



## Tool 2-6

### Essential restorative grazing Part two – Rotational approaches

December 2020

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### Part two – Rotational approaches

#### Objective

To assist communities that already have a seasonal grazing plan with stepwise enhancement of rangeland productivity and rangeland restoration that can be conducted by local institutions without significant outside support.

#### Anticipated output

Improvement of the grazing management plan for a rangeland unit through appropriate rotational resting or rotational grazing approaches.

#### Participants in this activity

- Members of community rangeland management institutions and other pastoral community leaders actively involved in rangeland management.
- Personnel from the organization facilitating management improvement by a community.
- Other stakeholders actively involved in rangeland management in the county, sub-county or community: livestock experts from county and other government agencies, non-governmental organizations, influential elders, chiefs and traditional leaders.

#### When to use this tool

This tool relates to Step Eight of the participatory rangeland management (PRM) process—developing the rangeland management plan (see Tool G-2 for a description of the stages and steps in PRM). This tool can also be used in later stages of PRM to improve upon the existing management plan and management system.



## Introduction

In Tool 2-1, the steps in developing a seasonal grazing plan were described. When a community rangeland management institution has a seasonal grazing plan in place, the next steps likely to improve the rangeland and deliver more efficient livestock production might range from simple resting to planning grazing and recovery periods and more modest approaches to site restoration such as reseeding where feasible. Tool 2-5 described simple rangeland resting approaches, and here in Tool 2-6, different rotational resting and rotational grazing approaches are presented. As the community considers options, you may want to weigh all the options outlined in these two tools.

## Rotational resting

Rotational resting is an approach in which degraded grasslands are rested for short or long periods of time, in large or small portions of the grassland in a shifting pattern over time, encouraging ecological regeneration of priority rangeland resources. Resting areas are shifted to new areas each year in rotations extending over multiple years to rest the entire grassland. Since the grassland ecosystem does most of the ‘work’, resting can assist ecological regeneration at a low cost, and some resting is necessary for reseeding of grasses (at least the minimum time needed on a per-species and per-site basis). Rotational resting is less costly and easier to implement than rotational grazing.

In rotational resting, over several years periods of restorative resting are rotated around the rangeland. For example, every portion of pasture in the rangeland can be rested for one season out of five every five seasons, with nearly continuous grazing in most seasons. The one season of rest will help to maintain high-quality grasses over the long term, protecting against droughts and perennial grass mortality. If rotational resting includes short-resting of three months or less, resting plans should incorporate the general principles of resting outlined under ‘Short-resting’, in Tool 2-5.

As for short-resting, the experience of producers from the area is required to carefully determine the areas to be rested, the length of time each will be rested, and how many years it will be until it is rested again. Resting one area will automatically push grazing to other areas, risking degradation there. The longer the resting period, the smaller the area that is rested. The return interval—the number of seasons before a portion is rested again—should be short enough to effectively maintain rangeland quality, but not so short and frequent that livestock are continually pushed out and they degrade other areas.

Resting rotations can follow any number of management goals with improving grass biomass production and species composition being among the most common. To minimize costs of lost grazing due to long rest by using short-resting, multiple priority areas of the grassland could be rested for short time periods at the beginning of the rains, improving grass production and regeneration at a low cost. In other cases, long-term resting may be possible to restore severely degraded areas. A rotational resting plan can include both short-resting and long-term resting to accomplish different management goals in different parts of the grassland.



To begin the process of creating a basic rotational resting plan, start with a summary of seasons of the year, including which months they cover and how many days, and add them to the table in Worksheet 2-6-1 below. Ask the community representatives in which season resting is feasible, which potential locations of the grassland can be rested, and the objective of resting (toward their management goals) and add them to the table. Ask the community representatives how large each resting location should be, how long it should be rested, and the resting return interval (how many years can pass until the same location will be rested again).

The information in the table in Worksheet 2-6-1 is sufficient to create an essential plan for rotational resting. Once the table is complete, work with the community to prioritize areas of the grassland for resting. Note which resting areas in the table are of the highest priority for resting in the eyes of the community.

Use a discussion of constraints to help the community identify what resting will be feasible, and what will not be. Constraints may include loss of grazing, rule-breaking by the community or by neighbouring communities, low grassland productivity, invasive or unpalatable species, etc.

Once the community has a clear and realistic understanding of what feasible resting looks like in their area, create a rotational resting plan using the table in Worksheet 2-6-2 below. Separate each location or area to be rested on a different line of the table. Start with the areas given highest priority for resting by the community. Rotational resting on community lands implies significant costs in terms of organization and lost grazing (mostly temporary). However, compared to rotational grazing, the costs of rotational resting are lower and implementation is easier.

Discussion, coordination and enforcement (transaction costs) would be more costly for a more complex rotational resting system with many small portions rested in different seasons. In areas with high transaction costs—in rangelands with large areas, long livestock movements, heavy communication or negotiation needs, or very unpredictable rainfall—a simpler, lower cost rotational resting system may be more practical (fewer areas, smaller areas, less resting time). In very dry rangelands (e.g. < 400 mm rainfall per year) these transaction costs can be high.

As noted under 'Short-resting' in Tool 2-5, resting can be combined with range reseeding of grasses such as buffel grass (*Cenchrus ciliaris*), especially in years of high rainfall. However, the reseeded area will likely require additional rest in the dry season following reseeding. The area can usually be grazed down fully after resting, but the young grasses will likely die if they are continually grazed and re-grazed throughout the dry season (note that severely degraded areas are not highly suitable for reseeding and will require longer rest from grazing). If range reseeding is an interest of the community, they should create exclosures for range seed production. Range seeds are currently expensive, costing KSH10,000 for reseeding only one hectare. Creating exclosures (zero-grazing or cut-and-carry) is feasible in areas close to water or near cropping areas (or invasive species such as *Prosopis* can be cleared and exclosure planted), where soil conditions lead to high production and grazing is easier to prevent. For exclosure in pastoral areas, usually the selected grass species should be (1) tall and of high quality for cut-and-carry fodder harvesting; and yet also (2) able to survive reseeding in rangelands where soil moisture and fertility are low (buffel grass—*Cenchrus ciliaris*—is often the best grass). Only a few grass species meet both of these criteria. As the exclosure is cut for fodder to feed livestock, the seeds are removed and stored for reseeding in the next rainy season. Maximum production of cut-and-carry fodder and range grass seeds will require use of manure as fertilizers (NPK and other chemical fertilizers are not recommended unless use is to be repeated every year).



## Simplified rotational grazing: wet season grazing areas

Planning grazing and resting periods is the easiest approach for planning rotational grazing in dry communal rangelands. Like resting, rotational grazing prevents overgrazing of individual perennial grasses of high quality, which normally re-sprout after grazing. When grazed repeatedly, these grasses will eventually die reduce pasture quality and production. However, in dry pastoral rangelands, rotational grazing of the entire rangeland requires extensive planning and organization often beyond the current capacity of many communities. The simplified approach described here—using grazing and resting periods to plan rotations—can only be applied in wet season grazing areas of pastoral rangelands. Dry season pastures cannot be grazed, rested and grazed again in the same dry season, as there is no rainfall and therefore no regrowth (some swampy locations with certain soils are an exception where grasses have access to shallow water to fuel their growth, and the same approach can be used).

Planning grazing based on the simple rule, that more grazing time means less resting time, is the easiest way to plan rotations among divisions (often called paddocks or blocks) inside a grazing area of a pastoral rangeland. This simple method of planning rotations does not necessarily require calculating or changing stocking rates, but rather using resting periods to guide grazing periods (Butterfield et al. 2006).

Usually, it is better to have longer resting periods, and shorter grazing periods, which require division of the grazing area into many smaller divisions to be grazed intensely by many animals for short periods of time. However, long resting times and many smaller divisions are often not feasible or challenging to implement in many community-managed rangelands.

One of the major advantages of rotational grazing in pastoral rangelands is the effect of ‘bunching’ animals together—grazing a larger number of animals together within a smaller area for a shorter period of time (often called ‘bunched grazing,’ ‘mob grazing,’ or ‘flash grazing’). Bunching effects will be stronger when there is a large number of small divisions inside the grazing area. Note, however, that this approach differs dramatically from traditional practice of herd-splitting in many pastoral societies in which livestock are sent to different areas resulting in low grazing pressure over large areas. For this and other reasons, bunched grazing can be difficult to introduce to pastoral community rangeland management. The best ‘selling points’ of rotational bunched grazing, in addition to the benefits of resting in maintaining or improving pasture quality and production, are that grazing large numbers of livestock in one area for a short period results in (1) grazing down or trampling of unpalatable plant species (including invasive species), giving grasses a competitive advantage over other plants; and (2) the breaking of soil surface crust allowing rainfall to better infiltrate, reducing erosion, mixing manure into the soil and improving soil conditions for grass seedlings.

In rangelands with many residents and users, there will normally be only a few divisions created; for example, between 3 and 10 divisions within the wet season grazing area. The most useful resting period to use will often be the maximum resting period—the longest period of time that a pasture can be rested. Although minimum resting is most useful in areas that face heavy grazing, such as near settlements and water points and in pastures used all-year-round (see also ‘Short-resting’ above), this logic does not apply here. Using the maximum resting period has the advantage that grazing periods are also longer, and fewer movements of animals are needed, reducing organizational costs (longer resting times also allow more grass regrowth and recovery).



To use this approach with a community, the overall process is:

- (1) Herders from the community identify the maximum feasible resting period for their wet season grazing area, the maximum resting period ( $RP_{Max}$ ).
- (2) Herders from the community identify the maximum feasible number of divisions that the wet season grazing area can be divided into.
- (3) To show to the community how the length of resting periods affects the length of maximum grazing period ( $GP_{Max}$ ) for each division of the wet season grazing area, the following simple equation is used:

$$GP_{Max} = \frac{RP_{Max}}{(Number\ of\ divisions - 1)}$$

- (4) Calculate how many rotations will be needed through the wet season. Calculate the number of rotations as  $Rotations = Number\ of\ days \div GP_{Max} \div Number\ of\ divisions$ . The number of days is the number of days the wet season grazing area is grazed in an average year (or the number of days in the wet season).
- (5) Discuss the results with the community. If the grazing and resting periods are not acceptable to the community, change the values to find a better approach.
- (6) By changing the values for (a) maximum resting period ( $RP_{Max}$ ) and (b) the number of divisions inside the wet season grazing area, the equation can be used to recalculate the maximum grazing period ( $GP_{Max}$ ) for each division. These values can be changed until the best feasible grazing and resting periods have been identified by the community for their area.

### Example of planning wet season grazing area rotations

In this example a typical community-managed rangeland unit has three main grazing areas—wet season grazing areas, dry season grazing areas and drought reserve. Here the focus is only on the wet season grazing area. The two wet seasons per year are each three months (90 days) long. If the community divides the wet season grazing area into multiple divisions, these divisions can be grazed in a rotation through each wet season, enabling some amount of grass regrowth in each division when it is being rested, and allowing each division to be grazed more than once per wet season.

We begin with the equation:

$$GP_{Max} = \frac{RP_{Max}}{(Number\ of\ divisions - 1)}$$

for which we need the community to estimate  $RP_{Max}$  (the maximum resting period) the maximum feasible resting period for their wet season grazing area. We also need the community to estimate and identify the maximum feasible number of divisions that the wet season grazing area can be divided into.





Herders from the community have suggested that one month (30 days) is the maximum feasible resting period ( $RP_{Max}$ ) for their wet season grazing area. The community has also suggested dividing the wet season grazing area into three divisions since a larger number of divisions and the rotations of animals among them would be impractical for community institutions to manage.

The maximum grazing period ( $GP_{Max}$ ) for each division of the wet season grazing area is:

$$GP_{Max} = \frac{30 \text{ days}}{(3 - 1)}$$

$$GP_{Max} = 15 \text{ days}$$

In this case, the grazing period is 15 days for each division, with each division being rested for 30 days.

Then calculate the number of rotations = Number of days (90) ÷  $GP_{Max}$  (15) ÷ Number of divisions (3) = 2 rotations needed. The number of days is the number of days the wet season grazing area is grazed in an average year (or the number of days in the wet season). Each division of the wet season grazing area will be grazed twice during the wet season, for 15 days earlier in the season and 15 days later on.

In other words (1) the first division is grazed for 15 days, then (2) the animals are sent to the second division for 15 days, then (3) the animals are sent to the third division for 15 days. The first rotation is then complete. Next, (4) the animals are sent again to the first division for 15 days of grazing, (5) the animals are sent to the second division for 15 days, and (6) the animals are sent to the third division for 15 days. Divisions 1, 2, and 3 each receive 30 days of rest after grazing.

However, 30 days or one month of rest may not allow sufficient resting from grazing. If herders from the community suggest that two months (60 days) is the maximum resting period (RP) on average for their wet season grazing areas, the maximum grazing period (GP) for each division of the wet season grazing area is:

$$GP_{Max} = \frac{60 \text{ days}}{(3 - 1)}$$

$$GP_{Max} = 30 \text{ days}$$

In this case, the maximum grazing period is 30 days for each division if each division is rested for 60 days. Since each division is grazed for 30 days, and the entire wet season is 90 days (three months), each division of the wet season grazing area will be grazed only once during the wet season for 30 days (number of rotations = number of days (90) ÷  $GP_{Max}$  (30) ÷ number of divisions (3) = 1 rotation needed).

If the maximum resting time is longer than two months, this approach will not be feasible with only three divisions. The wet season grazing area would need to be divided up into a larger number of smaller divisions (for example, 20 divisions with grazing periods of five days each in one rotation), which would increase management costs.



For different lengths of resting periods ( $RP_{Max}$ ) and different numbers of grazing divisions, the grazing period ( $GPM_{ax}$ ) and number of rotations will vary. Several examples of different combinations of  $RP_{Max}$  and the number of divisions are provided in the table below.

Days in the wet season	Number of divisions in the wet season grazing area	Maximum resting period ( $RP_{Max}$ )	Maximum grazing period ( $GP_{Max}$ )	Number of rotations
90	3	15	7.5	4.0
90	5	15	3.8	4.8
90	10	15	1.7	5.4
90	20	15	0.8	5.7
90	50	15	0.3	5.9
90	3	30	15.0	2.0
90	5	30	7.5	2.4
90	10	30	3.3	2.7
90	20	30	1.6	2.9
90	50	30	0.6	2.9
90	3	60	30.0	1.0
90	5	60	15.0	1.2
90	10	60	6.7	1.4
90	20	60	3.2	1.4
90	50	60	1.2	1.5
90	3	90	45.0	0.7
90	5	90	22.5	0.8
90	10	90	10.0	0.9
90	20	90	4.7	1.0
90	50	90	1.8	1.0

Note: if the number of days in the season is changed, the rest of the calculations will change as well.

### Other ways to calculate rotations from grazing and resting periods

Here we have used the maximum resting period to estimate the maximum grazing period. The same equation can be used in three other ways:

- *maximum grazing period* can be used to calculate the *maximum resting period* (longer rest is more effective);
- *minimum grazing period* (the shortest grazing feasible) can be used to calculate the *minimum resting period*; and
- *minimum resting period* (the shortest resting feasible) can be used to calculate the *minimum grazing period* (but short grazing periods require frequent animal movements).





In using this approach to facilitate community dialogue on grazing patterns and planning, the most useful option for calculating grazing and resting periods in the local area should be chosen.

### Further important information on rotational grazing in pastoral rangelands

1. Rotational grazing is not a 'best practice' or a 'best bet' applicable to all rangelands.
  - In rangelands where the stocking rate is high, and realistically cannot be reduced, rotational resting or other simpler grazing and resting approaches are more likely to be accepted.
  - In very dry rangelands (e.g. < 400 mm rainfall per year), rotational grazing is unlikely to be successful and may be impossible to implement. Rotational grazing requires either sufficient, predictable rainfall. In dry areas setting aside large, little-used blocks of pasture would cause wasteful opportunity costs since both the timing and the location rainfall is extremely unpredictable.
2. Rotational grazing systems are effective where communities are organised and where rainfall is sufficient.
  - Traditional rotational grazing systems exist in some areas, such as *ngitili* in central Tanzania.
  - In higher rainfall savannas (e.g. 600–1000 mm rainfall per year or higher) rotational grazing is highly effective and enables other rangeland investments. A well organised community is a requirement for rotational grazing to minimize transaction costs from enforcing by-laws.
3. In dry rangelands with low rainfall, rotational grazing can be inefficient and unrealistic, and rotational grazing needs to be simpler than in higher rainfall savannas:
  - In very dry rangelands (e.g. < 400 mm rainfall per year), rainfall is extremely unpredictable. Each season is different from the last and smaller rain events often fall only in small patches.
  - Highly unpredictable rainfall places severe constraints on rotational grazing.
    - a. Planning management in a detailed way will be much more difficult than in higher rainfall savannas and may be virtually impossible in extremely arid rangelands (e.g. < 200 mm rainfall per year)
    - b. Transactions costs (discussion, coordination, enforcement) required to implement rotational grazing may be much higher than in higher rainfall savannas.
  - Dry rangelands have other challenges to rotational grazing.
    - a. Drier rangelands cover larger areas.
    - b. Drier rangelands have long livestock movements.
    - c. Drier rangelands therefore have heavy communication and negotiation needs.
  - These problems of rotational grazing in very dry rangelands are usually best addressed by adopting a different approach, including seasonal grazing, targeted resting of critical pastures, short-resting and rotational resting.



## References

Butterfield, J., Bingham, S. and Savory, A. 2006. *Holistic Management Handbook: Healthy Land, Healthy Profits*. Washington, DC, USA: Island Press.



# Essential restorative grazing

## Part two – Rotational approaches

### Worksheet 2-6-1

#### Template for rotational resting preparation

Season	Months	Days	Potential location(s)	Objective of resting	Size of resting area (ha or acres)	Length of resting period(s) (months)	Resting return interval (years)

Note: An alternative approach is to start with grazing areas rather than seasons. In this case, ask which grazing areas (or any small portions of the grazing areas) can be rested feasibly for a significant benefit. Then, ask the season for resting, objective of resting, size of resting areas, length of resting period, and resting return interval. Otherwise the process is the same.



# Essential restorative grazing

## Part two – Rotational approaches

### Worksheet 2-6-2

#### Template for rotational resting planning

Separate each location or area to be rested on a different line of the table. Start with the areas given highest priority for resting by the community.

Year (for rest)	Resting location (grazing areas, or which portions of grazing areas)	Season(s) for resting	Month(s) for resting	Objective of resting	Size of resting area (ha or acres)	Length of resting period(s) (months)	Next planned resting period (year)



This document is part of the Participatory rangeland management toolkit for Kenya, an initiative led by the International Livestock Research Institute (ILRI). This tool was developed by ILRI, with financial assistance from the CGIAR Research Program on Livestock and the United States Agency for International Development Feed the Future Kenya Accelerated Value Chain Development (AVCD) program.

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Citation: Sircely, J. 2020. *Essential restorative grazing: Part two – Rotational approaches. Tool 2-6 of the Participatory rangeland management toolkit for Kenya, Second edition*. Nairobi, Kenya: ILRI.



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