

Instructions:

The refuge manager has asked you to tell her the best options for managing the grassland vegetation. You need to select the vegetation treatment alternative that performs best across the seven objectives.

You've just become the biologist at Rolling Thunder NWR in the upper Midwest. Years ago, the refuge acquired several prairie parcels to protect rare orchids. These plants only grow in open grasslands, usually requiring direct habitat manipulation to limit the invasion of woody species. Management objectives on these parcels have also included maintaining habitat for game birds, especially winter vegetation cover. More recently, conservation objectives have been expanded to include sustaining rare butterfly and beetle populations, which are also endemic to these prairie habitats. Meanwhile, residential development has increased and is now in proximity to these areas, prompting new constraints on management to avoid conflicts with local residents.

Objectives: Minimizing costs and neighbor complaints, while maximizing rancher support (grazing opportunity), and of course, conservation of birds, plants, butterflies, and beetles.

Alternatives: The refuge has five treatment options: Spring Burning, Fall Burning, Mowing, Grazing, and No Action.

Performance Attributes: The refuge has collected some data on the effects of different management strategies, such as grazing, mowing and controlled burning, on a variety of species. Your predecessor as refuge biologist has already compiled a "Consequences Matrix" summarizing the performance of the five treatment alternatives on the seven objectives. He used "proxy measures" for the objectives, such as "stem density" as the index for effects on plants, "estimated number of complaints" for neighbor complaints (from a survey), and "grazing units" or number of permitted cattle-months as an index for rancher support (see full matrix, attached).

Additional Background Information:

- The most influential habitat factor predicting bird population density is the presence of over-winter grass cover. Thus, the bird conservation objective can be considered through winter vegetation cover.
- Except in wet years or locations, fall burning leaves the prairie relatively bare of standing vegetation until spring regrowth.
- Plants benefit most from burning, which not only limits woody plant encroachment but releases nutrients into the soil.
- Butterflies suffer direct mortality from burning, yet are strongly dependent on several species of plants that thrive with burning. Burn timing affects butterfly survival, with losses greater in spring burns as eggs die or fail to emerge. Because they can fly between patches, adult butterflies are able to recolonize habitat patches after treatments provided source populations are maintained.

- Beetles are relatively non-vagile and therefore suffer direct mortality in burning and some mortality from cattle trampling, and also are slow to recolonize areas where local populations are eliminated. Fall burning also leaves beetles exposed to winter mortality.
- Mowing causes the least direct mortality to beetles and also orchids (which cattle eat), but is also logistically most challenging and cannot be implemented across all patches consistently to control woody vegetation. Mowing during butterfly hatch can reduce populations.
- Failing to conduct any vegetation management (no action alternative) has the fewest direct impacts, but by allowing woody encroachment, harms prairie species conservation in the long term.
- Rancher revenue stems from the issuance of grazing permits on the refuge, thus, can be considered an economic or monetary value.
- Grazing permits generate \$120/grazing unit in revenue.

Rolling Thunder Prairie Management Part A

Reduce the number of alternatives in the table on the next page by finding and eliminating any dominated alternatives, in the process also deleting any irrelevant objectives that result as alternatives are dropped.

Simplifying a consequence table. First, look for an alternative (*column*) that ‘can’t win’ because at least one of the other alternatives ranks better (or ties) on ***all*** objectives. Cross that alternative off the table and then see if any objectives have become irrelevant (no difference between the remaining alternatives). Repeat (we’ve set this up so you can reduce the table at least to four alternatives, but maybe you can go farther?). *Optional tip for finding dominated alternatives:* Convert the performance measures on each objective (every row) to simple relative ranks, from 1-5 for best to worst performance (remember to pay attention to whether your goal is to *minimize* or *maximize* each objective!). For example, the top row, Cost, would have ranks 3, 3, 5, 2, 1 from left to right (e.g., no action is best or 1, spring and fall burn alternatives tie for relative rank 3)

CONSEQUENCES TABLE		Treatment (Alternative)				
Objective	Goal	Spring Burn	Fall Burn	Mowing	Grazing	No Action
Cost (\$/year)	Min	10,000	10,000	15,000	7,000	2,000
Rancher Support (# of Grazing Units)	Max	0	0	0	50	0
Neighbor Complaints (Estimated Number)	Min	5	5	0	1	1
Maintain Cover for Birds (Yes = 1, No = 0)	Max	1	0	1	1	1
Effects on Listed Plants (Stem density / m2)	Max	10	9	2	1	1
Effects on Butterflies (Emergence Index % hatch)	Max	0.05	0.03	0.1	0.2	0.01
Effects on Beetles (% Area Occupied)	Max	0.02	0	0.35	0.2	0.02