*

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Darrel Weybright (505) 827-7893
Larry Temple (505) 376-2946

ELK STATUS REPORT - *OREGON*



ATTENDING REPRESENTATIVE: *Dan Edwards*

NUMBER OF ELK: (Winter) *58,000- 61,000*
SPECIES: *Roosevelt-Rocky Mtn.*
COMMENT: *58,000-Roosevelt; 61,000 - Rocky Mtn.*

BULLS/100 COWS:
WINTER: *11* **RANGE:** *5 - 32*
COMMENT: *Roosevelt 9 Range 3 to 29 for Rocky Mountain elk. Based on 3 year average.*

CALVES/100 COWS:
WINTER: *37* **RANGE:** *30-43*
COMMENT:*Roosevelt: 36 ,Range 21 to 49 for Rocky Mtn. elk.Based on 3 year average.*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *122,530* **BOW:** *17,131* **TOTAL:** *139,661*

NONRESIDENT TAGS (includes muzzleloader):
RIFLE: *3,659* **BOW:** *1,211* **TOTAL:** *4,870*
GRAND TOTAL: *143,320*
COMMENT: *Data are from 1992 tag sales information.*
Rifle tag numbers include antlerless permits

TAKE OF BULLS:
RIFLE: *12,049* **BOW:** *1,033* **TOTAL:** *13,082*
TAKE OF ANTLERLESS:
RIFLE: *7,679* **BOW:** *1,241* **TOTAL:** *8,920*
GRAND TOTAL: *22,002*

COMMENT: *This information includes harvest for both Roosevelt and Rocky Mountain elk.*

BULL HUNTER SUCCESS: *13%* **TOTAL HUNTER SUCCESS:** *17%*

HOW ARE HARVEST DATA OBTAINED?
Sample is obtained by telephone survey and sample size is targeted at a 95% confidence interval.

WHAT CENSUS METHOD USED (sample size)?
Aerial trend and herd composition data collected from February through March each year. We census 47,000 elk on trend routes and comp. 33,500 animals for estimating age and sex ratios.

PERCENT OF HUNTING BY DRAWING: *44%*

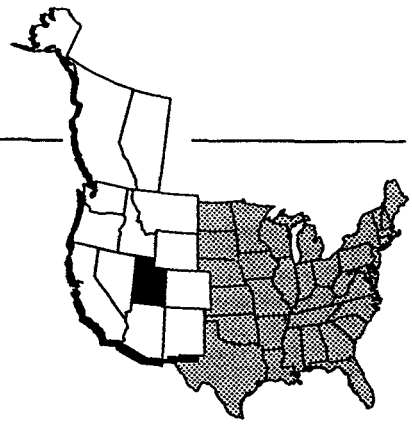
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
How age of breeding bulls effects pregnancy rates and conception dates. Evaluating mix of age and ratio of breeding bulls/100 cows necessary to get early and synchronous parturition. Evaluating the effects of human disturbance on pregnancy rates and partuition date. Studying competition among elk, deer, and cattle. and evaluating the effects of intensive timber harvest.

RECENT ELK PUBLICATIONS:
Oregon's Elk Management plan (1992) ODFW. There are some manuscripts that have been submitted or possibly even accepted for publication by University and other researchers not associated with ODFW. No information on titles or where these were submitted is available.

MAJOR MANAGEMENT ISSUES OF CONCERN:
Forest health, elk damage to private property, ODFW relations with private landowners because of elk on private property, roading and cover loss on public land and how elk vulnerability is affected, private game farming of elk, fee hunting operations and tag allocations to landowners, how to change to an ecosystem management approach.

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Management: Dan Edwards or Chris Wheaton (503) 229-5410, ext. 445 or 478
Research: Donavin Leckenby or Bruce Johnson (503) 229-5410, ext. 447
Bruce Johnson's phone is: (503) 962-6556.
Please call Dan Edwards if you have questions: (503) 229-5410 ext. 445

ELK STATUS REPORT - *UTAH*



ATTENDING REPRESENTATIVE: *Wes Shields*

NUMBER OF ELK: (Winter) *50,000*
SPECIES *Rocky Mtn.*
COMMENT:
Utah has no formal, comprehensive statewide elk population survey.

BULLS/100 COWS:
PRESEASON: *23* **RANGE:** *3-61*
WINTER: *21* **RANGE:** *6-36*

CALVES/100 COWS:
WINTER: *39* **RANGE:***28-52*
COMMENT: *Utah has experienced 6-7 consecutive years of drought which appears to have ended.*

RESIDENT TAGS (includes muzzleloader)
RIFLE: *42,716* **BOW:***4,602* **TOTAL:** *47,318*

NONRESIDENT TAGS (includes muzzleloader)
RIFLE: *2,264* **BOW:** *321* **TOTAL:** *2,585*

COMMENT:
Of the total tags, 39, 169 are general rifle and 4,923 are general archery; 1,041 are limited entry bull, balance are antlerless tags

TAKE OF BULLS :
RIFLE: *6,958* **BOW:** *401* **TOTAL:** *7,359*

TAKE OF ANTLERLESS: :
RIFLE *6,958* **BOW:** *78* **TOTAL:** *3,966*
GRAND TOTAL: *11,325*

BULL HUNTER SUCCESS: *17%* **TOTAL HUNTER SUCCESS:** *24%*

HOW ARE HARVEST DATA OBTAINED?
General season harvest is determined by telephone interview; limited permit harvest by mail questionnaire.

WHAT CENSUS METHOD USED (sample size)?
Best estimate. Utah has no formal, comprehensive statewide elk population survey due to budget constraints

PERCENT OF HUNTING BY DRAWING: *12%*

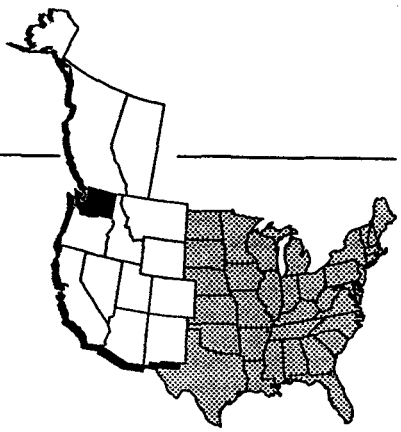
MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
Utah presently has no major elk research projects; however, we are conducting studies on various elk management units to determine elk distribution patterns as well as elk forage use, particularly spring use. We are undergoing increasing criticism from the cattle and sheep industry, and they are receiving support from the US Forest Service that elk are, in fact, causing damage to forage resources. The forest service has little or no data (mostly no data) to support their claims.

RECENT ELK PUBLICATIONS: *None at present.*

MAJOR MANAGEMENT ISSUES OF CONCERN:
Agricultural depredation, perceptions that elk are causing wholesale damage to range resources, pressure for supplemental feeding programs, and political agendas to slaughter elk herds. We also are addressing crowding issues as popularity of elk hunting grows. We would like to develop a comprehensive annual elk population survey -- pending funding.

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Wes Shields, Big Game Coordinator, Ph# (801)538-4780
Grant Jense, Ass't Chief, Big Game, Ph # (801)538-4781

ELK STATUS REPORT - *WASHINGTON*



ATTENDING REPRESENTATIVE: *Rolf Johnson*

NUMBER OF ELK: (Winter- note species)
26,450 - Rocky Mtn.
37,750 - Roosevelt

BULLS/100 COWS:
PRESEASON: *30* **RANGE:** *25-35*
WINTER: *10* **RANGE:** *1-25*
COMMENT: *Extremely variable depending on management restrictions, i.e. limited entry, antler restrictions, etc.*

CALVES/100 COWS:
WINTER: *35* **RANGE:** *18-50*
COMMENT: *Poor calf survival in Blue Mountains has lowered calf/cow ratios considerably.*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *72,909* **BOW:** *13,372* **TOTAL:** *86,281 (1991)*

NONRESIDENT TAGS (includes muzzleloader):
RIFLE: *804* **BOW:** *178* **TOTAL:** *1,032*
GRAND TOTAL: *87,313 (1991)*

TAKE OF BULLS:
RIFLE: *4,648* **BOW:** *444* **TOTAL:** *5,092*

TAKE OF ANTLERLESS:
RIFLE: *2,786* **BOW:** *768* **TOTAL:** *3,554*
GRAND TOTAL: *8,646.*

BULL HUNTER SUCCESS: *6%* **TOTAL HUNTER SUCCESS:** *10%*

HOW ARE HARVEST DATA OBTAINED? *3 wave questionnaire and game harvest report cards*

WHAT CENSUS METHOD USED (sample size)?
Fixed wing and helicopter trend surveys of established routes (sample size variable but averages 10% statewide)

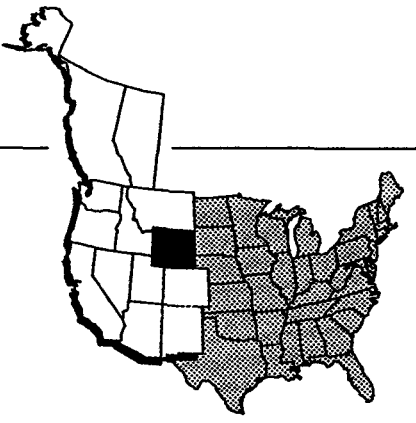
PERCENT OF HUNTING BY DRAWING: *8%*

MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
- *Elk Mortality Study - Jack Smith, Kreg Sloan, Warran Michaelis*
- *Radio telemetry of 300-400 adult elk to determine cause of mortality*
- *Blue Mountains Calf Elk Study - Woody Myers*
- *Radio telemetry of newborn calves to determine cause of mortality*

MAJOR MANAGEMENT ISSUES OF CONCERN:
- *Tribal hunting impacts*
- *Antler restrictions*

CONTACT PERSON FOR MANAGEMENT INFORMATION:
Rolf Johnson - Management
Jack Smith - Research

ELK STATUS REPORT - *WYOMING*



ATTENDING REPRESENTATIVE: *James "Jay" Lawson*

NUMBER OF ELK: (Winter) *Not reported*
SPECIES: *C. e. nelsonii*
COMMENT: *Long term objective - Management emphasis is on recreational opportunity rather than trophy qualities.*

BULLS/100 COWS:
PRESEASON: *Not reported* **RANGE:** *Not reported*
WINTER: *Not reported* **RANGE:** *Not reported*

CALVES/100 COWS:
WINTER: *Not reported* **RANGE:** *Not reported*

RESIDENT TAGS (includes muzzleloader):
RIFLE: *38,000* **BOW:** *6,000 (incl. Nonres.)* **TOTAL:** *Not reported*

NONRESIDENT TAGS (includes muzzleloader):
RIFLE: *7,000* **BOW:** *Not reported* **TOTAL:** *Not reported*

GRAND TOTAL: *51,000*

COMMENT: *Hunters may participate in both the archery and rifle seasons but may harvest only one elk a year. During the special archery seasons, archers with general licenses must hunt for the type of animal specified, any or antlered, for general licenses for the particular hunt area. Archers with limited quota licenses may hunt for the type of animal specified by their license type. Regular season rifle hunters with a general license may take any or antlered elk depending upon hunt area. Rifle hunters with limited quota licenses must hunt only in areas and for the type of animal specified by license type. The legal sex of late season permits varies. A resident hunter may hunt the archery, regular rifle and late seasons but only in general license areas and may harvest only one elk per year.*

TOTAL ELK HARVEST:
RIFLE: *not reported* **BOW:** *not reported* **TOTAL:** *19,000 (5 year average)*

COMMENT: *Manage elk herds by population objectives. Quotas and seasons are set to control each herd near our desired population size and composition.*

BULL HUNTER SUCCESS: *Not reported* **TOTAL HUNTER SUCCESS:** *Not reported*

HOW ARE HARVEST DATA OBTAINED? *Not reported*

WHAT CENSUS METHOD USED (sample size)? *Not reported*

PERCENT OF HUNTING BY DRAWING: *Not reported*

MAJOR ONGOING RESEARCH SUBJECTS AND INVESTIGATIONS:
Wiggins Fork Elk Movements and Habitat use, Life History and Habitat Use by the Jackson Hole Elk Herd, Habitat Use and Migration Patterns of Elk in the North Fork Powder River, and Horse Creek Elk Distribution and Migration Study.

RECENT ELK PUBLICATIONS: *None Reported*

MAJOR MANAGEMENT ISSUES OF CONCERN:
Tuberculosis, Brucellosis (Full-time biologist position created in 1992), Habitat security loses in the Bighorn Mountains with displacement of elk to private lands, Exotic Cervus Species, Special interest groups (season lengths and bull/cow ratios), Privatization and commercialization of elk and their habitat, Getting an adequate harvest of herds using National Parks and Feed Grounds, Chronic elk depredation of stored and growing crops

SUCCESSFUL PROGRAMS:
General "any elk" licenses, Habitat Acquisition Program, Habitat Improvement Program, Maintaining bull:cow ratios through one-year implementation of spike-excluded hunting when needed, Permanent haystack year fences to minimize depredation

FAILURES:
Antler point restrictions to produce big bulls, Maintenance of elk habitat through input on Forest Plans

PROGRAMS TOO NEW TO EVALUATE:
Shortened bull elk season to improve quality of bulls

LIVESTOCK/ELK GRAZING

Conflicts, Opportunities, and Panel Discussion

CHAIR: MIKE FRISINA Montana Department of Fish, Wildlife & Parks

Effects of Winter and Spring Grazing by Elk on Performance of Cattle in Sagebrush Grassland

TOM HOBBS, Division of Wildlife
Colorado Department of Natural Resources, Fort Collin, CO

In many areas of western North America, populations of Rocky Mountain elk (Cervus elaphus canadensis) avoid snow at high elevations during winter by migrating to sagebrush rangelands in mountain valleys, rangelands that are used by cattle in the spring and early summer. As a result of these patterns of range use, the impact of elk on cattle has emerged as an important issue in policy and management throughout the West.

We conducted an experiment to determine how variation in elk population density affects forage and cattle production on sagebrush grassland ranges. Elk were stocked in twelve 80 acre pastures at densities equivalent to 0, 20, 40, and 80 animals per square mile during January-April of 4 consecutive years. These same pastures were stocked with cattle during May-June. We observed effects of elk on the amount of forage available to cattle, and on cattle growth and reproductive performance.

Elk reduced the amount of forage available to cattle. These reductions occurred as a result of removal of dead grass during the winter and from removal of live grass during the early spring. Elk grazing had no effect on the amount of grass that was produced during the growing season. The nutritional quality of forage available to cattle as well as the quality of their diets was improved moderately by elk grazing. However, when elk grazing caused forage supplies available to cattle to fall below about 400 lbs/acre, daily energy intake by cattle declined. When forage supplies exceeded this threshold, elk grazing had no effect on energy intake by cattle.

Reductions in cattle energy intake caused reductions in weights of calves at the end of the spring grazing season. End of spring calf weights were highest in the control (0 elk/mi2) pastures and declined in proportion to increasing elk density. We did not observe statistically significant effects of elk grazing on cow weights at the end of spring, or on cow weights at weaning. We did not find a statistically significant effect of elk grazing on pregnancy rates of cattle. However, in all of these cases, values for the control pastures tended to exceed values for the elk grazed pastures. Total cattle production (lb/cow/year) was reduced by about 10% as a result of elk grazing at all elk population levels (20, 40, 80 elk/mi^2).

Our results have 3 important implications for management. First, we conclude that elk can cause meaningful harm to cattle production on sagebrush grassland ranges. Consequently, sustained investment in resolving conflict between elk and livestock should be viewed by managers and policy makers as an ongoing cost of wise elk management. Second, the absence of a straight-line relationship between elk population density and production by cattle makes it difficult to predict the effect of reducing elk populations on cattle production. However, our results suggest that large scale reductions in elk numbers may fail to reduce the impacts of elk on cattle at local scales. This implies that management of the spatial distribution of elk populations may be more effective than reducing large scale population densities in ameliorating competitive effects of elk on livestock. Third, we surmise that when rangeland conditions and cattle stocking rates resemble those we studied, impacts of elk on cattle can be minimized by assuring that herbaceous forage supplies available to cattle after elk grazing exceed about 400 lbs/acre.

Elk and Livestock Interactions In California

DOUG UPDIKE, California Department of Fish and Game
1416 9th Street, Sacremento, CA 95814

California elk populations continue to increase in numbers, currently estimated at 7,500. The two native subspecies (tule and Roosevelt elk) in the State are expanding into their historic ranges. Tule elk are periodically translocated to suitable historic habitat by the Department to facilitate the expansion of the subspecies. High quality habitat within historic range for Roosevelt and tule elk exists in various locations in the State.

Competition for forage between elk and livestock in California is currently insignificant. This is partly a result of the ability of local elk herds to move to neighboring foraging areas when forage resources become scarce due to livestock grazing. Conflicts between elk and private landowners are usually from damage to fences or depredation of crops.

A recent lawsuit was filed against the Department to recover costs for damage to private property caused by free ranging, wild tule elk. The plaintiff claimed that the Department was responsible for the damage because the elk moved onto his land after they were translocated to nearby public land by the Department. The court ruled in favor of the Department, concluding that the Department was not responsible for the behavior of free ranging, wild elk. This judgement was mostly because the elk were relocated to suitable public land capable of supporting the elk.

Elk-Livestock Conflicts

JIM OLTERMAN, Senior Wildlife Biologist, Colorado Division of Wildlife
2300 S. Townsend Ave., Montrose, CO 81401

In southwest Colorado elk and livestock occupy essentially the same habitats and compete for many of the same forage plants on both public and private lands. Most elk summer at higher elevations, usually on National Forest lands, and move to lower elevation winter ranges on National Forest, Bureau of Land Management, State and private lands. During severe winters elk move increasingly to State Wildlife Areas and private lands. Private landowners often complain about depredation problems and submit claims for damage payments as provided for by Colorado statute. Proposals for reducing elk population levels are common. If adequate forage of sufficient quality is not available the health of individual animals suffers and mortality rates increase.

Winter movements of elk and general body condition are driven by the availability of forage. The availability of forage is a function of the amount of forage present on the range and the influence of adverse conditions, usually snow cover, on the ability of the animals to move about and obtain the forage.

As Tom Hobbs pointed out, elk grazing at very high stocking rates influenced the ability of cattle to gain or retain body weight. It seems reasonable that the reverse is also true. Cattle grazing at high stocking rates will reduce the availability of forage for elk. It has been my experience that livestock stocking rates on many U.S. Forest Service and B.L.M. lands are at levels that leave little forage available for other species. In many cases entire habitat types have been converted to other types by livestock grazing pressure. For example in southwestern Colorado many native fescue grassland sites are now Kentucky bluegrass sites. On dry years the non-native bluegrass hardly grows and provides little forage for livestock or elk. In most cases grazing systems are designed to extract maximum livestock forage over time. Few pastures or allotments are rested from livestock grazing for a season. Almost no areas are set aside for the exclusive use of wildlife.

Livestock grazing is an appropriate use of public lands. Abusive grazing practices are not an appropriate use of public lands whether the abuse is caused by livestock or wildlife. Public land managers must regulate livestock use to allow for recovery of rangelands that are in poor condition. Wildlife managers must work closely with public land managers to insure that big game populations do not overuse rangelands.

Livestock grazing on B.L.M. lands is regulated by the Taylor Grazing Act of 1934. National forests are governed by the Granger-Thye Act of 1950. Both are influenced by numerous other laws. The Acts require permittees to have commensurate private "base property" in order to qualify for the permit. They do not not provide for competitive bid for the permit. Apparently a permit cannot be held for purposes other than livestock grazing. I have been told by National Forest supervisors that multiple use means that livestock grazing should occur on every available allotment. It is very difficult to set aside critical big game ranges even if a permittee is willing to give up the permit. The key is to influence the planning process. Wildlife biologists within Federal and state agencies must take a more active role in the revision of Forest Plans and Allotment Management Plans to insure to insure that wildlife interests are protected.

Public lands grazing regulations should be amended to provide for permits to be retired for the benefit of wildlife. The law could be structured to allow for the retirement of specific permits when they are willingly transferred by the current permit holder. The present system is cumbersome and difficult to work with. I believe the retirement of a relatively small number of permits on public lands in key winter and intermediate range areas would alleviate many private land depredation problems and ensure the long term welfare of many elk populations. The public in this Country wants change in the way public lands are managed and we as wildlife professionals must take the lead in shaping that change.

Livestock Grazing and Elk in Montana

JOEL PETERSON, Regional Wildlife Manager, Montana Department of Fish Wildlife & Parks
1400 S. 19th, Bozeman, MT 59715

MIKE FRISINA, F & W Biologist, Montana Department of Fish, Wildlife & Parks
1330 West Gold, Burte, Montana 59701

In most situations in Montana, the co-existence of livestock and elk grazing is a fact of life. Approximately two-thirds of Montana is privately owned and roughly 65% of the land base in this state is managed as rangeland and pasture. The number one industry Montana is the agricultural industry and the production of wildlife on private lands will continue to be a secondary land use. With a significant number of our elk spending at least a portion of their time on private land, the health and condition of that land is critical to the well being of those animals. The FWP will never control enough land base to provide for the needs of the approximately 100,000 elk in this State.

There are essentially three ways that the FWP can influence how lands are managed relative to the maintenance of wildlife habitat: (A) influencing public land management; (B) directly controlling land through ownership or lease; and (C) influencing the management of private lands.

Influencing Public Land Management - Montana has a considerable public land base (40%) made up primarily of Forest Service, Bureau of Land Management, and State School Trust lands. FWP Wildlife Division biologists routinely make recommendations on actions by these agencies that affect habitat, such as logging and grazing activities.

Directly Controlling Land Through Fee Title Ownership or Leases - Since the middle of this century, the Wildlife Division for the FWP has actively sought to acquire lands important for wintering elk. Our department has had and continues to have a strong resolve to manage for elk numbers compatible with native range conditions and to prevent any reliance these animals could acquire to artificial feeding.

Presently approximately 20 of the Wildlife Management Areas (WMA) that the department controls were purchased primarily for elk winter range. These constitute around 250,000 acres. A number of these WMAs have livestock grazing on them. In the southwestern portion of Montana (administrative Region R-3) we have 8 WMAs which amounts to around 135,000 acres that we control for elk habitat. Eight to 10,000 elk winter on these 8 WMAs and four of them are grazed by livestock.

Over the years the department has used a variety of means to acquire these lands such as sportsmen's license fees and Pitman Robertson funds. More recently, the Montana legislature passed HB 526 which earmarks dollars for the purchase or lease of land. This money comes from sportsmen's license fees and amounts to around two million dollars a year. Eighty percent of that money can be used to directly obtain property, while twenty percent goes into a trust fund that is used for maintenance of the WMA's.

Influencing the Management on Private Lands - On a few of our WMAs we have entered into cooperative grazing agreements with adjacent landowners that provide benefits to both of us. These benefits include: providing for additional forage for elk on private land; providing for an added tolerance of elk by adjacent landowners, and provide for some grazing opportunities on the WMA for the private landowners.

Another influence the FWP can have on the private sector grazing is through the demonstration of management practices on our WMAs that can have application on their lands. These demonstrations illustrate the potential compatibility of wildlife and livestock in a properly managed system - a system geared to protect and enhance the soil and vegetative resource as well as provide for wildlife forage. Remember, the private landowner controls a very large proportion of the states wildlife habitat (including winter range) making the resource maintenance of these lands vital to maintaining our present wildlife populations.

The FWP philosophy regarding grazing management centers around the maintenance of the soil and vegetative resource. To maintain this resource, we must allow four basic biological processes to take place: photosynthesis (food production); food storage; reproduction; and seedling establishment.

While there is a wide disagreement in some circles about which grazing systems is the best, our department believes that which ever method is chosen, it must entail adequate rest. In our opinion, the minimum amount of rest is two consecutive years without grazing during the growing period. This will allow for the processes listed above to occur. We also believe that the intensity of livestock use in our opinion is not as important as timing of livestock use. Also, the more simple the grazing plan is, the easier it is to monitor and for livestock people to follow.

Variations on the amount and timing of grazing will be necessary in all systems to take care of special needs such as riparian problems or the need to leave residual forage for wildlife in certain areas. These have to be handled on a site by site basis.

Monitoring is a very important aspect of our grazing programs that we are involved with. These include direct vegetation measurements and photo plots. These measurements will establish whether the system is working and any need for adjustment in the plan. Monitoring also emphasizes compliance by the stockman with the grazing prescription.

Grazing is not allowed on a number of our game ranges where such activity would not be a benefit to the management plan for those specific sites. However, in Region Three, we are actively involved in grazing programs on four of our eight WMAs. One of these is a three pasture rest-rotation grazing program on the **Mt. Haggin WMA** during summer months. This is primarily a spring through fall elk summer range. The removal of old growth by cattle has proved attractive to elk and the herd is induced to remain on the WMA instead of on adjacent private land. The summer needs of elk are met by limiting cattle to one of three pastures during summer months when elk prefer riparian and wet meadow types. During fall there is little overall in range use between cattle and elk. Elk numbers have increase on the WMA, reproduction has been good and improvement in both riparian and upland vegetation has been documented through extensive monitoring.

On the **Fleecer WMA** elk winter range, early spring and fall cattle grazing are incorporated into the management plan. This grazing plan leaves ungrazed forage on private land available for elk. This has allowed the carrying capacity for wintering elk to increase by 25% over what could be carried on the WMA alone.

The **Wall Creek WMA** elk winter range is part of a nine pasture rest-rotation system associated with the adjacent Forest Service lands. In this situation, cattle graze a portion of the WMA prior to rapid spring vegetative growth and then move off the area. This grazed area experiences regrowth for use by elk the next winter. Cattle again come on to the WMA for a very short period in the fall. This late grazing leaves a significant amount of residual forage for wintering. Rested winter range located on Forest Service within this grazing system but off of the WMA, provides additional winter forage for elk. Fourteen hundred elk are provide with substantial forage on the WMA and adjacent Forest Service winter range each winter.

The **Robb Creek WMA** is grazed also in a nine pasture restoration system. While the final grazing plan is yet to be developed for this WMA, it will be engineered to provide for wildlife needs in a cooperative venture with adjacent Forest Service and BLM lands which will benefit elk and other wildlife on all ownerships. As with all of our WMA's, vegetative monitoring will continue to be an important aspect of the system to insure habitat maintenance.

In summary, we feel our involvement in grazing management can demonstrate what can be accomplished when good land management practices are applied. Additionally, these activities are having a positive effect on lands under other ownerships in Montana. Our department currently is in the process of or has already developed grazing programs on several private ranches. Landowners requested FWP to do this after they evaluated grazing programs on Department lands. In fact, the Wildlife Department employs a range specialist/biologist (Mike Frisina) to provide more direction in our grazing operations.

Grazing is a very important program to FWP because we are the agency responsible for management of wildlife on all habitats in Montana, both publicly and privately owned. Livestock grazing is and will continue to be a dominant land use in Montana making promotion of grazing strategies that protect the soil and vegetation the most effective way to positively effect large acreages of wildlife habitat. When the soil and vegetation are kept in a healthy and productive state, conflict between wild and domestic animal use of the same land is usually resolved.

HUNTING STRATEGIES

Reports

CHAIR: LEN CARPENTER Colorado Division of Wildlife

Who's Changing Elk Hunting?

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After World War II elk hunting became a sport for the common man. Elk on traditional ranges had recovered from 19th-century market hunting, and elk transplants were bearing fruit. There was nothing particularly right about elk management after the war; this was simply a time of plenty.

The decade of the fifties was, for some, a time worth keeping. Land and gasoline were cheap; Elvis was not only alive but still in shape. President Eisenhower and Congress spent money responsibly.

Western towns welcomed out-of-state hunters who left money and took elk. One of every three hunters killed an elk, and many of the racks strapped to the hoods of surplus jeeps straddled them.

A big surge in elk hunter traffic came in the 1960s and '70s. Hunter numbers doubled in most elk states, while animal numbers remained static. Tag sales in Arizona, Colorado and New Mexico quadrupled. These changes prompted a shortening of seasons, then "either-or" rules to limit hunters to one weapon (season). Next, Colorado and Oregon split general elk seasons to spread hunters. Washington issued tags for specific areas in the state. Finally, limits were imposed on tag sales and preference points awarded to unlucky applicants in the draw. Ostensibly the points were a stab at fairness; in practical terms, they kept hunters from quitting.

We still have plenty of elk — more, in fact, than we did before Krushchev. But by any measure our elk hunting is not so good. There are fewer private acres to hunt because some people who own elk range don't like elk hunters and others don't like elk. Still others sell elk hunting at prices most of us can't afford to pay. Public land is crowded; the proliferation of logging and fire roads enables too many people to get too close to each other and the elk.

Hunting pressure keeps mounting, partly because hunters who remember only a decade of hunting accept restrictive rules as part of the game. They're new recruits, with only the present standard by which to judge hunting. They've been encouraged by photos and stories of big bulls, by an elk hunting industry with lots to sell and by reports that there are plenty of elk to shoot. Some hunters who are not satisfied also buy tags — perhaps because hunting is habit, or because a group goes and they are a part of it.

Tag sales probably won't dive soon. But even if half of the elk hunters quit, there'd be five times as many afield as bought licenses in 1950!

To tap this strong demand, state game departments have boosted fees. A 1965 Wyoming elk tag sold, over the counter, for $150; now you pay $350 or $550 for an application, depending on the odds you accept. This is not far in theory from selling tags to the highest bidders, a policy that would alienate working-class hunters.

"Governor's permits" that entitle the buyer to special hunting privileges, or substitute for a tag that would be hard to draw, get strong hunter support because they don't affect the tag pool, and the money generated for elk programs can be substantial. This year RMEF auctioned a permit for $42,000. This is good conservation; it is also entertainment with a subtle message: Mature bulls are no longer game for people of average means.

Hikes in non-resident tag fees have brought legal challenges because most elk are shot on federal land (1970 percentages: 85 in Colorado, 88 in Wyoming, 95 in Idaho). Responding, the Public Land Law Commission wrote: "State policies which unduly discriminate against non-resident hunters and fishermen in the use of public lands through license fee differentials ... should be discouraged." It concluded that federal fish and wildlife cost-sharing programs should be offered only to states with reasonable fee differentials; but it did not define "reasonable."

In 1965 Montana charged 100 times the resident license fee to non-resident elk hunters. That may have been unreasonable; by 1980 most states were charging from 5 to 10 times the resident fee for out-of-state licenses. Montana had pared its ratio to 28:1.

Few elk hunters contest these ratios, or strictures that limit non-resident tags to a small percentage of the total. They do balk at fee increases when short seasons exacerbate crowding and almost all the bulls taken are young. Why, hunters ask, do agencies need more money to manage elk, when most herds are at carrying capacity and need only to be shot selectively to be managed?

Most hunters are willing to pay handsomely for a chance at a big bull. What frustrates them now are slim prospects for big elk on public ground. Though many hunters shoot yearlings, they buy a tag thinking about a six-point. When after many days or seasons afield they don't even see one, hunting loses some of its allure.

The importance of the six-point fantasy was demonstrated when Washington began "spikes-only" shooting in its Blue Mountain herd. Hunter numbers fell-by half, despite the fact that for many years spikes had comprised 80 percent of the Blue Mountain harvest. What apparently mattered to many hunters was not the outdoor experience or even the meat. It was a big rack on the tailgate.

Hunters who haven't shot big elk may not concede this, because to say killing is important when you have not killed means you have failed. They may instead talk like Thoreau, as if wandering about the woods during a November ice storm improved their perspective.

This isn't to say that all hunters must kill to retain their interest in hunting. Some decline shots at the biggest elk they're likely to see, waiting for a truly outstanding bull because anticipation, not the kill, brings them pleasure. Or they hunt so they can camp or pack the horses or help a youngster to his first elk. Or because they really do enjoy being afield in a November squall.

Still, most people who buy elk tags want to use them on a big bull. Sportsmen who pay outfitters $2,500 and more for a hunt are not, for the most part, paying to experience a pack trip or wilderness camp. They are gambling that the guide can show them a mature bull. Those who pay $8,000 and more for hunts on private ranches and reservations seek higher records-book scores, better odds.

A Boone and Crockett score is essentially the measure of an elk's age and genetic material. It has nothing to do with the way the bull was killed. A fine bull can be easy to take on a ranch that maintains one-to-one bull/cow ratios and limits hunter access. In contrast, a harried three-year-old elk dodging bullets on public forest, where cows outnumber bulls 12 to 1, can be as elusive as smoke. So there's no real connection between a hunter's prowess and the score of the antlers he tags.

But there is a perceived connection, reinforced by hunters who have shot big bulls and by people from publishers to elk call manufacturers who want you to think you can too. Antlers are bone-hard proof. You may have hunted well in a tough area and passed up elk another hunter would have taken. But without the antlers, it's all just talk. Even seasoned hunters who don't care about big antlers can feel pressure to produce evidence, because our obsession with big bulls derives mostly from ego, not from a detached fascination with outstanding natural specimens. It is a primal tug, urging us to prove ourselves. It is fueled by people who make money selling bullets and hunting trips to help us prove ourselves.

This race to get bigger bone is unfair, of course. There is no common start. Money makes a difference, and hunters who enter the race must be prepared to ante up. After that, good luck and an able guide often bring the bullet and the bull together. All this is dismissed by hunters who don't care how they win.

Buying a big elk is neither illegal nor immoral. But money can surely change a sport. Assessing trophy fees for sheep horns by the inch or charging more for a six-point bull than for a fivepoint is not the way the game was played by hunters who long ago fashioned the image of hunting we like to keep.

That image — of good camps, good comrades, uncrowded coverts and big bulls fairly taken —

has faded. The ballooning price of solitude and success is changing the character of "trophy hunting" to reflect the character of the privileged who can afford it. On public land big crowds chasing little bulls often obliterate with boorish behavior the values and practices that once defined hunting. We're approaching the point at which hunting with class is too costly and hunting with the masses is socially unacceptable.

This squeeze is deadly. While in our own company we who order our lives after elk seem successful and potent, nationally we get less attention than a homosexual sailor. Even if we're not bound by tradition to the 1950s, there's reason to keep hunting available to men with lunch buckets, to court a broad base of support — not only for elk and elk management, but for the shooting of elk.

During the 1970s and '80s the character of hunters came under attack by animal preservation groups like Friends of Animals. They told us we hunters are "noisy, belligerent and the dirtiest of all outdoor users." "Domineering and sadistic", we "generally shoot at anything that moves."

Reasonable people might question claims that hunting is "an act against nature", or that "it teaches callousness." But if they saw the behavior of some elk hunters, they'd quickly call for an end to the sport. Before we could defend it, we'd have to distance ourselves from the offending hunters. That's hard. We have forged the links binding hunters and hunting and game management!

Preservationists won't yet cripple elk hunting with a frontal assault. They're most effective exploiting faults in management and hunting practice, and in painting hunters as derelicts. The extremists — those who picket and obstruct — can more readily reach deer and dove hunters. If they want to attack management, it's easier to demand an accounting for depressed waterfowl populations. They lack the rationale for stopping elk hunts, and their power base is still far from elk country.

But preservationists can win by default, because in politics people count as percentages. We have as many elk in most places as we want; we are shooting as many elk as we think we can. There's no room for more hunters. Stories and hunting toys won't recruit fast enough or satisfy long enough to keep elk hunters growing as a percentage of the American people — especially as social forces move to make hunting appear brutal. Sensitive, conscientious hunters and youngsters will feel the pressure most acutely. They'll be top talking about hunting in public and the first to quit hunting. They're the people we'd best not lose. They'll hang on longer if elk managers listen to their concerns and if organizations like RMEF can sell hunting to their peers who don't hunt.

Hunters who demand higher-quality hunting usually mean less hunter traffic and more mature bulls. Closing roads and limiting tags both reduce traffic. Protecting young bulls yields more old bulls. Regulations that limit hunters to three-, four- or fivepoint bulls fall short, however; they protect only yearlings and perhaps two-year-olds. They increase pressure on the first legal age class, merely postponing the slaughter of a generation.

Colorado held an experimental season protecting spike bulls in 1971. Nearly half the branch-antlered bulls shot were yearlings; only six percent had six points per side. Post-hunt counts showed 1.7 branch-antlered bulls per 100 cows — the lowest ratio in five years. So the next year a four-point minimum was enforced. This shifted pressure from yearling elk to two-year-olds, reduced hunter success and increased the illegal take of yearlings that did not meet the point requirement.

Reversing the rule works better. If spikes are the only legal elk, bulls that survive their first season needn't dodge any more bullets. Maturing, they build a reservoir of big bulls. Raising the average age of bulls and boosting bull/cow ratios by protecting branch-antlered bulls while shooting spikes and cows also brings natural selection back into play.

In many heavily-trafficked areas, "spikes only" shooting sells surprisingly well to hunters. But those who most enjoy seeing big bulls also want to hunt where they can shoot them. Some hunters have volunteered to forego one season if the next year they'd have better hunting — for example, in an every-other-year hunt arranged alphabetically or by birthdate. But a reduction of hunter numbers by half cannot guarantee any hunter will see more big bulls or have a chance to shoot.

Hunters tend to look optimistically on regulations designed to improve their sport. It's a practical view: Once regulations are adopted, you might as well like them; and thinking they will work is like thinking of that huge bull you never see but imagine will one day ghost from the bushes. It is more hope than anticipation.

But many hunters who have stuck with the game for a generation are losing interest. They've found that measures to improve hunt quality do not guarantee more elk sightings and bigger bulls on the meat pole. They've found that drawing for tags instead of buying them, and paying more for those they win, will not bring back the hunting they remember or deliver the hunting they've been promised. They are spending more time afield to shoot less often — or are forced by short seasons to spend less time and shoot hardly at all. And they are losing their vision of The Big One.

Diminishing opportunity and higher costs will eventually discourage the most optimistic and tenacious hunters. But for now, there's demand enough for tags to sustain a sharp racheting of tag fees among game agencies. This is bad business for this business because, while it maintains revenues in the short run, it narrows the client base. If you're selling cars or diamonds, you may not need to worry that the same money comes from fewer pockets, but paring the political muscle afforded by license-buyers may someday prove fatal for agencies required to do business with legislatures.

No one has yet proposed a way to allocate licenses to the most deserving hunters — those who abide by all the rules of fair play, take only killing shots and behave with dignity and courtesy. If we first licensed these people, we'd certainly have tags left over. Tests for shooting proficiency, as done in Europe where hunters are fewer, still can't ensure ethical conduct.

Since the 1950s, themanagement of elk has become the management of hunters. By manipulating riflemen we can dictate the size and composition of our herds. Shooting, a ready throttle, remains the practical one. But now we must determine not only how many elk to take, and which kind, but who is to take them. On private land this is increasingly a business decision. A strong market for big bulls gives elk management incentives to landowners who would not otherwise accommodate or even tolerate elk. But on public forest, the hunter with two weeks vacation and a four-year-old pickup is struggling to maintain enthusiasm. The market can't be fenced in.

Disenfranchised hunters are no threat to elk; but neither are they of any use to elk managers. It is not enough, in legislative session, to justify programs solely from a biological perspective. It isn't enough to count among our allies only those who can write $40,000 checks for elk tags. The people directing game management policy will serve hunters only to the degree that hunters remain a big and articulate voting block. To that end, the hunter may have to reassess his standards, and the game agency its business strategies. This is a poor time to lose strength through attrition.

Sixteen Years of 3-Point Bull Hunting in Northeast Oregon

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Abstract: *During the early 1970's low post season bull to cow ratio and the paucity of mature bulls in the Snake River Management Unit of Northeast Oregon, resulted in a hunting regulation change from any antlered bull to 3-point or larger bull in 1977. A limit on the number of hunters was implemented in 1979 and has continued through 1992. Bull to cow ratio improved following the implementation of the 3-point regulation, but recruitment of bulls beyond the three year old age class has remained static. Sixteen years of data collected under management with a 3-point plus antler regulation are evaluated and discussed.*

The Snake River Unit (SRU), is located in the northeast corner of Oregon, bordered on the east by Hells Canyon and the Snake River. The Imnaha River drainage forms the west boundary of the Unit. Open bunchgrass slopes, large rock outcrops, and timber stringers characterize the unit. Road and vehicle access is minimal with much of the area containing steep rugged drainages and providing a rugged back country experience for elk hunters.

In the early 1960's an expanding Rocky Mountain elk (Cervus elaphus) population with relatively low annual hunter numbers afforded increased hunter success and opportunities for mature bulls. Hunter numbers increased through the 1960's to greater than 2000 bull hunters annually during the early 1970's. Bull escapement diminished during this time period resulting in annual harvests consisting primarily of yearling bulls. Concerns over the decline in branch antlered bulls and post season bull ratios prompted public and political requests for the Oregon Department of Fish and Wildlife (ODFW) to manage the SRU under a 3-point minimum antler regulation.

Bull hunting regulations and season structure during the early 1970's consisted of 19 day season in late October early November and a bag limit of one bull with antlers longer than the ears. In 1977 a 3-point regulation (3-PR) was implemented in the SRU, and season length reduced to 9 days. The regulation limited harvest to bulls having a minimum of 3 points on one antler. In 1979 the rifle bull season was divided into two hunt periods (5 and 9 days) with a quota of 500 tags issued per hunt period. In addition to the new rifle season, a 46 day August-September archery season was established with a bag limit of one elk of either sex. In 1981 the rifle tag quota was increased to 550 per hunt period. This quota remained in effect until 1991 when tag quotas were reduced to 450 per hunt period. In 1984, the archery season was reduced to 30 days and a 3-PR initiated. Archery season regulations remained unchanged from 1984-92. Regulations in units adjacent to the SRU remained the same as pre-1977 SRU regulations with the exception that seasons were divided into two periods in 1979 and hunters were required to choose which period they would hunt.

In the early 1980's, post season herd composition surveys indicated a substantial proportion of the yearling bulls in the SRU could not be accounted for although the majority of the age class should have been protected by the 3-PR. ODFW initiated a study in 1984 to gain information regarding the loss of yearling bulls. During the springs of 1984-86 a total of 45 bulls were radio collared in the SRU. The movements of these bulls were monitored from 1984 to 1990. Radio monitoring indicated a significant portion of the bulls were moving into adjacent units to spend the summer and early fall and returning to the SRU to winter. Consequently, many bulls were being harvested in adjacent units (Anonymous, 1988).

Annual population surveys indicate the wintering population of elk in the SRU has doubled since the early 1970's. In 1987 5200 elk were estimated to be wintering in the SRU; however, since then

the population has been reduced to a 1992 estimate of 4,200 elk. The reduction in elk numbers in the SRU resulted from management objectives adopted by the Oregon Fish and Wildlife Commission in 1982 which set upper limits on unit herd sizes and required ODFW to control population levels of wintering elk.

In this paper we discuss the results and consequences of the 3-PR with respect to: 1) the response in the bull:cow ratio, 2) recruitment of older aged bulls into the population, 3) age structure of bulls in the harvest, 4) effect on hunter recreation, and 5) the effectiveness of this regulation with bull interchange between adjacent units.

We thank Walt Van Dyke, Chris Carey, Leonard Erickson, Ron Bartels, and Marty St. Lewis for their work obtaining herd composition information and field harvest data. The piloting expertise of Bud Stangel and Joe Spence is appreciated. Bill Knox provided helpful review comments and Rosemary Peterson typed and retyped the manuscript.

STUDY AREA

The SRU lies in the very northeast corner of Oregon, and encompasses 640 km of primarily timber and rangeland. Ninety three percent of the unit is publicly owned and managed by the United States Forest Service. Since 1976 the area has been managed under National Recreation Area designation. The unit is lightly roaded and characterized by steep rugged drainages, with elevations ranging from 400 m to over 2100 m. Annual precipitation ranges between 25 cm and 100 cm with most received at higher elevations.

Low to mid elevations are characterized by steep sloped grasslands alternating with vertically oriented timber stringers. Grasslands are dominated by bluebunch wheatgrass (Agropyron spicatum), Sandburg's bluegrass (Poa sandburgii), and Idaho fescue (Festuca idahoensis). Northerly aspects consist primarily of Douglas fir (Pseudotsuga menziesii) in association with ninebark (Physocarpus capitatus), and scattered Grand fir (Abies grandis) and ponderosa pine (Pinus ponderosa) near stream bottoms. Grand fir and subalpine fir (Abies lasiocarpa) dominate high elevation timbered areas.

METHODS

Sex and age composition information was obtained by post season surveys from a Piper Supercub aircraft. Bull elk were classified as yearlings, medium (2.5 - 3.5 year old), and mature (4.5 + years old). Total elk counts were also recorded during these flights and used to derive winter population estimates. Flight procedures for herd composition and population estimation are described by Coggins (1986). Bull harvest information was obtained from annual statewide harvest surveys (ODFW 1971-93). In addition, from 1986-92, special efforts were made to contact SRU hunters in the field and through road check stations. Harvested bulls were aged based on presence or absence of deciduous teeth, tooth eruption, and tooth replacement. Additional information concerning bull mortality, age at harvest, movements, and harvest outside the SRU, was obtained by tracking radio collared animals.

RESULTS

Herd Composition and Bull Ratios

During years without 3-PR regulations (1971-1976) post season antlered bull ratios averaged 4.5 per 100 cows (range 1-7, Fig. 1). Following the first season of 3-PR bull hunting (1977) the bull ratio increased to 11 per 100 cows, and consisted of 94% yearlings, 5% medium (2.5 -3.5 year olds), and 1% mature (4.5 - year olds) bulls (Fig. 2). Post season bull ratios, under the 3-PR and limited tag quotas (1979-1992), averaged 11.5 bulls per 100 cows and varied from 8-16 (Fig. 1). There was no trend up or down in the number of bulls per 100 cows between 1977 and 1990. In 1991 and 1992 bull:cow ratio improved slightly after the hunter tag quota was reduced by 200. During the 1977-92 time period yearling bulls accounted for an average of 84% of the bulls classified, while medium and mature bulls accounted for 13% and 3%, respectively. Although the proportion of medium bulls increased following implementation of the 3-PR, the percentage of this age class has remained static since 1980. The number of mature bulls also remained static, with no evidence of increased recruitment within the bull segment of the population (Fig. 2).

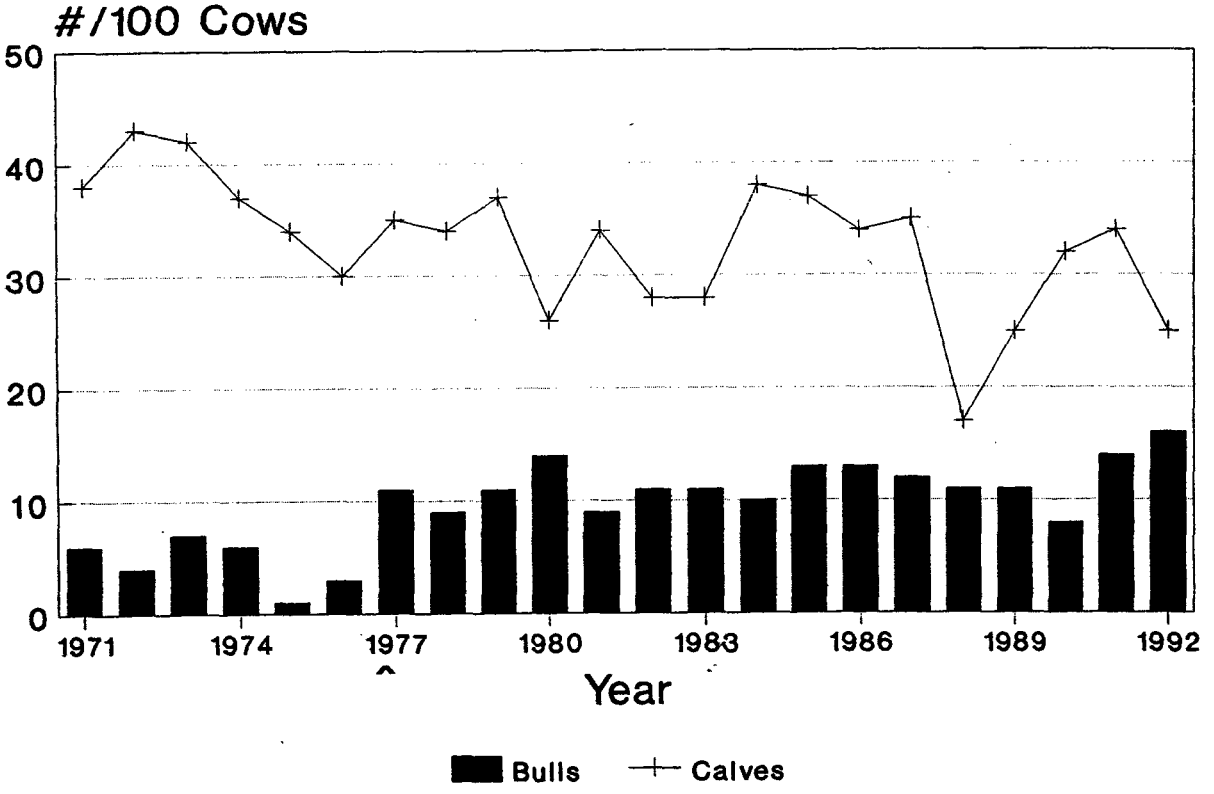

Figure 1. Post season bull:cow and calf:cow ratios in the Snake River Management Unit, 1971-92.

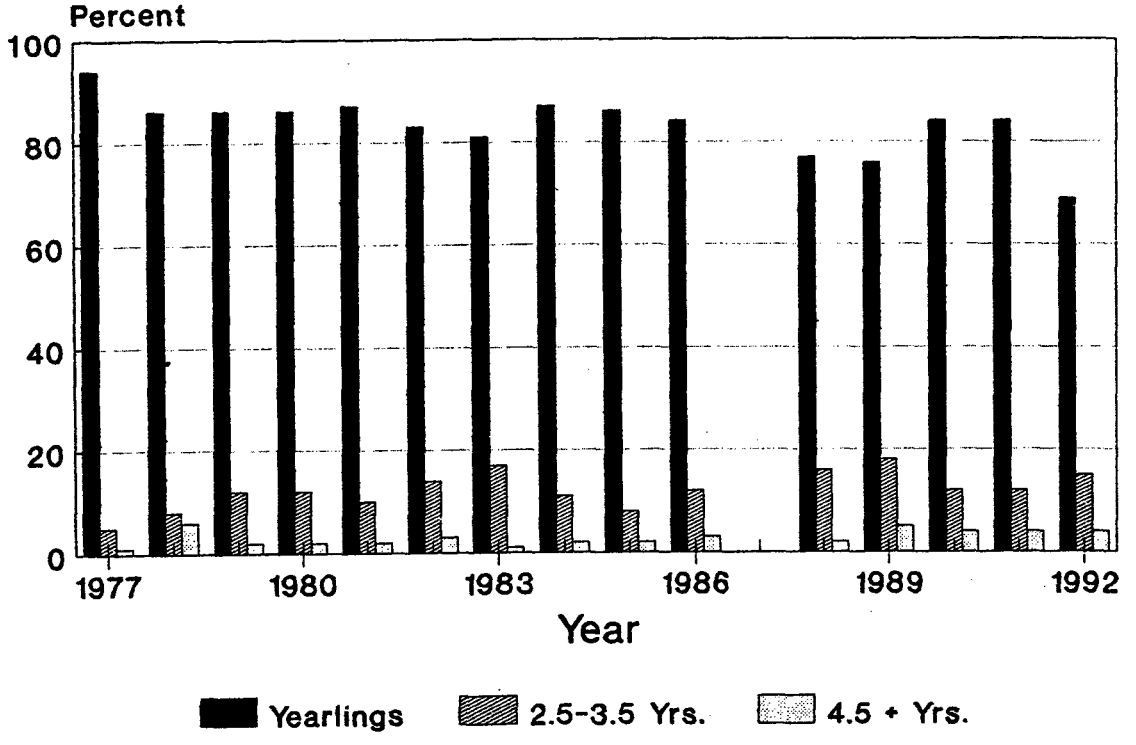

Figure 2. Percent of bulls within each age class from post season classific ation surveys, Snake River Unit, 1977-92.

Calf Recruitment

Information from late winter classification surveys indicated a downward trend in calf:cow ratios (Fig. 1), despite a two fold increase in bull:cow ratios after the 3-PR was initiated. The average number of calves/100 cows prior to 1978 was 37, while between 1978 and 1992 the ratio averaged 31 calves/100 cows.

Bull Harvest

Annual harvest prior to the 3-PR averaged 243 bulls and ranged from 217-285 (Fig. 3). In 1977 (3-PR initiated) total bull harvest decreased, but harvest increased in succeeding years following protection of the yearling age class. The 1977 decline was due to the paucity of 2.5 year old bulls, because of low yearling escapement in previous years. From 1978-92 annual harvest varied considerably from 127-259 bulls, with an average of 187. Average annual bull harvest was considerably lower following the 3-PR than during years with any bull regulation (Fig. 3).

During 1986-92, 29% of the annual estimated bull harvest was observed by ODFW personnel during hunter field checks. Yearling bulls accounted for 2% of the observed harvest, while 2.5 and 3.5 + year olds accounted for 81% and 16%, respectively (Table 1). A slight increase in the percentage of 3.5 + year olds observed in the harvest in recent years may have been due to the reduction in available bull tags, and limited hunter quotas in adjacent units during 1991 and 1992.

Radio Collared Bulls

A total of 45 bulls (39-10 month olds and 6-1.5 year olds) were collared in the SRU during 1984-86. Thirty- three percent of the marked bulls (15 of 45) were legally harvested within the SRU in succeeding years, while 40% (18 of 45) were legally harvested outside the SRU in adjacent management units under any antlered bull harvest regulations (Table 2). Seventy-three percent (11 of 15) of the bulls legally killed in the SRU were harvested as 2.5 year olds, and no collared bulls lived beyond 5.5 years of age. Illegal harvest of radioed yearling bulls, within the SRU, averaged 10% (4 of 39) annually. Of the 18 bulls legally killed outside the SRU, 39% and 44% were harvested as yearlings and 2.5 year olds, respectively. Among the 39 bulls collared as yearlings, combined mortality accounted for an average of 33% (13 bulls) annual mortality within that age class.

Table 1. Percent of harvested bulls in each age class from hunter field checks in the Snake River Unit, 1986-92.

		Age Class		
Year	n[a]	1.5 (%)	2.5 (%)	3.5+ (%)
1986	66	4	85	11
1987	35	0	97	3
1988	42	5	57	38
1989	78	3	87	10
1990	72	3	82	15
1991	41	0	83	17
1992	58	0	79	21
Avg.	56	2	81	16

[a]Number of bulls checked.

DISCUSSION

Post season classification surveys indicate the 3-PR accomplished the objective of increasing bull:cow ratios by protecting yearling bulls. Similar findings have been reported by Boyd and Lipscomb (1976), Vore and DeSimone (1991). From 1977-90 there was no apparent trend in SRU bull ratios. Annual variations were likely a product of the number of bulls harvested outside the SRU and calf recruitment from the previous year. Information from radioed bulls suggests the overall ratio would have been higher if the yearling bulls had not been harvested outside the SRU.

Classification surveys and hunter field checks suggest that during the past sixteen years the point regulation has not effectively increased the number of mature bulls in the population. Similar results were reported by Boyd and Lipscomb (1976). Rocky mountain elk generally attain 4-5 antler points as two year olds and become legal for harvest. In addition, yearling bulls which have 3-points on a spike type antler are occasionally harvested. Yearlings with this type of development are believed to be animals with genetically superior antler characteristics but are removed from the population reducing the opportunity for these desirable traits to be passed on. The 3-PR regulation results in transferring the majority of the bull harvest from yearlings to two year olds. Further reductions in available bull tags in the SRU, coupled with limited hunter quotas during first period hunts in adjacent units (initiated in 1991), probably accounts for the slight increase in post season bull ratios and three year old age class observed in the 1991 and 1992 harvest.

Table 2. Fate of 45 bull elk radio collared in the Snake River Unit, during winter 1984-86.

	Legal Harvest		Illegal Harvest		Natural		Collar
Age	SRU (%)	Out[a] (%)	SRU (%)	Out[a] (%)	SRU (%)	Out[a] (%)	Failure (%)
1.5		7 (16)	4 (9)		2 (4)		1 (2)
2.5	11 (24)	8 (18)				1 (2)	1 (2)
3.5	1 (2)	1 (2)		1 (2)			2 (4)
4.5	2 (4)	1 (2)					
5.5	1 (2)	1 (2)					
Total	15 (33)	18 (40)	4 (9)	1 (2)	2 (4)	1 (2)	4 (8)

[a]Mortalities occurred outside of Snake River Unit.

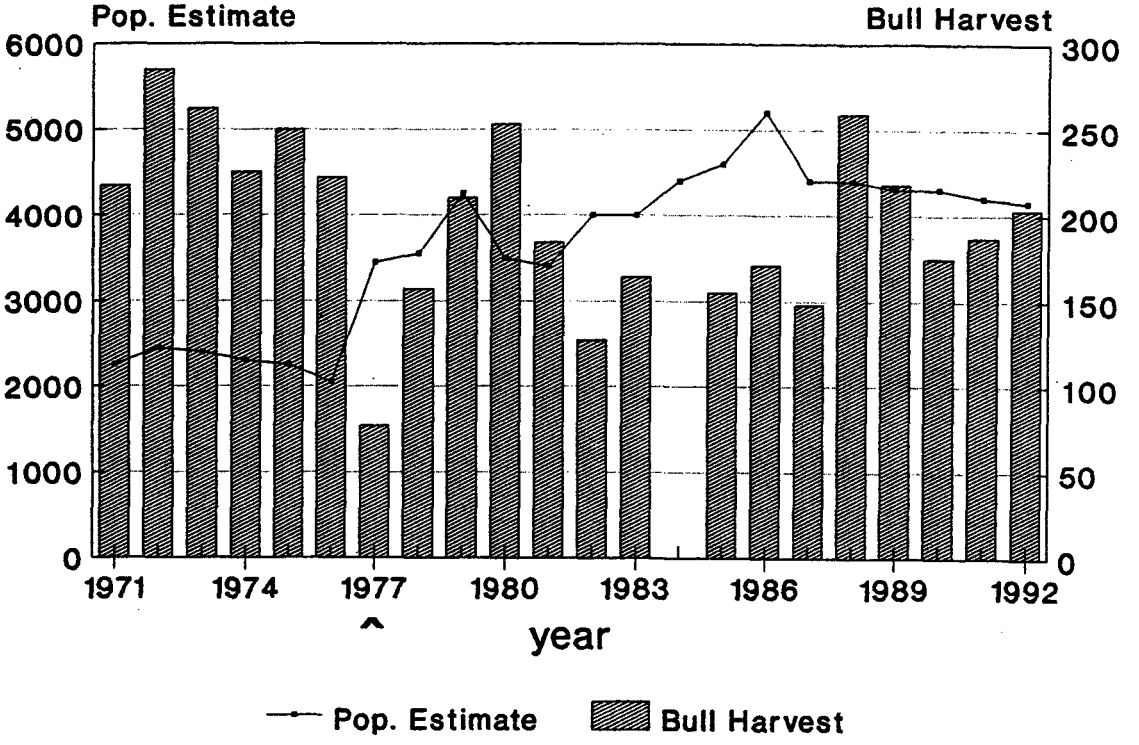

Figure 3. Annual hunter harvest of bull elk, and winter population estimates of elk in the Snake River Unit, 1971-92. No harvest survey conducted 1984..

A major consideration when managing harvest rates is the regulation of hunter numbers and/or pressure in relation to the habitat characteristics of the area and desired composition of the harvest. Although a quota on hunter numbers has been maintained since 1979, hunters have effectively harvested the majority of legal bulls annually. Despite the rugged terrain and lack of roads in the SRU, bulls remain vulnerable to hunters due to the extensive open slopes and lack of adequate hiding cover. Furthermore, regulations which allow hunters to legally harvest one bull have been difficult to enforce. Many hunters after legally tagging a bull will continue to hunt and harvest additional bulls for their hunting companions to tag. This sort of hunter ethic further reduces bull escapement.

Radio monitoring suggests average annual illegal kill of yearlings bulls in the SRU (10%) was considerably lower than that observed in the Elkhorn Mountains of Montana (34.8%) under a branch antler bull regulation (Vore and DeSimone 1991). Perhaps the fewer number of hunters (hunter quota) in the SRU may explain the reduced incidence of sublegal mortality.

Total annual bull harvest was lower in years following implementation of the 3-PR despite increases in total elk population. This was believed to be a function of the total number of legal bulls available. Radio monitoring of SRU bulls indicated a higher proportion of two year old bulls leave the unit than yearlings (Anonymous, 1988). Therefore, among bulls which remained in the SRU and were protected by the 3-PR as yearlings, 20% of these bulls migrated from the unit as two year olds, reducing the number of legal bulls available for harvest.

Public pressure to maintain the 3-PR has centered around the misconception that the regulation increases the number of mature bulls. In addition, most hunters are satisfied with the regulation since it provides ample opportunity to harvest branch antlered bulls. Most northeast Oregon Units do not provide this type of opportunity. Future management strategies in the SRU are to maintain bull ratios at management objective levels and improve survival to older age classes, while optimizing hunter opportunity and harvest. Management success will depend on regulating hunting pressure and garnering public support for change. Vore and DeSimone (1991) have demonstrated that application of a spike bull season coupled with limited branch antlered bull hunting in the Elkhorn Mountains was effective in providing hunter opportunity, harvest, increased bull ratios, and recruitment of older bulls. The Washington Department of wildlife has reported similar results with this type of regulation (Pat Fowler, pers. commun.). A spike/limited branch bull season is currently being evaluated in other northeast Oregon units. Achieving desired results and hunter acceptance of this regulation will largely determine the potential application in the SRU.

In summary, the 3-PR effectively increased the bull:cow ratio in the SRU, but did not improve the recruitment of mature bulls into the population. Two year old bulls comprise the bulk of the harvest with minimal escapement beyond this age class. Total hunter numbers and bull harvest has been reduced despite increases in the SRU elk population. Because a portion of the bulls migrate in and out of the unit, future management schemes employed in the SRU will also need to be implemented in adjacent units to achieve desired bull composition and hunter opportunity.

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Older Bulls - Who Needs Them?

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Abstract: The absence of older bulls in many of our hunted elk herds has resulted in considerable concern and discussion. The literature indicates that in herds where young bulls dominate breeding pregnancy rates may be sightly reduced and conception dates may be delayed a month. However, there is inconclusive evidence that calf production or recruitment are significantly affected. Information from the Elkhorn Mountains indicates that although total bulls were increased by over 4 times and older bulls increased by over 40 times, no significant increase in calf production and recruitment was recorded. Concerns over long term evolutionary consequences of young bull breeding are discussed including disruption of social organization, loss of the rutting behavior of mature bulls and the interruption of the natural selection process. Evidence from the Elkhorn Mountains suggests that wildlife agencies may have overstated concerns that managing for older bulls will result in the loss of hunter opportunity. The decision to manage for mature bulls will probably not be made on the basis of hard science but on the basis of human values and our desire to preserve an important part of our wildlife heritage.

In recent years there has been considerable discussion about the loss of older bulls in many of our hunted elk herds and the biological consequences of having young bulls as the dominant breeders. In herds where older bulls have been eliminated, concern has focused on potential changes in pregnancy rates and conception dates and ultimately calf production and recruitment. Several authors have also speculated on possible effects on the evolutionary process, behavior, ecology and social well-being of herds where older bulls are absent (Geist 1982, 1991, Peek 1985, Bubenik 1982, Cowan 1974).

In many of our hunted elk herds, few bulls live to physical and sexual maturity. Heavy harvest of bulls is a function of vulnerability resulting from increases in hunter density, hunter efficiency, and loss of habitat security, primarily due to increased roading and loss of cover through timber harvest. Agencies responsible for managing elk are often reluctant to manage for older bulls because they fear that restrictions necessary to allow older bulls to survive will result in a loss of hunter opportunity.

This paper reviews literature dealing with the biological effects of breeding by young versus older bulls and presents information from a 10 year study in the Elkhorn Mountains of south-central Montana about changes in calf production after numbers of older bulls were substantially increased. In addition, we monitored changes in hunter opportunity (numbers of hunters, number of hunter recreation days, and bull harvest) before and after changes in hunting regulations and increases in numbers of bulls. In the Elkhorns, hunting was allowed for all antlered bulls through 1985, during 1986 hunting was restricted to branch-antlered bulls, and since 1987 spike bulls were open to all hunters while harvest of older bulls was controlled through permits.

CALF PRODUCTION CONCERNS

Information from some studies of free-ranging elk indicated that pregnancy rates were lower in herds where older bulls were few and yearling bulls probably did most of the breeding. Work on Roosevelt elk in Washington (Smith 1980) indicated that pregnancy rates significantly declined (77% to 61%) at the same time the number of preseason branched bulls declined from 8 to 5 per 100 cows. Additional work on Roosevelt elk in Oregon (Hines et al. 1985) also reported lower pregnancy rates (67% versus 47%) when the number of preseason branched bulls were low (39 versus <1 per 100 cows). Studies of Rocky Mountain elk in Utah (Squibb et al. 1991) also indicated that pregnancy rates tended to be higher in an area with 41 bulls per 100 cows preseason versus another area with 15 bulls per 100 cows and few older bulls.

Similar to pregnancy rates, conception dates tend to be later in herds with predominantly yearling sires (Squibb et al. 1991, Hines et al. 1985). Hines and

Lemos (1979) reported that among captive elk, yearling sired births peaked in early July while mature sired births peaked in late May. Other captive elk studies in Utah indicated that yearling bulls were sexually active 1 month later than mature bulls (Prothero et al. 1979). Conception and calving dates were estimated to be 4 to 6 weeks later in cows sired by yearlings.

Several studies demonstrated an interrelationship between the lack of older bulls and declines in pregnancy rate and later conception dates; however, little evidence has convincingly related the lack of older bulls to declines in calf production, survival, or recruitment. A review of information collected on Colorado's White River herd (Freddy 1987) suggested a significant decline in postseason bull per 100 cow ratios from 13 to as low as 4. During the same time there was a significant decline in postseason calf per 100 cow ratios from 57-62 to as low as 43. Although a possible relationship between declining bull and declining calf production was suggested by the data, the author concluded: (pg. 1) "The definitive cause of declining postseason calf:cow ratios...could not be determined...declining nutrition as related to increased numbers of elk was hypothesized as the most likely factor affecting reproduction in the White River elk population."

Studies of elk in the Gravelly Mountains of Montana (Hamlin and Ross 1991) indicated that postseason bull per 100 cow ratios increased from lows of 2 to 3 to about 15. During the same time calf per 100 cow ratios increased from lows of 25 to around 50. Although numbers of males and calves increased in later years of the study, the authors indicated that other factors were involved and concluded: (pg. 247) "We could not document a convincing relationship between numbers of breeding bulls and calf production and survival".

After change from open bull hunting (1982-85) to the spikes legal/older bulls by permit regulation (1987-93) significant increases in the number of bulls in the Elkhorn Mountains were recorded (Fig. 1). During this time, the average number of bulls postseason increased from 2 to 10 per 100 cows (X^2=314.5,P=000, 1df) and the number of bulls older than yearlings increased from 0.1 to 5 per 100 cows (X^2= 287.9,P=.000,1df). During this same time period the average number of calves per 100 cows slightly increase (32 versus 37) (Fig. 1) although not significantly (X^2=2.04,P=.153,1df).

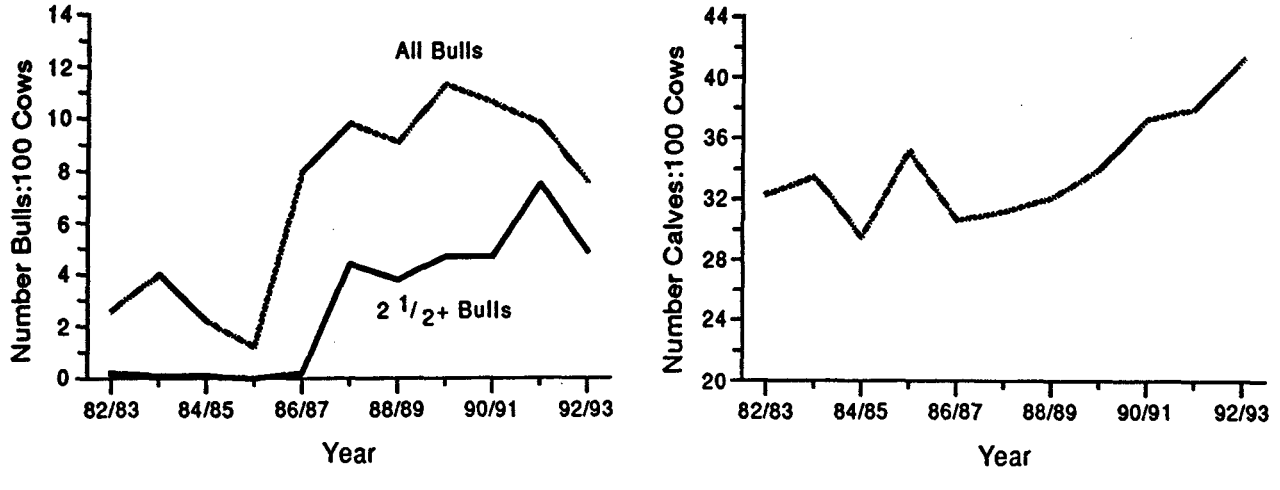

Figure 1. Trends in bull and calf ratios in the Elkhorn Mountains

In summary, there is some evidence in herds where young bulls dominate breeding that pregnancy rates may be slightly reduced and conception dates in some cows may be delayed by 1 month. However, there is little evidence to convincingly demonstrate that net calf production and survival is reduced.

HUNTER OPPORTUNITY CONCERNS

Wildlife agencies have traditionally managed with the philosophy of emphasizing hunter opportunity by encouraging liberal hunting regulations that maximize hunter participation and game harvest. This philosophy worked well until recent years when increasing elk vulnerability led to substantial declines in the number of older bulls. In many parts of the West numbers of mature bulls (6 to 8 years of age) per 100 cows are probably as low as have occurred. Agencies are hesitant to manage for more mature bulls primarily because of concerns over loss of hunter opportunity.

The change to the spike regulation in the Elkhorn Mountains resulted in an increase of over 4 times the number of total bulls in the herd postseason and an increase of over 40 times in the number of bulls older than yearlings. After 7 years of this regulation, 6 to 8 year old bulls occur in the hunter harvest and are breeding cows.

A question often asked is: "What has been the cost in hunter opportunity in order to return mature bulls to the Elkhorns?" The statewide harvest survey (Fig. 2) indicates an initial decline in hunter numbers after the new season was implemented, although numbers of hunters returned to former levels (1982-85) after 2 years. Since 1989, the number of hunters has increased each year. In fact, the rate of increase in Elkhorn hunters since 1989 is over twice the rate of increase in elk hunters for the entire state (Fig. 2). Trends in elk hunter days and bull harvest for the Elkhorns (Fig. 3) are similar to the trends in number of hunters. The most recent information (1992) indicated the highest number of hunters, hunter days, and bull harvest ever recorded in the hunting district (Fig. 2,3). Recently, one of the highest densities of elk hunters, hunter days and bull harvest in the state of Montana has been recorded in the Elkhorns.

In summary, information from the Elkhorns provides evidence that the concern over managing for older, mature bulls will lead to loss of hunter opportunity has been at least partially overstated. We do not want to oversell the spike season that has worked in the Elkhorns, but do challenge the commonly held belief that additional regulation automatically results in loss of hunter opportunity as traditionally measured by hunter participation and harvest levels.

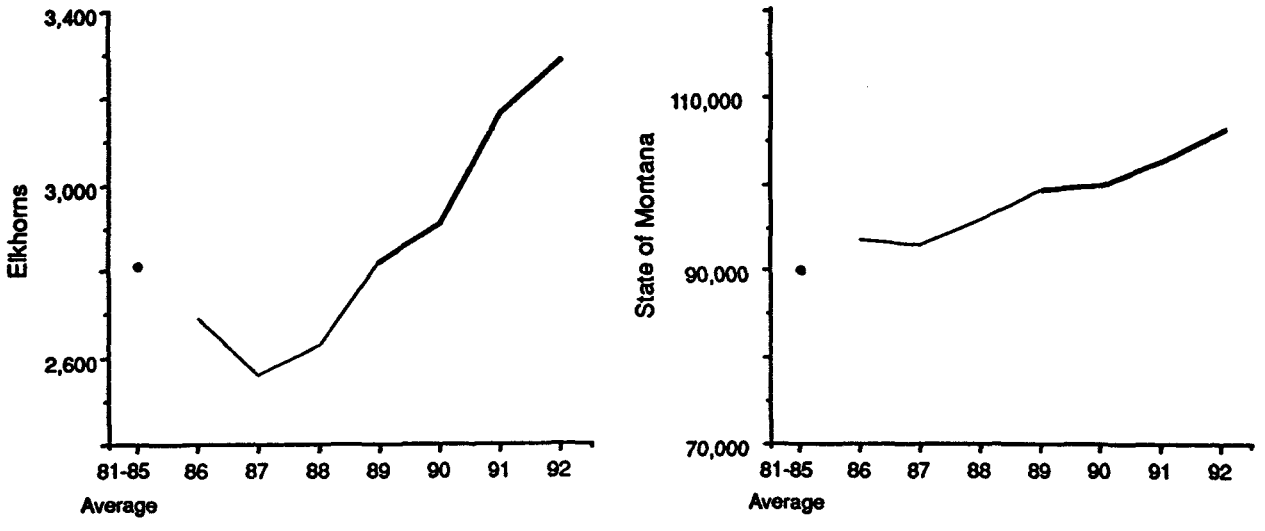

Figure 2. Trends in numbers of elk hunters.

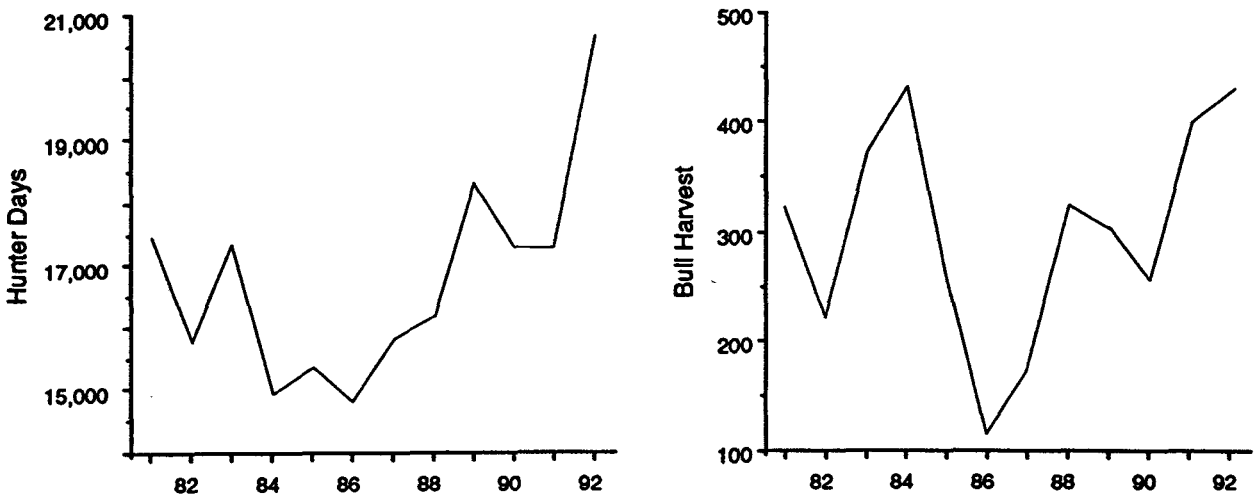

Figure 3. Trends in hunter days and bull hravest in the Elkhorn Mountains.

EVOLUTIONARY CONCERNS

How are social organization, rutting behavior and the natural selection process affected in herds where older bulls are no longer present and young bulls dominate breeding? In order to address this question it is important to summarize some of the knowledge of elk ecology from studies of populations with 'naturally' occurring age and sex ratios.

Information from 7 national parks (Table 1) indicated that nonhunted elk populations usually had approximately 50 antlered bulls per 100 cows, and about two-thirds of the bulls were older than yearlings. This adult sex ratio is similar to those found in the studies of unhunted European red deer where approximately 2 females per male have most commonly been reported (Mitchell et al. 1977, Lowe 1969).

In an attempt to maximize hunter participation and bull harvest, hunted elk herds usually carry far fewer bulls than occur 'naturally'. An example is the Elkhorn Mountains' elk herd where bull per 100 cow ratios averaged only 2 postseason and less than 5% of these bulls were older than yearlings during the early 1980s prior to changes in hunting regulations (Fig. 1). This herd had only 5% of the total bulls and 1% of the older bulls typically found in unhunted herds (Vore and DeSimone 1991). In contrast to North America's game management approach, European managers attempt to optimize trophy size and perturb adult bull per cow ratios the opposite way by aiming for ratios approximating 1 bull per cow (Ueckermann 1982, Mitchell et al. 1977).

Table 1. Bull ratios reported in National Parks.

NATIONAL PARK	YEARS	AUTHOR	BULLS:100 COWS	BAB: 100COWS
Yellowstone	Prior to 1956	Houston, 1982	47	39
Theodore Roosevelt	1985-1988	Westfal et al, 1989	44	26
Jasper	1957-1967	Flook, 1970	43	26
Banff	1957-1967	Flook, 1970	46	34
Waterton Lakes	1957-1964	Flook, 1970	58	32
Olympic	1976, 1977, 1979	Smith, 1980	43	28
COMBINED			47	31

Bull elk attain physical, social and sexual maturity between 6 and 8 years old (Flook 1970, Clutton-Brock el al. 1982, Bubenik 1982). Bulls are known to live to about 15 years (Flook 1970) although bulls much older than 10 are usually considered past their prime. From birth to age 5 there are substantial increases in body size, weight, and antler growth (Flook 1970, Clutton-Brock et al. 1982). Growth continues at a slower rate after age 5.

In herds with unperturbed age and sex ratios, the peak in fighting success and harem size usually occurs between 6 and 10 years old and most bulls rut for 3 to 5 years (Clutton-Brock et al. 1982). Bulls under 4 or 5 years old usually do not hold harems (Clutton-Brock et al. 1982, Struhsaker 1967). Although yearling bulls are capable of breeding cows (Lincoln 1971, Conaway 1952), cows usually aggressively reject advances of yearling bulls during the rut (Clutton-Brock et al. 1982). In fact, during the many years of studying red deer on the isle of Rhum biologists did not observe a free-ranging cow mating with a bull less than 5 years old (Clutton-Brock et al. 1982).

Reproductive success of bulls is closely related to their fighting ability which was strongly correlated with age, body size, body weight, and antler growth (Clutton-Brock et al. 1982). To attain physical characteristics necessary for fighting success a bull must be a successful forager and be able to conserve energy and health (Geist 1982). Bulls that have learned to adapt successfully to local environments grow the largest, are successful in fighting and are assured of reproductive success (Geist 1982). Even in herds with a full complement of bulls, very few actually participate in breeding. The work on Rhum indicated that in any year nearly 50% of all bulls 4 years and older failed to breed and that only about 5% of the breeders sired more than 4 calves (Clutton-Brock et al. 1982). Reproductive success, therefore, is assured for only those few bulls that live long enough and successfully exploit local environmnets to attain physical, social, and sexual maturity and dominance. This evolutionary process is interrupted in herds where bull numbers have been substantially reduced. In these herds a much higher percentage of a particular age cohort participate in breeding.

In order to learn what experts had to say about this issue, in 1987 Terry Lonner, who headed elk research in Montana at the time, wrote letters to several well published authorities on ungulate ecology. A question asked of these experts was: "What do you think the biological and evolutionary ramifications are if we don't manage for larger and older bulls in our elk populations?"

Valerius Geist: *"The biological ones would be a reduced body and antler growth rate, and increased natural mortality of the surviving bulls...The evolutionary implications are likely to be trivial."*

Anthony Bubenik: *"By harvesting only the juvenile males, and not having prime males, you expose the population to the danger of behavior, and genetical deterioration, with low recruitment, low fitness and overall resistance to infections, low body weights and inadequate antler quality."*

Richard Goss: *"...if the hunting sector is allowed to select out mature bulls, such mating as may still occur will not perpetuate those qualities in the population that will yield larger racks and more robust animals. Whenever artificial selection substitutes for natural selection, the genetic wellbeing of the population suffers...By allowing hunters to eliminate older males, you inevitably subvert evolution."*

In summary, in herds where young bulls dominate breeding, social organization is disrupted, rutting behavior of mature bulls is reduced or entirely lost, and the natural selection process is interrupted.

DISCUSSION

Elk managers have a compulsion to be good scientists and to look at the question of the necessity for older bulls from a objective and analytical perspective. This approach may indicate that total dependence on yearling bulls as sires is not a good idea. Available evidence, however, indicates that bulls 2 years of age can effectively accomplish breeding and maintain calf production. Hunters complain about the absence of older bulls but are often satisfied with harvesting 2 year olds. Managing for 6 to 8 year old bulls in our elk herds cannot be justified very effectively from a short term biological perspective. In addition, older bulls with larger antlers are a result of

natural selection (unless Charles Darwin was wrong) although any attempt to measure what their loss could mean in an evolutionary sense may not only be impractical, but impossible. So why manage for physically, socially, and sexually mature 6 to 8 year old bulls? The answer to this question may not lie in the realm of hard science, but rather in the realm of human values.

Biologists are uncomfortable addressing the issue of the need for older bulls from a human value perspective and usually try to confine the argument to hard scientific evidence. However, human values are at the heart of wildlife management (Livingston 1981) and at the heart of our wildlife heritage. Sixty years ago Leopold (1933) wrote: (pg. 392) "But it is not merely a supply of game, in the strictly quantitative sense, that is in question. The conservation movement seeks rather to maintain values in which quality and distribution matter quite as much as quantity." The incredible success of wildlife restoration in North America was brought about through human values desiring to preserve a link to our cultural past.

The necessity of maintaining older bulls in our elk herds is not only an issue of human values but an issue of what biological standards are we setting for our wildlife? The question is one of the degree of wildness (wild wild, mild wild, defiled wild) (Lonner 1991). Elk have the most spectacular rut of any member of the deer family (Geist 1991). Bull elk boldly advertize by bugling, wallowing, thrashing, posturing, and fighting. Elk managers need to ask themselves if the incredible drama of the elk rut is going to be limited to national parks, private ranches, and a few isolated herds.

Hunters in the Elkhorns and elsewhere have a strong desire to hunt elk each year and are usually thrilled with harvesting any elk. However, most hunters also dream of seeing, hunting, and possibly harvesting a mature bull at least a few times in their life. The successful season structure in the Elkhorns probably represents one of many possible strategies to maintaining older, mature bulls (6 years and older) while allowing abundant hunter participation.

Success in managing for older bulls is not measured in hunter harvest statistics but in the quality of our life. Simply knowing that older bulls are out there improves the quality of life for many people. Spiritual solace is provided to many of us when all the spectacular attributes of bull behavior are taking place each year and our elk herds are being sired by mature bulls like they have been for thousands of years.

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Control of Michigan's Elk Population and Bull-To-Cow-Ratios Through Antlered and Antlerless Harvest Quotas

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ABSTRACT: *Elk hunting has been offered to the residents of Michigan on an annual basis since 1984. These controlled hunts have been designed to regulate the overall elk population to reduce agricultural and forest regeneration conflicts yet maintain enough prime-age bulls for viewing opportunities. An overall winter population of 800-900 elk has been recommended within four management units. Specific quotas for numbers of bulls and antlerless elk to take during the hunts in each unit are determined and evaluated using a computer program that simulates the Michigan elk herd and is validated by aerial and ground censuses. Limited numbers of Antlerless-only and Hunter's Choice licenses are offered in each hunt in an approximate 2:1 ratio. Cows and calves are legal for the holder of an Antlerless-only license. Any elk is legal with a Hunter's Choice license, but bulls are almost always the "choice". High rates of hunter success (>90%) are achieved. In parts of the range, elk population size has been reduced or stabilized, while still maintaining high bull-to-cow (60:100) ratios in the herd. This paper will focus on the advantages of having separate bull and antlerless elk quotas and the precision that can be developed by having two types of elk hunting licenses.*

INTRODUCTION

The re-establishment of elk in Michigan began in the early part of this century. Herd growth was relatively constant and may have peaked in the late 1940's and 1950's. By 1963, the population was estimated at 1,500 elk, and the herd became the subject of considerable public debate (Moran 1973). Elk were a popular attraction to a growing tourist industry, but increased range damage and agricultural crop depredations created conflict. In an attempt to control elk numbers, two regulated hunts were held in 1964 and 1965 with a combined removal of 452 elk (Moran 1973). Illegal shooting and encroachment of human development had a substantial impact on the herd. A combined ground and air census in the winter of 1975 was estimated to include only 200 elk. With increased law enforcement and public education efforts and improved habitat management primarily for white-tailed deer, the herd decline was reversed. In January 1984, 850 elk were estimated in the winter herd. Again, complaints of damage to crops and forest regeneration suggested a need for population control, but a strong interest in elk-related recreation and the public's concern for herd protection required careful considerations. In 1984, the Michigan Natural Resources Commission approved an elk management plan with a goal of "a viable elk population in harmony with the environment, affording optimal recreational opportunities" (MDNR 1984). One of the options recommended in the plan was recreational hunting as a tool for population control. In December of 1984, a very limited hunt was carried out. The controlled hunts were expanded in area, number of licenses, and season dates, and have been continued annually. The use of antlered and antlerless harvest quotas has been an integral part of these hunts. The emphasis has been on the harvest of cows and calves to depress elk population size. Control of the bull harvest has maintained that segment of the population in demand by the viewing public. This report will explain the concept of Hunter Choice and Antlerless-only licenses presently used in Michigan elk hunts.

BACKGROUND

The elk range is located in northern lower Michigan and includes parts of Montmorency, Otsego, Cheboygan and Presque Isle counties, totaling approximately 820 square miles. State ownership comprises about 50% of the area and is managed by the Michigan Department of Natural Resources for multiple purposes. Most is gently rolling forest land with interspersed components of big-toothed and trembling aspen, northern hardwoods (sugar maple, beech), upland pine (natural and plantation red, white and jack), lowland conifers, and grassy openings. Average annual snowfall is almost 100 inches with normal snow depths reaching 20-24 inches. High quality cold-water trout streams traverse the area. Non-industrial private land makes up the other half of the range and is characterized by rural residential and seasonal recreational properties and cash-crop farms. Individual holdings range in size from a few acres to 12,000 acres. Timber management is common on both private and public land. Oil and gas development is scattered throughout and a unique development agreement with this industry on a portion of the range has benefitted elk management (MDNR, 1982).

The area is divided into four elk management units (Fig. 1). These units have unique characteristics and roughly represent discrete elk populations. In 1988, winter population objectives were recommended for each of the management units for a total of 800-900 elk (Table 1). Outside these boundaries, the objective is to have no elk. The population goal within each unit was reached by evaluating habitat conditions, elk population dynamics, and giving consideration to human tolerance levels. Hunting zones, season dates, and antlered and antlerless harvest quotas are individually tailored for these units on an annual basis.

While no formal objective has been posed for a bull-to-cow ratio, it is believed that about 60 adult bulls to 100 adult cows is desirable in the Michigan elk herd. The rationale for maintaining this high ratio, relative to herds in western states, is that a larger herd with lower recruitment provides good opportunity to view mature bull elk. The biological ramifications of such a ratio may be an interesting investigation.

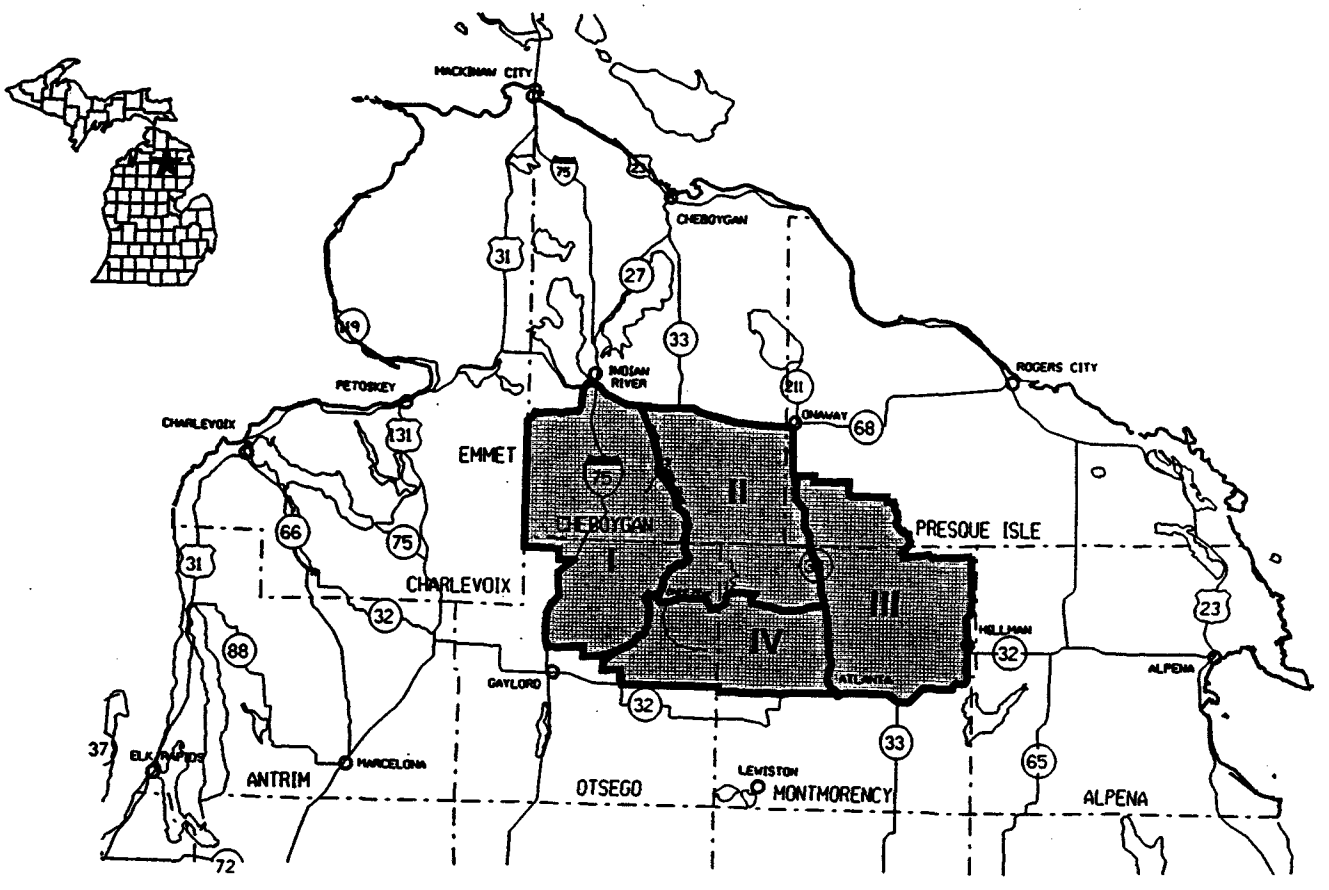

Figure 1. Elk Management Units in Michigan.

Table 1. Winter population objectives for elk management units in Michigan.

Unit	Number of Elk
I	250-275
II	170-200
III	80-100
IV	300-325
Total	800-900

METHODS

Field recommendations for harvest quotas are based in part on the knowledge of elk numbers in each unit, which is obtained from a mid-winter census. This census is an intensive ground and air search designed to locate as many elk as possible. Census participants are asked to identify bulls and cows and to differentiate between spike bulls and animals with larger racks. A population estimate is then generated (Table 2) based on a subjective evaluation of survey conditions. The estimate is used as a gauge to evaluate progress towards the population goal. For instance in 1992 and 1993, Unit IV was at or near the desired objective, yet Unit I continues to show an increase in herd size.

Harvest quotas are refined by use of a computer simulation model, POP-II (Fossil Creek Software, Ft. Collins, CO). Originally developed by Beyer (1987), the model has been recently revised (Bender 1992). By manipulating the number of bulls, cows and calves removed in a simulated harvest, field personnel are able to evaluate population trends and bull-to-cow ratios. Depending on the need to reduce or stabilize elk numbers in any one management unit, quotas for Hunter Choice and Antlerless-only licenses are recommended. Cows and calves are legal for the holder of an Antlerless-only license. Any elk is permitted with a Hunter Choice license, but the "choice" for Michigan elk hunters is almost always a bull.

An example of how the strategy is used is described below. Parts of Management Unit IV have been open to hunting since 1984. Most of the unit is state land, making it very accessible to the viewing public and quite vulnerable to hunting pressure. Recent census results suggest that the elk population is near the established objective for this unit. The 1992 harvest resulted in a removal of 19 bulls, 26 cows and 3 calves by issuing 20 Hunter Choice and 30 Antlerless-only licenses (Carlson et al. 1993). The harvest recommendations for 1993 were simulated using the POP-II model and the results are shown in Table 3. A slight reduction in harvest quotas is warranted in order to maintain the stability of this herd. Hunting pressure may be further manipulated by adjusting unit boundaries, and restricting hunters' freedom to make late season unit shifts.

Table 2. Michigan elk population estimates by management unit, 1988-1993.

	Jan 1988	Jan 1990	Jan 1992	Jan 1993
Unit I	385	285	450	565
Unit II	225	335	340	315
Unit III	80	100	100	135
Unit IV	330	260	310	335
Total	1020	980	1200	1350

Table 3. The 1992 elk harvest and 1993-94 simulated harvests for Michigan Elk Management Unit IV and the resulting post-harvest population and bull-to-adult cow ratios.

YEAR	HARVEST		POPULATION *	RATIOS *
	Bulls	Cows & Calves	(post-harvest)	(bull:cow)
1992	19	29	317	63:100
1993	15	27	323	64:100
1994	15	27	330	65:100

* from POP-II model simulation

Another harvest option has been considered for Management Unit I where the elk population has been growing rapidly (Table 2). This unit is quite different than Unit IV in that as much as 70% of the elk herd located here may move to protected private lands prior to the traditional December season. In order to effectively harvest elk, early fall hunts in September or October have been tried. Hunters have been restricted to a relatively small proportion of the total management unit, but at a time when the elk were available. POP-II simulations have been used to develop the antlered and antlerless elk quotas. Continuing to increase these quotas and to consider three hunt periods of 7-10 days in September as well as a hunt period in December, are recommendations for the 1993 season.

RESULTS AND DISCUSSION

Since 1984, a total of 942 Antlerless-only and 533 Hunter Choice licenses have been offered during Michigan elk hunts (Table 4). This approximate 2:1 ratio, heavier to cows and calves, demonstrates the emphasis placed on population reduction. The harvest of 879 cows and calves and 500 bulls shows very high hunter success rates, which may be due to ease of access, lack of elk wariness, clumped distribution of elk, knowledgeable hunting guides, and cooperative landowners. These high success rates, along with the two different types of hunting licenses, enable managers to accurately predict the elk harvest.

Table 4. Quotas and harvest for Michigan elk hunts, 1984-1992.

	ANTLERED ELK		ANTLERLESS ELK	
YEAR	QUOTA	HARVEST	QUOTA	HARVEST
	HC *	Bulls	AO **	Cows & Calves
1984	10	10	40	39
1985	30	29	90	90
1986	40	39	55	54
1987	49	48	81	81
1988	95	82	140	133
1989	75	65	115	104
1990	80	77	150	127
1991	57	57	98	91
1992	97	93	173	160

* Hunter Choice licenses
** Antlerless-only licenses

Only one management unit has an elk population that is near the recommended goal, but all units maintain a ratio better than 60 adult bulls to 100 adult cows most times of the year. Elk viewing remains a popular activity and a small community in the elk range has been able to successfully promote a fall weekend "elk festival". The method of allocating licenses has encouraged a high proportion of older prime-age bulls in the population. The controlled hunts have affected elk distribution as there has been a significant decline in the number of agricultural crop damage complaints. An average of 41,000 applications have been received annually for the chance of drawing an elk license. The 1,475 lucky residents who were able to participate in a Michigan elk hunt have had a unique recreational experience. That elk hunting has been sustained in Michigan since 1984 is quite an accomplishment (R. Moran, personal communication).

There are many challenges facing elk management in Michigan. Elk herds are welcome on some private recreation lands — perhaps too welcome, in that these lands act as refuges, preventing hunter access and consequently, population control. At the same time, other private landowners demand increased harvest quotas in order to reduce elk that browse heavily on new forest regeneration. In two management units, elk populations far exceed the desired objectives, yet some areas of state ownership within those units could support more elk. The public may also become dissatisfied with an elk herd that after nine years of hunting, is becoming increasingly shy. The continued success of the management program will depend on strong agency and public support.

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Innovative Elk Management Through A Cooperative Landowner Incentive Program in Washington State

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ABSTRACT: A program to increase branched antler bull representation while maintaining hunting opportunities on private lands has been implemented on Champion International's Kapowsin tree farm in west central Washington state. The plan extends for 5 years and relies on season structure and harvest management to increase the representation of mature bulls in the population. From a current branched antler only season structure, the plan calls for alternating through two years of spike only seasons, then back to branched antler only seasons. This will allow for escapement of bull cohorts through several seasons, after which a harvest cap will be used to maintain the projected increase in mature bulls. In addition to general bull elk hunting seasons, a special early season hunting opportunity will be offered through a lottery permit system.

Introduction

In these times of increased pressure on, or at least increased public awareness of, wildlife habitats on private lands, both state wildlife departments and private landowners are looking for ways to integrate wildlife management and resource production. Innovative programs which provide incentives to private landowners are necessary to ensure the protection, and possible enhancement, of wildlife habitat on private lands. Champion International's Kapowsin tree farm has been involved in intensive wildlife management since the late 1970's. Champion's program has evolved over time to include a fee access program that has resulted in revenues being earmarked for wildlife management. In 1992, Champion International entered into a cooperative agreement with the Washington Department of Wildlife to promote wildlife habitat, wildlife management, and public recreational opportunity on their forest lands, while maintaining or enhancing the economic return to Champion.

Location of the Kapowsin tree farm

The Kapowsin tree farm encompasses approximately 135,000 acres of commercial forestland in west central Washington state. Of these lands, 113,000 acres are managed as fee access lands. These fee access lands are located in one large, and one small block on the western edge of Mount Rainier National Park and encompass the upper drainage of the Puyallup river. The area is dominated by commercial forestland and is managed primarily for the production of wood fiber.

History of fee access on the Kapowsin tree farm

Fee access was begun on the Kapowsin tree farm in 1987 in response to an attempt by Champion International to develop multiple sources of revenue to help cash flow during poor timber markets (Ward 1988). Prior to institution of the fee access program, public access was only allowed during the general buck deer season and during special permit seasons. These permit seasons were usually antlerless only seasons aimed at reducing the deer population in response to high seedling browse damage.

Because of the browse damage problems, and because Champion International places a very high priority on management of other natural resources such as wildlife, fisheries, and water, a very intensive wildlife research program was begun on the Kapowsin tree farm in 1979. To better under-

seasons, funding was provided to begin a long term monitoring program of the deer population. In 1986, the deer population had been successfully controlled and research efforts were expanded to the elk population.

Since 1986, annual herd composition flights have been conducted on the Kapowsin tree farm and detailed records of all elk harvested during each elk season during a given year have been recorded. The extremely controlled access to the Kapowsin tree farm eliminates most poaching, and the validation process associated with fee access forces all hunters to check in at a manned gate before entering, and when leaving, the tree farm. This process allows for accurate estimates of the number of hunters hunting in any given day, or over any season, and the number of animals harvested. In addition, data on each harvested elk has been taken since 1987. Besides general data on the sex, antler development, and location of harvest within the tree farm, a tooth from each carcass is collected and sent away for cementum annuli analysis. This allows for correlations between age and antler development of bulls, as well as allowing for accurate reconstruction of the population over time. Population reconstruction has been a very effective method for analyzing the population dynamics of the deer herd in this area (Gilbert 1992).

Deer and elk hunters encompass approximately 80% to 90% of the annual fee access visitor use days on the Kapowsin tree farm. As a consequence, the management of the deer and elk populations are very important to the success of the fee access program.

Both direct and indirect benefits have been associated with fee access on the Kapowsin tree farm. The primary benefit of the fee access program is the funding source for wildlife management on the Kapowsin tree farm. Without fee access revenues, of which a large portion goes directly into a wildlife management budget, it is unlikely that most of the current wildlife management activities would occur on the tree farm. This additional money goes into data collection to determine appropriate game management regimes, habitat enhancement for both game and non-game wildlife, and pure wildlife research in association with universities and the Department of Wildlife.

Additional direct benefits to the fee access users include:

1. Year-around access to the bulk of the tree farm (except during severe fire weather or dangerous road conditions)
2. Designated camping areas
3. Cured and split firewood at access points for use in designated camping areas.
4. Portable toilets in high use camping areas.
5. Dumpsters at access gates so that access users can deposit their garbage upon leaving the tree farm.
6. Year-around security provided by a professional contractor who works closely with state wildlife agents on game violations.
7. A newsletter which provides information about access, results from hunting seasons, and information relating to the management of the tree farm that would be of interest to fee access users.
8. Animal retrieval from road management areas by Champion personnel or security contractors.

Indirect benefits relate primarily to the quality of the hunting experience. Because the Kapowsin tree farm is located within 1 hour's drive of three major metropolitan areas (Seattle, Tacoma, Olympia), there is the potential for overcrowded hunting conditions. Fee access appears to result in lower hunter densities which usually equate to a higher quality hunting experience. The high proportion of road closure areas (approximately 33,000 acres) on the Kapowsin tree farm allows additional benefits for hunters that prefer to hunt in closed areas.

Private Landowner's Wildlife Management Area

In the fall of 1991, the Washington Department of Wildlife began a program titled "Partners for the 90's: Public Resources, Private Lands". The goal of this program was "to develop programs which will preserve, protect, improve, and perpetuate wildlife habitat on private lands and increase recreational access for all wildlife users" (Washington Dept. Wildlife 1991). One of the objectives was to develop and evaluate a set of landowner incentive alternatives including the designation of "Private landowner wildlife management areas" (PLWMA).

These PLWMAs were to "provide a reasonable economic return to the landowner in exchange for developing and/or maintaining habitat and allowing recreational use of private property" (Washington Dept. Wildlife 1991). The Kapowsin tree farm was unanimously approved by the Washington Wildlife Commission in the fall of 1992 as the second pilot PLWMA, the first on industrial forestlands. The plan will be implemented beginning with the 1993 hunting season. The pilot project will last for a minimum of 5 years and will be reviewed annually by the Washington Wildlife Commission, the Washington Department of Wildlife, and Champion International.

The primary goals of the Kapowsin PLWMA are to 1) further the development of the area's natural habitat potential for the benefit of wildlife, 2) enhance the recreational potential of the area for the benefit of the general public, and 3) provide an economic return to Champion to cover the costs of wildlife population monitoring, public access management, wildlife habitat enhancement, and wildlife population management in addition to a return on investment.

With the fee access program, Champion already had moved a long way towards these goals. The PLWMA helped by providing more flexibility for game harvest management on the tree farm, and by diversifying the sources of revenue for the fee access program.

The flexibility in harvest management will come from the designation of the Kapowsin tree farm as its own management unit. The tree farm was previously in 3 different Game Management Units (GMU's) with three different season structures and harvest restrictions. Seasons and harvest restrictions will be simplified and harvest managers will be better able to address the specific needs of the game populations on the Kapowsin tree farm.

The diversification of the revenue sources will come from a special branched bull hunting access opportunity in the third year of the PLWMA plan. Champion managers felt that in order to maintain a non-exclusive fee structure and to keep access fees at a level which the "common man" could afford to recreate on the tree farm, a new source of revenue was needed. It was determined that a lottery drawing for a special bull elk hunting access opportunity would allow for continued return on investment, as well as subsidization of the general access fees. This lottery drawing would be a non-refundable chance for 7 elk hunters to hunt on 112,000 acres during the late September rut. In the PLWMA plan, the fee this special access opportunity is set at $100.00. However, the actual fee may be less than this depending on the results of a survey effort to be conducted of local and statewide elk hunters to determine the "optimal" fee. The actual fee can be less, but will be no more, than the $100.00 level in the plan.

Elk management on the Kapowsin PLWMA

In order to generate a demand for the special bull hunting opportunity, it will be necessary to have an elk population with a large number of mature bulls with above average antler development. The PLWMA plan allows harvest managers on the Kapowsin PLWMA the opportunity to use bull harvest restrictions to increase the representation of branched antler bulls in the elk population.

From 1987 to 1992, only branched antlered bulls with at least 3 points on one side were legal game. This type of harvest restriction allows the bulk of the yearling cohort to go unexploited until their second year. In the PLWMA plan, the harvest restriction for all bull harvest will change to spike only for the 1993 and 1994 seasons. This means that the 1992 yearling bull cohort was not hunted in 1992 (at least the yearlings with less than 3 points on a side), and will not be hunted in 1993 or 1994 because only spikes will be legally harvested. In addition, all the branched antler bulls that are currently in the population will not be hunted for the next two years. Finally, the proportion of yearlings in the 1993 and 1994 cohorts that develop branched antlers will not be harvested during the spike only seasons. These measures, considered with the fact that controlled access minimizes poaching, should result in a greater proportion of branched antler bulls in the population, as well as an increase in the average age of the bull segment of the population. With an increased number of older branched antler bulls in the population, there should be an increased demand for an opportunity to harvest a branched antler bull on the Kapowsin PLWMA.

In the third year of the PLWMA plan, the special access opportunity during late September will begin, and the tree farm will revert back to branched antler (3 point minimum) restrictions in the general bull seasons, but with the institution of a harvest cap. This harvest cap will be set so that the branched antlered bull representation can be maintained in the population. This should lead to a sustainable level of larger, older bulls in the population. If the branched bull representation declines due to overharvest in general seasons, spike only seasons will again be used to reinvigorate the population.

Summary

The fee access program on the Kapowsin tree farm has been successful at providing an incentive to Champion International to manage for healthy wildlife populations and quality wildlife habitats. The PLWMA has the potential of enhancing the fee access program by providing increased management flexibility and control and diversifying revenue sources. The elk management plan on the Kapowsin tree farm illuminates the possibilities of creating a quality elk population, increasing the opportunity of the general public to hunt elk on private lands, and of using funds from recreational access users to improve the health of wildlife populations and to enhance wildlife habitats.

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Evaluation of a Spike-Only Regulation in S.E. Idaho

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INTRODUCTION

Across the rocky mountain states elk vulnerability has increased, this increase in vulnerability is largely due to the increase in road densities and the removal of security cover associated with timber harvest (Lonner and Cada 1982). Southeastern Idaho Big Game Management Units 60, 61, and 62A are no exception. These units are characterized by extensive clearcuts, high road densities, and low topographic relief. The combination of high road densities and low topographic relief produced conditions where bull elk were highly vulnerable to hunters under the 5-day any-antlered-bull regulation. In response to the high elk vulnerability in these units in 1992, Idaho Fish and Game implemented a spike antlered bull only regulation in Big Game Management Units 60, 61, and 62A.

STUDY AREA

The study area was located in southeastern Idaho and encompassed Idaho Fish and Game Big Game Management Units 60, 61, and 62A in sections of Freemont, Clark, Jefferson, and Madison Counties. Adjoining sections of Montana, Wyoming, and Yellowstone National Park were also included in the study area (Figure 1).

Timber management practices in the 1970-1990's have altered summer range in the study area. In 1974, approximately 85% of the merchantable lodgepole pine stands on the Targhee National Forest were classified as dead or dying due to mountain pine beetle (*Dendroctonus montanus)* infestation (USFS 1981). In response, the Targhee National Forest accelerated timber harvest. Of the 216,600 ha (535,000 acres) within

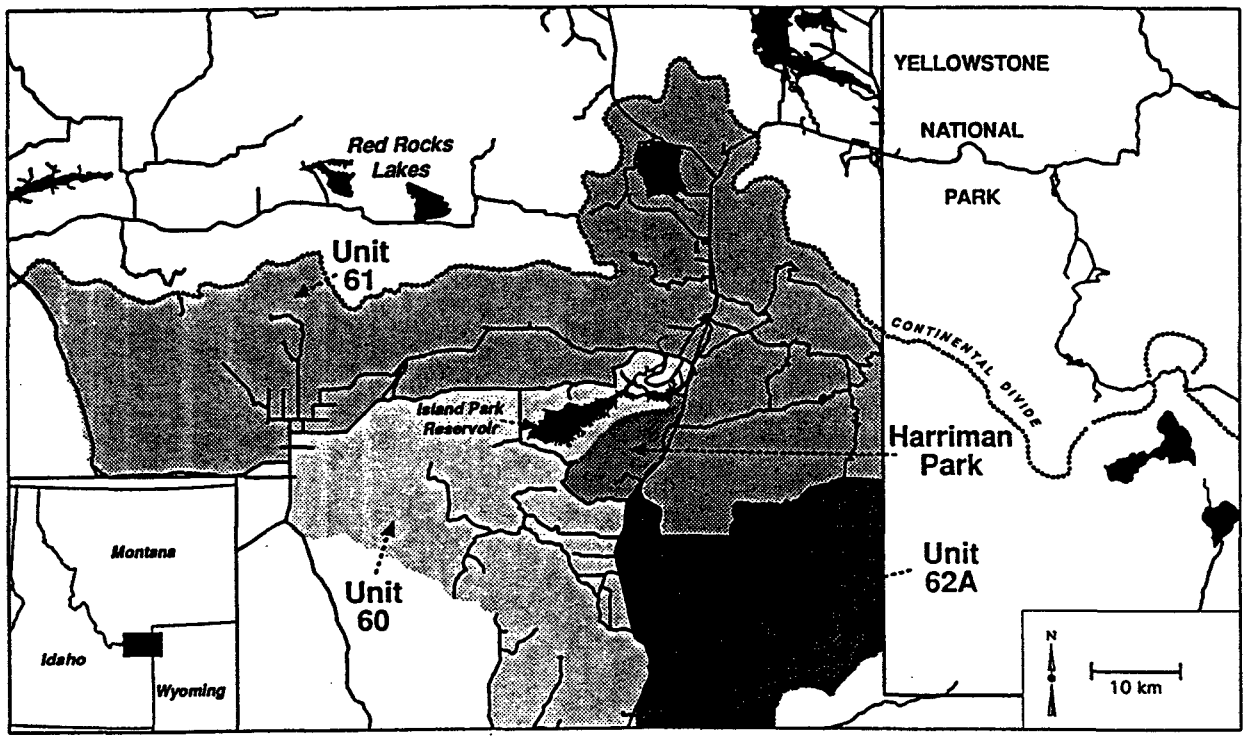

Figure 1. Study area for the Sand Creek elk herd.

the study area administered by the Targhee National Forest, 35,210 ha (86,970 acres) (16%) were classified as seedling or nonstocked timber stands in 1992 (USDA Targhee unpublished data 1992). Most of the timber management activity occurred in Big Game Management Units 60 and 62A. Of the 94,332 ha (233,000 acres) administered by the Targhee National Forest in Units 60 and 62A, 22,672 ha (56,000 acres) (24%) were classified as seedling or nonstocked timber stands in 1992 (USDA Forest Service unpublished data 1992).

OBJECTIVE

Idaho Fish and Game established a management goal of increasing the recruitment of bull elk into the 3-year-old and older age classes. The spike-only regulation focuses hunting pressure on yearling bulls by allowing general hunting of spike antlered yearling bulls but restricting hunters to permit hunting for branch antlered bulls. The spike-only regulation in Idaho protects yearling bulls with antler branches greater than 1 inch. So that even if all legal yearling bulls are taken, recruitment of bulls into older age classes will still occur since 24% of the yearling bulls in this area have branched antlers. The objective of our study was to see how well this management goal was met using regulation changes.

METHODS

Elk calves were captured using net guns on winter range in the spring of 1991 and 1992 (Barrett et al 1982). Eighty-six male elk calves were fitted with radio collars (Telonics Inc., Mesa, Ariz.). Radio transmitters were equipped with activity sensors (4-6 hour delay) to detect mortality. Radio-marked yearling bulls were located monthly prior to general season and every 1-3 days during the general season. At each location UTM coordinates, cover class, and land ownership were recorded. We compared results from 1991 and 1992 with results from radio-telemetry work conducted in 1985-1987 (Pauley 1991) under the any antlered-bull regulation to access the efficacy of the season.

RESULTS AND DISCUSSION

The spike-only regulation was successful in reducing bull elk mortality due to hunting. Under the any antlered bull regulation, few bulls which remained in areas open to hunting survived the general season. Both adult and yearling bull mortality decreased under the spike-only regulation. Only 9% of the (2 of 22) radio-collared yearling bulls that remained in an area open to hunting survived under the any antlered bull regulation. Under the spike-only regulation, 72% (36 of 50) of the yearling bulls available to hunters survived the general season. Only 6% (1 of 17) of the radio-marked 2-year-old bulls available to Idaho hunters were killed illegally under the spike only regulation. None of the 4 radio-marked 2-year-old and older bulls that remained in an area open to hunting survived the general season under the any antlered bull regulation.

Why did the mortality rate of yearling bull decrease under the spike-only regulation if this regulation focuses hunting pressure on the yearling age class? Both hunter days and antlered elk harvest decreased under the spike-only regulation. Hunter days and antlered elk harvest decreased 60% and 80%, respectively, the first year of the spike-only regulation (Figure 2). Hunter days increased the second year of the spike-only season to 50% of the 3 year average under the any antlered bull season. Hunters that did not participate in the spike-only units evidently hunted in nearby any-antlered-bull units.

Despite the decrease in elk harvest and hunter numbers, the percentage of the total antlered elk harvest occurring on opening day remained high. Check station data indicates that over 50 percent of the antlered elk harvest occurred on opening day under both the any bull regulation and the spike-antlered-only regulation (Figure 3). Although in 1992 check stations were not operated throughout the general season, and the season length increased to 10 days, the trend in daily harvest rate does not appear different.

Under the any-antlered-bull regulation, some elk evidently responded to the lack of security cover in this area by migrating to a refuge areas during the general season (Figure 4). Movement into refuge areas during the general season also occurred under the spike-only regulation (Figure 5).

Illegal mortality appeared minimal during 1991 and 1992. Of the radio-marked bulls, none of the (legally) branch-antlered yearling bulls and only 6%

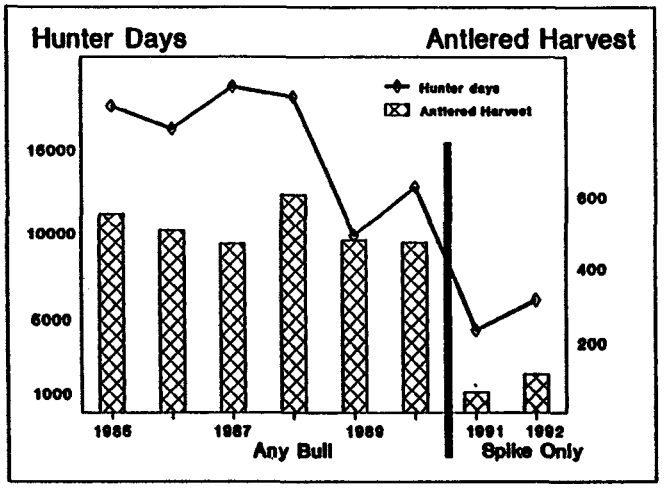

Figure 2. Hunter days and antlered elk harvest.

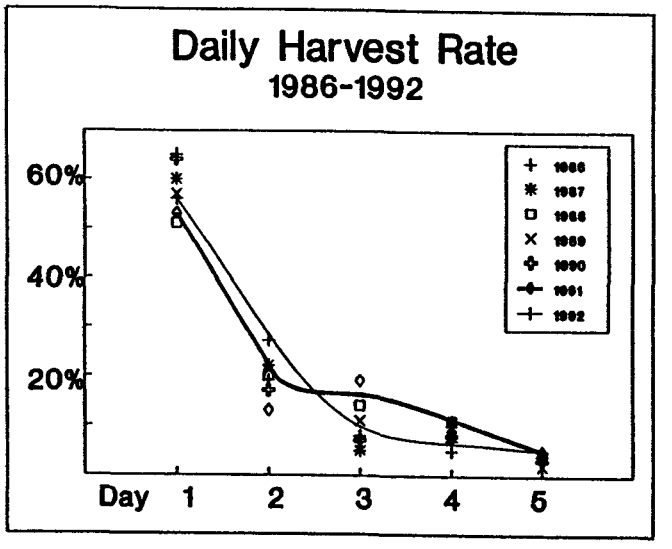

Figure 3. Rate of antlered elk harvest by day.

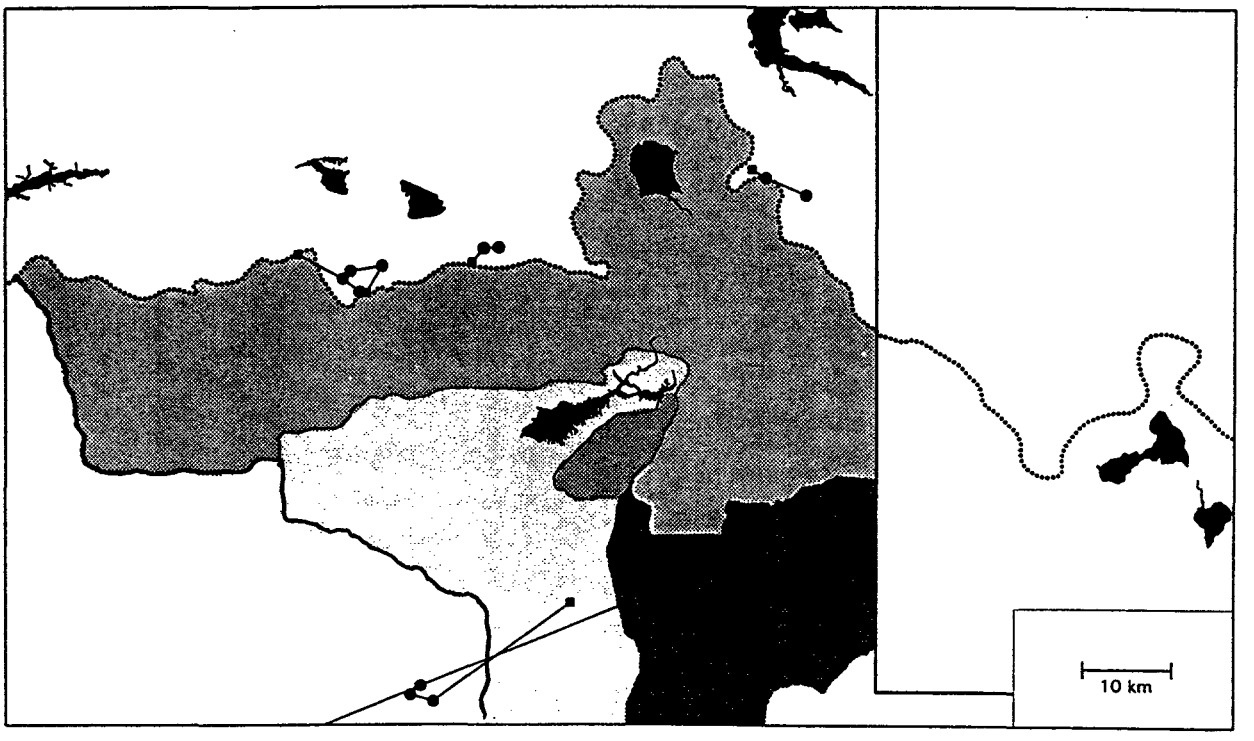

Figure 4. Radio-marked bull elk movements into refuge areas 1985-1987.

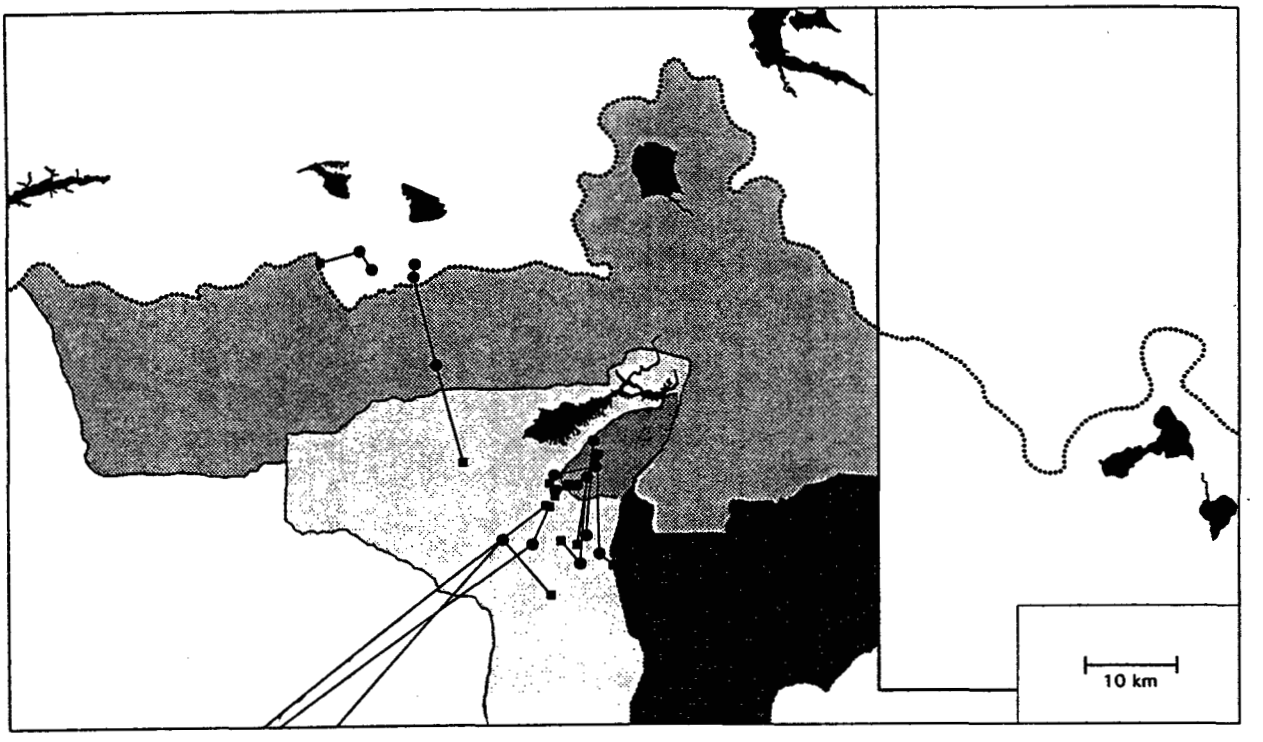

Figure 5 Radio-marked bull elk movements into refuge areas 1991-1992.

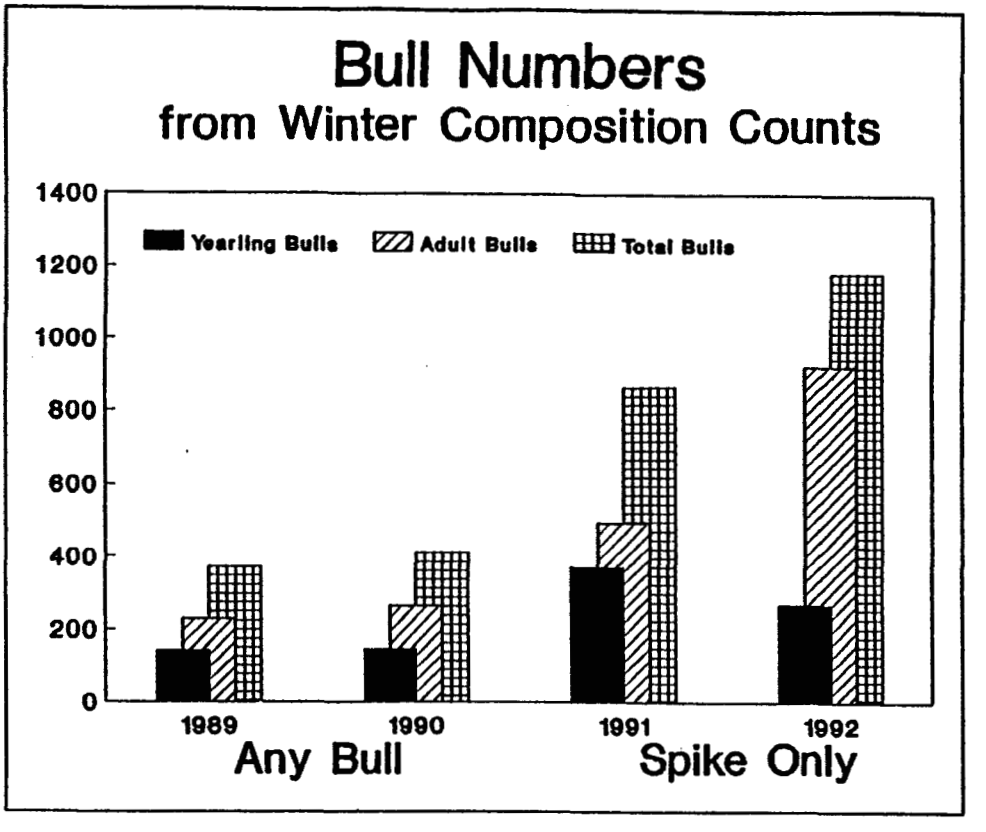

Figure 6. Bull numbers from the Winter Composition Counts for the Sand Creek elk herd..

(1 of 17) of the two-year-old bulls were illegally killed during the general season under the spike-only regulation.

Although no formal opinion survey was conducted in 1991 and 1992, most of the hunters in the spike-only units supported the spike-antlered-only regulation. Hunters supported the new regulation because they were able to see branch antlered bulls and hear bulls bugling through the general hunting season.

Winter composition counts indicate that the spike only regulation succeeded in increasing bull recruitment into the older age classes. The number of bulls on the winter range doubled the first year of the spike only regulation (Figure 6). Of the 450 additional bulls on the winter range the first year of the spike only regulation, 220 were yearling bulls and 230 were subadults (bulls 2-3 years of age). After the second year of the spike-only season, bull numbers were triple the levels reported under the any-antlered-bull season. The total elk count increased from approximately 2900 in 1989 to 3600 in 1992, with the increase in bull numbers accounting for most of the increase. The corresponding bull to cow ratio increased from 23 bulls per 100 cows to 68 bulls per 100 cows in 1992.

CONCLUSIONS

The spike-only regulation succeeded in increasing the recruitment of bulls into the older age classes in 1991 and 1992, but will the regulation continue to work in the future? A reduction in hunter numbers occurred in Montana the first year of their spike antlered elk only season, but in the following years hunter numbers returned to near previous levels (DeSimone and Vore 1992). In Oregon under a 3-point or better regulation, Harper (1985) reported that illegal bull mortality increased with hunter numbers. Illegal mortality diminishes the success of the spike-only regulation. DeSimone and Vore (1992) reported an 8% illegal mortality rate for 2-year old and older bulls in the Elkhorn Mountains under a spike-only regulation in Montana. Current hunter densities in the Elkhorn Mountains are somewhat greater than historic hunter densities for Units 60, 61, and 62A. This suggests that even with substantial increases in hunting pressures within Units 60, 61, and 62A the level of illegal mortality will remain low.

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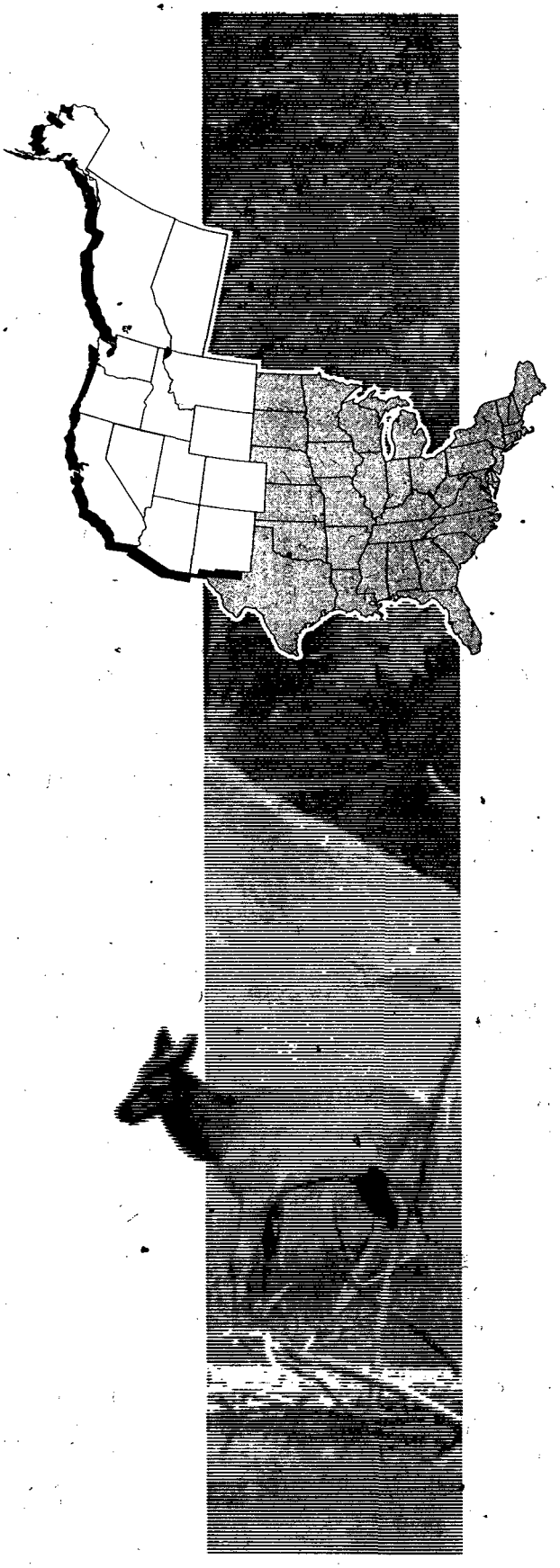
HUNTING STRATEGIES
Panel Discussion



CHAIR: LEN CARPENTER Colorado Division of Wildlife

Arizona Elk Management Guideline

VASHTI "TICE" SUPPLEE, Arizona Game & Fish Department,
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GUIDELINE OBJECTIVE

To maintain elk populations at levels which provide recreational opportunity to as many individuals as possible, while avoiding adverse impacts to the habitat, and minimizing substantiated depredation complaints.

Procedure 1: To determine annual calf recruitment rates and bull to cow ratios.

Pre-Hunt Surveys:

A. A pre-hunt survey will determine recruitment rates and herd composition. Field Operations personnel will conduct annual pre-season surveys in each unit having a huntable elk population. Game Specialists in Regions with elk will establish survey areas subject to meadow counts, spotlight counts, etc. Surveys shall be conducted by vehicle, horseback, or foot between August 10 and September 30. Surveys should be confined to the first and last 2-1/2 hours of daylight. If finances permit, helicopter and/or fixed-wing surveys may be authorized. Helicopter surveys must be approved by the Regional Supervisor and the Game Branch Supervisor. Survey data obtained by different methods should be recorded separately.

B. Elk observed will be classified as bulls (branched antlers), spikes, cows, and calves. Elk that cannot be positively classified will be recorded as "unclassified." Each group observed will be recorded as one observation as per Elk Survey Record Form 3025 (Appendix 9). Incidental observations outside the survey period will not be included as survey data.

C. Surveys will be designed to representatively sample select populations in the primary elk summer range in each unit. Game Specialists with Game Branch assistance will, with past years' survey information, determine desirable sample sizes and areas to obtain bull:cow:calf ratios of +/- 5 at the 90% confidence level. Where insufficient herds are tallied to obtain reliable ratio estimates, additional survey effort may be expended or data may be pooled with adjacent units and areas having similar vegetation and hunt characteristics. Survey effort will sample the major population concentrations. Eventually, survey effort should be designed to sample individual herds as determined in Procedure 4.

Post-Hunt Surveys:

A. A post-hunt survey will index population levels and determine wintering areas. Field Operations personnel may conduct post-hunt surveys when sufficient snow cover is available to obtain an index of wintering elk populations. Such surveys should be conducted by fixed-wing aircraft or helicopter between December 5 and March 15.

B. Surveys will be conducted in primary elk wintering areas and total numbers tallied for each identified herd unit. Elk concentrations too large for an accurate census may be photographed to assist counts.

C. Each group observed will be recorded as one observation on the Elk Survey Record Form 3025. Incidental observations outside survey period will not be included as survey data.

Procedure 2: To collect data on the age classes and condition of harvested elk.

A. When the need for biological data and/or precise hunt success information is justified, field checks and/or hunt check stations will be used to sample populations in select areas. Station locations will be determined by the Big Game Supervisor and Regional Supervisor. Operation of the check station will be the responsibility of the Regional Supervisor. Assistance may be provided by Game Branch personnel.

B. Elk may be weighed, aged, and examined for body condition, and any other pertinent data recorded. Data from each animal should be recorded on a multiple species check station card (Appendix 2).

C. The Game Branch will send hunt questionnaires to elk permit holders prior to the last day of their hunt. The questionnaire will be designed to obtain statistically sound harvest and hunt success data for hunt units; confidence intervals will be calculated for harvest figures and hunt success. Supplemental questions or questionnaires may be sent to obtain information of particular management interest (e.g., tooth solicitation).

D. Harvest and hunt success information will be sent to Regional Supervisors within 60 days of the initial questionnaire mailing. The collection, tabulation, and distribution of these data will be the responsibility of the Game Branch. Additional data analysis may be done by Game Branch and Regional personnel.

Procedure 3: To use survey and hunt data to determine a prescribed annual harvest of elk in each hunt unit and formulate hunt regulations to accomplish that harvest.

A. Annual survey and hunt data will be summarized by Wildlife Managers and Game Specialists as outlined in the Elk Management Summary Form 3026 (Appendix 10).

B. Regional personnel will analyze survey and other data, determine a desired harvest per unit, and develop hunt recommendations to achieve that harvest. Antlerless harvests should maintain the herd size at levels consistent with the Management Guideline Objective. Permit numbers to achieve the desired harvest will be calculated on the basis of past hunt success and hunter participation data. The allocation of archery, firearms, early and late season permits will be consistent with the Elk Strategic Plan.

C. Hunt recommendations will be made in conformance with the Guidelines for Hunting Season Recommendations 1992 - 96.

D. Hunt unit recommendations and survey data must be submitted to the Game Branch for review in accordance with the Hunt Recommendations Guideline schedule.

Procedure 4: To index elk population levels and estimate the size of particular populations.

A. Key summer and winter ranges for selected elk "herds" will be identified by monitoring the movements of color-marked and radio-instrumented animals.

B. Population estimates of our elk herds are very important. Presently, population estimates are made by survey techniques and by computer modeling. We recognize the need for additional advances in the use of GPS and GIS technology to better develop population estimates.

C. Population estimates will be derived from pre-hunt surveys. Regional personnel will model herd population levels and composition using preseason classification data, postseason population estimates, and hunt data. Summer and winter population densities will be calculated for each herd unit. These data will assist in determining the numbers and kinds of animals to be removed each year, desired population levels, annual mortality rates, and key areas to be acquired.

Procedure 5: To maintain and enhance select summer range (meadows) and key wintering range sites as elk habitat.

A. Habitats of importance to major elk herds will be identified, rated, and ranked in importance. An attempt will be made to acquire important areas in private ownership and transfer them to AGFD or U.S. Government management. Acquisition may be through trade of state or Federal lands or by purchase through Federal-Aid or donated funds

B. Livestock grazing allotments within important elk areas will be evaluated for forage condition. Those areas in need of upgrading will be discussed with the USFS and permittees. Elk

and/or cattle numbers will be adjusted downward until forage conditions improve. Range and/or pellet group transects may be established to determine if cattle, elk, or both need to be reduced. Such studies will be determined, established, and conducted in cooperation with the land management agency involved. Data will be recorded on Form 3014 (Appendix 11).

Procedure 6: To address elk depredations on private lands.

A. Complaints of elk depredation will be investigated by Regional personnel as per ARS 17-239.

B. When significant elk depredations are documented, special efforts may be made to alleviate these problems (eg. by fencing, by improving forage on adjacent public lands, Stewardship agreements, or through harassment techniques). Where the above methods are impractical or prove inadequate, special hunts may be authorized.

C. Where depredation problems persist, an effort to acquire these lands will be made by the AGFD or Commission. These lands may be acquired through purchase, trade, or exchange.

Arizona Elk Habitat Partnership Program

VASHTI "TICE" SUPPLEE, Arizona Game & Fish Department,
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INTRODUCTION

The Arizona Game and Fish Department's (AGFD) elk management program is conducted within game management units, with portions of the state being further subdivided into individual elk herd units. Management of elk within these units allows for maximum flexibility in hunt structures. It also allows identification of areas where concerns have developed between elk and either private or public land users; as well as the identification of areas with prime riparian values and key habitat areas for elk. A program consisting of a partnership to address concerns and take advantage of opportunities will result in benefits to the involved parties.

Partnership programs consisting of private land owners, land management agencies, wildlife agencies, and other private and public interests have been formed in other states to develop cooperative approaches through habitat enhancement to address elk/habitat interactions. The Elk Habitat Partnership Program (EHPP) will assist in resolving issues between elk and agricultural interests. The participants will work towards minimizing elk/habitat concerns through cooperative projects.

EHPP OBJECTIVES

-Encourage an atmosphere of partnership between wildlife managers, habitat managers, and public and private interests.

-Establish local committees to ensure appropriate public involvement in identifying habitat management concerns and recommending solutions before these concerns become problems.

-Identify and allocate the necessary funds to implement these solutions.

-Ensure that private land and habitat issues are considered in elk herd management plans.

ESTABLISHMENT OF LOCAL EHPP COMMITTEES

Local EHPP committees will be established and be encouraged to function in accordance with the Arizona Coordinated Resource Management Handbook and Guidelines. Already established committees such as the Forage Resource Study Group may continue to operate under their existing guidelines. Other local groups may be established formally or informally as determined by Federal and State agencies.

These local EHPP committees will act as subcommittees to the State EHPP committee which will review proposed projects to determine whether or not the project meets the EHPP goals and objectives, and for funding availability and priority.

Levels of Concern

Level 1 concerns occur when elk impact private property such as vegetable gardens, fruit and ornamental trees, golf courses, etc. This typically occurs where elk habitats are in close proximity to urban areas. These concerns should be addressed through provisions of Arizona Revised Statute Title 17:239. The AGFD may provide technical assistance and in many cases can solve these situations. Habitat projects designed to pull problem animals from private land are not recommended as they may compound the problem.

Level 2 concerns occur when elk impact private property where land owners or lessees suffer loss to agricultural crops or forage for livestock operations. In some cases, this occurs in isolated land tracts surrounded by other private land where the practice of farming or irrigation attracts elk from surrounding elk habitat. Enhancing habitat adjacent to the affected area may provide only temporary or partial relief. In other cases, the land owner suffering damage is surrounded by public land. In both cases, the concept of a lease agreement or a conservation easement should be

explored. This is where the EHPP can be most effective. Where private land is surrounded by public land the partnership could result in habitat enhancement projects both on public and private land. A cost sharing approach could be used expending funds from the various partners. There also exists the potential for land exchange or "buy-out" opportunities.

Level 3 concerns occur when elk compete for available forage on public lands which are currently under a permitted livestock grazing system. These situations hold the greatest potential for partnership opportunities. Much of the framework is in place for such partnerships through the existing elk herd unit committees. Additional areas could form local EHPP committees within game management units. To date, the elk herd unit committees are comprised of livestock permittees, the AGFD, and the U.S. Forest Service. Looking at the entire range of elk within a management unit, there is opportunity and need to add committee members from the State Land Department, Bureau of Land Management, and possibly from conservation interests such as the Rocky Mountain Elk Foundation and non-consumptive wildlife resource interests. Where applicable, various Indian Reservations would be included as well.

Committee Involvement

-Level 1 concerns will not involve the EHPP.

-Level 2 concerns will be addressed through involvement within a local EHPP committee or by direct feedback from the AGFD to the State EHPP committee. Various criteria may be deemed necessary to qualify, such as acreage impacted, minimum dollar amount lost, or some minimum deductible amount prior to consideration.

-Level 3 concerns will be addressed through the local EHPP committees. Projects need not be tied to a specific complaint, but can reflect improvement to the overall resource condition of the range. Recommendations from the local EHPP committees may affect livestock operations, livestock numbers and/or elk numbers, but projects should be tied to habitat enhancements on public land. Members of the local EHPP committees should consider the entire ecosystem. While some habitat projects may primarily benefit elk and livestock, they should also benefit other species and the ecosystem as a whole.

Role of committees

Each local EHPP committee will develop a summary of issues and identify and describe areas of concern. Each committee will produce a 5-year Habitat Partnership Plan for their area. This plan will identify locations and seasonal use of elk which the local EHPP committee considers to be areas of concern. For each issue identified, the plan will include a strategy agreed to by the committee for addressing the issue.

The AGFD will develop a Herd Management Plan which: includes a herd size objective consistent with forage availability; maintains productive range resources; considers the objectives of affected land managers; and resolves the identified issues.

The role of the local EHPP committee is to solve elk habitat management concerns by:

-Identifying habitat concerns for use in elk herd management planning processes.

-Recommending management actions to address the issues identified.

-Representing local interest groups to ensure public participation in development of the proposed management actions.

Process for developing Elk Habitat Management Plans

Elk Habitat Partnership Plans will be established according to the Arizona Coordinated Resource Management Guidelines.

Process for project prioritization and selection

The State EHPP committee will be responsible for selection and prioritization of projects identified by the local committees.

FINANCIAL SUPPORT

Increased funding will be needed to implement the EHPP. The AGFD will utilize resources from

the special elk tag fund, the Federal Aid habitat development program, and Heritage Funds (Stewardship Program). This revenue will be matched with funds from other agencies and organizations.

IDENTIFICATION OF CONCERNS

On private lands an area of concern is where the landowner believes an excessive concentration of elk is causing a problem in the management of his rangeland and he describes the problem in a written statement to the local EHPP committee.

On public lands an area of concern is one where the management agency makes a finding that the combination of wildlife and livestock use is inconsistent with the long-term ecological objectives of approved Land or Resource Management Plans.

STRATEGIES

Distribution management hunts may be open for any time period when it is feasible to harvest cows between September 1 and March 1 in order to provide the maximum opportunity to take animals in the place where they are causing problems. However, these hunts will not be held during regular rifle seasons. The Commission may approve different time periods for a particular elk herd management unit. Licenses would be for cows only, to provide maximum herd control and to avoid taking bulls at times when they are unusually vulnerable. The AGFD Director may approve the taking of bulls, if necessary to alleviate a specific problem. Licenses would be valid for a designated area only, in order to ensure the harvest would be from problem animals. The pre-hunt adult elk population would not be reduced by more than 10 percent in the area, unless the Commission approves a different percentage as a strategy within a particular elk herd management area. The AGFD will shift the harvest emphasis to those animals that are causing problems and away from those animals that are not.

Investments in the rangeland resources may include artificial seeding of desirable forage plants, fertilizing, or weed control. Other strategies could include brush manipulation, water developments, silvicultural treatments, and installation of improved grazing management systems (including pasture fencing where necessary). Improvement of fences may be made at major wildlife crossings to facilitate movement while reducing long-term maintenance and damage costs.

Other strategies developed by the local EHPP committees consistent with the spirit of the program may be considered after providing opportunity for public comment and subject to AGFD, State EHPP committee, and pertinent land management agency approval.

A Summary of California's Elk Hunting Program

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California has three subspecies of elk (Cervus elaphus). Tule elk (C. e. nannodes) are endemic, Roosevelt elk (C. e. roosevelti) are native and Rocky Mountain elk (C. e. canadensis) are introduced to the State. Regulated public hunting in California has occurred annually since 1986 for Roosevelt elk and 1987 for Rocky Mountain elk. The opportunity to hunt either subspecies in California is limited at present because much of their range is privately owned or on public land where hunting is not allowed. Since 1988, the Department of Fish and Game (DFG) has translocated approximately 130 Roosevelt elk to public land in northern California to reestablish historic populations. This translocation effort appears to have been successful and DFG will consider recommending limited public hunting in the near future.

In 1971, State Senate Bill 722 (Behr Bill) passed to prohibit the authorization of tule elk hunting until the statewide population reached 2000 individuals. The Behr Bill also directed DFG to relocate tule elk to suitable areas. In 1976, the United States Congress passed Public Law 94-389, which concurred with the Behr Bill and required the secretaries of Defense, Agriculture and the Interior to cooperate with the State in making suitable Federal lands available for tule elk. Subsequent to these state and federal mandates, the DFG translocated more than 900 tule elk and the statewide population increased from approximately 500 animals in 1971 to more than 2500 in 22 distinct herds today (1993).

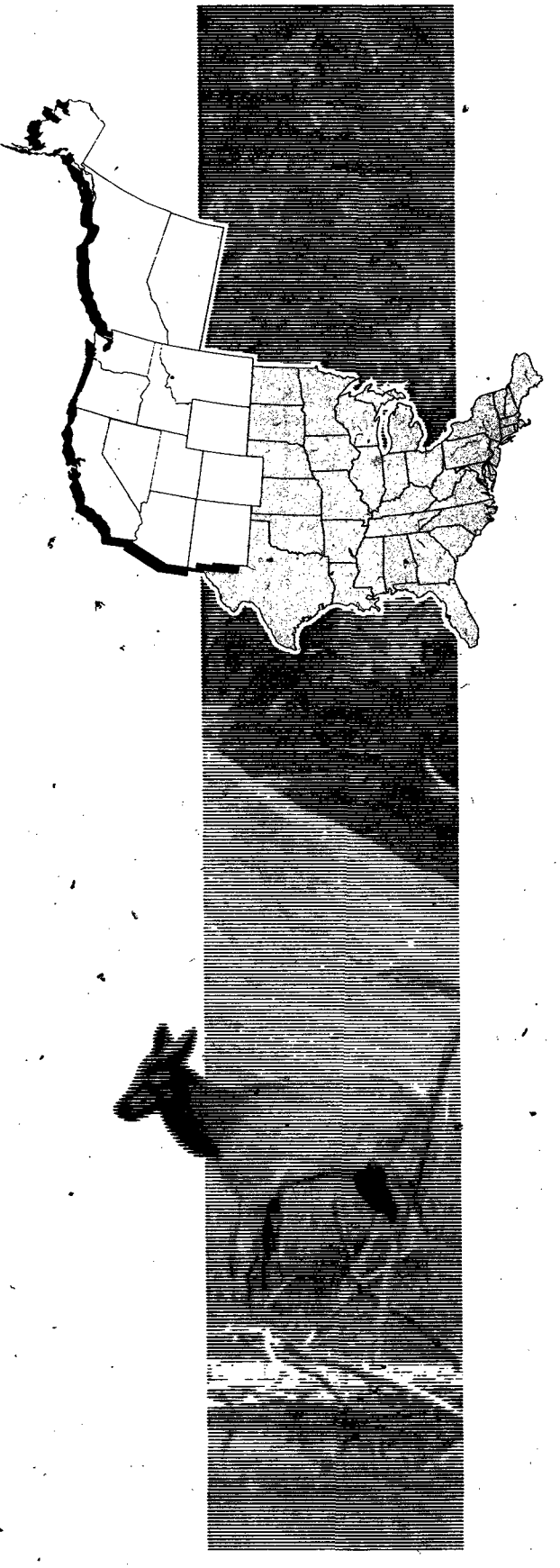
The DFG's tule elk population estimate first exceeded 2000 animals in 1987. The DFG recommended limited public hunting in 1988. In April 1988, the Fish and Game Commission (Commission) adopted regulations that provided for limited public hunting of tule elk. However, in September 1988, a citizens group obtained a court order preventing the proposed season based on a finding that the Commission's decision did not comply with the California Environmental Quality Act. In 1989, DFG prepared and circulated for public review an environmental document regarding tule elk hunting. In April 1989, the Commission certified the document and adopted regulations that allowed DFG to issue 95 tags to hunt tule elk at three locations in the State. Eighty-four tule elk were taken by hunters during the 1989 season.

Individuals protested the approved tule elk hunts in 1989 and 1990. Protests of 1990 culminated with 23 arrests and/or citations by DFG wardens, Solano County Sheriff's deputies and State Highway Patrol officers. Anti-hunting protestors were convicted of various charges including unlawful trespass and obstruction of a public road. Protestors appealed the convictions. The Appeals Division of the Superior Court denied appeals and resentencing occurred at the Municipal Court level in May of 1992. Sentences included jail time, individual monetary fines of up to $385, restitution to DFG ranging from $250-$585, probation periods and more than 700 collective hours of community service. Hunt protest activity since 1990 has been minimal but is not nescessarily expected to remain so.

Since 1989, tule elk hunting has occurred annually in California. Most tule elk hunts are population control hunts and hunter success often is above 90 percent. DFG will continue to translocate tule elk to reestablish populations in suitable historic habitat. However, suitable unoccupied historic tule elk habitat is scarce, especially on public land. The DFG has used regulated tule elk hunting to maintain tule elk populations in balance with their habitat and to reduce depredation complaints. It is hoped that private landowners will come to view regulated hunting as a viable means of population control. As this occurrs, some landowners will become more receptive to having tule elk on their property and additional suitable habitat that is privately owned will become available to tule elk.

MISCELLANEOUS

Reports



CHAIRS LYNN IRBY Professor, Wildlife Mgmt.
Montana State University

Characteristics Of Forested Habitats Used by Elk In A Timber - Scarce Environment

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ABSTRACT: *We conducted a study of use of timber by a radio-collared sample of 20 cow elk (Cervus elaphus nelsoni) in the southeast Bighorn Mountains, from May through October 1991 and May through November 1992. LANDSAT TM images were processed using the MIPS remote sensing system, and were used to determine that timber availability in this area was less than 8%, far below the 40% forest cover ratio that is generally considered optimum for elk. Despite this apparent lack of forested cover, this area has historically supported a viable elk population Characteristics of 212 sites where study elk were relocated were compared to characteristics of 236 randomly available locations using stepwise logistic regression, to identify variables which significantly predicted probability of use by elk at the alpha = .05 level. Distance to timber was the most powerful predictor of use by elk ($p<.00005$); 77% of the used and available cases were correctly classified using only this variable. Distance to water ($p=.0001$), elevation ($p=.002$), and the distribution of maintained gravel roads ($p=.003$) were also identified by the logistic regression model as significant variables in predicting elk use. LANDSAT TM data indicated that the mean size of discrete timber patches in the study area was 5.5 hectares ($N = 1,611$), while the mean size of patches used by the study elk was 47.3 hectares ($n = 51$, $p<.0001$), indicating that elk preferentially used larger timber patches than were randomly available in this area. Multiple regression was used to test whether the number of independent relocations associated with each used timber patch could be predicted using the measured characteristics of the timber patches; none of the variables measured had partial effects which were significant at the alpha = .05 level. Stepwise logistic regression was used to compare the structural characteristics of those used stands to a sample of 36 randomly available timber patches with a similar size distribution. Evidence of fire ($p=.001$), diameter at breast height of limber pine ($p=.001$), and slope ($p=.02$) were significant positive predictors of timber stand use by elk. Aspect was also significant in predicting use, with northeastern aspects positively related and southeastern and western aspects negatively related to probability of use by elk.*

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Observations of Elk and Deer Competition and Commensalism On A Western Montana Winter Range

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ABSTRACT: *The senior author recently completed his third field season of study on the Blackfoot-Clearwater Wildlife Management Area (BCWMA) in western Montana to document winter interrelations of sympatric elk and deer populations. Population levels were approximately 1,000 elk (Cervus elaphus), 1,000 mule deer (Odocoileus hemionus) and 500 white-tailed deer (Odocoileus virginianus) on a 35-mi^2, forested-browse/bunchgrass winter range. At this time, our conclusions are based upon field observations primarily, in advance of detailed data analysis. Under the conditions of this study, we observed intraspecific and interspecific interactions that may be categorized as competition and commensalism. Habitat conditions that determined the nature of these interactions varied from site to site within the narrowly defined winter range. Environmental conditions that determined the nature of these interactions varied not only from winter to winter, but from day to day within winters. Elk and deer dietary overlap was consistently low throughout the winter of 1992. Generally, the short and relatively mild winters of the early 1990s permitted cervids on the study area to coexist with minimal negative impacts. Further, we recognized a possible commensal relationship whereby forage beneath deep snow, or above deer browse heights, was made available by elk and was shared by deer. We suggest that the potential for intraspecific competition among deer and elk at high densities is of greater concern than interspecific competition.*

INTRODUCTION

Competition has been described as a mutually harmful interaction that occurs when two or more organisms of the same or different species utilize a common resource that is in short supply (Smith and Julander 1953, Salter and Hudson 1980, Nelson 1984). When distributional overlap occurs among individuals of the same or different species, opportunities for direct or indirect conflict arise (Mackie 1985).

Variables such as snow conditions; forage quality, quantity and availability; and individual variation in animal survival strategies all obscure an assessment of competition among wild ungulates on winter range. One species also may respond differently to any of the above variables in the presence of another species. Further, differentiating between forage or habitat "preference" vs "requirement," which is an important step in assessing the extent of competition, is confounded by the adaptability of animals to local environments or the proximity of a studied population to ecological carrying capacity.

Some researchers have reported that winter competition is minimal between elk and deer (Pengelly 1954, Morris and Schwartz 1957, Mackie 1970), but others have found more evidence for competition, especially when animal densities are high or snow depths are excessive (Wydeven and Dahlgren 1985, Jenkins and Wright 1988, Singer 1979). Jenkins and Wright (1988), Singer (1979), Kramer (1973), and Telfer (1970) implied that some degree of spatial, habitat or dietary partitioning exists among cervids which ameliorates excessive competitive interaction.

Interspecific interactions other than competition are possible. Commensalism, a relationship benefitting one species and not harming the other, was reported for large herbivores in Africa by Bell (1971), and considered by Salter and Hudson (1979) between feral horses and elk.

Managers' major concerns when assessing deer and elk interrelations may be summarized as follows.

Can more elk be supported in a given area as a result of reductions in sympatric deer populations? Conversely, can more deer be supported as a result of reductions in sympatric elk populations?

Our objective for this paper is to report some preliminary observations on the interactions of migratory elk, mule deer (MD) and white-tailed deer (WTD) on a western Montana winter range. Analyses will be completed in the coming year and will be presented in a M.S. thesis from the University of Montana, Missoula.

ACKNOWLEDGEMENTS

We would like to thank the Montana Department of Fish, Wildlife and Parks; University of Montana, School of Forestry; Lolo National Forest and the Rocky Mountain Elk Foundation for their generous financial support of this project. Special thanks go to M. Barton and D. Dickson for their technical assistance and dedication to this project.

STUDY AREA

This study was conducted on the Blackfoot-Clearwater Wildlife Management Area (BCWMA), located approximately 45 miles (72 km) east of Missoula. The study area encompassed 22,400 acres (9,065 ha) and a 3,900-5,600 ft (1,189-1,707 m) range in elevation. Elk and deer browsing over the past 15 winters exerted an effect on trees and shrubs that was readily apparent. No livestock grazed on the study area, and feeding by cervids occurred almost exclusively in winter and early spring. Population estimates during the time of this study were approximately 1,000 elk, 1,000 MD and 500 WTD. Animal densities on the winter range often exceeded 71 animals per mi^2 (28 km^2). For comparison, Constan (1972) and Mackie (1970) evaluated interspecific competition among ungulates at lower densities (50/mi^2 and 25/mi^2, respectively).

Approximately 66% of the area is comprised of second growth Douglas-fir (Pseudotsuga menziesii) stands ≥40 ft (12 m) tall with a serviceberry (Amelanchier alnifolia) and patchy Douglas-fir seedling/sapling understory that developed after extensive logging over the past 60 years. Overstory canopy cover is sparse (10-40%). The remaining 34% of the area is rough fescue (Festuca scabrella) grassland.

METHODS

Five track counting transects totaling 25 miles (40 km) were positioned at 1-mile intervals and were assumed to intersect vegetation types in proportion to their occurrence on the study area. These were surveyed on snowshoes a total of 10 times from 1 January to 30 March during 1992 and 1993. Incidental animal observations were made from transects and roads, and individually identifiable animals were available for all 3 species. Elk and deer diets were estimated using microhistological analyses of fecal samples. Composites were made from at least 16 pellet groups from each species per month (Jan-Mar), from representative habitats. Additionally, subsamples were pooled to form a January-March composite for each species. Composites were analyzed at the Wildlife Habitat Lab, Washington State University, Pullman, using 200 random fields of view (Davitt and Nelson 1980). Dietary overlap was calculated using the methods of Morisita (1959), as modified by Horn (1966), for each cervid pair for the winter of 1992.

SPATIAL, HABITAT AND DIET PARTITIONING

Although the extent of spatial and habitat partitioning is unclear in advance of detailed analysis, we observed differences and similarities in spatial and habitat use between deer and elk. Overlap between elk and MD was most pronounced, and intensified during mid-winter.

Elk and MD spatial separation was greatest in early and late winter. MD were rarely observed on extensive open grassland, but large groups of elk (>500) concentrated there until snow became deep and crusted. At that point, elk moved into forested areas and fed more intensively on browse. This shift commonly occurred in February. Some spatial and habitat overlap with elk occurred in virtually all forested areas that MD occupied throughout the winter; however, it was during this mid-winter period that the greatest overlap occurred.

WTD concentrated along west-facing cliffs and slopes with mature Douglas-fir and ponderosa pine (Pinus ponderosa) overstories. Elk also frequented these areas throughout both winters, but rarely were observed in group sizes >20. MD were never observed in core WTD wintering areas until WTD

began to disperse in March. This suggests the possible spatial exclusion of MD by WTD when WTD were at high densities. This possibility will be examined in the senior author's M.S. thesis.

Deer and elk diets were relatively dissimilar for winter 1992. Elk-MD and elk-WTD winter dietary overlaps (Jan-Mar combined) were 34% and 36%, respectively. Diet composition changed monthly, but elk-MD and elk-WTD dietary overlap for each month remained relatively constant (29-32% and 32-40% respectively).

OBSERVED SOCIAL INTERACTION

Wydeven and Dahlgren (1985) hypothesized that competitive exclusion may have been responsible for spatial differences among elk and MD in Wind Cave National Park. We have no evidence for competitive exclusion between elk and MD or elk and WTD on the BCWMA.

Interspecific aggression among the three cervid pairs was never observed, but intraspecific aggression was frequently observed. Elk-MD and elk-WTD mixed-groups were commonly observed within areas of spatial overlap. Elk and deer of both species were observed within 10 ft (3 m) of each other on several occasions. Further, elk-MD and elk-WTD mixed-groups were observed when elk densities were highest within forested habitats and when winter stress was substantial. Overall impressions of elk-MD, and elk-WTD social interaction on the BCWMA indicate they are quite tolerant of one another.

COMMENSALISM

We recognized a possible commensal relationship. This would be possible where forage beneath deep snow, or above deer browse heights, was made available by elk and was shared by deer as commensals. Observations suggested this relationship occurred frequently. Both MD and WTD appeared to benefit from their association with elk. However, since MD had the highest spatial overlap with elk (especially when snow was deep), we suspected MD to benefit more than WTD.

As noted above, deer were observed feeding within elk groups, and both deer species were observed revisiting elk feeding sites. During January, 1992, 54 fresh elk-feeding craters were examined. Of these, 59% contained deer tracks. Unused portions of grasses, shrubs, forbs and sedges remained in elk feeding craters, and could provide beneficial foraging opportunities for deer. Elk also were observed revisiting prior feeding areas when snow was not excessively crusted, suggesting the presence of remaining forage. Similar interactions where elk were feeding in craters made by feral horses were observed by Salter and Hudson (1980).

Elk also improved forage availability for deer by dislodging the lower limbs of conifers in order to acquire tree lichens (Alectoria spp.). Piles of limbs and lichen accumulated which were later visited by deer. Elk also commonly broke the tops of overgrown shrubs in order to feed on current annual growth that had grown out of reach. They seldom consumed all of the leaders on broken tops, leaving some available for deer.

More importantly, elk improved forage availability for deer by creating extensive trails to feeding sites when snow depth exceeded 24 in (60 cm). Deer tracks commonly were found in elk tracks and trails, and deer were observed foraging on shrubs in deep snow that might have been previously unavailable without the benefit of broken trails. Others have observed that deer and elk tend to increasingly rely on trails as snow depth increases, in order to expend less energy during daily activities (Telfer 1970, Geist 1982, Potvin and Huot 1983). Large numbers of elk consumed considerable quantities of browse in a short time. However, they also left buds and stems that were less accessible within decadent "caged" shrubs which deer could more easily obtain.

The extent of the benefit to the commensal species is difficult to assess. However, it appeared that benefits to deer could partially offset or possibly exceed competition pressure from large elk groups.

DISCUSSION

We found the BCWMA to be a particularly interesting location to study the interrelations between elk, MD and WTD in winter. The authors are unaware of any other situation where extensive, productive bunchgrass and browse winter ranges abut. The availability of bunchgrass to elk during early winter (before snow accumulates and crusts)

reduces the extent and duration of potential competition with forest-dwelling deer throughout the winter. However, we believe that the large elk-group sizes (>500) which form on the bunchgrass range, and might not form otherwise in a forested-browse habitat (Geist 1982), magnify the possibility of competition when these elk shift to browse en masse.

Historically, the vertical zone of winter browse availability for elk and deer was considered to be between 1-6 ft (Cole 1958). In our study, elk trails, feeding craters and stem breakage extended the zone of browse availability for deer vertically in both directions. Additionally, elk trails extended the deer browse zone horizontally to plants that might otherwise have been isolated because of snow accumulations. Potvin and Huot (1983) examined the energetics of WTD foraging under varying snow conditions, and concluded that carrying capacity on their study area would triple in the absence of snow. Elk did not "remove" snow on our study area, but they did mitigate the effects of snow accumulations, and a substantial energy savings for deer may have resulted.

Competition is often assumed when little is known about resource availability or supply. Resource availability is often measured during periods of fair weather when the actual and dynamic influences of availability (such as elevated snow-packed trails, crusted and drifted snow, and ungulate behavior) are not observable. This could lead to mistaken interpretations.

We agree with Mackie (1970) that when resources are limited, elk would be more efficient competitors than deer because of the elk's lower thermoregulatory costs, greater foraging height, greater mobility and ability to tolerate lower quality forage. However, the ability of deer to utilize Douglas-fir and subsist on much lower quantities of forage may compensate.

Our preliminary observations imply that competition on this study area is more intraspecific than interspecific. Reducing deer numbers probably would not allow greater elk numbers as a result. Conversely, it does not appear that a decrease in the elk population would allow deer numbers to increase. Moreover, it seems possible that substantial reductions in elk numbers may actually lower deer winter carrying capacity, depending upon the extent of the commensal relationship.

Concerns remain regarding forage condition and viability, as well as ungulate population sustainability. Mackie (1985) noted that while examining elk and deer competition it is important to be aware of unique differences in animal densities, animal species composition, local environments and range conditions before drawing conclusions about competitive interactions. Our observations further suggest that competition should be evaluated on a daily or weekly basis, rather than a seasonal basis.

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Movements of Yearling Bull Elk in Michigan

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Abstract: *Dispersal movements of juvenile elk can result in increased vulnerability and greater mortality in these age-classes. If such movements are more pronounced in one sex, such as in bull elk, highly skewed sex ratios may result, which in turn can affect population productivity, potential harvest, and habitat needs and utilization. In Michigan, concern existed that high bull:cow ratios (>60:100) may result in increased dispersal movements among yearling bulls into peripheral, primarily agricultural, areas of the elk range, where depredation problems are common. However, real social and political barriers exist in Michigan limiting expansion of the herd outside the traditional elk range. Such barriers may act to limit dispersal movements. We therefore investigated the nature of yearling elk movements in Michigan. Movements of elk radio-collared as calves in 1990-1991, geographic locations of bull elk hunt kills, and harem observations were used to investigate yearling elk dispersal. Dispersal movements were not observed in either yearling bull or cow elk in Michigan. Dispersal may not be seen due to limited habitat available for successful dispersal, or extremely high bull:cow ratios resulting in tolerance of juvenile bulls by harem bulls. Alternatively, dispersal movements may not occur until bulls reach age 2.5 or older.*

Movements of yearling elk, particularly dispersal movements of bulls, play a significant role in the dynamics of elk populations. Dispersal movements of young ungulates are thought to result in increased vulnerability and hence greater mortality in the immature age-classes. If such movements are more pronounced in one sex, such as in cervid males, highly skewed sex-ratios can result. Skewed sex-ratios in turn can affect population productivity, potential harvest, and habitat needs and utilization. Thus, the dispersal movements of immature elk can potentially have a significant effect on the population dynamics, structure, and recreational attributes of the Michigan elk herd.

The high bull:cow ratio present in the Michigan elk herd (≥60:100) indicates that bull elk are plentiful in the elk range. The presence of large numbers of older bulls may result in increased dispersal movements among immature bulls. Concern in Michigan exists over agricultural and forestry depredation problems caused by the elk herd. Dispersal movements of young bulls into peripheral areas of the elk range, which are predominately agricultural, may result in increased frequency of such problems. Conversely, real political and sociological barriers exist preventing expansion of the elk herd into areas outside the desired elk range, which may limit or prevent major dispersive movements by young bulls. The goal of this paper is to determine the nature of dispersal movements of yearling bulls in Michigan. Specific objectives include:

(1) Compare seasonal movements of yearling bull and cow elk.

(2) Compare home range sizes of yearling bull and cow elk.

(3) Evaluate differences in distribution patterns of adult and immature bull elk.

(4) Evaluate the tolerance of adult bull elk towards immature bulls during the rut.

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STUDY SITE AND METHODS

Study Site

The elk range in Michigan covers approximately 1500 km^2 in the northern lower peninsula and includes portions of Otsego, Cheboygan, Montmorency, and Presque Isle counties. It is centered on the 340 km^2 Pigeon River Country State Forest, Vanderbilt, MI, and the adjacent Camp 30 Hills area of Black River State Forest, Atlanta, MI. Adjacent private forested and agricultural lands comprise the remainder of the elk range.

Vegetative cover in the primary elk range is mostly forested, with scattered agricultural land and wildlife openings. Approximately 79% of the primary elk range is in forest cover types (Moran 1973). Forest coverage is diverse due to high diversity in soil types, drainage, and exposure. Morainic uplands support sugar maple (Acer saccharinum), basswood (Tilia americana), hemlock (Tsuga americana), northern red oak (Quercus borealis), red maple (A. rubrum), white pine (Pinus strobus), and red pine (P. resinosa). Steep morainic slopes support aspen (Populus tremuloides), various oaks, and red and white pine. The outwash plain-morainic ecotone is typified by red maple, aspen, and white birch (Betula papyrifera). Sandy outwash plains support jack pine (P. banksiana), cherry (Prunus spp.), and willow (Salix spp.). Coniferous swamps are dominated by northern white-cedar (Thuja occidentalis), balsam fir (Abies balsamea), black spruce (Picea mariana), and balsam poplar (P. balsamifera).

Approximately 450 ha in the primary elk range are maintained in managed wildlife openings of alfalfa, buckwheat, clover, or cool season grasses. Permanent openings account for approximately 15% of the primary elk range (Moran 1973).

Bull Distribution

The geographic locations of each bull elk harvested during the 1984-1990 Michigan elk seasons were plotted, and X-Y coordinates determined for each harvested bull. A geographic mean of all bull kills was determined, and linear distances from the geographic mean to each individual kill determined. Mean linear distances from the geographic mean were compared by age-class, and by combining age-classes to equilibrate sample size in the following manner: yearlings, 2.5 year-olds, 3.5 year-olds, 4.5 year-olds, 5.5 year-olds, 6.5-7.5 year-olds, and ≥8.5 year-olds. A significantly greater mean distance for an age class from the geographic mean would be indicative of dispersal movements, as these animals would have been consistently harvested towards the periphery of the elk range.

Movements and Home Range

Elk calves were immobilized and radio-collared during September-November 1989, 1990, and 1991. Radio-collared calves were subsequently located at least weekly throughout the duration of this study. Mean minimum, mean, and maximum seasonal distances moved from point of capture were compared between bulls and cows for the following traditional dispersal seasons: Pre-CALF (March-June), Post-CALF (July-October), and Post-RUT (November-February). Additionally, minimum convex polygon home-ranges were calculated for all elk radio-collared as calves in 1990. The ARC/INFO Geographic Information System (GIS) (ESRI, Inc., Redlands, CA) was used to plot all locations from Fall 1990-May 1992 and calculate home ranges for the radio-collared calves/yearlings.

Harem Bull Dynamics

Elk harems were monitored in 1990 and 1991 for group compositions. All observations were made in the evenings during peak harem activity. The composition of each distinct harem was recorded to determine the presence or absence of yearling and other immature bulls in or adjacent to the harem. The presence of younger age-class bulls within a harem would indicate lack of aggressive dispersal of young bulls by harem-master bulls.

Data Analysis

All comparisons were made using the non-parametric Kruskal-Wallis ANOVA (Siegel 1956). A generalized Scheffe-type test was used for multiple comparisons (Miller 1981). The level of statistical significance was set at α=0.10.

RESULTS

Bull Distribution

Mean distances from the geographic center of harvested bull elk did not differ among age-classes (Table 1). Similarly, mean distances from the

geographic mean did not differ among grouped age-classes (Table 1). Although the differences were not statistically significant, older age-classes and older age-groupings tended to occur further from the geographic center than did yearlings and 2.5 year-olds.

Movements and Home Range

Yearling bulls and cows did not differ in minimum, mean, and maximum seasonal movements for any season (Table 2). Movements of cow calves/yearlings tended to be greater than bull movements during the Pre-CALF and Post-CALF periods (Table 2). As yearlings aged, bull movements tended to become larger than cows (Table 2).

Minimum convex polygon home-ranges did not differ between yearling bulls and cows. Mean home-range sizes were 26.0(3.3) km^2 for yearling bulls and 29.7(2.4) km^2 for yearling cows.

Harem Bull Dynamics

A total of 27 distinct harems were observed in 1990; 16 distinct harems were observed in 1991. Twenty-two point two percent of the 1990 harems, and 18.8% of the 1991 harems, included >1 bull elk. Mean harem sizes were 6.11 (0.75) and 5.75 (0.66) elk in 1990 and 1991, respectively; these were reduced to 5.48 (0.64) and 5.38 (0.58), respectively, when the additional bulls were excluded from the harem count, indicating that additional males represented 10.3% and 6.4% of total harem membership in 1990 and 1991, respectively. The additional bulls present in these harems were yearlings or other young (≤4X4) bulls, suggesting that young bulls are not being actively dispersed by many harem masters in Michigan.

DISCUSSION

Yearling bull elk in Michigan showed no dispersive movements relative to yearling cows (Table 2), nor did they exhibit larger home ranges. Additionally, the location of yearling bulls killed during the 1984-1991 hunting seasons plotted inside the locations of other age-classes, suggesting that yearling bulls are not being forced to peripheral areas of the Michigan elk range by other dominant bulls (Table 1). Many harem bulls in Michigan also tolerated the presence of yearling and other young bulls in or adjacent to their harems. These results suggest that yearling bulls in Michigan are not being actively displaced by dominant bulls, and thus are able to stay in close proximity to their dam's range if they choose to do so.

These results are contrary to what has been traditionally believed about yearling elk movements (Altmann 1963, Franklin and Lieb 1979, Clutton-Brock et al. 1982, Houston 1982, Geist 1982).

Dispersal movements of young elk can be confused with the greater movements shown by bull elk in general. Due to differing nutritional and predation-avoidance strategies, seasonal home ranges and movements of bulls tend to be larger than for cows (Franklin and Lieb 1979, Clutton-Brock et al. 1982, Geist 1982, Beyer 1987, Hurley and Sargeant 1991). This pattern has been demonstrated for adult elk in Michigan by Beyer (1987).

Table 1. Mean±SE distances (km) of harvested bull elk from the geographic mean by age-class and grouped age-classes, 1984-1990.

	AGE CLASS							
	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5
DISTANCE	11.2±0.8	11.2±0.6	12.9±0.8	13.7±0.8	13.4±0.9	12.4±1.4	12.2±1.3	12.8±1.8
	9.5	10.5	11.5	12.5	13.5	6.5-7.5	≥8.5	
DISTANCE	10.2±2.8	12.7±3.1	———	7.7±1.3	16.2±5.3	12.3±0.9	12.3±1.2	

Table 2. Mean±SE minimum, maximum, and mean distances (km) moved from point of capture of bull and cow elk radio-collared during Fall, 1990.

	MOVEMENT PERIOD					
	Pre-CALF		Post-CALF		Post-RUT	
Movement	Bull	Cow	Bull	Cow	Bull	Cow
MEAN	2.3±0.3	2.7±0.3	2.9±0.6	3.0±0.4	3.8±0.8	2.8±0.4
MINIMUM	0.9±0.2	1.0±0.2	1.6±0.6	1.5±0.4	1.8±0.6	1.0±0.2
MAXIMUM	3.8±0.5	4.5±0.4	4.3±0.8	4.5±0.6	6.2±1.3	4.6±0.4

Our study, however, found no differences in movements and home ranges of yearling bulls or cows (Table 2). This suggests that the increased movements seen in bull elk may not occur until age 2.5 or later in Michigan. Such increased relative movements, however, are not necessarily dispersal movements; they may instead simply be the natural tendency of bulls to wander more than cows (Clutton-Brock et al. 1982, Geist 1982). True dispersal movements involve the complete abandonment of a home range and the establishment of a new disjunct home range.

Movements of bulls relative to cows may become greater in elk in Michigan at age 2.5 or older. Clutton-Brock et al. (1982) found peak dispersal for red deer to occur between the ages of 2 and 3, when immature stags left their mother's home ranges and joined stag only groups. Movements of dispersing red deer tended to be long; 70% of stags in England established new ranges >2 km from their birth places (RDCR 1978 in Clutton-Brock et al. 1982). Hurley and Sargeant (1991) also reported that bull elk dispersed from ranges occupied as yearlings at age 2.5 in the Bob Marshall Wilderness, western Montana. The mean distance between pre-and post-dispersal activity centers was 24.6 km, compared to mean distances of 3.6 km for cow elk. Additionally, home range sizes of 2.5 year-old bulls were significantly larger than all other sex- and age-classes, again attributed to exploratory movements by the dispersing 2.5 year-old bulls (Hurley and Sargeant 1991). Thus, increased movements of bulls relative to cows, or even dispersal movements, may not be seen in elk in Michigan until age 2.5 or older. However, no calves radio-collared during Fall 1990 showed dispersal movements as of September 1992.

Indirect evidence that also suggests young bull dispersal may be uncommon in Michigan involves the traditionally high bull:cow ratio seen in the herd (>60:100). Although bull elk in general show greater age-specific mortality than cows (causing bull:cow ratios to drop significantly from ~1:1), dispersal carries an additional significant risk of mortality for young bulls (Flook 1970, Clutton-Brock et al. 1982, Geist 1982, Hurley and Sargeant 1991), which leads to even lower bull:cow ratios in elk herds. Flook (1970) found bull:cow ratios of 85:100 in fenced areas of Elk Island National Park, Alberta, where dispersal was prevented by the enclosing of the herd. Comparable ratios in nearby Banff or Jasper National Parks, Alberta, where elk herds are not enclosed, were 37:100. The impedance of yearling dispersal and elimination of the associated mortality was felt to be responsible for these highly different ratios (Flook 1970, Geist 1982). Similarly, Murphy (1963) documented a high (55:100) bull:cow ratio in an enclosed population of elk in Missouri. The potential magnitude of the increased mortality associated with dispersing immature bulls was also demonstrated by Heptner et al. (1961) (in Geist 1982) in the USSR with comparisons between elk and red deer populations. Red deer bull:cow ratios in 4 reserves ranged from 63-83:100, while elk bull:cow ratios on 2 reserves were 27-33:100. Since elk are a colonizing or dispersing form relative to red deer, dispersal theory predicts that red deer should have higher bull:cow ratios than elk due to lower bull mortality rates (Geist 1982). Thus, the significantly lower bull:cow ratios seen in elk relative to red deer in the USSR reserves again shows that dispersing immature elk are highly vulnerable and subsequently suffer increased mortality relative to established bulls and cows, resulting in naturally low bull:cow ratios in elk populations where animals are free to disperse.

Bull:cow ratios have traditionally been high in the Michigan herd, usually greater than 50-60:100 (Moran 1973, Beyer 1987, Bender 1992). Moran (1973) attributed this high ratio to "the classic structure of an unexploited elk herd under average range conditions", due to the similarity with the 55:100 bull:cow ratio observed by Murphy (1963) for an unexploited captive elk herd in Missouri. However, the much lower bull:cow ratios documented for unexploited elk populations by Flook (1970) in Canada and Heptner et al. 1961) in the USSR indicate that lack of hunting exploitation alone may not result in high bull:cow ratios. The absence of harvest likely contributes to high bull:cow ratios, but Flook's (1970) ratios on elk populations in Banff and Jasper National Parks suggest that the absence of harvest alone is insufficient to create the high bull:cow ratios seen in largely unexploited confined elk populations in Missouri (Murphy 1963), on Elk Island (Flook 1970), and in the pre-1984 Michigan herd (Moran 1973) (the Michigan herd has been hunted annually since 1984 with no decline in observed bull:cow ratios; however, the MDNR harvest

strategy is designed to maintain the existing high bull:cow ratios). The historic high bull:cow ratios of the Michigan elk herd thus provide other indirect evidence that dispersal movements of yearling or other young bulls may be uncommon in this population.

SUMMARY AND CONCLUSIONS

Although yearling bull dispersal was not observed in Michigan, the lack of juvenile dispersal is still very important to the dynamics of Michigan's elk herd. Yearling bulls are not being actively dispersed by dominant bulls, and thus are likely much less vulnerable than juvenile bulls in typical Western USA elk populations. The absence of yearling bull dispersal, and subsequent low juvenile bull mortality rates relative to Western elk populations, contributes significantly to many of the unique attributes of the Michigan herd.

The historically high bull:cow ratios seen in the Michigan herd are at least partially attributable to the lack of juvenile bull dispersal. By minimizing mortality in this segment of the bull population, more bulls survive into older age-classes, resulting in the high bull:cow ratios seen in the Michigan herd. These high bull:cow ratios may in turn provide positive feedback to further minimize dispersal. With so many bulls around, elk in Michigan have apparently adopted a breeding system based on numerous small, dispersed harems to avoid constant harem possession conflicts (Bender 1992). In this rutting system, juvenile bulls, who pose little breeding threat to harem-masters, are tolerated, as the act of driving them away would likely bring unwanted attention to the harem from other harem-capable bulls. Thus, a positive feedback mechanism may be present in Michigan, whereby high bull:cow ratios produces tolerance of juvenile bulls in or adjacent to harems, resulting in lack of dispersal by juvenile bulls, which lowers juvenile bull mortality, thus maintaining high bull:cow ratios. Which variable, the absence of juvenile dispersal or a high bull:cow ratio, drives this hypothetical relationship is unclear.

The lack of juvenile dispersal may be the result of several factors. As outlined above, high bull:cow ratios may result in the abandonment of aggressive juvenile dispersal by dominant breeding bulls. Secondly, the impetus for juvenile dispersal may be lacking in Michigan. Total elk density is low, per capita resource availability is high, and juvenile bulls are not being actively dispersed by dominant bulls. Dispersal may therefore not be seen simply because juvenile bulls have no proximate reasons to disperse (although the likely ultimate driver of dispersal, increased reproductive success, should still be operating). Finally, it is possible that greater dispersal movements may not be seen until bulls reach age 2.5, as is common in red deer and some Western elk populations (although no dispersal movements have yet been observed for 2.5 year-old elk radio-collared as calves during Fall, 1990). However, bulls in general exhibit greater movements than do cows, partly as a consequence of food acquisition behaviors and partly as a predator-avoidance behavior. The greater movements of bulls in general should not be confused with true dispersal movements, which involve the complete, or at least seasonal, abandonment of a previous home range.

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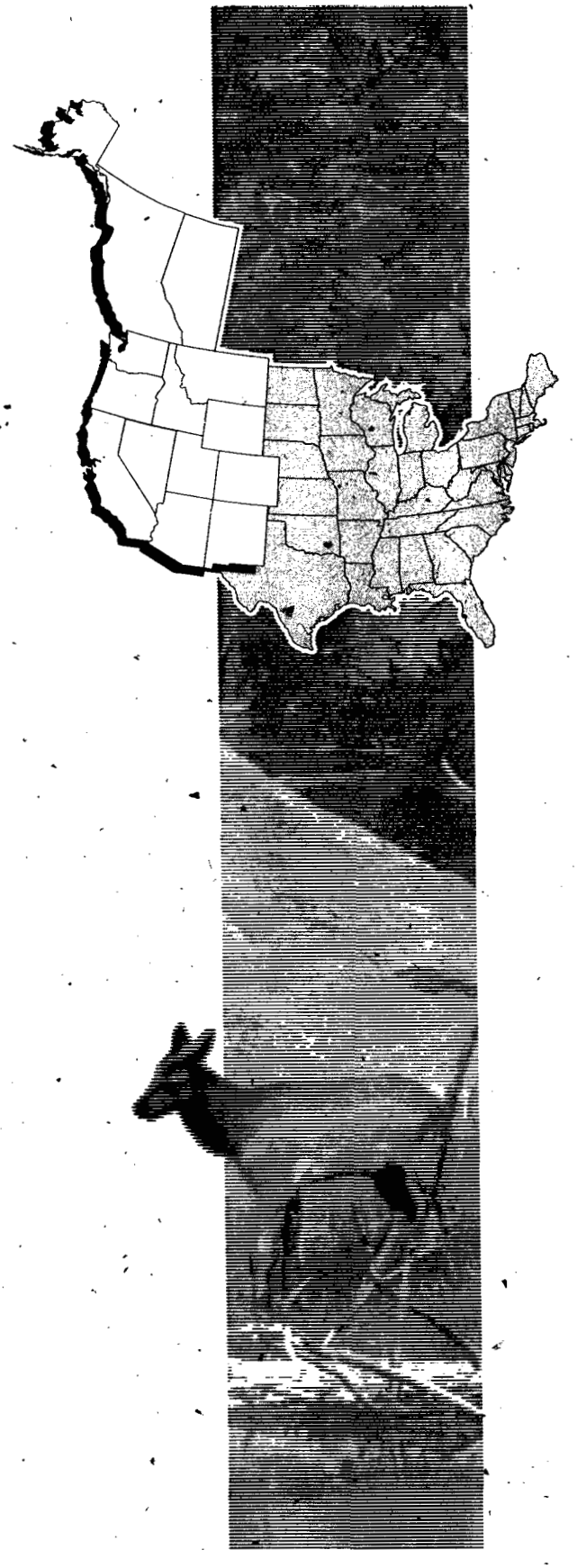
APPENDIX
Agenda & Registrants



AGENDA ○ WESTERN STATES & PROVINCES ELK WORKSHOP ○ AGENDA

May 19-21, 1993 • Gallatin Room • Holiday Inn • Bozeman, Montana

WORKSHOP FORMAT

This workshop will consist of a consecutive workshop oriented sessions, preceded by professional papers which relate to session topics. Panel members will be given time to make short and concise presentations representing their state's prospective. The remaining time will be for the panel to discuss the subject among themselves and to answer questions from the audience.

WORKSHOP OBJECTIVES

- Identify current and future management issues
- Share and evaluate management actions which have been successful
- Develop ways to avoid short term solutions which have long-term negative repercussions
- Seek ways to improve communication between state managers
- Work toward management compatibility

WEDNESDAY - MAY 19, 1993

Registration:
7:00 a.m. - 1:00 p.m. Holiday Inn Lobby (see map)

8:15 **Welcome & Opening Remarks** - Don Childress, Admin. Wildlife Division (MDFWP)

Session I **Status Reports of the Western States & Provinces**
8:30 Chair: John Firebaugh, Montana Department of Fish, Wildlife and Parks

State/Province	Representative	Title
Alaska	Roger B. Smith	US Fish & Wildlife Serv.
Alberta	Bill Glasgow	Regional Manager
Arizona	Vashti "Tice" Supplee	Chief Game Branch
British Columbia	Guy Woods	Regional Wildlife Section Head
California	Jon Fischer	Elk Program Coordinator
Colorado	Len Carpenter	State Wildlife Manager-Terrestrial
Idaho	Lonn Kuck	Wildlife Game & Research Manager
Montana	John Firebaugh	Regional Wildlife Manager
New Mexico	Darrel Weybright	Chief, Big Game
Oregon	Dan Edwards	Ass't Wildlife Staff Biologist -Big Game
Utah	West Shields	Big Game Program Coordinator
Wyoming	James "Jay" Lawson	Chief, Game Division

10:15 BREAK

Session II **Miscellaneous Papers** - *Chair, Lynn Irby, Prof Wildlife Management, MSU*

10:30 Characteristics of Stands used by Elk in a Sparsely Timbered Habitat. B. Patterson & F. Lindzey, Wyoming Coop. Res. Unit, Laramie.

10:50 Observations on Elk and Deer Competition on a Western Montana Winter Range. G.R. Baty & C. L. Marcum, School of Forestry, University of Montana, and M. J. Thompson, Montana Dept. of Fish, Wildlife and Parks.

11:10 Yearling Elk Movements in Michigan. L. C. Bender & J. B. Haufler, Dept. of Fisheries & Wildlife, Michigan State University and E. Carlson, Michigan Dept. of Natural Resources.

11:30 Elk Calf Mortality in Yellowstone National Park. F. J. Singer, YNP, K. K. Symonds, Colorado State University, A. Harding, YNP, & Dan Tyers, U.S. Forest Service, Gardiner, MT.

12:00 LUNCH

Session III **Livestock/Elk Grazing: Conflicts-Opportunities**
Chair: Mike Frisina, Montana Department Fish, Wildlife and Parks.

1:00 Results of Elk-Cattle Grazing Study. T. Hobbs, Division of Wildlife, Colorado Dept. of Natural Resources, Fort Collins, CO.

1:30 **Livestock/Elk Panel Discussion** Chair, Mike Frisina, Wildlife Specialist-Montana

State/Province	Panel Member	Title
Arizona	Vashti "Tice" Supplee	Chief Game Branch
British Columbia	Guy Woods	Regional Wildlife Section Head
California	Jon Fischer	Elk Program Coordinator
Colorado	Len Carpenter	State Wildlife Manager-Terrestrial
Idaho	Lonn Kuck	Wildlife Game & Research Mgr.
Montana	Joel Peterson	Regional Wildlife Mgr.
New Mexico	Darrel Weybright	Chief, Big Game
Oregon	Dan Edwards	Ass't Wildlife Staff Biologist for Big Game
Utah	Wes Shields	Big Game Program Coordinator
Wyoming	James "Jay" Lawson	Chief, Game Division

3:00 BREAK

3:20-4:30 Questions from audience and panel members to panel members

6:00-8:00 *Refreshments and snacks in Gallatin/MSU Room*

THURSDAY - MAY 20, 1993

Session IV Hunting Strategies Chair: Len Carpenter, Colorado Division of Wildlife

8:00 Elk Status Project. Bill Geer, Director of Chapter Development, RMEF

8:15 Who's Changing Elk Hunting. W. Van Zwoll, Rocky Mountain Elk Foundation, WA

8:45 Fifteen Years of 3 Point Bull Hunting in Northeast Oregon. P. E. Matthews & V. L. Coggins, Oregon Dept. of Fish & Wildlife.

9:15 Older Bulls - Who Needs Them? R. DeSimone, Montana Dept. of Fish, Wildlife and Parks

9:45 Control of Michigan's Elk Population and Bull-to-Cow Ratios Through Antlered and Antlerless Harvest Quotas. E. Carlson & Glen Matthews, Michigan Dept. of Natural Resources.

10:15 BREAK

10:30 Innovative Elk Management Through a Cooperative Landowner Incentive Program in Washington State. B. A. Gilbert & K. L, Persing, Champion International Corp.

11:00 Evaluation of a Spike Only Regulation in S.E. Idaho. D.L. Hughbanks & L.R. Irby, Dept. Biology, MSU and D.K. Koehler, Idaho Department of Fish & Game.

11:30 LUNCH

1:00 **Hunting Strategy Panel Discussion** Chair, Len Carpenter

State/Province	Panel Member	Title
Wyoming	James "Jay" Lawson	Chief, Game Division
Utah	Wes Shields	Big Game Program coordinator
New Mexico	Darrel Weybright	Chief, Big Game
Montana	John Cada	Regional Wildlife Manager
Idaho	Lonn Kuck	Wildlife Game & Research Manager
Colorado	Rick Kahn	Terrestrial, Deer & Elk Biologist
California	Jon Fischer	Elk Program Coordinator
British Colombia	Guy Woods	Regional Wildlife Section Head
Alberta	Bill Glasgow	Regional Manager
Arizona	Vashti "Tice" Supplee	Chief Game Branch

3:00 BREAK

3:15-5:00 Questions from panel members and audience to panel.

6:00 Prelude to Banquet, no host social hour.

7:00 **BANQUET**: Speaker, James I.S. Innes, Helicopter Wildlife Management

FRIDAY - MAY 21,1993

8:00-Noon **Field Trip**

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