AN EVALUATION OF OPEN ROTATIONAL GRAZING*

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ABSTRACT

Open rotational grazing (ORG) is a grazing system that originated in semiarid rangelands of the USA with highly seasonal vegetation and erratic, uneven distribution of rainfall. Camps should be utilised when the most desirable plants are physiologically ready for defoliation (early maturity) and defoliated to a predetermined level. Several adjustments are recommended to this very flexible grazing system to make it more suitable for Namibian conditions. Performance results suggest that ORG may be more productive, sustainable and profitable than continuous grazing, especially in the long term. However, after 60 years of rangelands research in southern Africa, it can still not be *proven* that rotational grazing is ecologically and financially more suitable to our conditions than continuous grazing. It may be more appropriate to emphasise factors such as realistic and flexible stocking rates, correct separation of veld types, planned veld resting and choosing adapted livestock rather than any particular grazing system.

THE ORIGIN OF GRAZING SYSTEMS

Grazing systems (grazing plans) attempt to utilize seasonal vegetation in a manner that is beneficial to both livestock and veld (range) (Heady and Child, 1994). They can only be applied when a farmer/producer/herder controls the movement of livestock or uses fences and camps to control livestock. Commercial livestock farmers in Namibia rely predominantly on fences to implement their grazing systems, while communal farmers rely mainly on herding and transhumance (seasonal movements of livestock with their herders) although deteriorating grazing is forcing an increasing number of communal farmers to claim parts of tribal grazing lands for their own exclusive use through fencing.

In Namibia, the first fences, erected mainly during the 1920's (Walter and Volk, 1954), were border fences that demarcated private property and kept livestock on the farm. At a later stage, farmers started to subdivide their farms to better control their livestock herds, e.g. to separate male from female animals in the non-breeding season or to prevent livestock from entering parts of the farm where predators or poisonous plants occurred and would have caused stock losses. However, by the 1940's, the majority of farms still had less than five camps and many had only one or two (Bester, 1993). Much progress was made during the 1950's with the camping of farms, thanks mainly to the good rains received during that decade and grazing systems research initiated on government-owned experimental farms. It was not until the 1960's that many farms had many camps and it was realised that one could use camps to control livestock *and* the utilization of indigenous veld, thereby manipulating veld condition *and* productivity. Grazing systems and recommendations proliferated, caused confusion and are being debated to this day.

The early grazing systems in Namibia, going back to the period between the two world wars, were paucicamp systems due to the small number of camps on each farm. As the number of camps per farm increased, the farmers had a bigger choice and many rotational grazing/rotational resting systems were advocated. Today, some farms have in excess of 10 camps per herd. Rotational grazing plans have been in use in the Middle East for over 600 years and in Europe for over 200 years, but have only been advocated in southern Africa since 1887. However, it is only since the 1960's really that many commercial farmers in Namibia had enough camps to apply any one of the many multicamp rotational grazing systems. Unfortunately, advocates of particular grazing systems often tend to be intolerant of others and it is sometimes forgotten that most grazing systems have the same basic aims.

BASIC OBJECTIVES OF SEASONAL GRAZING SYSTEMS

The primary objective of most grazing systems is to manipulate the distribution of livestock on the farm, to promote uniform forage utilization, effective resting of the veld and to control selective grazing. Most grazing systems also aim to, over time, improve the condition of the veld by manipulating the botanical composition, ground cover, plant vigour and vegetational succession and, if possible, also the quality of the forage. A third and very important objective in an arid environment is to create a fodder bank by deferred grazing (often combined with effective veld resting) or harvesting and preserving surplus grazing.

Many grazing systems aim to improve the productivity of livestock, either per individual animal or per unit area of land, thereby increasing income and decreasing costs. A few increase the flexibility of grazing management and decrease risk in the farming operation, while too few actually consider co-ordinating livestock forage requirements with wildlife habitat needs and other land uses. An overriding objective of most grazing plans is to control animal management and animal production cycles (Heady and Child, 1994).

The major tools to achieve these - mostly shared - objectives is the animal herder or the camping system, the foraging animal, water distribution, veld burning and the provision of nutritional

supplements. The best way to record how these tools are applied is to indicate for each camp or grazing section the period of occupation (or period of grazing) and the period of absence (or period of rest), the type and number of animals employed and what supplements they receive. However, record keeping and interpretation is an art form and a theme by itself.

THE OPEN ROTATIONAL GRAZING SYSTEM

This grazing plan was first proposed in 1967 for the semidesert ranges in New Mexico, USA, where it is called the "best-pasture" system (Holechek *et al.*, 1998). There, as in Namibia, forage productivity and growth stage within years may differ vastly over short distances due to localised rainstorms. The system makes provision for large farms that receive unevenly distributed rainfall, causing some parts of the farm to have actively growing and productive vegetation while other parts of the farm still have dormant or unproductive vegetation. The basic grazing principle is to utilise those camps that are most ready for grazing first, leaving those that are not yet ready for a later stage and harvesting those that are more than ready (overgrown, too mature) in a different manner altogether.

Using readiness of vegetation (the "readiness principle") as a grazing criterion has tremendous advantages for both plant and animal. Most of our important grazing and browsing plants are ready for grazing in early maturity (late tillering and early flowering), towards the end of their rapid growth phase. The plant at that stage is photosynthesising rapidly, forming a lot of tissue and nutrients every day. Defoliation at this stage is least harmful since the "factory" is still in full swing (high nett assimilation rate of nutrients) and the plant simply stays in its active growth phase a bit longer while it replaces the parts lost to the animal. The animal in turn utilises a plant that is full of nutrients required for plant growth such as soluble carbohydrates, proteins and minerals - which are also the nutrients most useful to the animal - and contains less fibre and especially less lignin - which is indigestible even to ruminants. At early maturity, a plant is slightly less nutritious than when immature, but still nutritious enough to support reasonable levels of animal production, and yields enough quantity to support a realistic stocking rate.

Readiness of a camp for grazing is determined by the farmer *in situ*, probably by using certain indicator species to judge by. These are most often grasses - since most of Namibia s commercial ruminants are grazers such as cattle and sheep - but may also include browse plants. The most valuable indicator grasses to assess veld condition are probably the local climax or decreaser grasses, although some increaser grasses may also be useful (Tainton, 1981). The camp judged to be most ready is then grazed either until the same indicator species exhibit a certain predetermined level of defoliation or, more often, for a set period of occupation. Duration of grazing is normally shorter in summer than in winter due to the grass plants different physiological requirements in the growing and the dormant season. The stocking rate is determined by the carrying capacity, which is either measured once a year at the end of the growing season, or estimated based on the farmer's experience.

Camps, which are not yet ready for grazing because the most desirable grazing plants have not yet reached early maturity, are put aside to be grazed once their maturity has advanced sufficiently. Camps in which the vegetation is too mature, i.e. grasses are already in the translocation (perennials) or die-back (annuals) stage, are left as a winter/spring grazing reserve, or are harvested to make hay, or are awarded an unplanned rest until they are needed or until their grasses are tillering again in the next growing season.

Open rotational grazing can easily be combined with seasonal-suitability grazing, as was the case in New Mexico where the system began or in South Africa s Karoo, where the more bushed camps are utilised in winter while the grassier camps are utilised predominantly in summer. Open rotational grazing may also be practised within any other grazing system such as controlled selective grazing (CSG, a low-density grazing strategy) or non-selective grazing (NSG, a high-density grazing strategy); the latter would merely require more camps per herd and faster camp rotation than the former. Or open rotational grazing may be combined with a conventional multicamp system, in which a certain number of camps are set aside to be grazed by one herd during one particular season (e.g. autumn) according to a predetermined plan, but which one is to be grazed first can be decided by plant readiness. In principle, open rotational grazing can be practised with any type (breed) of livestock or combination of animal species, although obviously adapted breeds would perform better in our harsh environment. In short, this grazing system increases the options of the farmer by making grazing management more flexible. It is in agreement with new approaches to the ecology of arid rangelands and their opportunistic management (Westoby *et al.*, 1989) as recommended by the state-and-transition ecological model (Westoby, 1980). This approach, together with other relevant strategies like improved animal health care, use of indigenous (adapted) breeds of livestock and additional fodder production, has been advocated for Namibia before (Kruger and Kressirer, 1996).

Open rotational grazing, correctly applied, is an ideal grazing plan since it allows grazing strictly on a plant-physiological basis. However, and that is the major drawback of this system, a farmer may soon run out of camps which are ready to graze especially during a dry spell or when the rains are late. The system itself does not provide for any purposeful or planned rest periods since vigour resting should be superfluous if grazing is guided by the readiness principle. Nor does the system recommend a certain percentage of the total area to be put aside for dry spells as deferred grazing. In practice, a farmer will often be forced to graze camps not yet ready for grazing simply because he has none which are already mature enough. This problem, which is due to our low and erratic rainfall, is exacerbated by an insufficient number of camps or by a defoliation level, which is too lenient and therefore requires fast camp rotation. If there is no regrowth and the farmer has not saved some of his camps as a drought reserve, plants that are physiologically vulnerable to defoliation (since they are still in their initial growth phase based on accumulated root reserves) will have to be grazed, leading to a weakening of these plants, or defoliation intensity will have to be increased. It is therefore recommended that open rotational grazing be

combined with a system of reserving between 15 and 30% of the farm, depending on the aridity of the area, to bridge temporary grazing shortages (Bester, 1993). If this reserve is rotated across the farm over the years, it will bestow each section a full growing season's rest. Open rotational grazing may also require at least three camps per herd, spread around the farm to benefit from isolated rainstorms, as recommended in the group-camp system (Joubert, 1974) to increase flexibility and decrease risk.

Another disadvantage of open rotational grazing is the tremendous input of time and expertise required to make it work. A farmer not only has to inspect all camps regularly and in detail, but also has to measure or estimate the carrying capacity and indicators of veld condition on a regular basis. With the increasing demands placed on farmers' time, such as accounting, personnel management and marketing activities, less time remains to do the biological basics and many farmers prefer to follow a fixed order of grazing their camps, based on convenience or the existence of certain infrastructure, but not plant readiness. For example, there are still camps without permanent drinking water on some farms, forcing the farmer to graze them in the growing season only, when there are puddles of rainwater available. Or only a few camps have been fenced sufficiently to keep predators out and have to be used preferentially for lambing small stock at the same time each year. Other camps might have a dense population of poisonous plants, preventing grazing in spring and early summer etc. The end result is that camps are grazed in an order dictated by circumstances and not plant readiness. While this may be called open rotational grazing, it is not in accordance with the principles of this plan nor is it conducive to good grazing management.

On a very heterogenous farm, it is possible that some camps - those in a more productive and resilient veld type - may be grazed more often than less productive camps, or at a different stocking rate to others. This may force the farmer to not only separate different veld types by fencing (always a sound utilization practice), but also to determine veld productivity and condition separately for each unit. While scientifically judicious, it is often not practical because of the time involved.

Performance results from this system are not readily available from Namibia or South Africa. In semiarid New Mexico, USA, continuous grazing outperformed open rotational grazing in all aspects when forage utilization was low (20% defoliation), but might have been inferior if utilization had been heavier. With moderate utilization, open rotational grazing performed slightly better than continuous grazing in terms of forage production (11% higher in kg/ha) and livestock production (3% higher in kg/ha), but was slightly less profitable than moderate continuous grazing after 10 years because of reduced cattle performance (in kg/animal) and financing costs associated with extra fences and cattle (Holechek *et al.*, 1998). It was concluded that its profitability after 30 years would be higher because additional fencing costs would no longer occur and further increases in carrying capacity were likely. This is of course an automatic drawback of all the more intensive, flexible grazing systems, viz. that to make more camps will cost much more money and the payback in terms of profitability may only occur to the next generation of farmers. If these are not going to be relatives, what incentive is there for the present farmer to switch to a more sustainable, less exploitive grazing system? It would require a degree of altruism not popular with today's consumer society.

The fact that continuous grazing outperformed such an advanced grazing plan as open rotational grazing may surprise the casual observer, but performance hinges on two critical factors: one is the circumstances and conditions under which a grazing plan is applied and the second vital factor - often ignored - is the ability of the farmer to manage his veld. Give a good veld manager and keen observer a poor system and he will make it a success in terms of improving both veld condition and animal output. In contrast, a poor manager might cause deteriorating veld and animal performance in spite of applying the theoretically most wonderful grazing system. Affinity and "gut feeling" for veld and animals may be totally underrated skills in an era of scientific information-overload.

COMPARISON OF GRAZING SYSTEMS

When comparing different approaches to grazing management, we might be tinkering at the edges because the similarities might indeed be greater than the differences. In a review of more than 50 grazing experiments in southern Africa, O'Reagain and Turner (1992) found five specific factors to be of much greater importance to the wellbeing of veld and livestock than any particular grazing system, and indeed many of them are common to the more successful grazing plans. These five factors are:

- Separation of veld types is very important because each veld type possesses pertinent utilization characteristics based on its specific botanical and abiotic characteristics. It also prevents area-selective grazing, a natural phenomenon which has to be regulated for increased efficiency. The basics of veld subdivision have been explained succinctly by Drewes and Venter (1989).

- Stocking rate has an overriding effect on veld condition, veld productivity and animal production. It appears that no grazing system can negate the degenerative effects of overgrazing, though a few might soften the blow and postpone the consequences. Given a realistic and sustainable stocking rate, most grazing systems are able to maintain veld condition as found at the outset. Stocking rate is of course determined by the carrying capacity of the veld, and that depends not only on the quantity of forage produced, but also on the management objective of the farmer (Behnke and Abel, 1996; Danckwerts and Tainton, 1996) and his/her ability to accurately measure it.

- Regular seeding and vigour rests are essential to maintain or recover the vitality of the veld. At the same time, these rest periods allow the accumulation of fodder to act as a grazing reserve in dry spells. The principle of resting veld for vigour and fodder accumulation is well-established in Namibia, having been recommended from an early date (Walter and Volk, 1954).

- Sheep have a greater potential for veld degradation than either cattle or goats, but this effect may be ameliorated by grazing cattle and sheep together at narrow ratios (1:3 to 1:6), while allowing flocks of goats to roam *ad lib.* across the farm (since goats are not restricted by "stock-proof" fences). It will increase efficiency, result in a wider spectrum of veld utilization, and increase livestock production per unit area.

- Continuous and rotational grazing differ little in their effect upon veld condition and animal production. At conservative stocking rates and correct separation of veld types on a farm, there was no consistent difference between continuous or near-continuous grazing systems that make use of just a few camps, and multi-camp rotational grazing systems in terms of veld condition, veld productivity or animal production in the more than 50 grazing trials analysed by O'Reagain and Turner (1992). Their results suggest that arguments for increasing range and animal productivity by changing patterns of defoliation through rotational grazing may be unfounded. In their analysis, the authors did not consider the costs of implementing a particular grazing system, which would have tilted the balance even more against rotational grazing.

While not contesting the validity of the hypothesis that rotational grazing systems *should* be superior to continuous grazing systems, O'Reagain and Turner (1992) are at pains to point out that, regrettably, after nearly sixty years of rangeland research in southern Africa, basic questions in rangeland management (e.g. the superiority of the various grazing systems) remain *unanswered* and claims remain *unproven*.

The recent analysis by O'Reagain and Turner (1992) corroborates an earlier review of more than 60 grazing experiments worldwide by Gammon (1978), in which he concluded that "... *In experiments in which various rotational systems were tested against continuous grazing, fewer than half revealed pasture improvement relative to continuous grazing. In the majority of experiments animal production in the rotational system was either similar to or poorer than was achieved under continuous grazing. No rotational system consistently resulted in improved pasture or animal production...*". These authors, after considering the costs of multi-camp systems, come to a similar conclusion, viz. that the objectives of maintaining long-term veld condition and ensuring stable animal production can be achieved through the use of simple rotational resting systems based on just a few camps like the one herd : four camp system or the two herd : five camp system of Scott (1955). This conclusion is supported by O'Connor (1985) who, in a survey of grazing trials in the savannah regions of southern Africa, noted that "... *There can be no irreversible change in composition* (read: condition) *or production of savannah grasslands without an associated irreversible change in the abiotic state structure which affects the availability of soil moisture or nutrients* ..." and that grazing or the grazing systems have very little direct effect on veld condition, veld productivity and animal production.

So much for the progress made in veld management research over the last half-century! It appears that a farmer might as well make do with the grazing system or camp plan which he has on his farm as best he can. Changing it to current theories will definitely cost him a lot of money, with dubious returns. Given the cost squeeze the average Namibian farmer already experiences, one wonders if an extensive livestock farmer should go to the trouble of re-fencing his farm to change his grazing system, other than to separate veld types properly. In the time span important to individual farmers, it may be more realistic to concentrate on the veld management *skills* of the farmer rather than on the veld management *system*. Of course, changing human values (increasing concern regarding desertification and pollution; community pressure for environmental conservation etc.) and additional incentives might change priorities and the relevant time span (Düvel and Scholtz, 1992), leading to more long-term experimentation with grazing systems that might yield more definitive answers than the current crop.

Meetings, like the third annual meeting of the Namibian Rangelands Forum, that encourage one to rethink conventional wisdom, serve a very useful purpose: If we wait until all the answers have been researched and proven beyond doubt, it might be too late already; or the questions might have changed! In the meantime, it appears as if grazing systems *per se* should not be a priority, but that we should rather concentrate on such basics as the correct subdivision of veld, accurately determining a realistic carrying capacity and changing it according to inter- and intra-seasonal variations in abiotic factors, purposeful veld resting, good veld management skills of individual farmers (e.g. correct identification of indicator plants, knowledge of the grazing habits of domestic livestock, measuring veld condition, trend and productivity etc.) and a holistic approach to the use and management of rangeland resources (Squires *et al.*, 1992). Given a good understanding of these basic issues in veld management, it is most likely that any of the wide variety of grazing plans available will result in improved veld condition and increased livestock production.

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