# ADAPTIVE HIGH STOCK DENSITY GRAZING

## Pasture Project – Wallace Center

**By: Allen R. Williams, Ph.D.**

Adaptive High Stock Density Grazing (AHSD) is a uniquely flexible grazing system designed and developed to facilitate maximum flexibility in land use and forage utilization, while optimizing animal performance and soil health goals. AHSD grazing relies on the basic tenets of observation and fencing portability. Stock densities and animal movement frequency can be altered throughout the annual grazing cycle in order to adjust to changes in climate, forage dry matter (DM) production, animal performance and soil health objectives.

There are a number of **key benefits** derived from AHSD grazing. These include:

1. Increased forage dry matter production on a seasonal and annual basis.
2. Enhanced animal performance.
3. Significant improvements in soil health, including:
    a. Increased water infiltration rates and soil water retention.
    b. Increased soil aggregation, improved soil tilth, and reduction in soil compaction.
    c. Reduced erosion and runoff.
    d. Increased soil microbial population and microbial balance.
4. Greater forage plant diversity through "tapping" of latent seed bank.
5. Increased atmospheric nitrogen fixation through plant legumes and N-fixing soil bacteria.
6. Reduced reliance on inorganic fertilizers.
7. Incremental increases in soil organic matter and CEC.
8. Natural soil pH buffering capacity.
9. Incremental increases in livestock carrying capacity.
10. Greater plant species and wildlife species diversity.
11. Improvement in earthworm, soil level arthropods, and pollinator insect populations.

There are numerous studies that support the key benefits derived from AHSD grazing principles. Savory (2008) shows that frequent livestock rotations increase forage production and improve soil and environmental health. Increasing stocking density may result in greater soil organic matter through manure and forage trampling (Schuman et al. 1999; Conant et al. 2003). Trials have also shown that providing extended periods of rest between high stock density grazing periods allows for optimum recovery of forages and increases overall forage dry matter (DM) production (Montazedian and Sharrow, 1990). Moreover, overgrazing reduces forage regrowth and mass both through repeated grazing of the same plant in a short amount of time and through excess removal of plant material in the same grazing event (Cullen, et.al. 2006; Phillip, et. al., 2001). With increased grazing intervals, plants

have more time to recover from prior grazing events and more effectively restore leaf area and root reserves, thus increasing forage mass (Phillip, et.al, 2001).

Improved grazing management strategies also had positive impacts on soil biota, soil chemical and physical properties, water infiltration and retention, soil aggregation and soil carbon fractions (Teague, et.al, 2011; Conant, et.al, 2003; Leake, et.al, 2004).

Basic AHSD grazing methodology involves first determining goals and objectives of your grazing program and then designing and implementing an annual grazing strategy that allows goals and objectives to be optimally achieved. The primary purpose of AHSD grazing is to utilize variable high stock densities throughout a grazing season to effectively realize accomplishment of key benefits.

Stock densities will vary depending on soil and forage conditions, management constraints, and goals. Practitioners should strive to achieve stock densities of at least 250,000 pounds per acre at least once annually. Many current AHSD grazers have effectively used stock densities exceeding 500,000 lbs. /acre, followed by long rest periods, to rapidly build soil organic matter (OM), increase soil water infiltration rates, tap into the latent seed bank, and apply "natural" fertilizer in the form of animal manure and urine. The key to successful implementation of such high stock densities is to allow the livestock to consume no more than 40-50% of total available forage DM before moving forward into a fresh grazing paddock. Forage dry matter availability can quickly be estimated on a per acre basis using a USDA NRCS "Grazing Stick". Temporary grazing paddocks can then be constructed using electrified polywire and tread-in posts that contain the appropriate amount of forage dry matter needed to support the stock density desired.

For example, if you want to move cattle forward daily to fresh grazing paddocks and you have 100 head of 800 lb. steers, first calculate the forage DM available per acre in the area you will be grazing. Let's assume your NRCS Grazing Stick formula shows you have an estimated 3000 lbs. of forage DM available per acre. Each 800 steer will need to consume up to 3.5% of his body weight every 24 hour period to achieve desired gains. That equates to 28 lbs. of forage DM daily on a per head basis. With 100 steers in the group, you would need 2,800 lbs. of forage DM every 24 hours. Since you do not want the steers to consume more than 50% of available DM, then each acre would provide 1,500 lbs. of forage DM every 24 hour period. If the steers are being moved once per day, then paddock size would need to be approximately 2 acres. Total stock density on the two acres would be 80,000 lbs. or 40,000 per acre. To increase stock density to 200,000 lbs. /acre, you would need to subdivide the 2 acre paddocks into multiple 1/5 acre paddocks and move the cattle forward into new paddocks frequently throughout the day. Once cattle are accustomed to frequent moves (i.e., every 1-3 days) they move readily into new grazing paddocks, so movement is as easy as opening a single strand polywire gap gate, lifting the polywire so cattle can pass under, or using automatic Batt Latches attached to electrified bungee gates so that release of each gate is set on the Batt Latch timers and cattle move themselves throughout the day (Picture 1).

**Picture 1: Batt Latch.**

*Courtesy of Gabe Brown.*

Once you are adept at setting up and moving temporary fencing, it becomes a fairly simple and quick task to build or remove paddocks. Most AHSD grazers can build paddocks for the entire week in approximately 6-10 hours per week. For smaller herds, the time requirement is even less. Cattle movement into new paddocks requires just a few minutes per day. Simply opening pre-built gap gates, spring gates, bungee gates, raising the polywire, or reeling in the divider strand is all that is required. The cattle will then flow into the new paddock readily and you can sit back and observe the cattle and forages carefully (Picture 2).

**Picture 2. Cattle Movement into New Paddock**

*Courtesy of Greg Judy.*

Close observation of grazing is required so that you can time cattle movement into new paddocks when no more than 50% of available forage DM has been consumed. A key component of proper grazing with AHSD grazing is leaving behind plenty of trampled forage or "ground litter" (Picture 3). This ground litter

is essential for maintaining ground cover and prevention of exposed soil, for protection of soil moisture and soil microbial, arthropod, and earthworm populations, and for creation of new soil organic matter. Many producers view this ground trample as "wasted forage" that should have been grazed, but nothing could be further from the truth. For optimum forage recovery after grazing, prevention of soil erosion and for better drought resistance and root growth, allowing cattle to consume no more than 50% of available forage DM is sound management. Table 1 illustrates what happens with plant root growth stoppage with increased plant leaf removal through grazing.

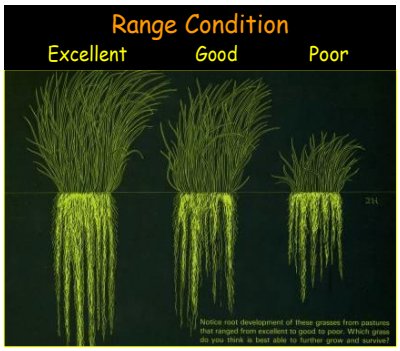
**Picture 3. Example of "Ground Litter" left behind.**

*Courtesy of Gabe Brown.*

**Table 1: Impact of Degree of Grazing on Plant Root Growth.**

## Decrease drought impacts

| % Leaf Volume Removed | % Root Growth Stoppage |
|---|---|
| 10% | 0% |
| 20% | 0% |
| 30% | 0% |
| 40% | 0% |
| 50% | 2-4% |
| 60% | 50% |
| 70% | 78% |
| 80% | 100% |
| 90% | 100% |




*Courtesy of Noble Foundation.*

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Wallace Center at Winrock International
2121 Crystal Drive, Suite 500 ▫ Arlington, VA ▫ 22202-3706
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An additional benefit of AHSD Grazing is the elevation of brix content in forages. Brix is a measure of dissolved plant solids in the sap of a plant (i.e., forage) and includes plant sugars, proteins, amino acids, minerals, lipids, and pectins. It is measured using a simple field instrument called a refractometer. Brix measurements are a quick and easy way to measure plant nutrient density in the field and to track changes in the dissolved solids as soil health improves and plant reach certain stages of growth. Brix data collected in both field trials and farm/ranch demos indicates that as SOM and soil microbial populations increase, plant brix increases as well. Table 2 shows brix values in several common forages ranging from poor to excellent as influenced by soil health.

**Table 2. Brix Index of Common Forages as Influenced by Soil Health.**

| Forage | Poor | Average | Good | Excellent |
|---|---|---|---|---|
| Alfalfa | 4 | 8 | 16 | 22 |
| Ryegrass | 6 | 10 | 14 | 18 |
| Sorghum | 6 | 10 | 22 | 30 |
| Fescue | 2 | 4 | 7 | 12 |
| Bermuda | 2 | 4 | 6 | 8 |

*www.ag-usa.net/brix_test_meaning.htm*

Further research on impact of plant brix and animal performance shows that as plant brix improves, animal performance improves. In gain studies conducted by LMC, LLC on farms in Mississippi, Kentucky, and Virginia, involving stocker steers, yearling bulls, and yearling heifers, average daily gains (ADG) improved as plant brix was increased. Table 3 shows ADG ranges for various brix levels in forages.

**Table 3. Cattle ADG Ranges as Affected by Plant Brix.**

| Brix (%) | ADG Range (lbs./day) |
|---|---|
| <5.0% | 0.5 – 1.2 |
| 8-12% | 1.7 – 2.3 |
| 12-15% | 2.3 – 2.8 |
| >15% | 2.8 – 3.5 |

*Dr. Allen Williams, LMC, LLC*

Regression analysis shows that for every 1.0% increase in plant brix, cattle gains increase an average of 0.1 to 0.3 lbs. /day ADG.

With just a little bit of observation practice and careful calculation of available forage DM, paddock size construction becomes second nature. Just as with any other management practice, the more frequently you move cattle, the better you get at it. The primary factor is not becoming discouraged at the beginning if you leave cattle on a paddock a little too long or move them a little too soon. Simply observe what happened with the forages in the paddock, how much ground litter was left, and recovery

time required before re-grazing. There will be some trial and error involved, but good observation will prevent you from making an error too large to easily overcome.

Your primary objective through the entire grazing season should be to move cattle at a frequency of every 1-3 days. This will produce solid gains in forage DM production, soil moisture protection, and soil organic matter (OM) enhancement. For maximum soil OM building and significant increases in forage DM, soil aggregation, water infiltration, soil microbial population growth, and plant species diversity development through the latent seed bank, it is recommended that you implement ultra-AHSD grazing at least once annually on selected acreage. Move frequencies of every 1-3 days will typically result in stock densities of 30,000 to 50,000 lbs. /acre. For optimum soil stimulation and maximum soil building, higher stock densities are required. The best way to achieve this and not restrict yourself to month after month of multiple daily cattle moves, is to simply pick 3-5 days (or longer of you prefer) out of the year and implement ultra-high stock density grazing at stock densities of 250,000 lbs./acre or greater on selected acreage (Picture 4). Provide these specific areas with an extended rest period before re-grazing. The benefits that result will be quite noticeable after paddock recovery and will carry over into next year's grazing season. After doing this once and experiencing the benefits, you will want to repeat each year on different sections of your farm.

**Picture 4: Ultra-High Stock Density.**

*Courtesy Gabe Brown.*

**AHSD Grazing Case Studies**

<u>Mississippi</u>

In Northeast Mississippi in the heart of the Black Belt prairie, a farm consisting of approximately 1,000 acres was acquired in the fall of 2008. The farm had had been completely mismanaged and was choked

with weeds and brush with little perennial forage base (Picture 5). Cattle were stocked on the place during the winter of 2008-2009 and bale grazing was implemented to start the soil building process.

**Picture 5: Mississippi Farm in Fall 2008.**

*Courtesy Allen Williams.*

During the first grazing season of 2009, spring-calving cows were grazed at high stock densities of 100,000 lbs. /ac and higher with daily and even multi-day moves in order to stimulate soil biology and to control prolific weeds. Cattle primarily consumed weeds such as ironweed, ragweed, pigweed, and thistle, along with grazing perennial forages (Fescue, Bermudagrass, Dallisgrass, Johnsongrass,) that were growing sporadically throughout the farm (Picture 6). Stocking densities were high so that the desired trample would be accomplished. No mechanical or chemical intervention was applied and no seeding or over seeding was done. The purpose of the grazing method was to stimulate the latent seed bank to provide "reseeding". Each grazed paddock received extended rest periods of 90 days or greater before re-grazing. Cattle quickly learned to readily consume all plant materials in front of them and would strip the leaf material from ironweed and ragweed (Picture 7).

**Picture 6: Grazing "Weeds".** **Picture 7: Leaf Material Stripped from Weeds.**

*Courtesy Allen Williams*

Cow/calf pairs grazed the farm all through the warm season grazing period the first year with no loss of animal performance and no supplementation other than mineral. High stock density/short duration grazing was applied through the next four grazing seasons. Changes in soil OM, soil microbial population, water infiltration rates, and plant species diversity were significant (Picture 8). No seeding or interseeding, mechanical or chemical intervention was performed throughout the four year period.

**Picture 8: Plant Species Diversity and density after Four Years.**

*Courtesy Allen Williams.*

At the end of four warm/cool season grazing cycles (4 years), soil OM increased from 1.5% to 4.2%, water infiltration rates increased from 0.75 inches/hour to over 4 inches/hour, forage species diversity improved from 3-4 major forage species to more than 24 species, forage DM production increased from less than 1,500 lbs. /ac to over 4,000 lbs. /ac.

Nebraska

Wayne Rasmussen started farming and ranching in the 1960s near Plainview, NE. He was diligent to follow all university recommendations for fertilization, forage and grazing management. However, he found that productivity was consistently decreasing, input costs were rising, and net profits were declining. In the late 1990s, he was influenced by a number of innovative grazers and educators who altered his concept of grazing and forage management. Through their influence, Wayne started practicing rotational grazing programs, using strategic fencing and water sources to better utilize his grass. He experimented with stocking densities and forage "rest periods" and was able to transform pastures and more than double his stocking rate on the same acreage. This allowed Wayne to expand his cow herd. The primary "turning point" came in the early 2000's when Wayne made a full commitment to strategic, well managed grazing systems that focused on working with, rather than against, his natural resources. He installed water lines and started a more intensive and expansive rotational grazing program, which involved moving the cattle frequently. The new grazing strategy allowed more than a dozen natural springs to appear on his ranch and opened up water sources. This so impressed his neighbors that several asked Wayne to rent their land and graze it to improve it.

By implementing high stock density/short duration grazing, he effectively improved water resources, forage DM productivity, and soil health parameters. About 10 years ago, with the emerging grass fed beef market; Wayne entered the grass fed beef finishing business. His new confidence gained from years of practicing high stock density grazing facilitated his move into grass finishing of cattle. Today, he markets high quality grass finished cattle to a number of branded beef programs, often harvesting loads of cattle that are 80%+ USDA Choice and better from forage alone. He realizes premiums on his grass finished cattle ranging from $30 - $50/cwt over commodity markets.

His current goals include: 1) significantly improving ability to finish cattle to a high degree of finish and on a year round basis on forages and stored forage feedstuffs. 2) Effectively managing input costs so that he can obtain the net profit margins needed to grow the grass finishing portion of his operation, 3) Continuous, incremental improvement of the soil, riparian areas, water resources, land productivity through holistic management practices, 4) Further development of all his natural resources including water resources, wildlife habitat, soil microbiology, management of carbon cycles to effectively improve carbon sequestration.

North Dakota

Gabe Brown started farming near Bismarck, ND in the early 1990's. He purchased land that had been heavily tilled and row cropped for decades. Soil Organic Matter (SOM) ranged from 1.7 – 1.9% with water infiltration rates of less than ½ inch per hour. By contrast, native rangeland in the area that had not been tilled had SOM of 7.0% and greater and water infiltration rates averaging 6 inches per hour. Gabe spent his first few years trying to farm and ranch conventionally, but was going broke and came

very close to losing the farm. His lenders stopped providing operational loans and Gabe was forced to try something different. He implemented a program using diverse and complex cocktail cover crops coupled with high stock density livestock impact on his row crop ground and high stock density grazing on his rangeland. His SOM now averages 5.3% to 6.1% with water infiltration rates of 8+ inches per hour. In his row crop production, Gabe has reduced per bushel production costs on both corn and wheat to below $2.00, with a greater than 80% reduction in the use of inorganic fertilizer and herbicides. Gabe and his son Paul now produce row crops, grass finished beef and lamb and pastured poultry. Their farm is heavily featured in agricultural publications, documentaries, hosts numerous field days, and serves as a model farm in the Burleigh County Conservation District (www.bcscd.com).

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