# Grassland Adaptation Menu: Strategies, Approaches, and Example Tactics

## **Strategy 1: Sustain fundamental functions in grasslands**

Approach 1.1. Maintain or restore soils and nutrient cycling

 Example tactics:

* Add carbon-rich soil amendments such as biochar or sawdust to reduce nitrogen availability on rich or loamy soils.
* Apply lime to increase base cations in the soil profile in areas affected by long-term acid deposition.
* Modify operations to minimize soil compaction and rutting, such as using debris mats or transportable bridges to cross wet areas with heavy equipment.
* Restore native herbaceous groundcover following ground disturbance to reduce erosion.
* Apply prescribed fire to increase nutrient turnover.

### Approach 1.2. Emulate natural disturbances from grazing

 Example tactics:

* Mow grasslands to mimic grazing disturbance where grazing is not feasible.
* Implement high-intensity rotational grazing with cattle or other livestock to mimic natural grazing patterns.
* Return native ungulates such as bison or elk to large, intact grasslands.

### Approach 1.3. Emulate disturbances from natural and indigenous fire

 Example tactics:

* Mow grasslands to limit encroachment of woody species.
* Conduct prescribed fire during the growing season to reduce woody vegetation.
* Allow prescribed fires to burn at varying intensities to mimic natural fire effects.

### Approach 1.4. Maintain or restore hydrology

###  Example tactics:

### Maintain suitable litter cover to sustain soil moisture in drier grasslands.

* Remove drain tile from grasslands and allow wetlands to reform.
* Reduce groundwater withdrawals in recharge areas (e.g., playa lakes, prairie potholes).
* Retain livestock ponds and other deep wetlands to provide permanent wetland habitats within grasslands.
* Control woody species invasions in wetlands, especially if they limit native species and alter site hydrology.

## **Strategy 2: Reduce the impact of physical and biological stressors on grassland communities**

### Approach 2.1: Reduce impacts from extreme rainfall and drought

 Example tactics:

* Restore wetlands within grassland areas to help store and naturally release water from intense rain events.
* Reduce stocking levels or grazing duration during periods of drought.

### Approach 2.2: Reduce the risk of unacceptably severe wildfire

 Example tactics:

* Consider winter or night-time prescribed burns to reduce the risk of high-severity fire.
* Regularly conduct prescribed fires to reduce fuel loads.
* Create fire breaks by connecting natural features such as wetlands with less-receptive cover such as agricultural fields.

### Approach 2.3. Reduce the impacts of climate change on grassland-dependent wildlife

###  Example tactics:

### Promote a variety of nectar-producing plants across the growing season to provide food sources for pollinators.

### Provide natural or artificial water sources for wildlife that will be accessible during periods of low and high water levels.

### Approach 2.4. Prevent or reduce encroachment of woody species

 Example tactics:

* Mow grasslands to limit encroachment of woody species.
* Conduct prescribed fires during the growing season to have the maximum effect on woody vegetation.

Approach 2.5. Prevent the introduction, establishment, and spread of non-native invasive plants

 Example tactics:

* Ensure that livestock that are introduced to a grassland are fed weed-free forage prior to introduction.
* Use herbicide treatments to control specific invasive plants.
* Clean equipment to minimize the spread of non-native species.
* Educate staff and landowners on identification and eradication of invasive species.
* Quickly over-seed, drill seeds, or plant plugs of native plants in recently disturbed (e.g., sprayed, burned, disked) areas to reduce risk of invasive establishment or regeneration.

Approach 2.6. Promote compatible management practices on agricultural land adjacent to grasslands

 Example tactics:

* Promote the adoption of crane-friendly crops such as wheat, barley, alfalfa, or corn near riparian areas that are migratory stopover locations.
* Ensure the continued availability of crop fields for migrating waterfowl in regions where crop suitability declines.
* Promote fall-seeded crops that do not require spring tillage, such as winter wheat or fall rye.

### Convert cropland to perennial forage or pasture.

Approach 2.7. Promote compatible management practices on rangelands

Example tactics:

* Implement high-intensity rotational grazing with cattle or other livestock to mimic natural grazing patterns.
* Provide alternative water sources and prevent livestock from entering sensitive wetland areas.
* Control noxious weeds on rangelands.

## **Strategy 3: Enhance plant genetic, species, and functional diversity and structural heterogeneity**

### Approach 3.1. Maintain and restore genetic diversity of grassland species

 Example tactics:

* Overseed grasslands with seed mixes that contain seed from multiple seed collection zones to increase genetic diversity.
* Translocate individuals from outside the area to supplement small or isolated populations.

### Approach 3.2. Maintain and restore a diversity of native plant species and functional groups (C4 and C3 grasses, forbs, and legumes)

 Example tactics:

* Prioritize grasslands with high plant species richness or rare species for protection.
* Plant a diverse variety of pasture grasses, including both cool-season grasses for high herbage production and native warm-season grasses with high drought tolerance.
* Protect seasonal wetlands within grassland habitats.
* Inoculate soils with mycorrhizae to increase plant establishment, diversity, and survival.
* Overseed grasslands with seed mixes chosen to maximize functional diversity.
* Preserve adequate shrub cover in grasslands to maintain temperature-regulated microsites.

### Approach 3.3. Increase and retain heterogeneous vegetation structure

 Example tactics:

* Use different livestock stocking rates in different management units to create heterogenous vegetation structure across the landscape.
* In heavily grazed landscapes, reduce stocking rates in a subset of pastures to increase the variety of available grassland.
* Restore distinct patches using species mixes of contrasting heights to promote a variety of structures.
* Implement differing management actions, such as different fire return intervals or mowing regimes, on nearby grasslands to provide adjacent habitat conditions.

Approach 3.4. Maintain and restore wetland vegetation within grasslands

Example tactics:

* Control woody species invasions in wetlands, especially if they limit native species and alter site hydrology.
* Release existing wetland seed banks by restoring historic water levels or by removing legacy sediment overlying the original substrate.
* In low-diversity plantings or degraded wetlands, interseed following prescribed burns or other treatments to boost diversity.
* Include wetlands within upland prescribed burn units.
* Create or enlarge grassland buffer strips around wetlands to reduce sedimentation.

**Strategy 4: Restore or maintain the extent of grasslands across the landscape**

### Approach 4.1. Protect or conserve existing grasslands that are functionally intact or ecologically valuable

 Example tactics:

* Protect intact grassland patches embedded in heavily impacted landscapes through conservation easements or land exchanges.
* Focus landscape-scale habitat protection and restoration efforts in areas where habitat quality for species of management interest is currently high.
* Protect overwintering and migratory stop-over habitats, which are frequently ignored or undervalued.

### Approach 4.2. Restore or establish grasslands in locations that are expected to remain suitable under future conditions

 Example tactics:

* Increase perennial cover to offset or reverse loss to cultivation
* Proactively apply prescribed fire to areas where forests and savannas have encroached into former grasslands.
* Convert agricultural land that is declining in productivity or frequently flooded to natural grassland cover.

Approach 4.3. Protect existing grasslands in locations that are expected to remain suitable under future conditions.

###  Example tactics:

* Establish conservation easements on grasslands along the prairie-forest border in Minnesota.
* Protect grasslands where they exist within a matrix of climate-vulnerable forest types.

### Approach 4.4. Enlarge existing grassland habitats and protected areas

 Example tactics:

### Prioritize grassland restoration on lands adjacent to intact habitats.

* Identify suitable parcels for protection that are adjacent to existing protected lands.
* Protect large amounts of habitat in target species’ core ranges, determined based on historical data.
* Restore croplands situated between grasslands and wetlands to merge fragmented patches into larger patches.

Approach 4.5. Create or maintain grassland habitat that includes a wide variety of sites and conditions, including wetlands

 Example tactics:

* Prioritize protection of grassland patches that contain a variety of soil types, topographic positions, and plant communities.
* Restore grasslands across areas that span environmental gradients of temperature or moisture.
* Implement patch-burn grazing (i.e., cattle have free access to graze an entire pasture, within which particular blocks are burned annually on a rotating basis) to maximize diversity within a grassland unit.

Approach 4.6. Discourage or prevent conversion of grasslands for agriculture or development

 Example tactics:

* Place conservation easements on remaining untilled habitat.
* Adopt zoning regulations that deter land development in natural areas.

## **Strategy 5: Provide for landscape-scale grassland resilience under future climate scenarios**

### Approach 5.1. Protect habitats along species’ range edges

 Example tactics:

* Focus conservation efforts at the northern edges of species range distributions to anticipate future range shifts
* Protect grassland habitat along prairie-forest ecotone borders where forests are anticipated to decline under future climate change.

### Approach 5.2. Maintain or create corridors for species migration

 Example tactics:

* Restore grassland cover along riparian corridors and wetlands.
* Use geospatial information to identify new and existing migration and dispersal corridors for species of interest.
* Connect habitat patches with linear conservation easements (e.g., prairie strips).

### Approach 5.3. Increase connectivity and reduce landscape fragmentation

###  Example tactics:

### Reduce fragmentation by prioritizing protection/restoration of lands adjacent to intact habitats.

* Prioritize protecting or restoring patches in landscapes with high densities of intact habitats.
* Restore croplands situated between grasslands and wetlands to merge fragmented patches into larger patches.

### Approach 5.4. Preemptively protect non-grassland habitats projected to convert to grassland

 Example tactics:

* Use habitat suitability models to identify important future habitats.
* Prioritize acquisition or easements in forests, grasslands, and croplands on northern edge of the Great Plains.

**Strategy 6: Adjust site-level management actions to account for changing conditions**

Approach 6.1: Adjust the timing, frequency, or intensity of prescribed fire to align with current and projected climate conditions

 Example tactics:

* Shift prescribed burn seasons to align with projected seasonal precipitation changes.
* Consider winter or night-time prescribed burns to reduce this risk of high-severity fire.
* Adjust prescribed fire or mowing to account for shifting phenology of grassland-dependent wildlife, such as retiles emerging from hibernation.

Approach 6.2: Adjust the timing, frequency, or intensity of grazing to align with current and projected climate conditions

 Example tactics:

* Reduce stocking levels or grazing duration during periods of drought to preserve tall vegetation and avoid overgrazing herbaceous layers.
* Reintroduce cattle below maximum stocking rates rates after heavy rain events.
* Adjust grazing seasons or mowing to account for shifting phenology of grassland-dependent wildlife, such as ground-nesting birds.

Approach 6.3: Adjust the application of mechanical treatments such as haying, moving, and brush removal to align with current and projected climate conditions.

Example tactics:

* Conduct mowing during other seasons as conditions shift.
* Take advantage of dry periods to conduct brush removal in wet or low-lying areas.

Approach 6.4: Adjust planting practices and timing to promote germination and establishment of grassland vegetation under changing conditions

 Example tactics:

* Experiment will fall planting if soils are consistently too saturated during spring planting seasons.
* Plan rapid-response planting to establish native cover following unexpected disturbances.

Approach 6.5: Adjust management of wetlands to align with current and projected climate conditions.

Example tactics:

* Plant drought-tolerant species in wetland sites that are expect to experience more frequent dry conditions throughout the growing season.
* Install small structures such as short rock dams to increase soil saturation and infiltration.
* Install energy dissipation features where a concentrated flow enters a wetland, in order to limit the impacts of an extreme rain event.

**Strategy 7: Facilitate species or community transitions to align with expected climate conditions**

### Approach 7.1. Promote plant species or genotypes expected to be adapted to future conditions

 Example tactics:

* Maintain drought-resistant vegetation patches for wildlife cover (e.g., warm-season grasses, prickly pear cactus).
* Collect and plant seeds or plugs from non-local grasslands where current climates are similar to conditions expected locally in the future.
* Collect and plant seeds from local flora that exhibit drought tolerance, pest resistance, or other desirable qualities.
* Promote plant species that have a large geographic range, occupy diverse site conditions, and are projected to have increased suitability in the local area.

### Approach 7.2. Move at-risk species to locations expected to provide future habitat

 Example tactics:

* Collect and move rare plants to unoccupied suitable habitat that is less vulnerable to climate disruption.
* Move vulnerable species to new locations outside their native range (assisted migration) where conditions are currently suitable and expected to improve.

Approach 7.3: Facilitate shifts in grassland community type to align with future conditions

 Example tactics:

* Allow wetland vegetation to expand in areas that are anticipated to become wetter.
* Promote shifts to mixed-grass prairie in areas that are expected to become too dry to sustain tallgrass prairies.

Approach 7.4: Convert non-grassland systems to grasslands if the climate can no longer support the current land cover (forest, savanna, marginal ag)

 Example tactics:

* Proactively apply prescribed fire to forests along the northern edge of the Central Grasslands to promote transitions to grassland communities.
* Convert agricultural land that is declining in productivity or frequently flooded to natural grassland cover.
* Convert marginal row crop fields to pasture.

Approach 7.5. Identify areas where it does not seem feasible to restore or maintain grassland habitat in order to focus adaptation efforts elsewhere

 Example tactics:

* Elect not to pursue high-cost, socially unacceptable conservation measures in order to focus on more viable actions.
* Elect to focus resources on threatened, but viable, Species of Greatest Conservation Need populations.
* Select grasslands to maintain as “no action” controls to compare the effectiveness of adaptation actions.

**Strategy 8: Engage human communities in grassland conservation and adaptation**

Approach 8.1. Develop outreach and technical assistance programs for private landowners

Example tactics:

* Guide private landowners to use tools like the Rangeland Analysis Platform to learn about their land and guide new management strategies.
* Establish technical assistance programs for private landowners to construct wildlife-friendly fencing on grasslands.
* Target outreach programs to reach diverse audiences, including absentee landowners.

Approach 8.2. Increase local community involvement in grassland management

Example tactics:

* Develop citizen-science programs to monitor wildlife use or changing phenology in grasslands.
* Work with community members stakeholders ahead of time to prepare for extreme events, such as “FireWise” planning.

Approach 8.3. Respect and incorporate values of indigenous communities in management decisions

Example tactics:

* Respectfully solicit input from local indigenous communities regarding the management of grasslands in homelands or ceded territories.
* Consult with Tribal Historic Preservation Officers, elders, and other knowledge holders to learn about the historical and present community relationships with an area.

Approach 8.4. Develop economic incentives for grassland adaptation and conservation on private lands

Example tactics:

* Employ local grassbank programs, enabling ranchers to pay discounted fees to graze their cattle on conservation grasslands in exchange for wildlife-friendly practices on their own lands.
* Promote certification programs for sustainable ranching practices, such as Audubon’s Conservation Ranching Initiative.
* Develop recreational opportunities on private lands, such as birdwatching tours or hunting opportunities that compensate local landowners.
* Promote conservation easements through tax incentive programs.

Approach 8.5. Coordinate across landowners and scales to make sure adaptation actions are complementary

Example tactics:

* Develop a network of farmers or ranchers around shared conservation goals.
* Establish landowner cooperatives to restore and manage grassland habitat, such as the Nebraska Prescribed Fire Council.
* Identify “boundary organizations” that can facilitate collaboration across organizations and help with landscape-scale adaptation projects.