Demographic uncertainty and disease risk drive climateinformed mountain goat management

Justin Gude North Central Climate Adaptation Science Center Webinar April 8, 2021

Photo: Bruce Smith

Outline

- Explain process and results
- Clarify outcomes and direction
- Recent developments
- Discussion and questions



Working Group Process

<u>Structured</u> <u>D</u>ecision <u>M</u>aking

"A formal application of common sense for situations too complex for the informal use of common sense"

"A way of thinking through any of the decisions you face. With much of decision analysis, such as understanding your objectives and creating alternatives, <u>you do not need axioms</u>. With other parts of decision analysis, <u>you do not need procedures or models</u>. <u>You need clear thinking directed at the</u> elements of decisions and at combining those elements to gain insights about your decision."



Key Elements of SDM

Values-focused thinking

- The objectives (values) are discussed first and drive the rest of the process
- In contrast to intuitive decision-making, which usually jumps straight to the alternatives

Problem decomposition

- Break the problem into components, separating policy from science
- Complete relevant analyses
- Recompose the parts to make a decision

When is SDM Appropriate?



FACTS

Montan. WD Management Ac. Montana Fish, Wildlife and Parks CWD Action. May 19, 2017



Where has SDM been used by FWP?

- Elk archery season setting
- Elk brucellosis management
- Effective elk management ("shoulder seasons")
- Broadening the conservation constituency base
- R2 Lion harvest management → Statewide adaptive management plan for mountain lions
- Bighorn sheep pneumonia risk management
- Wolf harvest management
- Improving FWP-USFS collaboration on applied research
- Chronic wasting disease management
- Developing a Comprehensive Hunting Access
 Plan
- Convening a Grizzly Bear Advisory Council



Keeney, R.L. 2004. Making better decision makers. Decision Analysis 1:193-204.



Structured Decision Making

58 mountain goat "population units"



Problem- responsibility

- FWP mission: stewardship of Montana's wildlife that contribute to the quality of life for present and future generations.
- Mountain goats:
 - Ecologically important and iconic
 - Declined across much of their range in Montana
 - Concerns for their present and future status
 - Concerns about future consumptive and nonconsumptive recreational opportunities

Problem- uncertainty

- Lack of information on abundance, vital rates, population boundaries
- Unknown impacts of predation and other ecological processes
- Changing climate
- Shared respiratory pathogens with bighorn sheep

Problem- challenges

- Lack of dedicated funding
- Competition for limited agency resources
- Logistics of working in remote, high elevation areas
- Limited public advocacy
- Absence of a management plan

Decision/ action

By the end of 2019, the working group, collaborating with partners across various jurisdictions, will recommend guidelines to the FWP Wildlife Division Administrator and Director.

- a suite of management strategies
- identifying information gaps
- prioritizing monitoring and research needs to address mountain goat conservation challenges



Overarching objectives (work on everywhere)

ATTENDED THE AND A THE STATES

Strategic objectives:

- 1. Foster cooperative working relationships among jurisdictions.
- 2. Provide sustainable public opportunity to hunt and view mountain goats.
- 3. Build public support for mountain goat conservation at local and larger scales.

Overarching objectives (work on where relevant)

- 1. Mitigate impacts of human development or recreation on mountain goat distribution.
- 2. Combat habituation.
- 3. Manage conifer encroachment where possible.

Fundamental Objectives

- 1. Maximize the number of occupied mountain goat population units.
- Maximize the number of mountain goat population units meeting population trend objectives statewide, considering limitations in each population unit.
- 3. Minimize disease risks to bighorn sheep.
- 4. Minimize disease risks to mountain goats.
- 5. Minimize cost.
- 6. Minimize social conflict resulting from mountain goat management.

Management Strategies

- 1. Status Quo
- 2. Top-down mortality management
- 3. Introduction
- 4. Augmentation
- 5. Habitat protection
- 6. Combined, with augmentations
- 7. Combined, without augmentations

Photo: Pat Shanley



Consequence Predictions

Modeling to incorporate uncertainty:

- Occupied mountain goat habitat

 Climate change
- 2. Mountain goat population dynamics
 - Population size, vital rates, age structure
- 3. Disease risks
 - Pathogen presence and mixing pathogens

Predicted without uncertainty:

- 4. Costs
- 5. Social conflict





Climate change uncertainty



Climate uncertainty and mountain goat habitat models

Primary conclusion

Under every model we considered, management alternatives that involve *new population introductions* will result in more occupied mountain goat habitat at mid-century.

Photo: Pete Meunnich

Photo: Julie Cunningham

factor(t)

Population Dynamics Uncertainty

• Population counts

Ranges provided by biologists

- Vital rates
 - AB and AK studies
- Age structure

Vital rates & MRRE database



Primary conclusions

Population dynamics uncertainty is influential:

- How best to increase mountain goat populations depends on population dynamics *in Montana*.
- The range of uncertainty is high.
- Different management strategies will be more effective depending on where our populations are within that range.

Disease risk uncertainty

- Pathogen presence
 - 3 hypotheses:
 - 1. Only known herds
 - 2. All herds
 - 3. Historic overlap with domestics
- Mixing microbial communities
 - Relative risk compared to pathogen presence



Primary conclusionspathogens

- Disease risk is always lower without translocations.
- *If we pursue translocations,* knowing pathogen communities will help us reduce the number of herds at risk.



Primary conclusions- microbial mixing



Importance of objective weights

Fundamental objective	Group mean weights	Recovery focused weights	Risk averse weights
Maximize the number of occupied mountain goat population units.	0.19	0.25	0.03
Maximize the number of mountain goat population units meeting objectives statewide, considering limitations in each unit.	0.27	0.36	0.18
Minimize disease risks to bighorn sheep.	0.19	0.07	0.26
Minimize disease risks to mountain goats.	0.20	0.07	0.26
Minimize cost.	0.06	0.11	0.13
Minimize social conflict resulting from mountain goat management.	0.09	0.14	0.13

Importance of objective weights



Management strategy recommendations

Continue and expand ongoing efforts:

- Provide sustainable public opportunity to view and hunt mountain goats.
- Translate public opportunity into outreach and public support for conservation.
- Foster cooperative working relationships within and among agencies.
- Avoid or mitigate effects of human development or recreation.
- Minimize habituation.
- Manage conifer encroachment in goat habitat where possible.



Management strategy recommendations



- Continue to reduce harvest in small populations.
- Protect habitat when negative impacts are clear.
- Be transparent and clear about disease risks due to translocations.
- Clarify risk tolerance at local and larger scales.
- Pursue new population introductions, augmentations, and carnivore reductions in an adaptive management context.

Priority research & monitoring needs

- Population dynamics
 - Population sizes, vital rates, age structures
 - Effects of carnivore harvest, habitat protection, translocations
 - Minimum viable populations and extirpation risk
- Disease risk
 - Pathogen communities
 - Effects of mixing pathogen communities
 - Risk tolerance- wildlife managers, decision makers, and the public



New developments and next steps

- Not a management plan But has led to project proposals
- Endorsement by agencies involved
- Reporting & outreach
 - Detailed report & readerfriendly summary (FWP website)
 - Peer-reviewed publication
- Coordination on mountain goat and bighorn sheep management & research: adaptive management
 - Working group assembled
 - 5-10 year work plan in development



Mandates: laws, policies, preferences

Objectives

Uncertainty

Alternatives

System understanding

Research, monitoring

Decide, take action

Trigger

Analytical tool kit

> Trade-offs and optimization

Values: Preference scales, objective weights, risk attitudes Consequences

Problem

Photo: Bruce Smith