



Cooperative Extension Program
College of Agriculture, Environment and Nutrition Sciences

Woodland Grazing Notes with Research Highlights

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Goats browsing and grazing in the fenced woodland plots, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

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Introduction

Woodland grazing involves developing the necessary facilities, such as perimeter and cross fences, watering systems, shelters, and mineral feeders in the existing woodland, and rotationally stocking suitable animal species in the fenced plots to utilize the understory vegetation. Animals are moved from one plot to the next when 50 percent of vegetation available within their reach is eaten. This will allow the understory vegetation to grow back quickly and support multiple grazings during a grazing season. The concept behind woodland grazing is to utilize and manage the understory vegetation for animal grazing without inflicting any untoward effect on the desirable tree species present in the system. By employing woodland grazing, livestock producers and landowners can get multiple benefits. Some of these benefits include supplemental grazing for animals and reduced costs of animal production, multiple incomes – short-term incomes from animal sales and long-term incomes from tree products, and reduced fuel build-up leading to decreased fire hazards. Woodland grazing also minimizes or nullifies the need for alternative control of unwanted understory brush and reduces competition of trees with understory brush, resulting in improved timber growth and increased income from quality timber sale. There is a great opportunity of woodland grazing in Alabama because of vast coverage of woodland belonging to private landowners, many of whom are livestock producers.

Woodland Grazing: Potential and Benefits

Alabama ranks the third in the nation in term of woodland acreage. There are 23 million acres of woodland in Alabama accounting for 69 percent of the total land area. Non-industrial private landowners own 87 percent of this woodland (Alabama Forestry Commission, no date). Hardwood trees occupy the greatest live tree volume (52%) out of Alabama's total live tree volume (39.5 million cubic feet). Among the forest type, loblolly-shortleaf pine forest is the most dominant (38.2%) followed by oak-hickory (30.6%), and oak-pine forests (12.7%) (USDA-FS, 2017). Early maturing pine trees, such as, loblolly require about 25 to 30 years, longleaf pine 30 to 50 years, and hardwood trees 50 to 100 years to arrive at the stage of final harvest (ACES, 2013). A sound woodland management involves controlling the unwanted understory vegetation, thinning, pruning, and minimizing fuel build-up to reduce the possible fire hazards. Unmanaged understory vegetation adds to forest fuel and increases fire hazards. There is a significant cost involved in managing forest fuel – ranging from \$100 to more than \$1000 per acre (Stephens et al., 2012). Although burning is considered the cheapest method of controlling forest fuel, it has several limitations; for example, it cannot be applied in areas with nearby neighborhoods and protected habitats, and may result in multiple environmental issues. Use of grazing animals, especially small ruminants, can be a sustainable way of managing understory vegetation in woodlands, and at the same time generating regular short-term incomes from the animal component.

By including woodland into the grazing systems, landowners and farmers can get multiple benefits as listed below:

- Animals will utilize the understory vegetation to fulfill their nutrient requirements, and at the same time, reduce the competition of such vegetation with the desirable trees in the system for water, nutrients, and space. Reduced competition will promote the growth of desirable trees.

- When the grazing animals defoliate the understory vegetation, the woodland system will be more open than before. This will facilitate an easier access into woodlands to conduct other management activities, such as thinning, pruning, raking of needles (in pine woodlands), and collecting other useful forest products.
- Removal of understory vegetation through grazing reduces the fuel build-up and minimizes the possible fire hazards. Thus, the use of animals in woodlands nullifies or decreases the requirement for using herbicide, fire, or other means to control forest fuel.
- Diversified vegetation available in woodlands adds variety to animals' diet, and leguminous and other high-quality vegetation will enrich diet quality for grazing animals.
- Some of the shrubs and trees available in woodland for animal grazing may contain condensed tannin, a bioactive compound that is detrimental to gastrointestinal (GI) parasites. These parasites, especially the barber pole worm (*Haemonchus contortus*), are very problematic in the Southeast because of the warm and humid climate, which is conducive for the survival and growth of these parasites.
- Most woodland vegetation is located above the ground level and beyond the reach of GI-parasite larvae, which usually remain close to the ground (2-3" from the ground) (Miller, 2004). Therefore, when animals are keeping their heads up while eating the woodland shrubs and tree leaves (browsing), the chances of picking up the parasite larvae is zero or extremely unlikely.
- Trees present in woodlands provide mild and comfortable environment for grazing animals with natural shade that protects animals from intense summer heat and direct sunlight. Moreover, trees barricade wind and lower the wind speed, and eventually protect animals from chilling wind in the winter (Karki and Goodman, 2015).
- In summary, by incorporating woodlands into the grazing system, farmers can save in feeding costs, extend and expand the grazing opportunity, lower the possible infection with GI-parasites, and provide comfortable environment to animals. Simultaneously, as animals eat the competitive understory vegetation, it will promote better growth of the desirable trees and reduce fuel build-up, resulting in the lower risk of fire hazard. Because of all these, farmers and landowners obtain multiple benefits from woodland grazing.

Woodland Grazing with Goats: Research Highlights

What was Done

Two grazing studies were conducted at the Atkins Agroforestry Research and Demonstration Site of Tuskegee University in 2015. In these studies, six woodland plots (1-acre each) were rotationally grazed with 29 Kiko wethers, castrated males. Goats were 6-8 months old with average live weight 59.1 ± 1.48 lbs. Before bringing animals into the plots, vegetation samples were collected and analyzed for quality: crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), lignin, and condensed tannin. The first grazing began on May 22 and continued for 45 days. The second grazing was conducted for 34 days beginning on September 2. Animals were moved from one plot to the next when at least 50% of the available vegetation was eaten. Animals had free access to mineral mix (loose), fresh water, and shelters in all the plots

throughout the study. Animal performance (body weight, condition score, and a FAMACHA score) was measured every two weeks, and fecal samples from animals having FAMACHA score of three or above were collected and examined to determine the parasite load.

FAMACHA is a card having five color categories ranging from 1 to 5, and used to determine the anemic condition of goats caused by barber pole worm, a blood-sucking parasite found in abomasum (the true stomach among the four compartment of ruminant stomach) of infected goats and other susceptible animals. Animals with FAMACHA score 1 and 2 are not anemic, and animals with score 4 and 5 are anemic, and require immediate treatment. The treatment decision for animals with score 3 depends on various conditions, such as their general health, body condition score, and the FAMACHA score of the rest of the herd. Animals with a high FAMACHA score accompanied with a high parasite load (fecal egg count >2000/g of feces) and a low body condition score (BCS) (<2.0) were drenched. Body condition score of goats ranges from 1 to 5 with 0.5 interval, and it is used to evaluate how much fat and muscle are present in between the skin and bone of the animals. Goats with BCS 1 are very lean and thin such that bone structures are clearly visible from outside and well felt on palpation, and goats with BCS 5 are very fat and their bones are hardly felt on a firm palpation. BCS ranging from 2.5 to 3 is considered ideal for grazing/browsing goats.

Hooves were inspected every two weeks when they were gathered for performance measurement, and the overgrown hooves were trimmed. In the second study, goats were supplemented with some feed (0.5 lb./goat per day) after the first observation was taken to improve their performance, as they were found not gaining any weight or losing weight. After animals were moved out of each plot in each grazing study, data were collected on browse preference of animals and browsing height for the major plant species present in the system. Preference of goats for different plant species were measured on a scale range of 0 to 5 as presented in Table 1; plant with “0” preference means that the plant was not eaten at all and preference scale “5” means 81-100% of the vegetation available to goats was eaten.

Table 1. Scale used to measure preference of Kiko wethers for different plant species available in woodlands, May-July and September to October, 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

Preference scale	0	1	2	3	4	5
Vegetation eaten (%)	0	1-20	21-40	41-60	61-80	81-100

What was Found

Woodland Plant Composition

Water oak coverage was the greatest among all plant species present in the woodland plots in both the first (29%) and second (30%) studies (**Table 2**). Yaupon and blackberry accounted for 12% each in terms of coverage in May. In September, loblolly pine cover was 12 percent followed by yaupon (11%).

Table 2. Composition of plant cover in May-July and September-October, 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

May-July (Study 1)		September-October (Study 2)	
Plant	Cover (%)	Plant	Cover (%)
Water oak	29	Water oak	30
Yaupon	12	Loblolly pine	12
Blackberry	12	Yaupon	11
Greenbrier	6	Longleaf pine	7
Sweetgum	5	Blackberry	6
Muscadine	5	Greenbrier	6
Loblolly pine	5	Southern red oak	6
Southern red oak	4	Hickory	5
Longleaf pine	4	Sweetgum	3
Sparkleberry	3	Sparkleberry	3
Hickory	2	Persimmon	3
Willow oak	2	Muscadine	2
Persimmon	2	Willow oak	2
		Winged elm	2
Others	13	Others	4

Quality of Woodland Vegetation and Their Utilization by Goats

Goats' preference for 32 plant species and quality of 20 plant species found in the study plots are presented in Table 3. Thirty-seven major plant species were detected in the study plots, and 23 of them were readily eaten by goats. Among these 23 species, 10 species were most preferred with 81 to 100 percent defoliation followed by 13 species with 61 to 80 percent defoliation showing the second preference for goats. Defoliation of the rest of the species was 40 percent or less indicating lower preference of goats for these species. A few highly-preferred species, such as wild plum and winged elm, consisted of a high level of condensed tannin, showing their potential of minimizing internal parasite problems in goats when incorporated into the grazing system.

Table 3. Preference of Kiko wethers for and quality* of woodland plant species, May-July and September-October, 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

SN	Species	Preference Scale	ADF %	CP %	NDF %	Tannin %
1	Sumac	5	19	11	25	1.5
2	Wild plum	5	17	11	26	5.7
3	Beautyberry	5	39	12	51	0.1
4	Blackgum	5	20	10	26	0.2
5	Kudzu	5	33	15	47	0.4
6	Dog fennel	5	31	14	36	0.2
7	Smilax	5	35	9	43	1.9
8	Winged elm	5	38	9	55	7.7
9	Black cherry	4	36	8	42	3.1
10	Hickory	4	29	10	33	2.9
11	Yaupon	4	41	8	51	0.1
12	Honeysuckle	4	42	7	45	0.2
13	Muscadine	4	33	8	50	0.8
14	Rubus/blackberry	4	35	9	41	0.9
15	Sweetgum	4	35	8	35	3.5
16	Sparkleberry	2	43	7	52	8.2
17	Water oak	2	41	9	52	5.2
18	Willow oak	2	46	7	52	4.9
19	Southern red oak	2	31	8	40	4.5
20	Persimmon	1	44	12	56	2.7
Only the preference was recorded for the following species, but not analyzed for quality.						
21	Shrubby oak	5	-	-	-	-
22	Yellow Jasmine	5	-	-	-	-
23	Broom sedge	4	-	-	-	-
24	River cane	4	-	-	-	-
25	Eastern red cedar	4	-	-	-	-
26	Hackberry	4	-	-	-	-
27	Huckleberry	4	-	-	-	-
28	Longleaf pine	4	-	-	-	-
29	Deerberry	3	-	-	-	-
30	Gallberry	2	-	-	-	-
31	Loblolly pine	2	-	-	-	-
32	Hawthorn	1	-	-	-	-
Preference scale: 0= 0% eaten, 1= 1-20% eaten, 2= 21-40% eaten, 3= 41-60% eaten, 4= 61-80% eaten, 5= 81-100% eaten						

*Samples for quality analyses were collected in May.

Browsing Height

Goats reached to an average height of five feet, and for a few preferred species up to 6.4 feet, and defoliated about 50 to 75 percent of shrub and tree vegetation within their reach (Figure 1).

Goats used the bipedal posture (standing on only the hind legs), bent the branches and stem of soft-build plants (e.g. sumac), and pulled down the vines to utilize the vegetation existing at the level higher than their average reach.

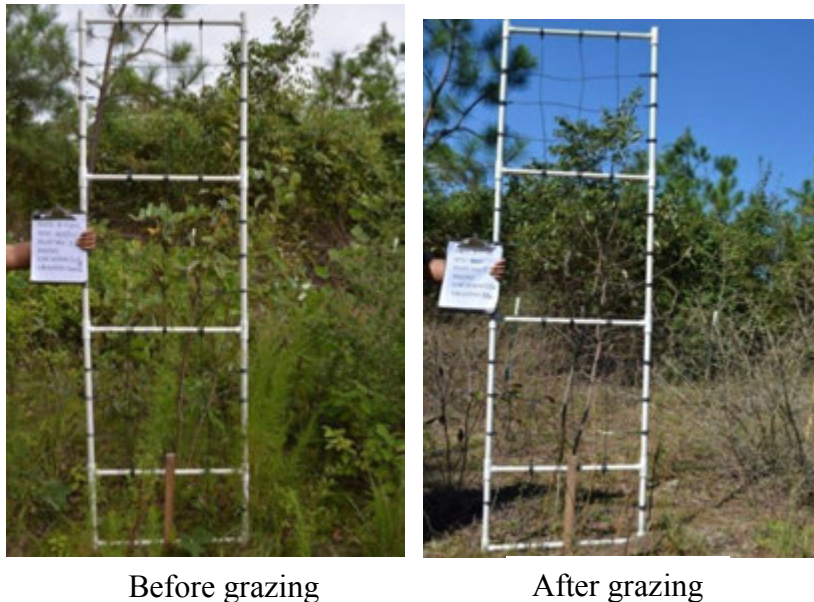


Figure 1. Vegetation removal by Kiko wethers while grazing woodlands, May-July and September-October, 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

Performance of Goats in Woodlands

Goat performance remained low while on woodland plots. In Study 1 (May-July), goats gained a little weight for the first three observations in Study 1 (Figure 2). However, on Observation 4, goats lost weight compared to that at Observation 3. The average daily weight gain was 0.5 oz. in Study 1, which is very low. Goats' average FAMACHA score was around 3 on Observations 1 and 2, and reduced to a little less than 3 in the latter two observations (Figure 3). The body condition score decreased continuously in Study 1 (Figure 4). In Study 2, the condition score

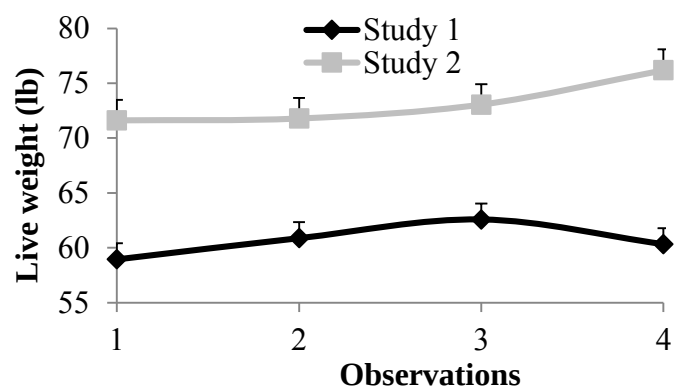


Figure 2. Live weight of Kiko wethers while grazing in woodlands, May-July (Study 1) and September-October (Study 2), 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

improved from the beginning to the end of the study; supplementation could have contributed to this result.

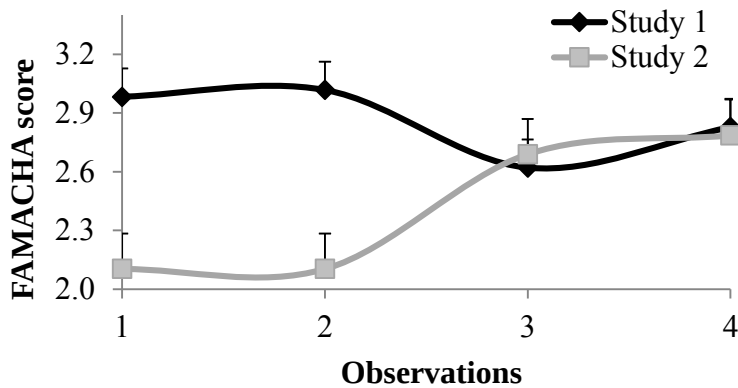


Figure 3. FAMACHA score of Kiko wethers while grazing in woodlands, May-July (Study 1) and September-October (Study 2), 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

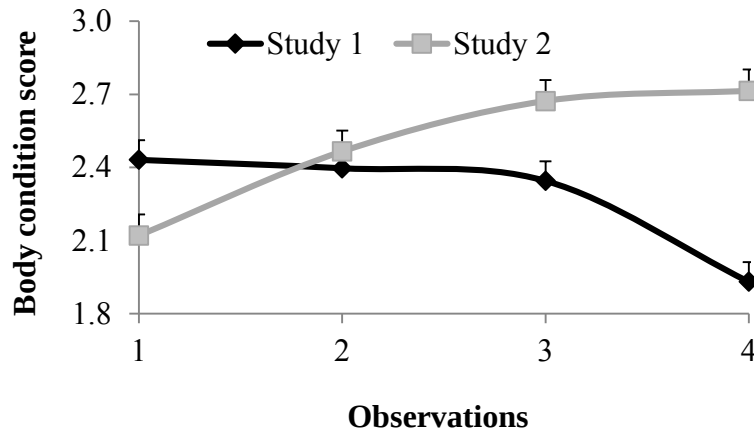


Figure 4. Body condition score of Kiko wethers while grazing in woodlands, May-July (Study 1) and September-October (Study 2), 2015, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL

Key Points from the Study

- Woodland provides a tremendous opportunity for goats' grazing, which minimizes the competition of volunteer understory plants with desirable trees present in the system.
- Goats ate a wide variety of vegetation available within their reach ranging from those present in the ground level up to 6.4 feet in woodlands. In this study, goats readily ate the vegetation from 23 preferred species, with defoliation ranging from 61 to 100 percent. The defoliation of other species was 40 percent or lower.
- Goats' performance while grazing woodland was low, and it was improved with some feed supplementation. Goats' performance in woodland may vary depending on the type and quality of vegetation available for grazing and browsing. Therefore, it will be very important for farmers to closely monitor animals' performance, and make necessary arrangements for a supplement if their performance is unsatisfactory. For supplementation, one either can allow goats to graze the pasture planted with quality forages or supplement with grains or prepared feed.

- Overall, goats removed 50 to 75 percent of the understory vegetation available within their reach. This showed that the use of other methods for controlling unwanted vegetation and reducing the fuel build-up in woodlands might not be necessary when goats are allowed to graze woodlands. This helps utilization of available resources sustainably to produce valuable animal products rather than wasting such resources through burning or herbicide application.
- It will be important to leave 50 percent of the vegetation while ending grazing woodland plots. This allows rigorous regrowth of the vegetation that supports more grazing/browsing versus when defoliated to a higher level.

NRCS Support for Woodland Grazing

Natural Resources Conservation Service (NRCS) provides support the qualified farmers through the Environmental Quality Intensives Program (EQUIP) on the cost share basis to develop woodland grazing systems (NRCS, 2011 & 2014). New and beginning farmers may be eligible for receiving support for developing 100 acres of woodland-grazing plots. Interested farmers should apply for this support through the local field office of NRCS. The approved applicants receive support for developing perimeter and cross fences to develop multiple woodland plots and watering systems for rotational grazing. Contact the local NRCS office in your county, get more information about this program, and apply for this support if you have not done so earlier.

Precautions!

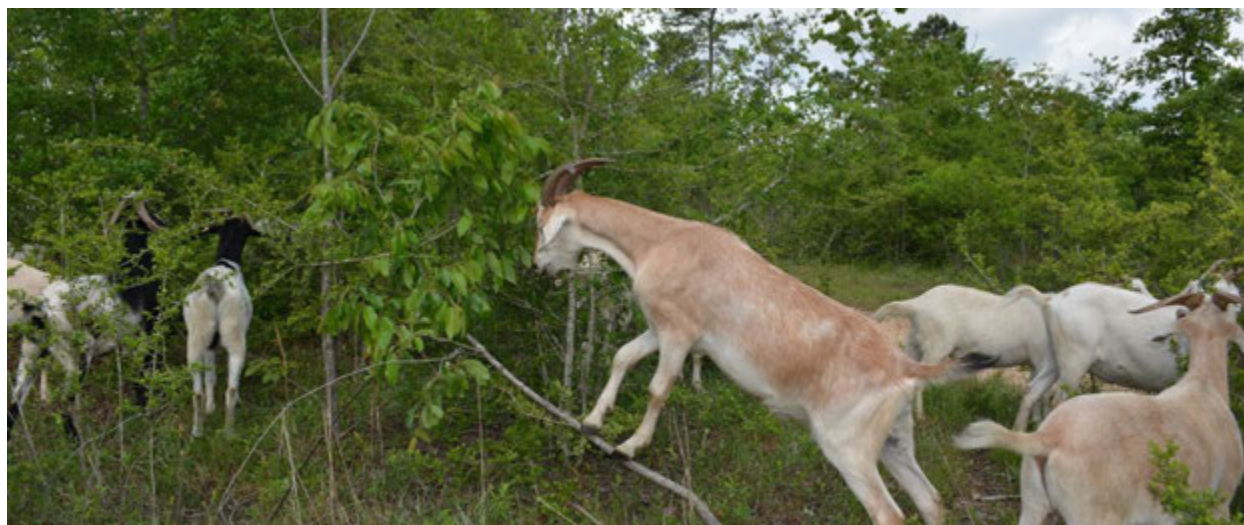
Be always watchful of animal behavior. Goats may debark some of the desirable trees. If such activity is noticed, animals must be moved to a new plot immediately.

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Goats browsing on understory vegetation in woodlands, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL



A woodland plot set up for rotational grazing with shelter, watering facility, and cross fence, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL



Goats utilizing the understory vegetation in a woodland plot, Atkins Agroforestry Research and Demonstration Site, Tuskegee University, Tuskegee, AL