Problem: How should we invest conservation/management dollars to maximize benefits to migratory birds, considering the full range of the species throughout its annual cycle?

Guidance to Decision-Makers

Multi-state/International: (e.g., Neotrop Act, National Fish and Wildlife Foundation, USDA Forest Service)

Regional: (e.g., U.S. Farm Bill programs, Mexican government/NGO easement programs, State private lands programs)

Conservation Investors want Positive Population-level Returns

Team

Coach - Jim Lyons, USFWS-Mig Birds
Apprentice – Jennifer Szymanski, USFWS-ES
Coordinator – Brad Andres, USFWS-Mig Birds

Bart Bly – Rocky Mountain Bird Observatory, Nebraska
Vicky Dreitz – Colorado Division of Wildlife
Antonio Chavez Ramirez – Pronatura NE, Chihuahua
Carol Roberts – USFWS-ES, California
Kelli Stone – Wildlife Biologist, Denver
Mike Wunder – University of Colorado-Denver

Mountain Plover (*Charadrius montanus*) Ecological Background

An uncommon, endemic breeding bird in the Rocky Mountain and Great Plains states; occurs in low density and low numbers (<20,000 individuals)

Dependent on disturbance by grazers (and fire)

Multi-clutched (i.e. female lays eggs in two nests)

>85% of current range on private lands

Can't account for 50% of population in winter; uncertain about survival throughout the annual cycle

Legal Background

Proposed for listing under ESA but withdrawn in 2003

Species of high conservation concern in U.S. Shorebird Conservation Plan

High conservation concern status in range states

Objectives

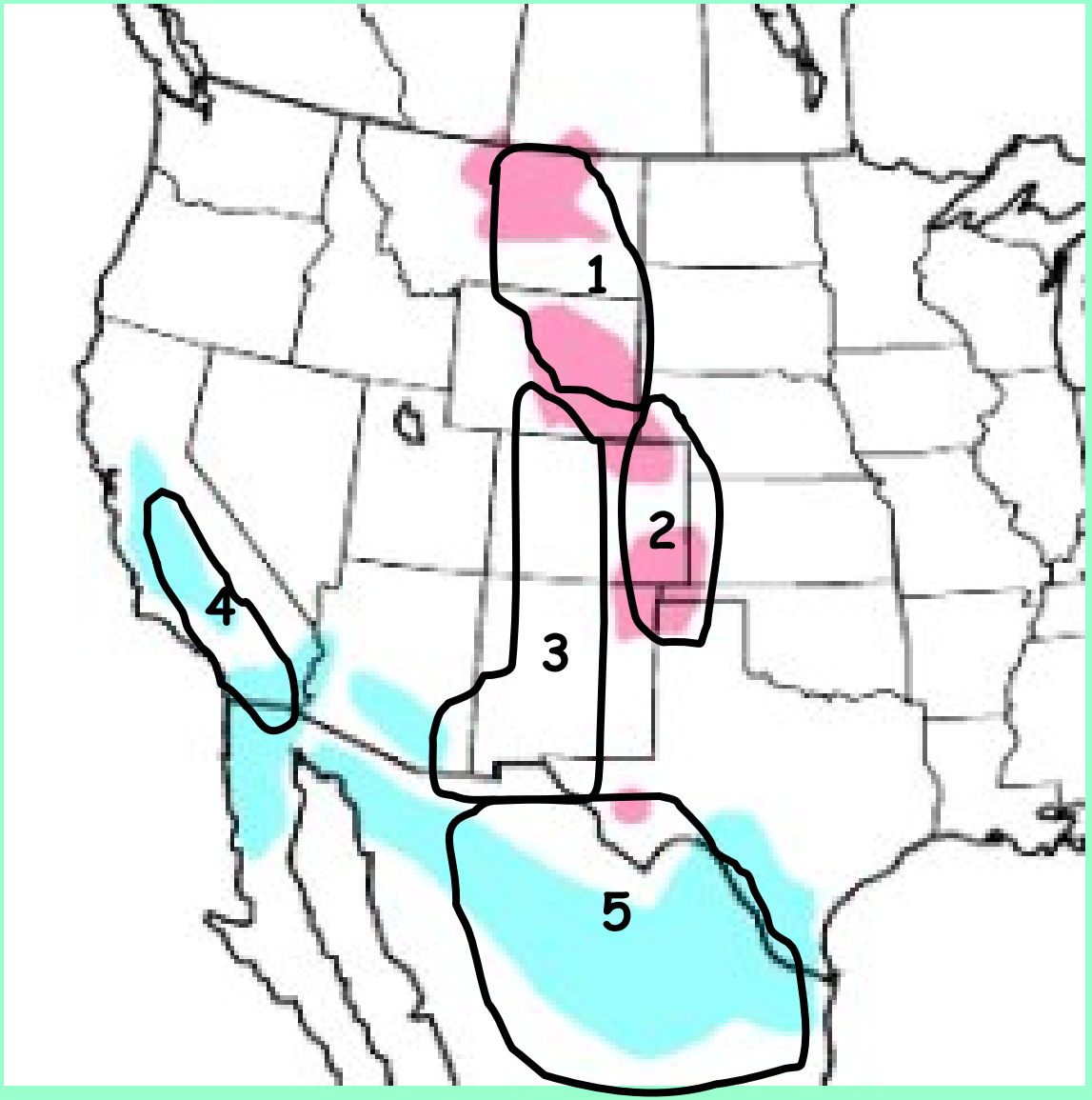
Fundamental: Minimize the probability of extinction

Secondary objective (means): minimize p ($\Lambda < 1$) in all regions (to hedge against weather effects) over the next 30 years.

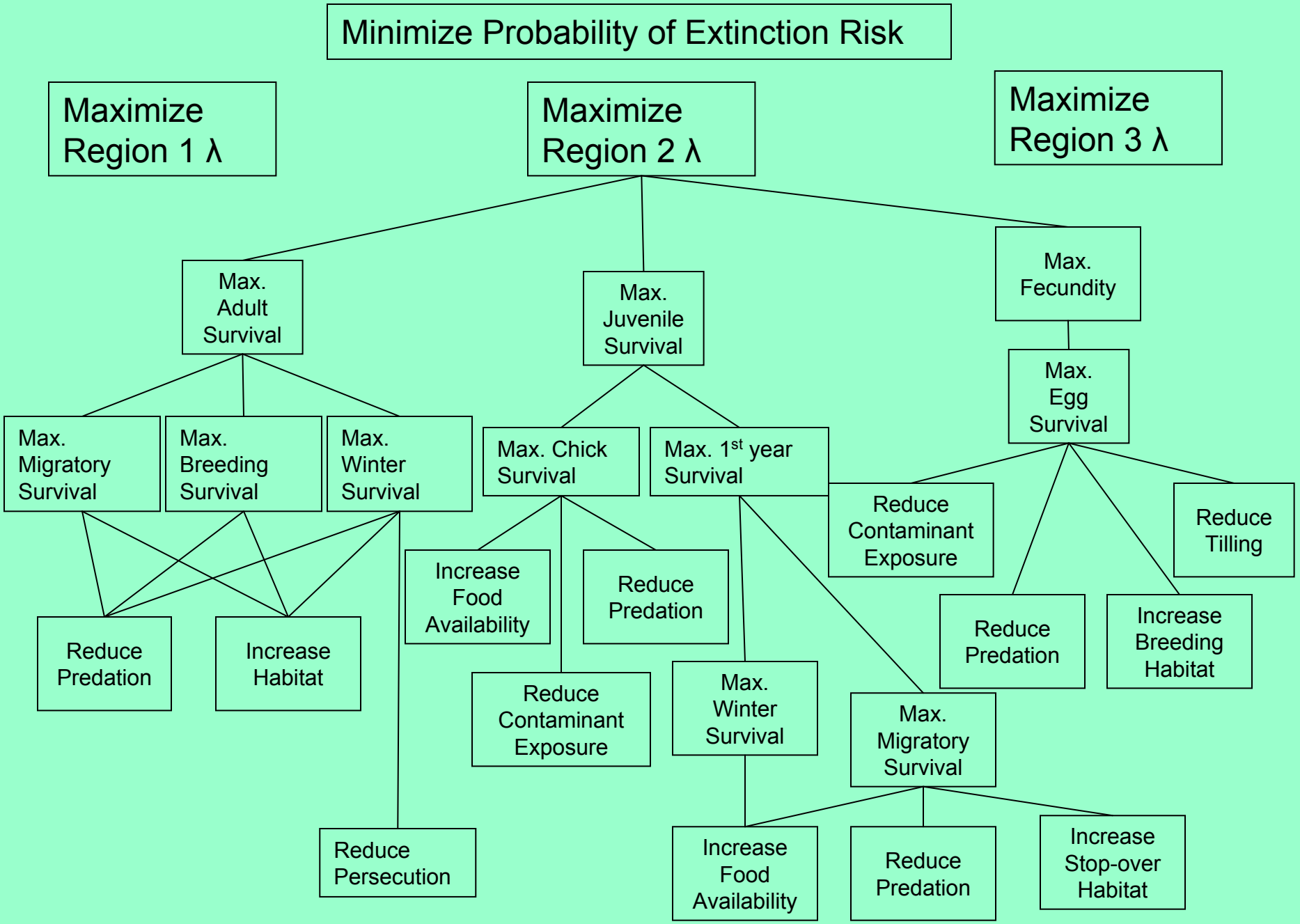
Tertiary objectives (means)

- Maximize survival (egg, chick, 1st-year, adult)
- Provide habitat (breeding, wintering, stop-over)

Regions



Mountain Plover Objectives Hierarchy



Alternatives

Regions:	1	2	3	4	5
Land protection (easements)		X	X	X	X
Land protection (acquisition)		X	X		X
Land management (grazing by cattle, bison, sheep)	X	X	X	X	X
Land management (prairie dog enhancement)	X	X	X		X
Land management (burning)	X	X		X	
Land management (CRP mixes)	X	X	X		
Protect nests		X			X
Promote Integrated Pest Management				X	

** use Conservation Measures Partnership lexicon

Consequences (modeling)

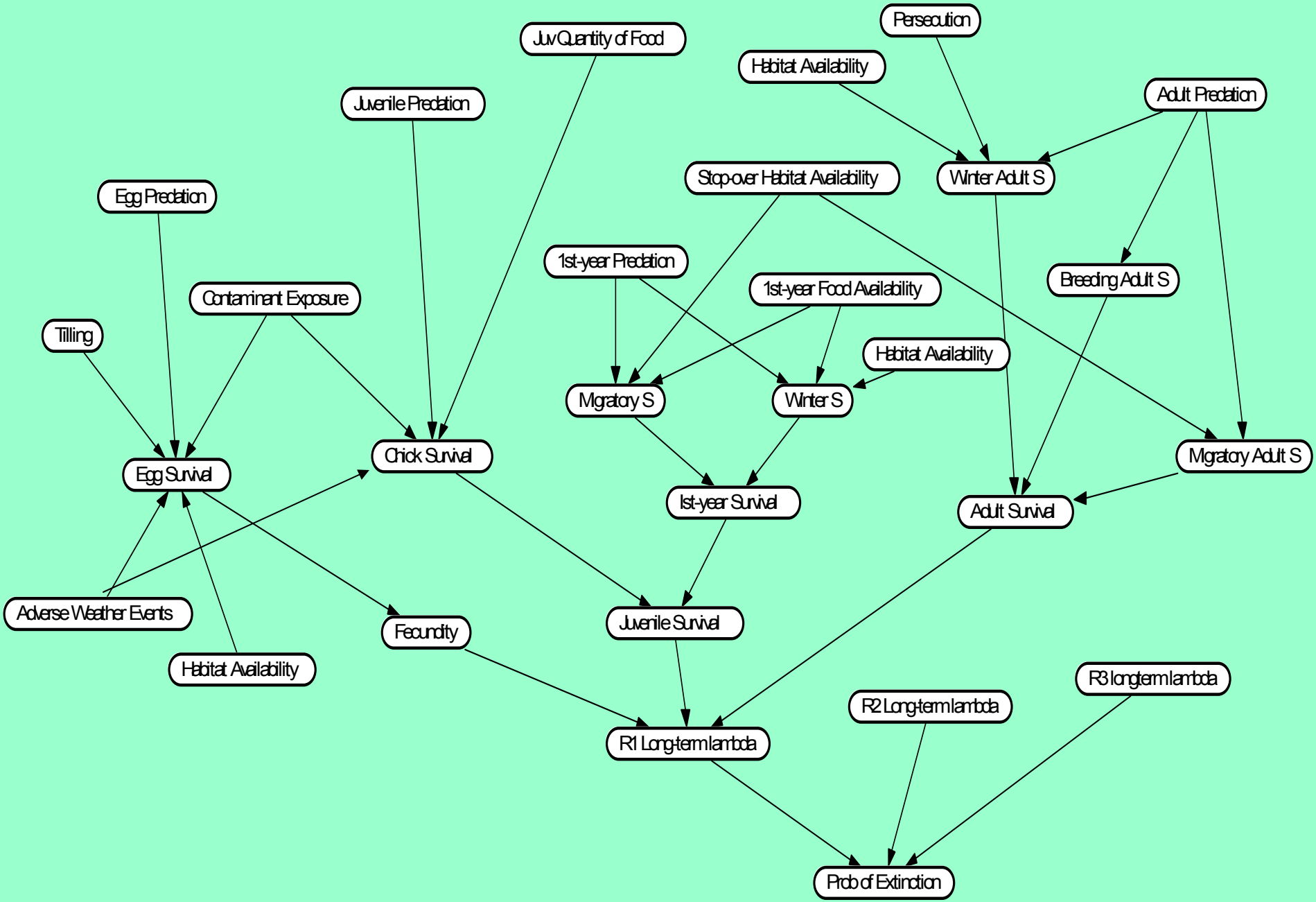
Influence diagram (conceptual/graphical)

Simulation population model to examine effects of actions on survival response and population growth

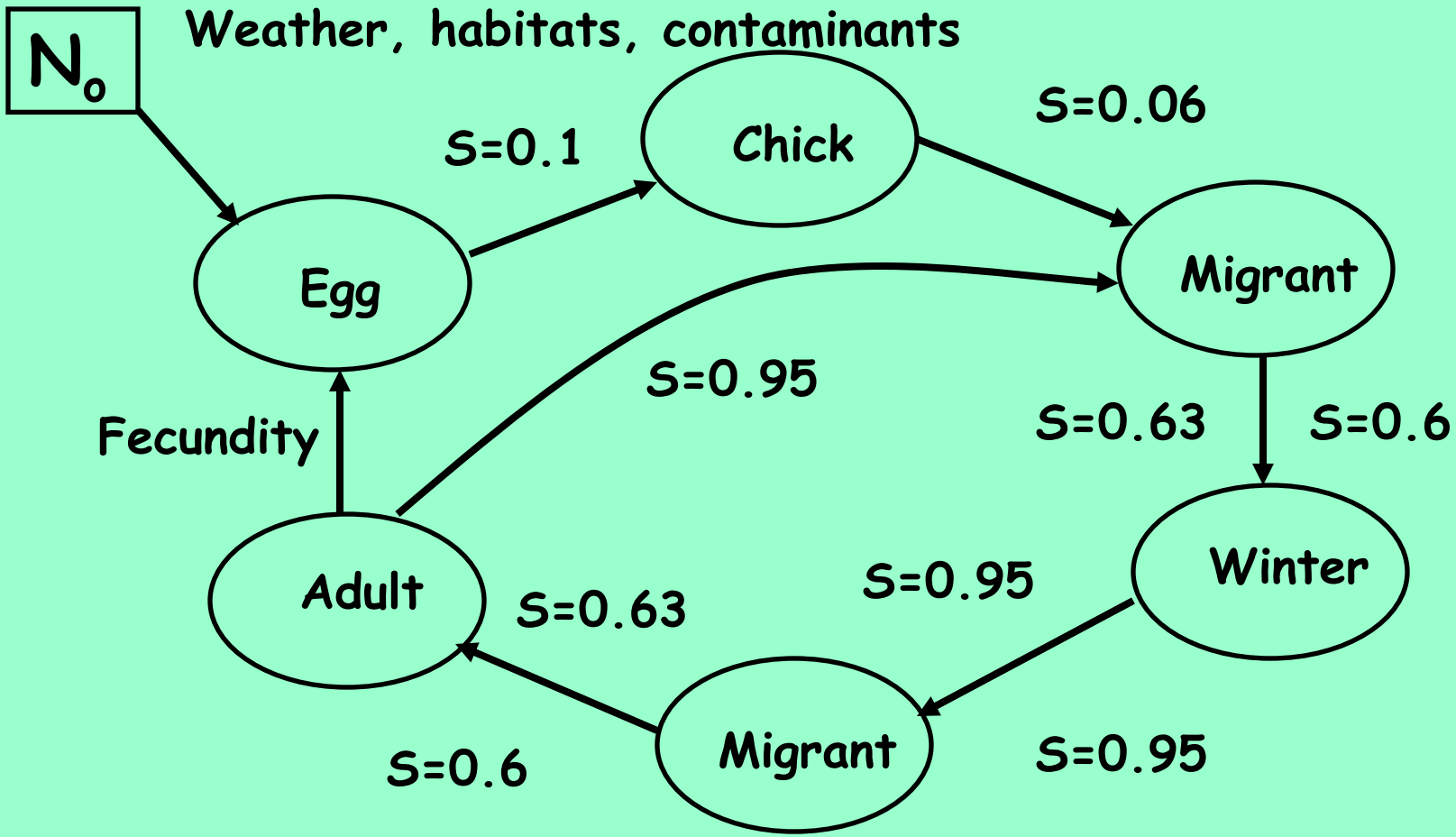
Allocation model to maximize efficiency (benefit/cost)

* abandoned Bayes net as analytical technique

Mountain Plover Influence Diagram

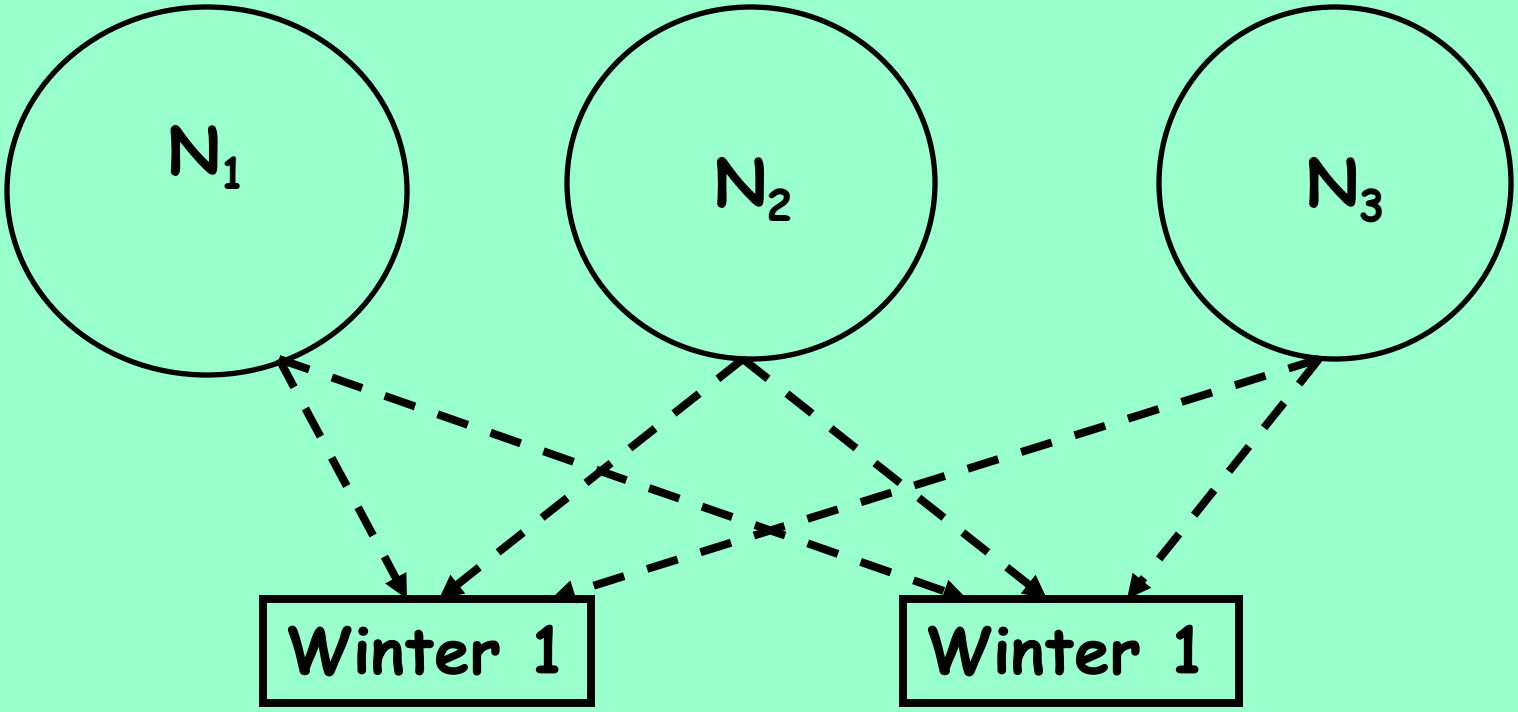


Population Model Structure

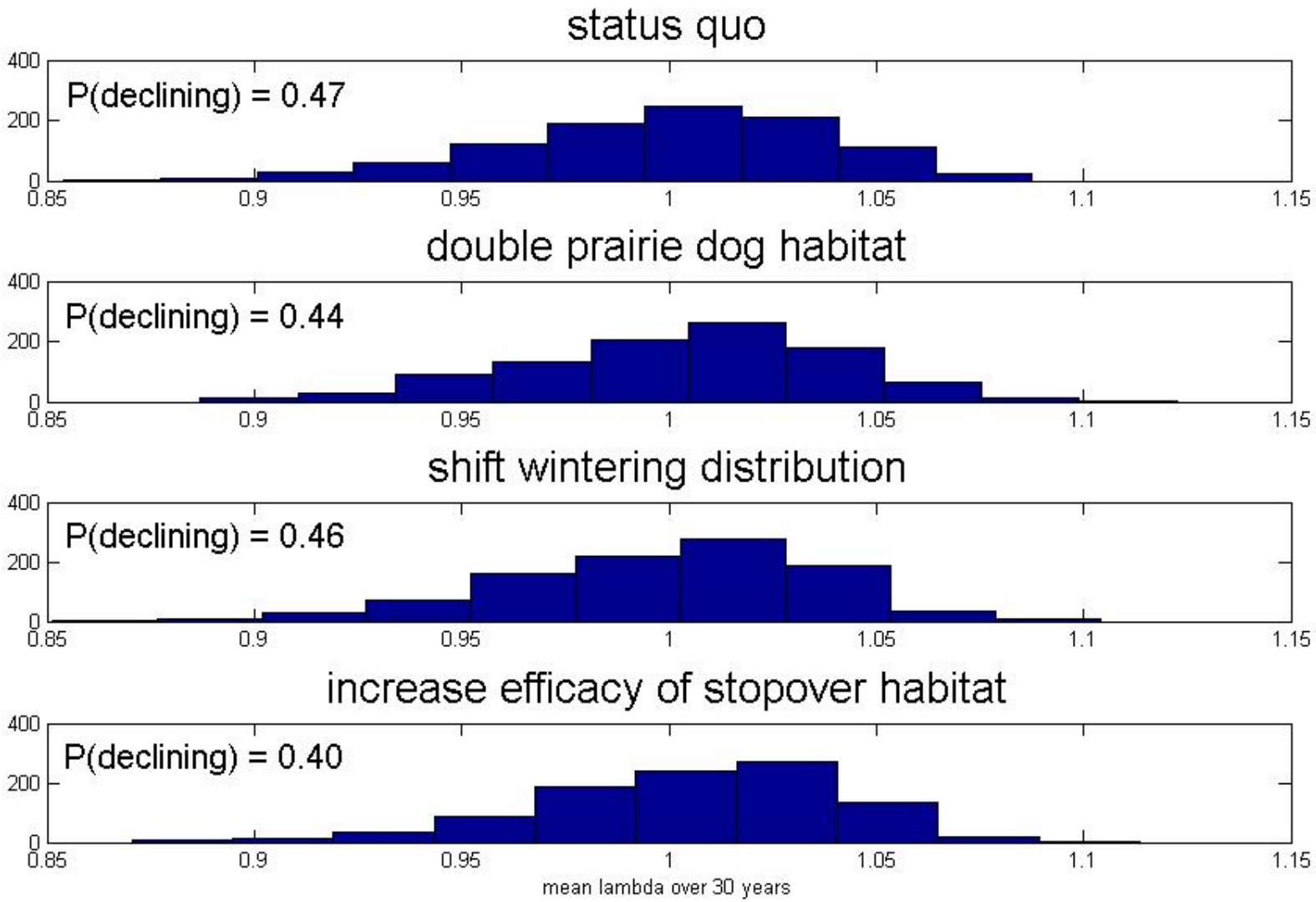


Universal effects of food and predation

Distribution



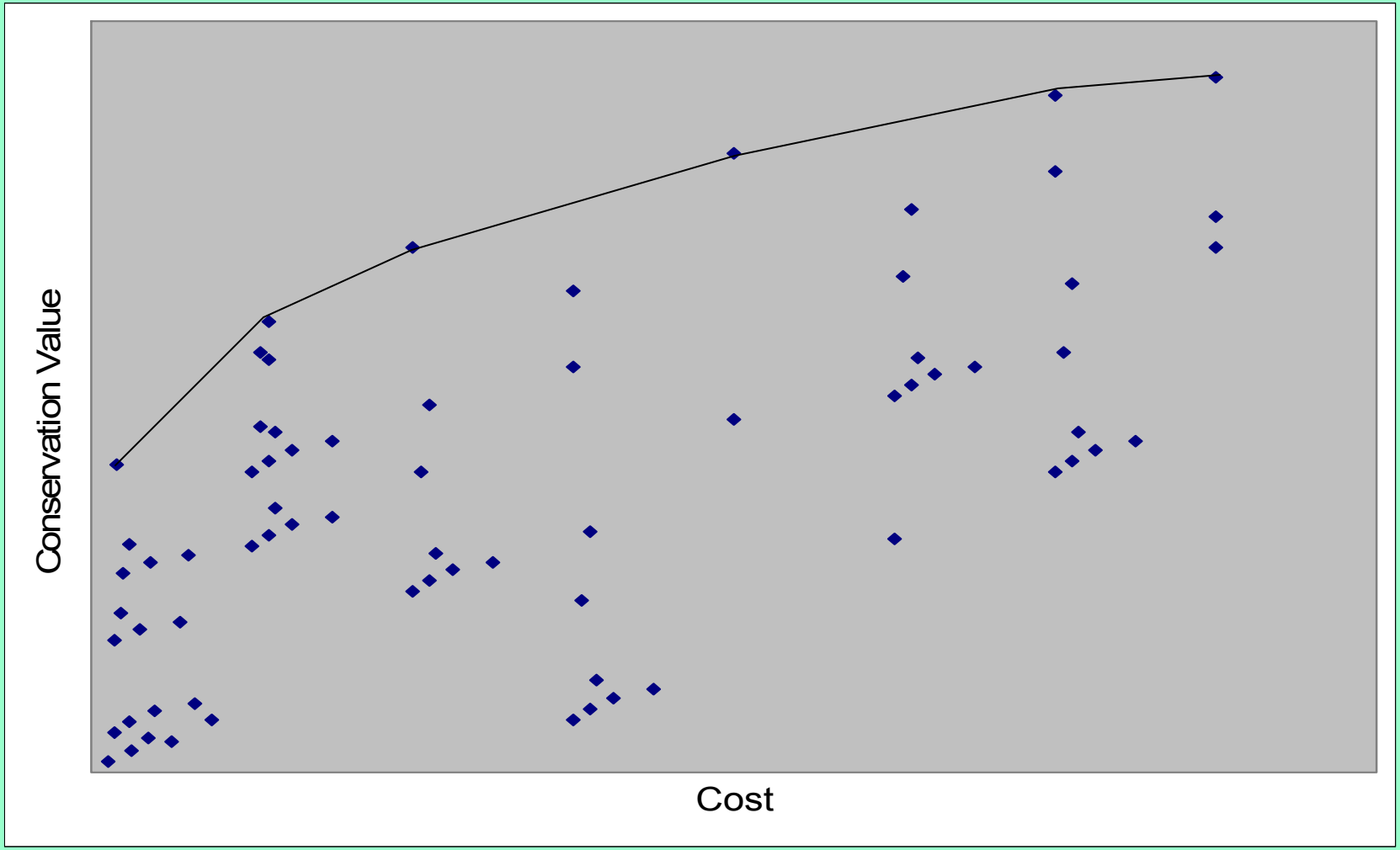
Model Simulations



Allocation Model (least to best benefit)

Region/action		Cost ($M)	Λ
1	Status quo	0.00	0
	Change grazing practices	0.10	3
	Burn land	0.25	6
	Farm prairie dogs	1.00	60
2	Status quo	0.00	0
	Protect nests	0.14	10.5
	Change seeding mixes for CRP	3.00	14
	Increase easements	10.0	70
3	Status quo	0.00	0
	Farm prairie dogs	0.50	8
	Increase easements	10.0	28
	Increase acquisition	20.0	40
4	Status quo	0.00	0
	Promote Integrated Pest Management	0.10	50
	Manage field crops (subsidy?)	1.00	80
	Increase acquisition/re-lease	5.00	100
5	Status quo	0.00	0
	Protect nests	0.05	32
	Lease ejido lands	2.00	48
	Increase acquisition	6.00	80

Efficiency Frontier – Determine value of alternative portfolio for a given cost



Test Simulation Results against Allocation Model

Providing habitat in California has little effect on reducing p ($\lambda < 1$):

0.473 to 0.468; 100 on allocation scale

Doubling prairie dogs in Montana and Wyoming has moderate effect on reducing p ($\lambda < 1$):

0.473 to 0.410; 5th best alternative

Uncertainty

Structural – best models/parameters/response

Limiting factors – migration (habitat quantity/ quality?); contaminants; range management (stocking density, intensity, timing); winter habitat availability land management; regionally differential

Environmental – weather effects (some consideration); shifting mosaic of habitats due to market forces; contaminants; climate change

Partial management control – prairie dogs introduced and die; considerations of other high concern species; easement compliance

Monitoring

Reduce uncertainty, evaluate action effectiveness, and track performance

Survival – mark-recapture in all regions with re-sighting on wintering and breeding grounds (egg, chick, 1st-year, adult).

Occupancy monitoring in all (breeding) regions.

Covariates – identify and measure (e.g., predator density, habitat condition, food availability, prairie dog density)

Reduce uncertainty about exposure effects of contaminants; monitor periodically

Determine distribution and abundance in winter range

Encourage development of technologies to uncover migration stopovers and routes (NASA)

Next Steps

Review first prototype and expand stakeholder input for development

Emphasize starting point for discussions

Set-up adaptive management components to evaluate and adjust actions

Conduct structural sensitivity

Develop approaches for outreach to conservation investors