

Spring Ranchers Forum Proceedings

a program by the

***Central Florida Livestock
Agents' Group***

Thursday, March 24, 2011

Yarborough Ranch

1355 Snow Hill Rd.

Geneva, Florida



SPRING RANCHER'S FORUM

MARCH 24, 2011

PROCEEDINGS

Central Florida Livestock Agents Group

Agents

Meg Brew (Lake)
Sharon Fox-Gamble (Volusia)
Ed Jennings (W. Florida Multi-County Livestock)
Dennis Mudge (Multi-County Livestock)
Mark Shuffit (Marion)
Joe Walter (Brevard)
Mark Warren (Flagler)

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SPRING RANCHER'S FORUM

**A program by the
Central Florida Livestock Agents Group
THURSDAY, MAY 11, 2000
YARBOROUGH RANCH
1355 Snow Hill Road, Geneva**

AGENDA

8:15 Arrival - Meet with Allied Exhibitors

Welcome

**Hosts: Dennis Mudge, CFLAG, IFAS Extension Agent, Orange & Seminole County;
Imogene Yarborough, Yarborough Ranches**

8:45 "Effective Body Condition Scoring of Florida Cattle"

Dr. Todd Thrift, Animal Sciences, University of Florida IFAS

9:30 "Cow Condition, Nutrition and Construction"

Dr. Matt Hersom, Animal Sciences, University of Florida IFAS

10:15 Trade Show Break

11:00 "Pasture Recovery in a Rough Year"

Dr. Yoana Newman, University of Florida IFAS, Forage Extension, Agronomy

11:45 Sponsor Give-Aways

12:00 Steak Luncheon

Yarborough Ranch, Yarborough Family - Invocation, Al Johnson, Seminole County Cattlemen's Assoc.

1:00 Allied Give-Aways

1:20 "Meat Goat Alternative"

Sharon Fox-Gamble, Livestock Extension Agent, Volusia County, CFLAG, University of Florida/IFAS

1:40 "Horse Feeding on a Budget"

Megan Brew, Livestock Extension Agent, Lake County, CFLAG, University of Florida/IFAS

2:00 "Feeding the Cow Herd"

Mark Warren, Livestock Extension Agent, Flagler County, CFLAG, University of Florida/IFAS

2:20 "Help with Invasive, Exotic Weeds"

Dennis Mudge, Livestock Extension Agent, Orange County, CFLAG, University of Florida/IFAS

2:40 "Weeds of Value"

Joe Walter, Livestock Extension Agent, Brevard County, CFLAG, University of Florida/IFAS

3:00 Evaluation and Final Give-Away

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Effective Body Condition Scoring of Florida Cattle
Dr. Todd Thrift and Dr. Matt Hersom
Associate Professor, Extension Beef Cattle Specialist
Department of Animal Sciences, University of Florida

INTRODUCTION

Body condition score (BCS) or changes in body condition is a more reliable indicator for evaluating the nutritional status of a cow than live weight or changes in live weight. Although cows with greater BCS tend to have heavier weight, the live weight alone is not a good estimate of overall nutritional status. Most cow herds have a range in cow frame size and muscling in their cows that make BCS a better measure of body fat than live weight. Live weight is also affected greatly by gut fill and pregnancy status both of which affect live weight, and are seasonal depending on the breeding season, forage quality and forage availability. In winter feeding studies, the body condition loss is usually much higher than the body weight loss.

On many ranches, cow body condition score can be evaluated regularly in circumstances where weighing cows may be impractical. This technique is easy to learn and can be very useful in making management decisions.

BODY CONDITION SCORES

Body condition score of beef cows is scored from 1 (thin) to 9 (fat). This system has been used by many cattlemen and researchers as a guideline in evaluating the body condition. It should be realized that any visual scoring system will vary depending on the people doing the scoring and scoring by different people will not agree exactly. However, condition scores should not likely vary by more than one score between experienced evaluators.

It is not difficult to evaluate body condition score of cattle. The first step is to determine which areas of the body are most useful in determining body condition (Figure 1). Fat deposits are visible over the back, tail head, pins, hooks, ribs and brisket of cattle. A description of body condition scores is given in Table 1.

A BCS of 5 should look average — neither thin nor fat. Initially establish what a BCS 5 looks like, then cows can be classified as fatter or thinner and a specific score applied. The fill or shrink from digestive contents or pregnancy can change the appearance of moderately fleshed cattle especially over the rib or in front of the hooks. Long hair is another factor that can make it more difficult to evaluate the amount of condition on a cow. When hair is long, physically palpating the cattle over the back and ribs, and feeling the flesh over the horizontal process of the backbone in front of the hooks can be helpful. The amount of flesh over the transverse process or sharpness of feel of this bone can be used to help evaluate body condition. The descriptions in Table 1 can be used to facilitate palpation for BCS.

Cattle with BCS of 3 or lower have very little fat and are evaluated on degrees of muscle loss. The bone structure over the back and ribs is very visible and another useful indicator is the area from the hooks to the pins. Cattle with muscle loss show a depressed or sunken appearance in this area.

Cattle with BCS of 6 or higher show a smoother appearance across the ribs and back. The breed type of cattle can influence where fat is deposited. Some cattle with Brahman breeding show very little fat over the ribs but will deposit fat over the hooks and pins. Other cattle show uniform deposits of fat across the ribs and back with no patchy deposits around the tail head.

A BCS range of 3 to 7 will include most beef cows in Florida. A cow of medium frame size will weigh approximately 1,100 lb at BCS 5 but only 950 lb at BCS 3. In this system, a medium frame beef cow would change in weight approximately 75 lb for each condition score.

SEASONAL CHANGES IN CONDITION SCORE

The BCS of the beef herd will change during the year. The condition is usually highest in mid to late summer then declines in the fall or winter and is lowest in late winter or early spring. The rate of loss of BCS should be gradual and not extreme if possible. The rate of loss of BCS should be gradual and not extreme if possible. A cow can lose one BCS during the fall and winter (75 lb of flesh), thus it is desirable for the cows to be supplemented to lose this gradually over 120 days instead of a very rapid loss in 45 days followed by feeding high levels of supplemental feeds in an attempt to prevent further condition losses. It is our observation that some Brahman and Brahman crossbred cattle will lose condition faster than other types of cattle especially after calving. It is important that these cattle be monitored closely and that forage and supplemental feeds be adjusted to avoid high rates of condition loss.

USING BCS IN MANAGEMENT DECISIONS

A good ranch manager must evaluate many management alternatives and adjust the program based on the current situation in each herd. Decisions such as stocking rate, fertilization, supplemental feeding, grouping of cattle, parasite control, and diagnosis of problems can use BCS to provide useful information about the overall nutritional status of the herd and individual cows in the herd.

The average BCS of a herd during the year can be used to evaluate the general nutritional status of the herd. If the BCS of the herd is low during the late summer or fall, several factors such as forage quality, stocking rate, mineral supplements and parasite control need to be evaluated to help determine possible causes and solutions.

The type, level and time to start supplemental feed should consider the BCS of cattle. Forage quality and quantity, time of calving, body condition, milk production level, breed type, pasture size, and weather all must be considered. If cattle have a higher BCS than normal, it may be possible to reduce the level of supplement provided. In other situations, the level of supplement given during the winter may need to be increased to maintain BCS. The amount of supplement usually needs to be adjusted to each herd and it may need to be adjusted during the winter depending on the conditions and cattle. An early frost or a drought can change the economically optimum levels of supplements.

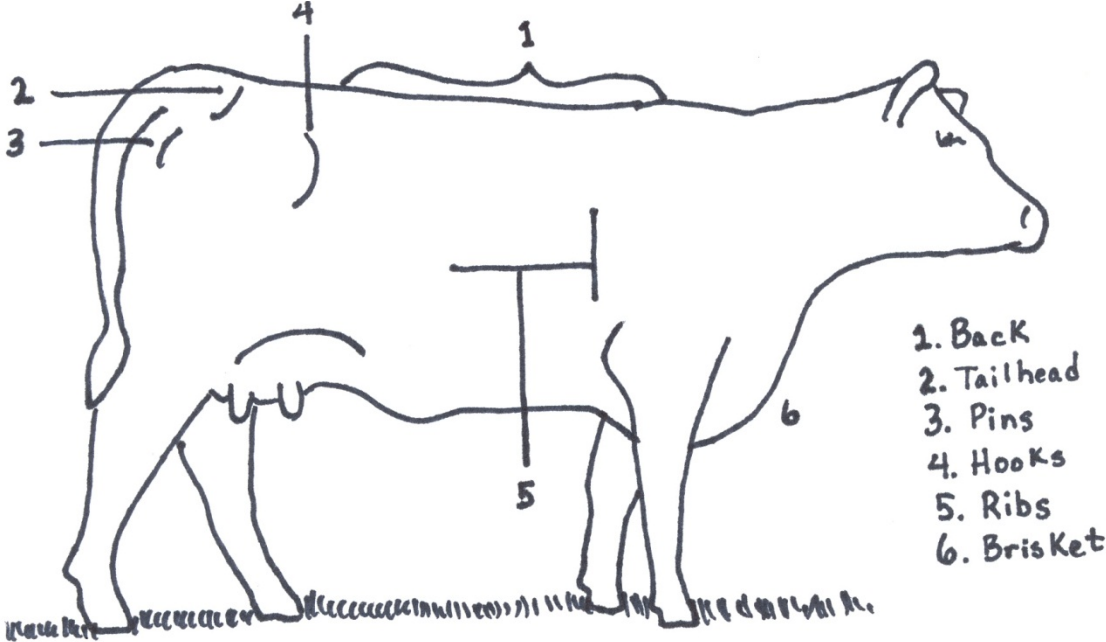
It is desirable to have cows in BCS 5 or higher at calving and if there is a considerable range in BCS in a herd, it may be desirable to separate thin cows. It is usually economically prohibitive to supplement the entire herd if only half of the cows or fewer will respond to the higher level of nutrition. An alternative is to separate thinner cows and manage these cows to improve BCS prior to calving. Possible alternatives may include grazing on a higher quality pasture, providing additional supplements and(or) treating for parasites.

SUMMARY

A BCS of 5 or higher at calving and through breeding is needed for good reproductive performance. Proper stocking rates, a good mineral supplementation program and timely use of protein supplements offer the most potential for economically improving BCS and pregnancy rates. Separating cows by condition at pregnancy testing or 2 to 3 month prior to calving and feeding both groups to calve in BCS 5 or above will maintain high reproductive performance while holding supplemental feed costs to a minimum. The

routine use of BCS in each herd will provide needed information to manage the cow herd for a high calf crop and profitability.

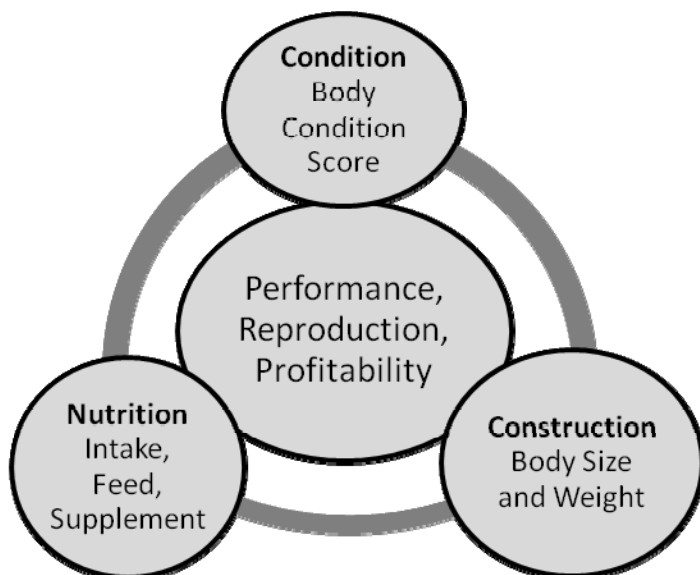
Figure 1. Assessment points for visual evaluation of cow body condition score.



BCS	Description	
1	Emaciated	Bone structure of shoulder, ribs, back, hooks and pins sharp to touch and easily visible. Little evidence of fat deposits or muscling.
2	Very Thin	Little evidence of fat deposits but some muscling in hindquarters. The spinous processes felt sharp to the touch and are easily seen with space between them.
3	Thin	Beginning of fat cover over the loin, back and foreribs. Backbone still highly visible. Processes of the spine can be identified individually by touch and may still be visible. Spaces between the processes are less pronounced.
4	Borderline	Foreribs not noticeable; 12th and 13th ribs still noticeable to the eye, particularly in cattle with a big spring of rib and ribs wide apart. The transverse spinous processes can be identified only by palpation (with slight pressure) to feel rounded rather than sharp. Full but straightness of muscling in the hindquarters.
5	Moderate	12th and 13th ribs not visible to the eye unless animal has been shrunk. The transverse spinous processes can only be felt with firm pressure to feel rounded - not noticeable to the eye. Spaces between the processes not visible and only distinguishable with firm pressure. Areas on each side of the tail head are fairly well filled but not mounded.
6	Good	Ribs fully covered, not noticeable to the eye. Hindquarters plump and full. Noticeable sponginess to covering of foreribs and on each side of the tail head. Firm pressure now required to feel transverse processes.
7	Very Good	Ends of the spinous processes can only be felt with very firm pressure. Spaces between processes can barely be distinguished at all. Abundant fat cover on either side of tail head with some patchiness evident.
8	Fat	Animal taking on a smooth, blocky appearance; bone structure disappearing from sight. Fat cover thick and spongy with patchiness likely.
9	Very Fat	Bone structure not seen or easily felt. Tail head buried in fat. Animal's mobility may actually be impaired by excess

Linking It All Together: Cow Condition, Nutrition, and Construction
Dr. Matt Hersom and Dr. Todd Thrift
Associate Professor, Extension Beef Cattle Specialist
Department of Animal Sciences, University of Florida

The concepts of cow condition, nutrition, and construction are all inter-related and function to affect the central aspect of a cow individually and on a herd basis. The 3 concepts are linked to each other and to the central aspect of cow performance, reproduction, and profitability (Figure 1). Each of the primary concepts will be addressed individually, but more importantly is that these 3 concepts are always linked to each other; one influencing the others, and always affecting the core mission of the cow herd. Figure 1. Inter-relationship of Condition, Nutrition, and Construction on cow herd parameters.



BODY CONDITION

Body condition scoring (BCS) is a visual estimation of body fat that a beef animal has. Body condition scores can be utilized in variety of manners, but primarily to gauge the effectiveness of the feeding program that the cow herd has and is experiencing. Body condition score can also be used as a decision making tool to determine the future feeding needs of the cow herd. Body condition score for beef cattle is measured on a 1 (thin) to 9 (fat) scale. Most Florida cows BCS should be in the range from 3 to 7. A medium-frame cow weighs about 1,100 lbs. in a BCS 5, whereas that same cow will weigh approximately 950 lbs. in a BCS 3. A BCS of 5 is the optimum BCS for mature productive cows for Florida cow herds. Body condition or the body fat that it estimates can be utilized as an energy source for the cow, but this is a finite source of energy and ultimately will have to be replaced through additional feed. Body condition score is also a good indicator of future reproductive performance. Body condition scores less than 5 results in:

- 1) Increased days to return to estrus,
- 2) Increase services per conception,
- 3) Increase days to conception,
- 4) Decreased overall pregnancy rate
- 5) Decreased calf performance

Table 1 presents a comparison of cow BCS and the resulting economic impact. As a result of fewer cows becoming pregnant, less revenue is derived from the cow herd. Likewise, because of decreased BCS fewer and lighter body weight calves are weaned. Fewer and smaller results in a decrease in the revenues generated from the annual calf crop. Finally, when expressed as dollars generated on a cow basis, revenue is decreased as cow BCS declines.

Table 1. Relationship of cow body condition score, reproductive performance, and economic measure.

	BCS 3	BCS 4	BCS 5
% Pregnant	\$41, 913	\$44, 907	\$47, 907
Weaning %	\$16,095	\$32,962	\$36,884
205-d Weaning Wt	\$468.13	\$487.73	\$491.06
Weaning Wt lb/cow, \$/cow	\$175	\$380	\$398

Assumptions: 100 hd herd, all calves marketed, calf weaning weight= 525 lbs, market price of \$114.05/cwt.

Body condition score is directly related to nutrition by the underlying nutritional status of the cow and the potential need for supplementation to maintain or regain cow BCS. Ultimately, BCS has a direct effect on cow performance, reproduction, and cow herd profitability.

CONSTRUCTION

Cow body size is a relevant consideration for a number of important production parameters in the beef cow herd. There are direct relationships between cow size/body weight and 1) feed intake potential, 2) cow nutrient requirements, 3) pasture stocking density, 4) cow performance, and 5) productive output. All of the production parameters affect the need for pasture, stored, and supplemental feeds. Ultimately every one of the parameters impacts the beef cow herd enterprise profitability. However, the accuracy of cow size/body weight estimation is a difficult measurement for most beef producers. I've heard several responses to the question of "how big are your cows?" The responses include "I don't know, why does it matter?" It matters because it affects so many other production parameters in the productive cow herd. "My herd runs 1,000 to 1,150 lbs." Really, how do you know, and how is it such a small range. "My cows average about 1,000 lbs." Two things, most cows aren't 1,000 lbs and the spread likely is 800 to 1,200 lbs. "My cull cows averaged 975 lbs, so my herd is a good size." Why were the cows culled, do they represent the whole herd. Figure 2 presents the cow body weight of 3 different Florida cow herds, none have an average cow body weight of 1,000 lbs, and all have a range of over 500 lbs. Likewise, in other Florida research cow body size has important considerations for weaning percent and lbs of calf produced per cow through the first 3 calving cycles (Figure 3).

Figure 2. Distribution of body weight of three cow herds

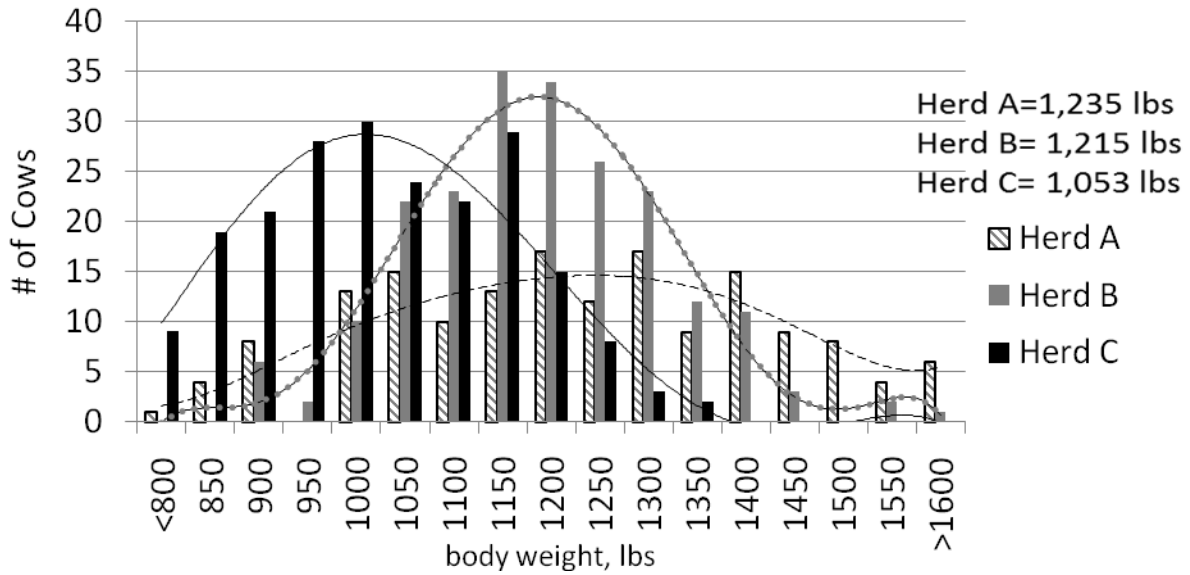
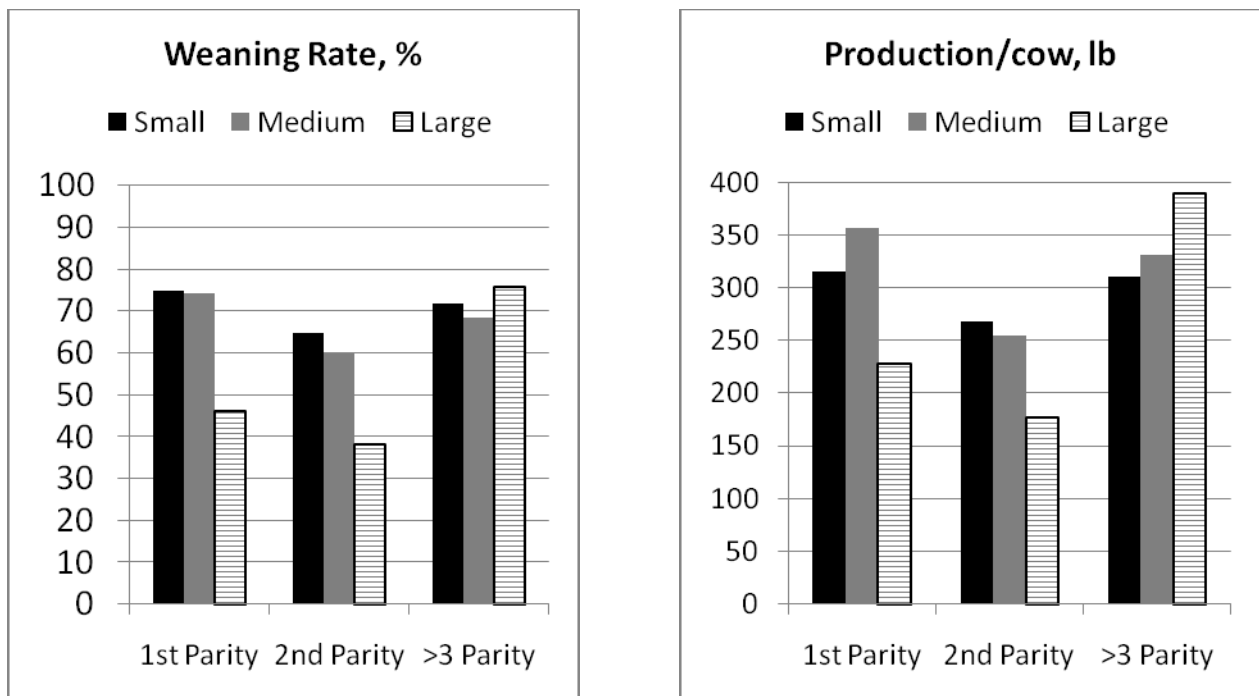


Figure 3. Effect of cow body size on weaning rate and calf production per cow.



NUTRITION

Feeding the cow herd is the largest cost area in beef enterprises and historically approximates 45-50% of the annual maintenance cows. In recent years, the proportion of the annual cost has increased as a result of increases in feed prices. The stored or supplemental feeds that make up a cow herd nutritional program constitute the largest and most variable portion of the annual maintenance cost (Table 1). Therefore, for each cattle producer designing an annual and/or seasonal nutritional-supplementation program correctly is a must. The nutritional program is connected to cow body size through the nutritional requirements mandated by cow body size (Table 2). Likewise, nutrition is connect to cow BCS either by a lack of nutrition leading to a decline in BCS or the need for increased BCS leading to increased nutritional needs.

Table 1. Supplemental feedstuff costs, price/unit of nutrient, and amounts to change body condition score

Feed	\$/Ton	% TDN	% CP	\$/cwt	\$/cwt TDN	\$/cwt CP	Lbs to move BCS	
							3 to 4	4 to 5
Whole Cottonseed	220	95	23	11.00	11.58	45.83	158	179
Corn	240	88	9	12.00	13.64	133.33	170	193
Dried Distillers Grains	198	88	30	9.90	11.25	33.00	170	193
Citrus Pulp Pellet	188	82	9	9.40	11.46	104.44	183	207
Corn Gluten Feed	196	80	24	9.80	12.25	40.83	188	213
Soybean Hulls	204	80	12	10.20	12.75	85.00	215	243
Cottonseed Meal	325	75	49	16.25	21.67	33.16	200	227
Molasses	200	72	5	10.00	13.89	200.00	208	236
Hay	89	51	8	4.45	8.73	55.63	278	315

Table 2. Relationship of cow intake, energy, and protein requirements and body weight/size.

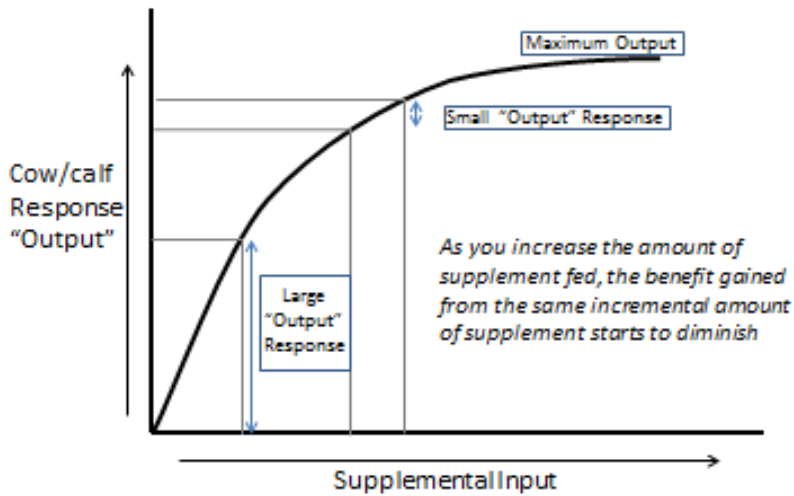
BW, lb	Months After Calving											
	1	2	3	4	5	6	7	8	9	10	11	12

Dry matter intake, lbs												
1,000	24.0	25.0	25.4	24.4	23.5	22.7	19.5	19.8	20.3	21.1	21	21.4
1,200	26.8	27.8	28.4	27.4	26.5	25.7	22.4	22.8	23.3	24.3	24.1	24.6
1,400	29.5	30.5	31.3	30.3	29.4	28.6	25.2	25.6	26.2	27.3	27.0	27.6
Total Digestible Nutrients, lbs												
1,000	14.3	15.2	14.9	13.9	13.0	12.3	9.1	9.3	9.7	10.3	10.6	12.0
1,200	15.7	16.7	16.4	15.4	14.5	13.7	10.5	10.8	11.2	11.9	12.6	13.8
1,400	17.1	18.0	17.8	16.8	15.9	15.2	11.8	12.1	12.6	13.4	14.2	15.6
Crude Protein, lbs												
1,000	2.53	2.79	2.64	2.36	2.08	1.85	1.26	1.30	1.35	1.45	1.61	1.86
1,200	2.71	2.97	2.82	2.54	2.26	2.04	1.45	1.49	1.56	1.67	1.86	2.16
1,400	2.88	3.14	2.99	2.70	2.44	2.21	1.63	1.67	1.75	1.89	2.11	2.45

Grazing forage alone often does not meet the intake, energy, and/or protein demands of the mature cow herd. The forage-cattle-supplement interaction can be complicated by the characteristics of forage quality, forage availability, cattle nutrient requirements that change during the year (Table 2), and supplement characteristics. Choosing the correct supplement is a decision making process that involves both animal requirement considerations along with economic considerations. There are a number of important considerations regarding choosing supplements.

1. **Start feeding before the grass runs out.** The cows have been lacking in intake, energy, and protein long before the grass is exhausted. However, if supplementation has not been initiated prior to a shortage of forage then the beef producer is playing catch-up to the nutritional deficiency of the cow herd. It is always harder to come from behind than it is to maintain a level of performance. This concept also relates to the law of diminishing returns (Figure 4). When a small amount of supplement is fed the response is large, however as supplement amounts increase the response per unit of supplement becomes smaller, to the point of no additional increase in performance as supplement amount increases.

Figure 4. Law of Diminishing Returns



2. Supplement only those animals where there is an economic return. The economic return is generally considered a calf. So only cows that will have or currently have a calf should receive supplement. Open cows should be able to maintain themselves on pasture/forage inputs until they are marketed.
3. Feed supplement where/how all cattle have access to the supplement. It does no good to put out supplement for 50 cows when only 30 cows can consume the supplement. The cows that are not able to consume supplement when offered are most likely the ones that need it the most. The exception is when self-limited supplements are offered.
4. Monitor cow body condition score. Body condition score is the best indicator of the cow nutritional environment, past nutritional experience, and future nutritional needs.
5. No one feed alternative is perfect. Supplements differ in nutrients supply, availability, feeding form, and many more issues.
6. Compare supplement to determine the optimal supplement to utilize for the cow herd.
 - a. Determine level of intake: how much supplement needs to be offered or how much will supplement will the cows consume. The need versus want is an important consideration when appropriately supplementing cattle, both from a nutrient supply and economic outlay.
 - b. Determine concentration of nutrients: the amount of energy, protein, mineral, etc. will aid in dictating the amount of supplement that is needed to meet nutrient deficiencies. Not every feedstuff supplies the same amount of energy, protein, or minerals in a pound of feed. Determining the concentration and amount of nutrient supplied is important to supplement cows appropriately.
 - c. Determine \$/lb of nutrient supplemented: fair comparisons between supplements needs to be made by integrating the amount of nutrient supplied on a cost basis. Raw costs per ton or hundred-weight can be misleading.
 - d. Factor in all cost/benefits associated with feeding: many issues influence the supplement decisions both positive and negative.

- e. **Suitability – Convenience: some feedstuffs do not always fit into some feeding schemes; likewise some feeds are not easily handled or fed without specialized or expensive equipment and storage facilities.**

Beef cattle enterprise profitability most frequently occurs when expenses and revenues are optimized. The difficulty is that it is always more challenging to optimize a situation than it is to maximize outputs or minimize inputs.

Pasture Recovery

Yoana Newman, PhD, Forage Extension Specialist

Producers in Florida keep enduring tough weather conditions. In the last five years, Florida has experienced five different records or near records for the last 40 years. We have faced the driest, the wettest, and the warmest fall, the coldest spring, and the most extreme winter-spring temperature changes. These weather conditions present the question — "How do we manage pastures after or during tough conditions?"

The challenge for forage production is to manage the onset of early warm-season conditions when pastures have been recently affected by freeze events.

Florida has the ideal environment for perennial warm-season pasture production. Florida counts with a long warm season, steady summer rainfall, and soil texture that favor abundant forage growth given proper management. Pasture recovery, however, requires managing by growing conditions more than by traditional seasonal practices.

There are many considerations for pasture recovery but the most critical include doing things in the right order — weed control first, forage fertilization second, and next comes pasture rest and proper stocking rate. 2



Following the right order of field practices. The goal in pasture management is to produce enough forage for beef, milk, or performance (horses) in the most economical way. Skipping practices frequently results in additional expenses, usually weed-control associated expenses!

Avoid falling in the traps that initial weather conditions bring. With the arrival of spring, more often than not, there is the appeal to overlook or skip the control of a 'minor' weed problem. The weeds may not look like a big threat when the grass is greening up. With the first signs of warm weather, you may be compelled to skip the weed control and go straight into fertilization. A precipitated fertilization will result in unnecessary weed problems. For some pastures, the first thing to do is to get rid of the thatch that has accumulated over the winter period by either burning or mowing. Many pastures, though, will be overgrazed and encroached with weeds early in the season.

Weed control prior to fertilization.

Overgrazed winter paddocks are not desirable but they occur frequently. Overgrazing results in grass stubble heights that are too short or minimal. Pastures with short stubble heights will have more bare ground exposed to sunlight, consequently stimulating germination of weeds seeds due to more light reaching the soil surface.

Weeds in forage pastures are the main competitors for light, soil nutrients, and water. In many cases, they are toxic plants, and if they are not, weeds in general do not produce a desirable yield.

Competition from weeds can be dangerous, particularly for recovering plants or forage seedlings trying to survive. In established stands, the weeds are passively waiting for the opportunity to encroach. Because most weeds are short lived, they flower profusely and early as a survival mechanism, while some weeds have vigorous rhizomes that make them very competitive. Pasture weeds need to be controlled early (at rosette stages) before they develop into larger plants. Many weeds have underground reserve storage or rhizomes that make them harder and more expensive to control. The worst case scenario is to allow them to flower and set seed.

Please check the guide for weed management in pastures and rangelands for your specific case, available online at <http://edis.ifas.ufl.edu/wg006>.

In most situations, fertilization is not recommended if the weeds have not been controlled. But if you have done the weed control fertilization is the next step. 3

Forage fertilization is the most practical tool to correct nutrient deficiency in soils and therefore improve pasture production. Chemical fertilizers are highly soluble, and the nutrients are promptly available. However, in order for these nutrients to be absorbed the forage plant needs to have the proper growing conditions and be 'ready' for the uptake of these nutrients.

Warm-season forages have specific conditions for their growth and optimum development, which requires not only that growing ambient temperature is warm but more importantly that the soil is warm.

The spring in Florida is confusing to many who are trying to get ahead with their pasture fertilizer applications. The spring season tends to follow an oscillating temperature pattern with wide differences between minimum and maximum. It is good to review the growing

conditions for the warm-season pasture plants in order to know when to apply the fertilizer for best utilization by the plant.

Bahia- and bermudagrass are tropical plants that have specific temperature and light requirements for maximum and efficient growth. They have high temperature requirements and are sensitive to freezing temperatures. Temperatures below 30°F kill the leaves and stems, but growth will continue with night temperatures as low as 34°F if day temperatures are near 70°F. (We are past these conditions, but it is good to keep as a reference to know the extent of damage if you experience some of these conditions earlier in the winter).

Soil temperatures of 65°F and above are necessary for growth of rhizomes/roots and stolons (runners). Wait for your fertilizer application until consistent warm soil temperatures (65° and above) are present. Optimum soil temperature for root growth is around 80°F.

Optimum daytime temperature is between 95 and 100°F. These grasses are most productive from May to September when average daily temperatures are consistently above 75°F.

In terms of light, what are the requirements and implications, and how do they work toward pasture recovery?

Bahia- and bermudagrass have high light requirements. They do not grow well in shady conditions, such as under trees, under a companion summer crop that will shade them, or under the spring growth of ryegrass. If ryegrass or other cool-seasons have been overseeded into bahiagrass or bermudagrass fields, they need to be removed very early in the spring; otherwise they may compromise the persistence of the warm-season grass.⁴

Pasture rest and adequate stocking rate. When plants are overgrazed, there is a reduction in the shoots and root development of the plant (see figure below). The root extension or elongation stops within 24 h after removal of 40 to 50% of the forage shoot mass, and some fine roots may also die soon after grazing. Resting pastures allows for leaf and root recovery. Providing enough rest from grazing defoliation allows for regrowth of leaves. First, the plant is able to start photosynthesis (process where the plant takes sunlight and converts it to green leaves), and over time the photosynthesis process increases. The new leaf area needs to capture light and translate it into carbohydrate (energy) stored in the roots. It is fairly simple. Allow the grass to grow (by temporarily resting the pasture), pasture shoots and leaves will re-grow, and the leaves will recover the root system. The proper stocking rate is the one that leaves a good portion of the above ground basal forage. In many cases this represents the lower 1/3 of the plant. Within sod type grasses, there are variations. Some will grow more upright than others (limpoglass > stargrass and T-85 bermudagrass >coastal bermudagrass > bahiagrass). The rule to follow when managing stubble height should be higher for limpoglass compared to stargrass or Tifton 85, higher in stargrass and Tifton 85 compared to coastal, and higher in coastal compared to



bahiagrass.

**Figure. Plant root growth as affected by grazing.
Left: Not grazed. Middle: Proper grazing stubble. Right: Overgrazed plant**



Meat Goats An Overview of Marketing, Demand and a Few Basics

**Sharon Fox Gamble
UF/IFAS
Extension Agent, IV**

Goats and sheep are among the oldest domesticated species. The meat goat industry is one of the fastest growing components of agriculture within the U.S. According the U.S.D.A. Agricultural Statistics Service, the overall goat population continues to increase annually throughout the U.S. While the wool sheep industry has seen a decline, there has been an increasing interest in the hair sheep (meat-type sheep).

While goats have been consumed worldwide, the genetics for thickly muscled, meat animals were relatively unavailable. In the early 1990's Boer Goats were imported. Today, genetics for Boer goats from South Africa, the Kiko, from New Zealand, the Spanish Meat Goat, Savannah and the Tennessee Woodenleg and Tennessee Meat Goats are available for producers.

Historical data series are not readily available on goat production, marketing and production. Information of consumption, product characteristics desired, the markets used by goat producers are not widely available nor is the relative importance of the markets or characteristics of the market. Little is known about the production problems experienced by producers and their relative importance on decision making process.

In the mid 1980's finding information regarding production and marketing was extremely difficult regarding goats, only slightly better for sheep. There are numerous goat breeds that are categorized by their capacity to produce fiber, milk or meat but little, if any research had been conducted relative to goats, let alone meat goats. In Florida, demand for goat meat was being realized but producers were limited to selling and consumers limited to buying the extra bucks or wethers resulting from the breeding of milking goats... an industry, in Florida, artificially depressed by milk marketing laws.

An eleven state region from Texas to North Carolina (TX, LA, OK, AR, MS, AL, FL, GA, TN, SC and NC) is the goat production area and accounts for 78% of all goat production and 81% of meat goat production in 1997. An interesting factor facilitating the expansion of the meat goat industry within the Southeast was the financial settlements resulting from class action lawsuits against the U.S. tobacco industry. As monies were designated to pursue alternative forms of agriculture production, basically tobacco fields were turned into goat grazing pastures in states such as Kentucky, the Carolinas, Virginia, and Tennessee. The economic benefits spread to adjoining states with producers offering quality brood stock for sale.

By 2008, the USDA National Agricultural Statistics Service reported 3,150,000 meat goats in the U.S., and American producers unable to meet domestic demand. Australia was listed, by the USDA Foreign Agricultural Service (FAS), as the prime exporter of goat meat into the U.S. market.

By 2009 a survey was conducted of Tennessee goat producers that defined the average meat goat producer as 55-65 years of age with less than ten years experience raising goats. Most lack a marketing plan and typically relied on live auctions to market animals. Meat goat production in the southern region increased by 59% from 1992-1997. Net imports of goat meat also increased during that period. Changes in goat production are thought to be related to increase in the segment of the population that has preferences for goat products. The implication of these statistics is an increase in goat meat demand. However, little research is available that explain the consumption demographics of goat meat, cut preferences

In 2011, much more information is available, along with creditable research. Much of this resulted from the formation of various producer groups and organizations. Land Grant Universities in particular have taken the lead in providing educational information and programs. The Alabama Cooperative Extension System offers a broad spectrum of information online (aces.edu) and Florida A&M, Fort Valley State, Langston State and Penn State Universities are among many institutions that offer extensive information and programs addressing various aspects of goat production and much of the research funded by Sustainable Agriculture Research and Education (SARE).

Goat production offers a viable form of sustainable livestock production, particularly for individuals with limited financial resources, limited land availability and limited physical abilities. While the young and old tend to be easily intimidated by large animal production such as beef or dairy cattle and hogs, goats are not as intimidating because of their smaller body size and general handling qualities (pet status). Goats can also serve as an environmentally friendly form of vegetation control and can easily be integrated as an alternative form of livestock diversification. They do not compete for the same type vegetation as cattle, sheep or swine and tend to complement other forms of livestock production.

What is the market outlook?

Currently demand is double the domestic production, so there is ample room for expansion.

Who buys and eats goat meat? The peak consumer age is 55 -74 years old. Consumer preferences are deeply rooted in demographic, social and economic characteristics of populations. Demographically, Hispanics, Muslims and individuals of the Caribbean region. Twenty-five percent of Hispanics as compared to 12 percent of the general population consume goat meat. Of the non-goat meat consumers, 32 percent of Hispanics said they were willing to try it as compared to 30 percent of non-Hispanics. Men tend to eat goat meat more but more so seasonably. Women, who eat less, tend to eat it year round and they prefer it more “showcase” ready.

Those who consume goat and lamb tend to be immigrants from other countries where they traditionally eat these meats. Ethnic groups relocating to the U.S. with a preference for

goat and lamb tend to come from (but are not limited to) Africa, the Caribbean, Mexico, Asia, Europe, and the Middle Eastern and Latin American countries. They also tend to settle in areas where others of the same ethnic backgrounds have settled. If a goat or sheep producer can identify locations where there is a concentration of similar ethnic populations, the farmer can make reasonable efforts to successfully market his or her product within these communities, however, the producer needs to understand consumer preferences.

How are goats marketed through organized auctions? The Federal State Market News Service classifies market goats by weight as follows:

Kids 20 - 40 #, 40 – 60#
 Bucks/billies 75 - 100 #, 100 – 150#, 150 – 300#
 Does/nannies 60 - 80 #, 80 - 100#, 100 - 120#
 Yearlings 20 - 40 #, 40 – 60#, 60 - 80#
 Wethers 20 - 40#, 40 - 60#, 60 – 80#

(wethers and yearlings, although classified are rarely available)

When are the highest prices received for market meat goats and for which market class? Kids 20 – 40# and 40 – 60 # by order of highest prices received:

1. April
2. March
3. February
4. May
5. June
6. July

How was this determined? The Federal State Market News Service in Tifton, Ga., over a 21 month period, tracked 72 sales events with over 24, 471 animals being sold. Most of the animals were sold during the spring and summer months. Prices received varied from Kids 20- 40# selling for \$35.72 per head to Bucks/Billies at \$110.12. The Kids classification has the lowest price variability. Billies/Bucks and Nannies/Does are not typically marketed as “slaughter class.” Most males are marketed intact as they are marketed before the secondary sex characteristics emerge and castration leads to slowed weight gains.

What are the religious holidays*?

Christian Holidays	Jewish Holidays	Islamic Holidays	Hindu Holidays
Epiphany	Passover/Pesach	Start of Ramadan	Navadurgara or Navratra Dasshara or Dassai
Western or Roman Easter	Rosh Hashanah	Eid ul-Fitr	Diwali
Eastern or Greek Easter	Chanukah	Eid ul-Adha	
Christmas		Muharram/Islamic New Year	

		Mawlid al-Nabi	
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***Holiday dates change annually – producers need to know when these dates occur annually to match marketing with demand.**

Ethnic Holidays and the Size of Kid Preferred for Feast	
Holiday	Size of Kid
Easter (Western)	20 – 50 pounds
Easter (Eastern and Greek)	20 – 50 pounds
Independence Day	20 – 35 pounds (older kids also accepted)
Caribbean holidays	60 pound bucks
Start of Ramadan (Muslim)	45 – 120 pounds, less than 12 months
Eid al Fitr (Muslim)	45 – 120 pounds, 60 pounds optimum
Eid al Adha (Muslim)	Yearlings, blemish free
Source: http://sheepgoatmarketing.info/education/ethnicholidays.htm	

Seasonal preferences currently exist. This may be in part to lack of overall availability however religious holidays are not the only events when goat or lamb is served. Ethnic groups may roast a goat or lamb during American holidays, such as Christmas, New Year’s, Memorial Day, July 4, and Labor Day. It is not unusual to serve goat or lamb at birthday parties, weddings, baptisms, graduations, anniversaries, and other celebration where family and friends gather.

What are the most popular breeds to produce? 70 percent of meat goat owners produce Boer goats while 43percent has Spanish and 15percent have Kiko goats. Eighty percent of producers with less than five years experience expected to increase their operations and 90 percent of producers with more than 100 animals and five years experience anticipated expansion.

What are the top five marketing practices? As listed by producers in order of decreasing importance:

- 1. Visitors to the farm (44%)**
- 2. Goat auctions (42%)**
- 3. Breeding and stock sales (39%)**
- 4. Livestock auctions (32%)**

What are the obstacles? In order of decreasing importance as listed by producers:

- 1. Parasite**
- 2. Marketing**
- 3. Feeding practices**
- 4. Prices received**

What are consumer preferences for live goat sales?

- 1. Do the customers prefer male or female goats?**

2. If male, do they prefer intact or castrated males?
3. What goat or sheep age do the customers prefer?
4. Does this group prefer a small or large goat?
5. Do the customers prefer a live animal or an animal processed in a particular fashion? When or where do they prefer the animal to be processed?

What are the consumer preferences for retail sales? In descending order of importance:

1. Safety assurance
2. Freshness
3. Bright color

The consumer preference is most influenced by gender. Females and smaller households demand higher quality assurances of goat meat products. Consumer concern with cholesterol content is high and most notably with consumers with higher incomes and educational attainment as well as with older consumers. Goats produce a 10-20% more lean carcass than beef or lamb which should eventually result in overall increased consumer demand.

Willingness to consume more goat meat was reported by more than 48% of respondents. Blacks and multi-culture households are much more likely to increase consumption compared to others. Value added activities such as prepacked products, labeling, and cooking instructions are factors that are expected to influence increases in consumption. Increases in demand from new consumers are likely to be influenced by store displays, price specials, in-supermarket tests and USDA inspections.

Meat Goat Basics

Fencing needs to be “right” goats are wonderful escape artists. Cattle fences may be adapted for goats by adding strands of barbed wire and stays or by installing offset hot wires inside the fence about 8” high and 6 – 8” away from the fence. Goats must be trained to electric fence and charges should be maintained at a minimum of 4,000 volts. Eight strands of tight barbed wire or five strands of high-tensile electric or woven wire 47” high (topped with barbed wire and with another barbed wire at ground level will make a good fence).

Housing, Pens and Chutes

Housing needs are minimal and in moderate climates consist of natural cover of thick trees and brush. Goats need protection from rain and cold wind and snow. While snow isn’t a concern in Florida, rain certainly is. A sturdy shed, opened to the south will do. Know that goats love to climb on things and will. Keep this in mind when designing housing. Movable sheds (on skids) can provide many options. Allow 5 square feet per goat. If the shed is near the farmhouse, predators may be deterred.

Working chute should be about 10 feet long, 4 feet high and 12 inches wide. Longer chutes tend to cause crowding and trampling at the forward end and should be divided into section with sliding gates. Goats with horns will work through chutes better if side walls are solid and sloped. Well design working facilities enhance the safety and well being of animal and human. For more information please consult Meat Goat Production and

Marketing Handbook, North Carolina by Gipson, T. and Housing, Fencing, Working Facilities and Predators by Harwell, L. and Pinkerton.

Multi-species Grazing

Goats make a valuable contribution to maintain the productivity of pastures they graze, particularly when used in a multi-species grazing scheme. Many cattle producers have found that adding goats to their farm or ranch increased profits while improving pasture. Goat Specialist, Jean-Marie Luginbuhl of NC State believes you can add one or two goats per head of cattle without reducing beef production. Goats and cattle do not share the same parasites and goats consume plants that cattle avoid, thereby increasing grass production for cattle as the suppression of brush allows more grass growth.

Stocking Rate

It is generally believed that six mature goats equal one cow on improved pasture and that 10 goats equal one cow on browse. When grazing brush, it may be necessary to adjust stocking rate in order to accomplish objectives. These figures depend on the carrying capacity of the land and observation and adjustment are necessary.

Conclusion

The meat goat industry is located in the southern states. Demand currently outstrips production. Information is much more readily available than what was 20 years ago. The Federal State Market News Service has recognized the increased sales and developed marketing classifications. More is known, but more needs to be determined regarding consumer preferences and demographics.

Future trends indicate that a consumer market will need to be more fully developed. As immigrants and their offspring become more “Americanized” goat products will need to more meat-case ready. Additionally goat meat consumption will increasingly compete with beef, pork, and poultry. Consumers may embrace goat meat more readily if more knowledgeable regarding the health aspects.

The U.S. Census Bureau confirms that continued growth of populations from the Middle East, Southeast Asia, and the Caribbean in the U.S. NASS forecast a continued increase in demand for goat meat and a consecutive growth in meat goat production. These opportunities will necessitate those institutions, organizations, and leaders active within the meat goat industry to continue to hold a stake to ensure promotion and producer education as outreach efforts are continued and expanded as needs arise.

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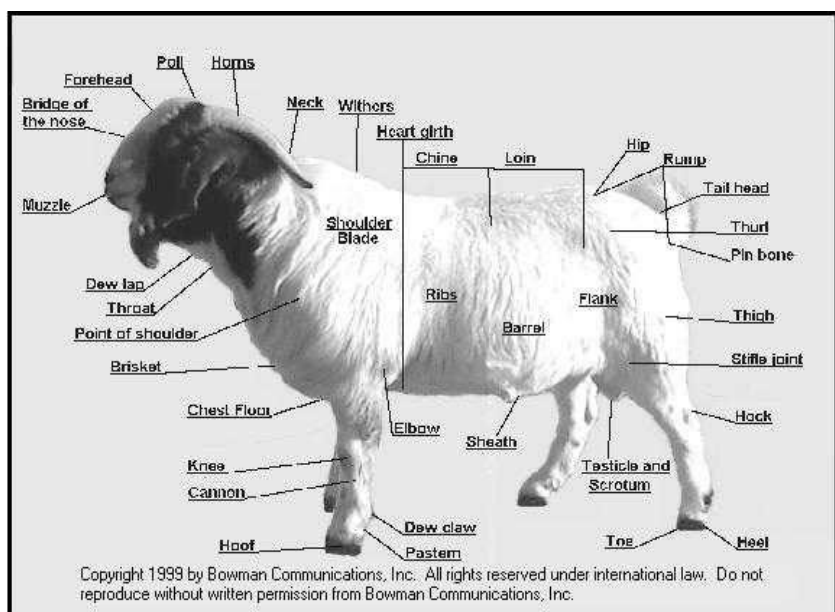
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Further Information



<http://www.sheepandgoat.com/>

Florida Meat Goat Association

<http://www.fmga.org/>

Meat Sheep Alliance of Florida

<http://www.msasheep.com/>

ATTRA National Sustainable Agricultural Information Service

<http://attra.ncat.org/>

Maryland Small Ruminant Page

Southern Consortium for Small Ruminant For Parasite Control

<http://www.scsrpc.org/>

FECAL EGG COUNT DETERMINATION

February 19, 2010

The research lab of Dr. Ray M. Kaplan offers laboratory services to veterinary practices as well as farmers and producers (institutions and researchers should contact the lab for the research service and price list) to aid in the management of livestock parasites. This document serves as a list of available services as well as the price and a brief description of each service provided by the Kaplan Lab. The instruction sheet and sample submission form is attached. Services can be arranged by contacting the lab at (706) 542-0742.

1. Fecal Egg Counts:

- a. 2 or 4 gram modified McMaster method - \$12.00 per sample**
- b. High sensitivity McMaster (8 epg sensitivity) - \$15.00 per sample**
- c. Wisconsin or Stoll method - \$20.00 per sample**

2. Coproculture and Larval Identification (fecal culture for -\$100.00 per culture speciation of parasites present) -\$75.00 each when multiple samples submitted.

3. DrenchRite Larval Development Assay* -\$450.00 per assay

a. Processing fee for un-testable sample -\$50.00

4. PCV & TS (hematocrit and total protein) -\$15.00 per sample

5. Blood smear examination (M. haemolamae) -\$20.00 per slide

6. Fecal Sedimentation (test for liver fluke) -\$20.00 per sample

7. Lectin Staining (quantifying relative percent of H. contortus in a given sample) -\$40.00 per sample

*** Performance of this test requires pre-arrangement with lab prior to collection and submission of sample.**

Ray M. Kaplan, DVM, PhD, DipEVPC

Professor of Parasitology

**PLEASE READ THE COLLECTION/ SUBMISSION PROTOCOL BEFORE
COLLECTION TO ENSURE PROPER SAMPLE SUBMISSION.**

**PLEASE CONTACT THE LABORATORY TO ENSURE LAB PERSONNEL
ARE AWARE SAMPLES ARE BEING SUBMITTED. (706) 542-0742**

**Sue Howell or Bob Storey, Dept. of Infectious Disease, College of Veterinary Medicine
501 D.W. Brooks Dr., University of Georgia, Athens, GA 30602**

**DIRECTIONS FOR FECAL SAMPLE SUBMISSION FOR FECAL EGG COUNT (FEC),
COPROCULTURES AND LECTIN STAINING:**

It is best to collect samples directly from the rectum, however, feces can be collected off the ground if the animals are first put into a shed with a clean floor (free of bedding, grass and dirt). Feces are easily collected from the rectum of mature animals using a latex glove with a little OB lubricant or KY jelly. The size of the sample that is needed to perform the test depends upon the tests requested per animal (several pellets (FEC) to a golf ball or lemon size clump for coproculture or lectin stain). We can always dispose of extra feces – better to include too much than too little.

On the day of collection, it is critical that feces be kept cool to prevent hatching of eggs, but care must be taken not to get the samples too cold because this will inhibit hatching. At the time of collection, feces should be placed in a cooler containing ice packs to keep the sample cool and can be placed in the refrigerator overnight. However, if requesting the

coproculture, feces should not be kept refrigerated more than 48 hours as prolonged chilling will inhibit hatching of eggs making it impossible to perform the coproculture. We have also found that samples in direct contact with ice packs for 24 hours often do not hatch well. Therefore, if kept cool with ice packs, place something like newspaper, cardboard, etc, over the ice pack to prevent the samples from touching the ice packs. Because of the problem with cold-inhibition, fecal collections should be shipped the same or the next day. If feces are to be shipped to the lab, it is important that air be excluded from the feces as much as possible to prevent the development of nematode eggs prior to their isolation and testing (see below).

SAMPLE PREPARATION (for shipping):

We currently recommend two different methods for packaging samples for fecal egg counts, coprocultures and lectin staining (see below). Samples can be sent by priority mail, so long as they arrive in our lab within 3 days of collection. Samples should not be exposed to extreme temperatures (i.e. do not freeze or leave in the sun). Refrigeration is not needed and is not desirable after samples are processed to exclude air. If the samples will be hand-delivered to the lab within 48 hours, then they can be kept cool and do not need “air-exclusion processing”.

1. Utilize the “Reynolds Handi-Vac” system which utilizes a small handheld vacuum pump and special zip lock type bags for vacuum sealing. The Reynolds Handi-Vac kit is available at most grocery stores and at Walmart for around \$10.00. The sample is placed in the Reynolds Handi-Vac bag and sealed. The Handi-Vac pump is used to evacuate all of the air out of the bag, providing an anaerobic environment that will delay the hatching of the nematode eggs until they arrive at our lab. Place a piece of tape over the vacuum seal to keep the bag air tight. Label the bag with the species (sheep, goat, llama, etc), farm name, and date of collection.

2. Samples may also be placed in individual baggies. Compress the pellets together and exclude the air as much as possible before sealing the ziplock on the baggie. Label the bag with the species (sheep, goat, llama, etc), farm name, and date of collection. Ship by overnight or priority express*.

*** If using the US Postal Service for the overnight delivery, be sure to check ahead of time to make sure they deliver to Athens, GA. With FedEx or UPS there should not be any problems.**

INFORMATION TO BE INCLUDED WITH SAMPLE: (Submission form attached).

- 1. Owner name and contact information (including email and fax if available)**
- 2. Name and contact information of veterinarian**
- 3. Species and breed of animals**
- 4. Number of animals feces were collected from, and manner of collection (from rectum or ground)**
- 5. Date of last deworming and drug used**

A check must be submitted with the sample. Samples received without payment may be discarded unless prior arrangements have been made. (This policy was required because we have had instances where payment was never received for the services provided despite repeated attempts to collect).

FOR MORE INFORMATION CONTACT:

**Ms. Sue Howell or Mr. Bob Storey (in lab of Ray M. Kaplan, DVM, PhD)
Department of Infectious Diseases
College of Veterinary Medicine
University of Georgia
Athens, GA 30602
voice: (706) 542-0742
fax: (706) 542-0059**

e-mail: jscb@uga.edu or bstorey@uga.edu

Please include Sue Howell or Bob Storey on the address when shipping the sample.

Kaplan Lab Clinical Submission Form

Client Name:

Farm Name (if applicable):

Client Address:

City, State, Zip:

Home Phone Number:

Cell / Other Number:

Fax Number (if applicable):

E-mail Address:

Name of Veterinarian / Clinic:

Address:

City, State, Zip:

Phone Number:

Cell / Other Number:

Fax Number (if applicable):

E-mail Address:

TESTS REQUESTED:

NUMBER of SAMPLES:

DATE of COLLECTION:

Animal Species / Breed Submitted:

Last Deworming Date and Dewormer Used:

Manner Samples were Collected (from Ground or Rectum):

Feeding Horses on a Budget

Megan Brew, UF/IFAS Lake County Cooperative Extension

Whether you own horses for pleasure or raise them for profit, reducing costs without sacrificing quality is of paramount importance. In tough economic times, making small adjustments to your feeding program can mean the difference between making it or breaking it in the horse business. The key to saving money on feed bills is not always to buy cheaper; in fact, always choosing the cheapest option, cutting corners on management and feeding like you've always fed can end up costing you a whole lot more in the long run. By feeding smarter instead of cheaper you can maximize the nutrition available to your horse while minimizing the damage to your wallet. Begin the journey to smarter feeding by asking yourself these questions:

- 1) *Am I feeding my horse what he needs?*
- 2) *Is he able to use what I give him?*
- 3) *Am I wasting resources?*

Am I feeding him what he needs?

Domesticated horses are often fed contrary to the way nature intended. The horse's digestive anatomy is designed to consume small quantities of roughages throughout the day (primarily in the form of grazing) as opposed to the one or two large high calorie grain meals which are standard fare on most horse farms. From both economic and health standpoints, diets should be roughage (grass and hay) based. In fact, most horses, unless they are in late gestation, lactation or heavy work, require little if any grain provided there is adequate forage availability and mineral supplementation. Start thinking about your feeding program as being roughage based with a grain supplement rather than the other way around.

Speaking of roughages, hay should be high quality, free of weeds, mold or dust, and palatable to your horse. That being said, the most expensive hay is not always the best. Over half of the cost of hay is in shipping. Look for hay which is grown locally (for example Coastal Bermuda grass hay or Perennial Peanut legume hay). These hays are nutritionally similar to imported grass and legume hay (for example timothy, orchard and alfalfa) but come at a much more budget friendly price. Forming a relationship with a local hay producer and buying hay out of the field can secure an even lower price.

Table 1: Comparison of retail price and nutrient value of four commonly fed horse hays

Hay	Price/Ton*	Digestible Energy (Mcal/lb)	%TDN	% Crude Protein	Ca	P
Alfalfa ¹	\$430	0.8-1.1	48-55	15-20	0.9-1.5	0.2-0.35
Timothy ¹	\$420	0.7-1.0	42-50	7-11	0.3-0.5	0.2-0.35
Perennial Peanut ²	\$280	0.9-1.3	54-68	11-20	1.1-1.7	0.2-0.3
Coastal Bermuda ¹	\$200	0.7-1.1	42-50	6-11	0.25-0.4	0.15-0.3

*price current as of

3/15/11

Certain classes of horse will not be able to maintain adequate body condition on roughage alone. When selecting a grain pay close attention to feed tags and use them to comparison shop. Feed companies dedicate a significant portion of their budget to advertising, hoping to appeal to the heartstrings (and purse strings) of horse owners. By reading labels, the educated owner is able to shop with their heads as opposed to their hearts. Of course, cheaper is not always better as cheaper feed is often less nutritious and may have to be fed in a greater volume to achieve the desired result. Look for a feed which is nutrient and calorie dense and complements your forage program.

Table 2: Comparison of lbs/d of a 14% complete horse feed vs. whole oats needed to meet the nutritional requirements of an 1100lb horse in light work consuming 18lbs of grass hay/d

Nutrient	14% CP pelleted complete feed (lbs/d)*	Oats (lbs/d)
Energy	5.25	6
Protein	5.25	6.2
Lysine	5.25	10
Potassium	5.25	16.4*
Copper	5.25	>50*
Zinc	5.25	>50*
Calcium	5.25	78*

*feeding more than 5lbs oats/meal is not recommended

Table 3: Cost comparison of three feeds which meet the nutritional requirements of an 1100lb horse in light work consuming 18lbs of grass hay/d

Feed	Cost/bag*	Cost/d*
Complete feed	\$14.50	\$1.52
Whole oats**	\$9.00	\$14.04
Whole oats + ration balancer	\$9.00 + \$20.25	\$1.62

*price current as of 3/15/11

**feeding more than 5lbs oats/meal is not recommended

Is my horse able to use what I give him?

In order to efficiently use the grain and roughages that are being offered to him, your horse needs to be able to ingest, digest and absorb all available nutrients. Start by watching him at the grain bucket. Is he dribbling a lot or producing excess saliva? If so, it may be time to have the dentist out for a float. Grain that is dribbled on the ground is doing nothing for him nutritionally and can actually contribute to sand colic as he tries to clean his mess later. Next, take time to evaluate your deworming program. Parasites in the GI tract can rob the horse of valuable nutrients and contribute to colic. The best deworming plans start with a fecal egg count to determine parasite load and involve targeting dewormer to the specific parasite populations present.

Am I wasting resources?

Spoiled feed and hay is money down the drain. Store your grain in air-tight vermin-proof containers (trash cans with locking lids make excellent feed bins) and be sure to empty one bin before adding fresh grain to prevent the bottom layer from spoiling. Feed grain off the ground when possible or in tubs which are difficult to tip.

A hay bag in the stall minimizes waste and a hay ring or above ground bale feeder in the pasture will prevent horses from walking in and soiling hay. Hay should be stored in a dry, covered area off the ground (preferably under roof and on pallets). Improper hay storage results in reduced feed intake as well as dry matter losses.

Table 4: Forage quality changes when storage method differs

Storage Method	Digestibility	Economic Loss (\$/T)
Barn	58.8	-
Outside	42.5	\$9.72

Poor pasture management practices can also result in a higher feed bill. Overstocked, under-managed horse pastures can quickly morph from fields of green to weed filled sand lots. If the amount of grass in the pasture is not adequate to meet the horses roughage requirements more hay will have to be supplemented at a significant cost to the owner. Regular soil testing, appropriate fertilizer and herbicide use, maintaining low stocking rates and practicing rotational grazing will extend the grazing season and dramatically lower hay bills.

Finally, be wary of over feeding horses. Obese horses (those of a body condition score of 7 .5 or higher) are at risk for major health complications. Feeding horses to the point of obesity not only raises your feed bill, it can raise your vet bill as well.

For more tips on horse keeping on a budget contact your local county extension agent.

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The Nuts and Bolts of Cow-calf Nutrition
Mark Warren, Flagler County Extension

Inadequate nutritional plans, for Florida's cow-calf enterprises, are one of the areas of management that results in greatest loss to production efficiencies. Poor nutrition affects the herd in a number of ways including increased disease incidence, lower conception rates, lower market weights/ prices, and increased replacement frequencies. (Maddock & Lamb 2010)

Permanent pastures in North Florida for operations on a Jan-March calving program and under normal growing conditions should be able to meet their herd requirements from about mid-May through September with little or no supplementation for protein and energy. In the southern parts of the state this season is slightly shifted due to calving windows and extended due to longer growing seasons and alternative forage varieties, but the bottom line is still that "supplementation is an important part of an adequate herd nutrition plan for an extended part of our production year."

Factors affecting Supplementation:

Herd/ Animal influences

- Stage of production—bred/ open, dry/ lactating, developing/ mature
- Current condition—body condition score and direction of change (low BCS with increasing demand versus high BCS with increasing demands)
- Climatic variables—extended rain, freezes, standing water
- Parasite loads—both internal and external
- Breed

Forage/ Feed influences

- Nutrient density—Crude protein (CP) and energy (TDN)
- Moisture content—Dry matter versus "as fed" basis
- Cost/ pound of nutrient

In the following two graphs you will find plotted both the CP and TDN requirements for

In this example, the bahia hay is reported to have an energy value of 55% TDN. Under certain management and for certain classes of livestock this number can fall short of meeting the requirements of the particular animal.

Example: An 800# replacement who needs to consume 15# of energy on a daily basis, would lose condition (starve to death) if she had unlimited access to 55% TDN hay with no other energy supplement.

800# x 2.5% BW = 20# DMI daily

20# @ 55% TDN = 11# Energy

She still needs 4# of energy and her

Average Bahia Hay

- **Small Round 800lbs @ 85% Dry Matter**

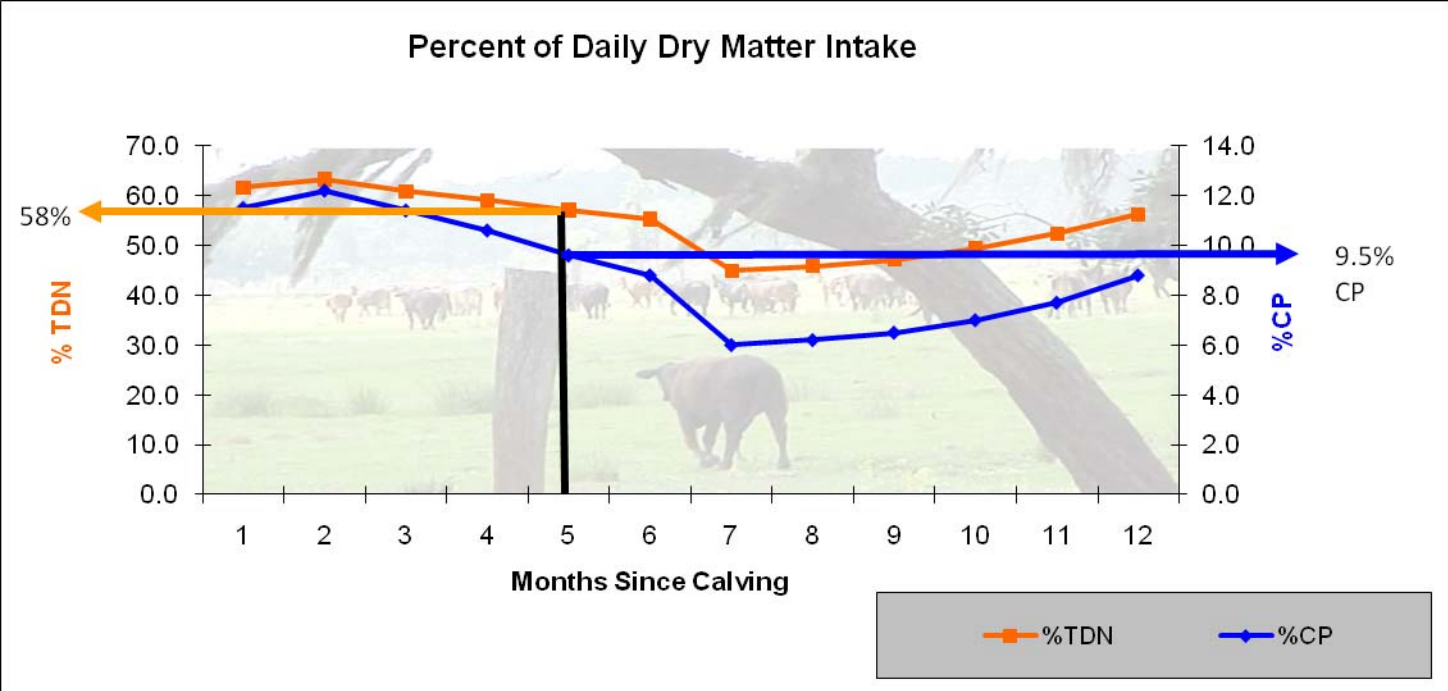
- 2.5 per ton
- \$40 per bale (\$100 per ton)
 - 2000lbs @ 85% DM = 1700lbs DM
 - 1700 @ 55% TDN = 935lbs of Energy
 - \$100 935lbs = \$.11 / pound TDN or \$220 per ton of TDN

\$220 per ton of TDN

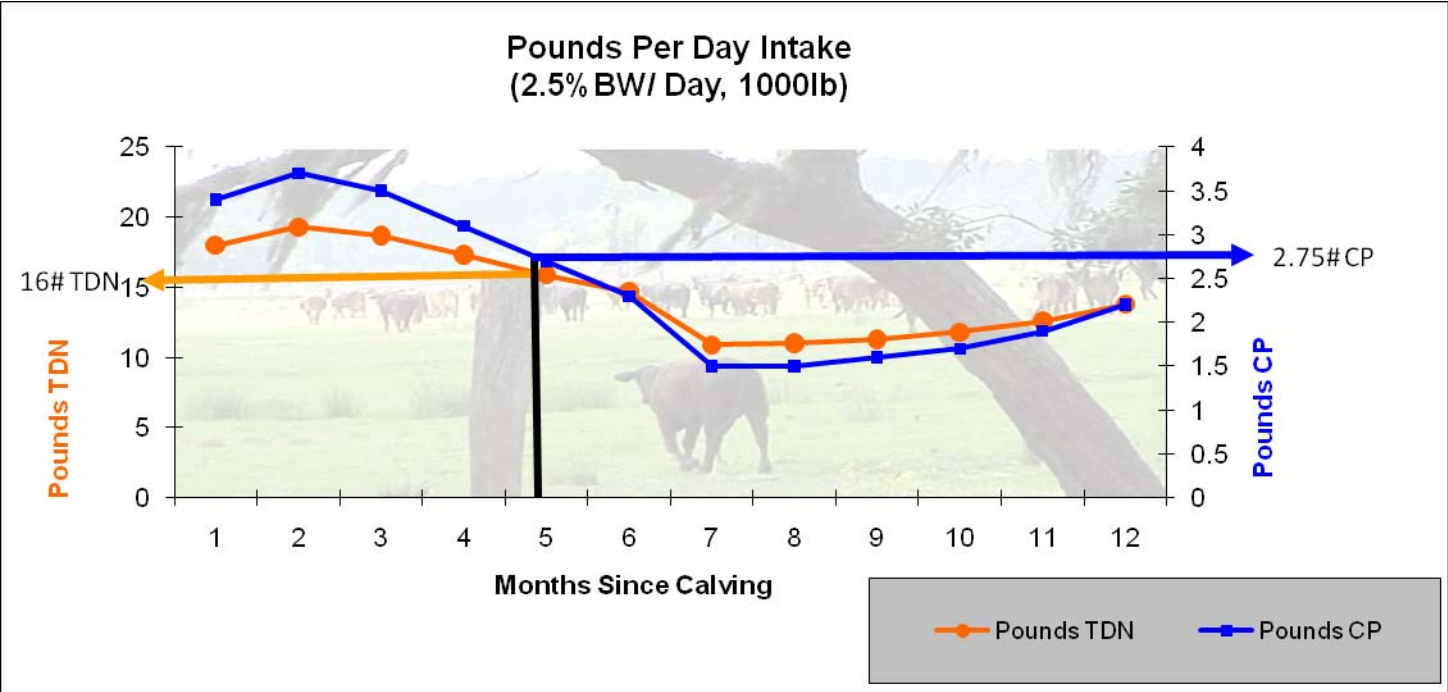
Comparisons (\$ per ton of TDN)

- Corn Gluten \$240/ ton
- Soy Hulls \$284/ ton
- Hvy. Molasses \$340/ ton

beef cattle based on the number of months since calving. (Hersom, 2008) In the first graph the data is presented as a feed composition on a dry matter basis (label or analysis information).



In the second graph it is stated as pounds per head assuming a daily intake of 2.5% of body weight on a 1000 pound animal.



Estimating winter feed requirements with stored forages requires that we know the quality of the feed, the average size of the animals being fed, and the expected duration of the feeding period. Below is an example of a typical feeding situation.

Sample Problem:

195 head of brood cows scheduled to breed beginning in April. The herd has an average weight of 1,100 lbs per cow. The producer plans to plant sufficient winter forages to meet the herd requirements after calving, but doesn't expect them to be available until ~January 1st and not up to full production until the 3rd week of Jan. In an effort to avoid a nutritional shortfall the producer wants to plan for the event of an early frost (November 1). If all of the nutritional requirements for the herd had to be provided for the months of November and December plus one half of the requirements for 4 weeks in January how much hay/ balage would he need to secure during the upcoming summer months.

100% Nov-Dec (8 weeks)

50% Jan (4 weeks)

Using *Winter Feed Estimator*:

Step 1: Pick a frame type—1,150# Medium Frame (according to USDA mature cow)

Step 2: Slide the chart to the appropriate number of cattle—195 or ~200 head

Step 3: Nov-Dec (8weeks)— 161.0 tons of dry matter

January (4weeks, @ 50%)— $81/2 = \underline{\sim 40.5 \text{ tons}}$

201.5 tons (Dry matter)

Step 4: Convert tons of dry matter (DM) to bales.

Option 1-- 200 tons 800#, 15% moisture bales = 588 bales @\$35/ bale = \$20,580

Option 2-- 200 tons 1000#, 20% moisture bales = 500 bales @\$45/ bale = \$22,500

Option 3-- 200 tons 1000#, 60% moist. balage bales = 1000 rolls @\$25/ bale = \$25,000

Nutritional quality of forage feeds can only be determined by collecting a representative sample and having it analyzed. Fees for these types of analysis typically range from \$10-16/ sample. Forage quality can change from field to field, from cutting to cutting, and from producer to producer. Each production lot should be sampled independently and then managed accordingly to fit the needs of the herd.

In the above example cost comparisons are only relevant if similar nutrient analysis are reported. If some of the samples have higher reported values, these may be saved for feeding post partum when livestock needs are increased.

Forage Analytical Labs:

UF Forage Extension Lab
Range Cattle REC 3401
Experiment Station Road
Ona, FL 33865
Joe Vendramini,
jv@ufl.edu, (863) 735-

Dairy One
730 Warren Road
Ithaca, New York
14850
Ph: 1.800.496.3344 or
607.257.1272

Waters Agricultural Laboratories, Inc.
P.O. Box 382
257 Newton Highway
Camilla, GA 31730-0382

Invasive / Non-Invasive Plants

Central Florida

When non-native plants become “invasive” by spreading aggressively into natural areas, they cause ecological issues and then have financial impact. They often quickly outgrow and replace native plants within native habitats. This threatens natural plant community structures as native species are displaced or when these plants hybridize with native plants.

Control

Millions of dollars are now being spent each year to fight invasive exotic plants and animals. Florida, more than any other state except possibly Hawaii, faces this problematic environmental and financial issue. Local, state, and federal governments, environmental organizations and private land owners all need to play a role in the control of non-native species.

Farmers and Ranchers

The farm community has a long history of battling invasive weeds on agricultural lands. The University of Florida Extension Service provides farmers with the research-based information needed for control. IFAS (Institute of Food and Agricultural Sciences) publications are available online at <http://edis.ifas.ufl.edu>.

New Funding

Following a strong lobby by farmers and ranchers, tax dollars are now being used to control non-native plants on public lands. This, though, is not enough. The list of non-native exotic plants is growing and farmers and ranchers must increase their efforts in this battle; especially if they border public lands where these plants have spread onto their lands in the past. They must not leave uncontrolled plant communities of exotics that could now spread back to public lands.

Steps to Take - Prevention, Detection and Control

University designed integrated approach to control is best. Each land manager in Florida needs to be practicing these methods in order to stop the spread of invasive plants.

Additional Problems for Farmers and Ranchers For over a decade this Agent has visited private lands all over Central Florida. It is well

Farm/Ranch Case Studies Series

Fact Sheet
#032411







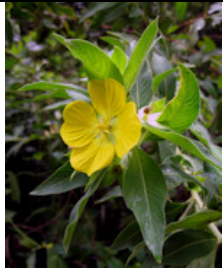




















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like “aliens” out of control because they are often toxic. Some are more poisonous than others, but this is the reason I have found that insects don’t keep many of them in check.

				
Lantana	Rosary Pea	Chinese	Chinaberry	Elephant
T/LK	T/LK/PP	T/LK	T/LK/PP	T/LK/PP
				
Mexican bluebell	Primrose willow	Coral	Brazilian pepper	Brazilian
ST/LK	ST/LK	T/LK	ST/LK	T/LK
				
Asparagus fern	Climbing cassia	Tropical Soda	Castor bean	Guava
T/PP	T/LK	T	T/PP	T/PP
				
Chinese privet	White wandering	Camphor tree	Air potato	Skunk vine
T	ST/LK	ST		

				
Hydrilla	Torpedo grass	Cogongrass	Johnson grass	Begonia
	PE	ST/PE	ST/PE	T

KEY

T = toxic, **ST** = suspected toxic, **LK** = Livestock killed, **PP** = people poisoned, **PE** = possible edible.

Additional information available from <http://plants.ifas.ufl.edu>

Control of Non-native Plants in Natural Areas of Florida¹

K. A. Langeland, J. A. Ferrell, B. Sellers, G. E. MacDonald, and R. K. Stocker²

Introduction

Florida's native habitats are protected for historical significance and to protect species, water quality, and water quantity. Setting aside certain lands to be managed for conservation is a method to protect them. According to the Florida Natural Areas Inventory, almost ten million acres of state and federal public lands are currently managed for conservation. Natural areas are conservation lands that have been set aside for the purpose of preserving (or restoring) native plant and animal communities. Natural areas are also maintained by counties and cities in Florida and by private land owners.

Nonnative plants, carried here by humans since European colonization, now threaten the states remaining natural areas. Of the 4,373 plant species growing on their own without cultivation in Florida, 30% are nonnative (Wunderlin, R.P., and B.F. Hansen. 2003. *Guide to the Vascular Plants of Florida*, Second Edition. Gainesville: University Press of Florida). Many of these nonnative plants were originally introduced as garden ornamentals or agricultural crops. Other nonnative plants were accidentally introduced. Regardless of how they arrived, these 1,200 or so nonnative plants grew so well in Florida that they naturalized, meaning that they spread on their own without cultivation into managed or natural areas. While some of these naturalized nonnative plants are not a problem, many became weeds, or undesirable plants, in agricultural and forestry areas, yards, and roadways. When these naturalized nonnative plants spread extensively into natural areas and dominate by displacing native plants and disrupting natural processes such as fire or water flow, they are called invasive. Invasive nonnative plants can be thought of as weeds in natural areas.

The Florida Exotic Pest Plant Council (FLEPPC) is a nonprofit professional organization founded in 1984 to increase public awareness of the significant threat that nonnative invasive plant species pose to native species, communities, and ecosystems, and to develop integrated management and control strategies to halt the spread of exotic species in natural areas. FLEPPC maintains a list of plant species considered by a committee of botanists, ecologists, and land managers to be invasive in Florida. This list is available on the FLEPPC Web site (<http://www.fleppc.org>). The purpose of the FLEPPC list is to alert land managers to plant species that have demonstrated invasiveness in Florida, but the list does not have statutory authority. Plants that are regulated by statute are listed on the Florida Noxious Weed List.

Plant species included in this publication are not limited to either of these lists but are included because they have warranted control measures in at least one natural area in the state and should be viewed as potentially invasive in other natural areas. Some of the plants included here are used in landscaping and are important to the nursery/landscaping industry. Mention of species in this publication does not necessarily mean IFAS recommends limitation of their use. The IFAS Assessment of the Status of Nonnative Plants in Florida is used by IFAS to evaluate the invasiveness of nonnative plants in Florida relative to IFAS recommendations. The results of this assessment can be viewed on the IFAS Center for Aquatic and Invasive Plants Web site (<http://plants.ifas.ufl.edu/assessment/>).

Management of invasive vegetation in natural areas requires control methods that will minimize damage to nontarget vegetation and soil. Often this need for caution necessitates more time and effort than does weed management in agricultural, industrial, or right-of-way settings. Some particular types of vegetation, for example woody or sprawling vegetation, may require removal of standing plant material even after it has been killed if its presence increases fire hazard, reduces aesthetic appeal, or could cause harm as it decays and falls. Control methods include manual removal, mechanical removal, physical controls, herbicides, and biological control alone or in combination with another method.

The purpose of this publication is to provide land managers in Florida with current methods being used to manage nonnative plants in the state. Identification of plant species is not included in this publication. For identification, recognition, and other information about many invasive plant species, readers are referred to *Identification and Biology of Nonnative Plants in Florida's Natural Areas*, 2nd Ed. by K. A. Langeland, H. M. Cherry, C. M. McCormick, and K. A. Craddock Burks (2008), which is available from the IFAS Extension Book Store (800-226-1764 or <http://www.ifasbooks.com>).

Regulatory Agencies

Removal of vegetation in certain areas such as public waters and wetlands is regulated by state and local agencies and a permit may be required. For questions regarding permits to control vegetation in public waters, contact one of the following Florida Wildlife Conservation Commission Regional Biologist Offices:

Northwest, (850) 245-2809

Suwannee River, (386) 758-0464

Southwest, (352) 726-8622

North Central, (321) 228-3364

St. Johns River, (407) 275-4004

South Central, (863) 534-7074

South Gulf, (813) 744-6163

South, (772) 871-5407

For regulatory questions regarding vegetation control in wetlands, contact the Water Management District (WMD) in which you are located:

Northwest Florida WMD, (904) 539-5999

Suwannee River WMD, (386) 362-1001

St. Johns River WMD, (386) 329-4500

Southwest Florida WMD, (352) 796-7211

South Florida WMD, (561) 686-8800

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Control Methods

Education and Prevention

The importation and spread of invasive vegetation can be significantly reduced by public education.

It is the responsibility of those who are aware of the problems caused by invasive nonnative plants to educate others about their identity, impacts, and control so that further ecological degradation of native ecosystems can be reduced.

Biological Control

Classical biological control involved the introduction of reproducing populations of foreign insects or diseases. In Florida, early efforts in invasive nonnative plants in nonagricultural areas focused on aquatic weeds. The first biocontrol agent introduced was the alligatorweed flea beetle (*Agasicles hygrophila*) in 1964 for control of alligatorweed (*Alternanthera philoxeroides*). Subsequently, the alligatorweed thrips (*Aminothrips andersoni*) was released in 1967 and the alligatorweed stem borer (*Vogtia malloii*) in 1971. The flea beetle and stem borer proved to be fairly effective for suppressing growth of alligatorweed, although harsh winters can reduce their populations. Less effective have been introductions of the waterhyacinth weevils (*Neochotina eichhorniae* and *N. bruchi*), released in 1972 and 1974, and the waterhyacinth borer, released in 1977 (*Sameodes albigutalis*) for waterhyacinth (*Eichhornia crassipes*) control. Likewise, effectiveness of a weevil (*Neohydronomous affinis*) and a moth (*Namangama pectinicornis*) released for control of water lettuce (*Pistia stratiotes*) has been unpredictable. Waterhyacinth and water lettuce continue to be problems that require management by other methods. Current biological control research is focused on hydrilla (*Hydrilla verticillata*), waterhyacinth (*Eichhornia crassipes*), melaleuca (*Melaleuca quinquenervia*), and Brazilian pepper (*Schinus terebinthifolius*).

In more recent years, efforts to develop biological controls for natural area weeds have focused on melaleuca (*Melaleuca quinquenervia*), tropical soda apple (*Solanum viarum*), Brazilian pepper (*Schinus terebinthifolius*), and Old

World climbing fern (*Lygodium microphyllum*). Current information on the status of these and other biological control programs can be found on the following Web sites: <http://edis.ifas.ufl.edu> and <http://plants.ifas.ufl.edu>.

While classical biological controls are currently under study and will be implemented in the future, their development takes years and they cannot be expected to solve all invasive plant problems. Biological control programs are typically implemented by state and federal agencies, and the potential role of individual resource managers and the public will depend on the particular action being implemented.

Introduction of animals such as cattle, sheep, goats, or weed-eating fish may also be used to control certain invasive plants. However, environmental impacts of using such nonselective herbivores in natural areas should be carefully considered before implementation.

Manual Removal

Manual removal is very time-consuming but often a major component of effective invasive plant control. Seedlings and small saplings can sometimes be pulled from the ground, but even small seedlings of some plants have tenacious roots that will prevent extraction or cause them to break at the root collar. Plants that break off at the ground will often resprout, and even small root fragments left in the ground may sprout. Therefore, repeated hand pulling or follow-up with herbicide applications is often necessary.

Removal of uprooted plant material is important. Stems and branches of certain species (e.g., ligustrum and melaleuca) that are laid on the ground can sprout roots, and attached seeds can germinate. If material cannot be destroyed by methods such as burning, it should be piled in a secure area that can be monitored and new plants killed as they appear.

Pulling plants from the ground may cause unwanted soil disturbance in some natural areas, especially pine rockland habitat. This soil disturbance may result in further invasion by invasive nonnative plant species, again requiring follow-up control measures.

Mechanical Removal

Mechanical removal involves the use of bulldozers or specialized logging equipment to remove woody plants. Intense follow up with other control methods is essential after the use of heavy equipment because disturbance of the soil creates favorable conditions for regrowth from seeds and root fragments, and recolonization by invasive nonnative plants. Plans for management or replanting of sites with native vegetation following mechanical removal should be carefully developed prior to implementation of mechanical removal. Mechanical removal may not be appropriate in natural areas because of the disturbance to soils and nontarget vegetation caused by heavy equipment.

Cultural Practices

Prescribed burning and water level manipulation are cultural practices that are used in management of pastures, rangeland, and commercial forests and may be appropriate for vegetation management in natural areas in some situations. One important consideration is the degree of degradation of the area in question. Cultural practices may have impacts to all parts of the habitat—native species included. If the habitat is so badly degraded that the need to reduce invasives strongly outweighs consideration of remaining native species, more aggressive control strategies can be considered. In less degraded areas, more careful use of integrated methods may be appropriate.

The land use history of an area is critical in understanding the effects of fire and flooding on the resulting plant species, composition. Past practices affect soil structure, organic content, seed bank (both native and invasive nonnative species), and species composition. While there is evidence that past farming and timber management practices will greatly influence the outcome of cultural management, very little is known about the effects of specific historical practices. Similar management practices conducted in areas with dissimilar histories may achieve very different results. Even less is known about the effects of invasives entering these communities, and the subsequent management effects of fire on the altered communities.

Understanding the reproductive biology of the target and nontarget plant species is critical to effective use of any control methods, but particularly so with methods such as fire management, which often require significant preparation time. Important opportunities exist if management tools can be applied to habitats when nonnative invasive species flower or set seed at different times than the native species.

Prescribed Burning

Fire is a very normal part of most of Florida's many ecosystems, and native species have evolved varying degrees of fire tolerance. Throughout much of Florida, suppression of fire during this century has altered historical plant communities, such as flatwood and oak scrub communities, enhancing fire-intolerant species, and reducing the coverage of species that possess fire adaptations. Within these communities, the fire-tolerant woody species have lingered in smaller numbers, and less fire-tolerant species have replaced ephemeral herbs. Little is known about the amount, frequency, timing, and intensity of fire that would best enhance the historically fire-tolerant plant species, and less is known about how such a fire management regime could be best used to suppress invasive species. Single

fires in areas with many years of fire suppression are unlikely to restore historical species composition. Periodic fires in frequently burned areas do little to alter native species composition.

In a special case, invasion of tree stands by exotic vines and other climbing plants has greatly increased the danger of canopy (crown) fires and the resulting death of mature trees.

Added biomass by invasive plants can result in hotter fires, and can greatly increase the risk of fires spreading to inhabited areas. In these situations, use of fire to reduce standing biomass of invasive species may better protect the remaining plant populations than doing nothing, even though impacts to nontarget native species will occur. Under these conditions, the expense of reducing standing biomass of invasive plant species might be justified by the savings on subsequent fire suppression.

In general, fire can be used to suppress plant growth, and even kill certain plants that are not fire tolerant. Most often, woody species are reduced while effects are less noticeable on herbaceous species. Some information has been published on responses of individual Florida plant species, but very little is known about the vast majority of native plant species, and less about invasive exotic species. Tolerance to fire can sometimes be predicted in species that have thick bark or seeds in the soil or held in the canopy; that are adapted to fire (either tolerant of high temperature; or requiring fire for seed release or germination); and seeds that are disbursed over a wide area.

Effects of a single burn are hard to predict, but under some conditions a single fire effect can persist for several growing seasons. The length of effect is due to the intensity of the fire, the timing (fire during the growing season can be more destructive than during dormant seasons), and the plant species involved. Smoke is now recognized as a germination triggering mechanism for fire-dependent and some non-fire-dependent species, so plant species composition

Whether fire can play a logical role in suppression or elimination of invasive exotic plant species depends on many factors. In addition to the principal factors described above, the resource manager must consider potential fire effects on soil loss and water quality, historical and economic impacts to buildings, possible harm to human life, and the potential for escape of a fire to nontarget areas.

Fire has been successfully used to manage plant species in grasslands, to maintain open savannahs (scattered trees in herbaceous species dominated habitats), and to promote seral (fire-induced or fire-tolerant) stages of forest succession. However, very little is known about the use of fire to enhance natives while reducing invasive exotic plant species. As a final caution in the use of fire, overly frequent burning has been shown to reduce plant diversity under many conditions, and it appears possible that increased fire frequency could provide opportunities for invasive plants to enter new areas.

Water Level Manipulation

Some success has been achieved regulating water levels to reduce invasive plant species in aquatic and wetland habitats. Dewatering aquatic sites reduces standing biomass, but little else is usually achieved unless the site is rendered less susceptible to repeated invasion when rewatered. Planting native species may reduce the susceptibility of aquatic and wetland sites in some cases.

In most situations, water level manipulation in reservoirs has not provided the level of invasive plant control that was once thought achievable. Ponds and reservoirs can be constructed with steep sides to reduce habitat susceptible to invasion, and levels can be avoided that promote invasive species, but rarely are these management options adaptable to natural areas.

Carefully timed water level increases following mechanical removal or fire management of invasive species can provide effective control of subsequent germination, and with some species, resprouting. Specific methods applicable to natural areas have not been described.

Re-establishment of Native Plant Species

Planting native species can be an effective, though expensive, way to reduce the likelihood of exotic species reinvasion following removal of nonnative species. Commercial plant nurseries currently offer seeds and plants of several wetland and upland species. Because some species cover a wide range of habitats and latitudes, care should be taken to obtain plant material suitable to the habitat under consideration. Seed collected from plants growing in more northern latitudes may do poorly in Florida. Introduction of seeds, plant parts, or whole plants should include thorough screening for any unwanted pests—plant or animal.

It often takes several years for plantings to become thoroughly established, and extra care (water, nutrients) and protection (from fire and pests) may be necessary for a while. Also during this establishment phase, past management practices may have to be altered to avoid injury to the plantings. If periodic burning or flooding, for example, is part of the current management practice, it may be necessary to reduce the intensity or duration until the plantings are able to exhibit their typical resistance to injury, whatever that may be. Unfortunately, little is known

about requirements for successful establishment of many native species, and less is known about their tolerances to cultural invasive plant management techniques. Even when tolerances are better known, responses may be affected by historical site effects, traits of particular genetic strains, site-specific nutrition and light conditions, and interactions of soil type, hydroperiod, and microclimate.

Herbicides

Training and Certification

A pesticide, or some of its uses, is classified as restricted if it could cause harm to humans or to the environment unless it is applied by certified applicators who have the knowledge to use these pesticides safely and effectively. Although none of the herbicides and few uses listed in this publication are classified as restricted use, the basic knowledge of herbicide technology and application techniques needed for safe handling and effective use of any herbicides can be obtained from restricted use pesticide certification training. This training can be obtained through the University of Florida Institute of Food and Agricultural Sciences. Certified applicators can be licensed as either public applicators or commercial applicators. Persons must successfully complete two examinations before they can apply to the Florida Department of Agriculture and Consumer Services (FDACS) for a license. These examinations are a general standards core examination and a category examination. Categories applicable to target species in the publication include the Natural Areas category and/or Aquatics category. The content of the core exam is based upon the manual, *Applying Pesticides Correctly: A Guide for Pesticide Applicators* (IFAS publication SM 1); the Natural Areas exam is based on *Natural Area Weed Management* (IFAS publication SP 295) and *Identification and Biology of Nonnative Plants in Natural Areas of Florida* (IFAS publication SP 257); and the Aquatics exam is based on the *Aquatic Pest Control Manual* (IFAS publication SM 3). Additional information about pesticide applicator licensing can be found on <http://edis.ifas.ufl.edu> and <http://www.flaes.org/complimonitoring/index.html>.

Active Ingredients and Formulations

A herbicide formulation, or product, consists of the herbicide active ingredient dissolved in a solvent (e.g., oil, water, or alcohol), or adsorbed to a solid such as clay. Formulations often include an adjuvant that facilitates spreading, sticking, wetting, and other modifying characteristics of the spray solution. Special ingredients may also improve the safety, handling, measuring, and application of the herbicide. Products mentioned in this publication contain the active ingredients 2,4-D, aminopyralid, fluzifop, glyphosate, hexazinone, imazamox, imazapyr, metsulfuron, and triclopyr (amine or ester) (table 1).

The active ingredients 2,4-D amine, triclopyr amine, imazamox, imazapyr, and hexazinone are formulated as watersoluble liquids (L). They are not compatible with oil-based diluents and are diluted in water for foliar applications and diluted in water or applied in their concentrated form for cut-stump applications. They are not normally used for basal bark applications.

Triclopyr ester, imazapyr, and fluzifop are formulated as emulsifiable concentrates (EC). Emulsifiable concentrates are compatible with oil-based diluents and also contain emulsifiers that allow the formulation to mix with water. Agitation is used to mix the EC in water. They may be diluted in water for foliar applications or mixed with oilbased diluents for low-volume applications (e.g., basal bark).

Hexazinone is also formulated as an ultra-low-weight soluble granule (ULW) formulation. This formulation is broadcast with specialized ground or aerial equipment.

Where Herbicides Can Be Used

No pesticide may be sold in the United States until the United States Environmental Protection Agency (EPA) has reviewed the manufacturer's application for registration and determined that the use of the product will not present unreasonable risk to humans or the environment. **Pesticide users are required by law to comply with all the instructions and directions for use in pesticide labeling.**

The EPA approves use of pesticides on specific sites, i.e., for use on individual crops, terrestrial non-crop sites or aquatic areas. Only those herbicides registered by the EPA specifically for use in aquatic sites can be applied to plants growing in lakes, rivers, canals, etc. For terrestrial uses, the EPA requires herbicide labels to have the statement: "Do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean highmark." Several active ingredients in this publication have separate products that are registered for applying directly to water for control of aquatic weeds (table 1). Other products mentioned can be used in non-cropland areas and variously described low-lying areas, including wetlands, but cannot be applied directly to water (table 1).

Absorption Characteristics

Herbicides recommended in this publication for invasive plant control are systemic. They move within the plant to the site where they are active after being absorbed by foliage, roots, or bark. The following herbicides can be absorbed by plant leaves and are effective for foliar applications: 2,4-D, aminopyralid, glyphosate, imazamox, imazapyr, metsulfuron, and triclopyr. Addition of an appropriate surfactant, as recommended on the herbicide label, is essential. Triclopyr, 2,4-D and glyphosate are adsorbed by soils or broken down quickly in soil and are not absorbed effectively

by plant roots, whereas imazapyr and hexazinone are readily absorbed by plant roots (table 2). Only oil-soluble herbicide formulations (i.e. emulsifiable concentrates) are absorbed readily through tree bark.

Behavior in Soils

Herbicides used for invasive plant control vary in their persistence and sorption to soils (table 2). The most important factor is the ability of various soil types to chemically bind herbicides. Soil-applied herbicides, such as hexazinone, have label recommendations that vary the application rate for different types of soils. In general, soils with more organic matter and/or clay have greater capacities for binding herbicides than coarse, sandy soils and require higher application rates. Because woody plants are a problem on a range of Florida soils, including highly organic muck, sand, and very thin soil layers over limestone, a broad range of herbicide behavior in different soils can be expected.

Selectivity

The ability to selectively control target vegetation with herbicides without harming nontarget plants is related to the relative sensitivities of target and nontarget plants, absorption and chemical characteristics of the herbicides, and placement.

Herbicides vary in their potential to damage nontarget vegetation, and unwanted results can be prevented or minimized by making the best choice of herbicides in conjunction with careful application. Fluazifop, which kills many grasses, can be used to selectively manage invasive grass species among nontarget broadleaf plant species. Formulations that contain the active ingredients 2,4-D, metsulfuron, and triclopyr can often be used selectively because many broadleaf species are more sensitive to them than to perennial grasses. Because 2,4-D, triclopyr, and glyphosate have little root activity and break down quickly (table 2), they have little potential for causing nontarget damage due to root absorption when carefully applied to target vegetation. In contrast, caution must be used with root-active herbicides (i.e., hexazinone and imazapyr) to minimize damage to nontarget vegetation by root absorption. In shallow, porous soils, extra care should be taken to avoid root absorption of all herbicides by nontarget plants.

Care must be taken to avoid unwanted drift of herbicide spray to nontarget plants when applications are made. Particulate drift can be minimized by avoiding windy conditions when spraying and by using low pressures and large nozzle orifices. Volatile compounds such as ester formulations may cause nontarget damage due to vapor drift when applied on very hot days. This damage, which may be observed as wilting or curling leaves, has been minimal and has not caused permanent harm to woody nontarget plants.

Wildlife Toxicity

Invasive plant management is often conducted in natural areas with the purpose of maintaining or restoring wildlife habitat. Therefore, it is essential that the herbicides themselves are not toxic to wildlife. Risk assessment to wildlife is conducted as part of the registration procedure for herbicides and is determined as the product of hazard and exposure. Hazard is measured as the toxicity of the herbicide to test animals and exposure depends on the use and persistence of the compound. Herbicides recommended in this publication have shown very low toxicity to wildlife with the exception of the relatively low LC50 of triclopyr ester (0.87 ppm) and fluazifop (0.53 ppm) for fish, neither of which can be applied directly to water (table 3). Ester formulations are toxic to fish because they irritate gill surfaces. However, because triclopyr ester and fluazifop (1) are not applied directly to water, (2) are absorbed by soil particles, and (3) have low persistence, exposure is low, which results in low risk when properly used.

Herbicide Application Methods

Foliar applications.

Herbicide in foliar applications is diluted in water and applied to the leaves with aerial or ground equipment. Dilution is usually about 20 parts water to 1 part herbicide concentrate for aerial applications, and 50 to 400 parts water to 1 part herbicide concentrate when making ground applications for woody plant control. Adjuvants, such as surfactants, drift control agents, or other spray modifiers, are often added to the spray mix, as specified on the herbicide label. Ground equipment ranges from handheld spray bottles for applications to small individual plants, to large high-pressure vehicle- or boat-mounted sprayers for larger areas. Foliar applications can either be directed, to minimize damage to nontarget vegetation, or broadcast. Broadcast applications are used where damage to nontarget vegetation is not a concern or where a selective herbicide is used.

For directed spray or selective applications, backpack sprayers such as the Solo Model 475 with diaphragm pump or Swissmex SPI are effective and commonly used. A spray tip such as a TP 2503 or TP 2504 produces large spray droplets to reduce spray drift. The 2503 spray tips may be installed in the spray wand that comes with the backpack sprayer, or a Model 30 Gunjet with the 2503 or 2504 spray tip may be attached to any backpack spray unit. If an adjustable tip is used, a Tee-Jet 5500 or equivalent is recommended. All backpack sprayers and spray guns should have chemical-resistant seals for the herbicides being used.

Power-driven ground equipment is commonly used to spray large/tall plants or large areas. Properly adjusted equipment should deliver a uniform spray with nozzle pressures of about 30 to 80 psi and should generate large spray droplets to reduce potential for spray drift. Higher spray pressures produce many small spray particles that may

drift onto sensitive desirable plants adjacent to the treated area. Application is made by directing the spray on the target foliage, being sure to spray the growing tips and terminal leader. Techniques must be employed to prevent the spray from contacting foliage of desirable plants.

Commonly used power equipment consists of portable, power-driven spray units mounted on a truck or all-terrain vehicle. A wide variety of pumps, tanks, and accessories are used. The most common and maintenance-free pump is a diaphragm pump driven by a gasoline engine, or a self contained, 12-volt pump unit. Routinely used spray guns are Spraying Systems Model 2 and 2A Gunjets. These are adjustable spray guns that produce patterns ranging from a solid stream to a wide cone spray. These spray guns may produce small spray particles at the cone spray setting, resulting in spray drift. Also, a Model 30 Gunjet with a Tee-Jet 5500-X10 adjustable tip is very effective for power sprayers. Dual spray Gunjets that accommodate two flat spray tips with different volumes and patterns are available. The spray gun can immediately be switched from one spray tip to the other by rotating the spray head. The most commonly used spray tips for the spray gun are TP 0512, TP 4010, or TP 4020. These tips produce few fine-spray particles so spray drift potential is reduced.

Basal bark applications.

In basal bark applications, herbicide is applied, commonly with a backpack sprayer, directly to the bark around the circumference of each stem/tree up to 15 inches above the ground. The herbicide must be in an oil-soluble formulation (EC) and if not in a ready-to-use form it may be mixed with a specially formulated penetrating oil. The spray tip should be a narrow angle (15-25 degrees), flat, fan-tip nozzle such as a TP 1502, TP 1503, or TP 2502/ TP 2503, a solid cone nozzle, or an adjustable conejet such as a Tee-Jet 5500-X4 or 5500-X5 or equivalent. Any of these tips can be installed in the spray wand that comes with the spray unit. A good alternative is a brass tip shutoff wand such as a Spraying Systems Model 31 with brass extension and tip shutoff or a Spraying Systems Model 30 Gunjet. A TP-0001/TP-0002 tip or DE-1/DE-2 disc should be used with the Model 30 Gunjet. The Gunjet can be attached to most backpack spray units that produce pressures between 20 and 50 psi. All backpack sprayers and spray guns should have chemical resistant seals for the herbicides and carriers being used.

Frill or girdle applications.

Frill or girdle applications are sometimes called "hack-and-squirt." With this type of application, cuts into the cambium are made completely around the circumference of the tree with no more than 3-inch intervals between cut edges. Continuous cuts (girdle) are sometimes used for difficult-to-control species and large trees. Do not make multiple cuts directly above or below each other because this will inhibit movement of the herbicide. Incisions should be angled downward to hold herbicide and must be deep enough to penetrate the bark and cambium layer. Herbicide (concentrated or diluted) is applied to each cut until the exposed area is thoroughly wet. Frill or girdle treatments are slow and labor intensive but sometimes necessary to kill target vegetation and minimize impact to desirable vegetation in mixed communities. To further minimize potential impact to desirable vegetation, cuts can be wrapped with tape to prevent rainfall from washing herbicide to the soil. Water- or oil-soluble formulations can be used for frill or girdle applications.

Backpack sprayers or 1- to 2-gallon pump-up sprayers can be suitable for frill or girdle herbicide mixtures as long as they contain chemically resistant seals such as Viton. Handheld, chemical-resistant spray bottles, such as the 1-quart Delta Industries "Spraymaster" are commonly used for frill or girdle herbicide applications.

Stump treatments.

Stump treatments are applied after cutting and removing large trees or brush. The herbicide (concentrated or diluted) is sprayed or painted onto the cut surface of the stump. The cut surface should be as level as possible so that herbicide solution does not run off. Sweep off dirt and sawdust that may prevent the herbicide solution from being taken up by the stump. The herbicide is usually concentrated on the cambium layer on large stumps, especially when using concentrated herbicide solutions. The cambium is next to the bark around the entire circumference of the stump. When using dilute solutions, the entire stump is sometimes flooded (depending on label instructions) with herbicide solution. Water- or oil-soluble formulations can be used. Spray equipment can be used as long as it contains chemical-resistant seals. Best results are obtained if the herbicide is applied immediately after cutting (no more than one hour), especially when using a water-soluble formulation (with less-susceptible species seconds can count). Oil-soluble formulations can be effective when applied after some time has passed and should then be applied to the bark as well. The procedure must ensure that cut stems, branches, or seeds do not take root and produce additional plants.

Soil applications

A soil application of granular herbicide formulations can be applied by hand held spreaders, by specially designed blowers, or by air. Soil-applied water-soluble or water dispersible formulations can be used with the same type of equipment described for foliar applications or spotguns that can accurately deliver a measured amount of herbicide.

Marker Dyes

Marker dyes are very useful for keeping track of what vegetation has been treated when making applications to large numbers of individual trees or stumps. Dyes are also a useful indicator of the applicator's efficiency in limiting herbicide contact with nontarget vegetation.

Control Methods for Invasive Nonnative Plants

Control methods being used for invasive nonnative plants by land managers in Florida are listed in this section. All methods listed have been found effective under certain circumstances. However, many factors can affect the performance of a herbicide application and results can vary. Choice of application method, herbicide, and rate for individual species depend on environmental conditions and personal experience. Experience has shown that treatment success may vary from site to site and on the same site.

Pesticide product labeling is the primary method of communication between a herbicide manufacturer and the herbicide users and provides instructions on how to use the product safely and correctly. Changes in herbicide label directions may occur that are not concurrently updated in this publication. Because pesticide users are required by law to comply with all the instructions and directions for use contained in the pesticide label, no herbicide applications should be made based solely on information presented in this publication. **Pesticide users must review and comply with all conditions set forth in the pesticide label.**

NOTE: All dilutions of Garlon 4 basal bark and cut stump applications are made with oil. Original branded product names are used for convenience. Generic products that contain the same active ingredient may be available. Refer to table 1 for active ingredient.

Tables

Table 1.

Herbicides commonly used in natural areas of Florida^a

Product	Formulation	Comments
Several	2,4-D various	Some products may be applied directly to water.
Milestone VM	Aminopyralid 21.1% L	Do not apply directly to water.
Fusilade	Fluazifop 24.5% EC	Post emergence, grass specific. Cannot be applied directly to water.
Rodeo	Glyphosate(isopropylane salt) 53.8% L	May be applied directly to water.
Roundup	Glyphosate (isopropylamine salt) 41.0% L	May be applied to ditch banks, dry ditches, and dry canals. May not be applied directly to water.
Touchdown Pro	Glyphosate 28.3% L (diammonium salt)	May be applied directly to water.
Velpar L	Hexazinone 25% L	May cause groundwater contamination if applied to areas where soils are permeable, especially where the water table is shallow. Nontarget plants can be damaged by root absorption.
Velpar ULW	Hexazinone 75% ULW	Same comments as Velpar L.
Arsenal	Imazapyr 28.7% L	May be applied to nonirrigation ditches and low lying areas when water has drained but may be isolated in pockets due to uneven or unlevel conditions. Otherwise, may not be applied directly to water. May be applied by government agencies or their contractors in Florida, under SLN, by injection, frill and girdle, or cut stump to melaleuca and Brazilian pepper when growing in water. Nontarget plants can be damaged by root

		absorption.
Stalker	Imazapyr 28.7% L	May be applied to nonirrigation ditch banks. Nontarget plants can be damaged by root absorption.
Clearcast	Imazamox 12.1% L	Can be applied directly to water.
Escort XP	Metsulfuron 60% DF	May not be applied directly to water. SLN for control of Old World climbing fern in/on freshwater marshes, mesic forests, hydric forests, Everglades tree islands, and Everglades prairie scrub.
Brush-B-Gon	Triclopyr amine 8.0% L	Homeowner packaging readily available in retail stores. Lower concentration than Garlon 3A may require follow-up applications.
Brush Killer	Triclopyr amine 8.8% L	Homeowner packaging readily available in retail stores. Lower concentration than Garlon 3A may require follow-up applications.
Garlon 3A	Triclopyr amine 44.4% L	May be applied to nonirrigation ditch banks, seasonally dry wetlands, flood plains, deltas, marshes, swamps, bogs, and transitional areas between upland and lowland sites. May not be applied directly to water.
Garlon 4	Triclopyr ester 61.6% L	Same comments as Garlon 3A.
Pathfinder II	Triclopyr ester 13.6% L	Same comments as Garlon 3A. Ready to use.
<p>^a Alphabetical by active ingredient. All concentrations are active ingredients. Original, branded-product names are used for convenience. Generic products that contain the same active ingredient may be available.</p>		

Table 2.

Soil behavior of herbicides commonly used in natural areas of Florida

	Half-Life (Days)	Mobility in Soil	Absorption by Plant Roots
2,4-D amine	10	Moderate	Slight
Aminopyralid	30	Low	Moderate
Fluazifop	15	Low	Negligible
Glyphosate	47	Negligible	Slight
Imazamox	20-30	Low	Moderate
Imazapyr	25-142	Mobile	Strong
Hexazinone	90	Moderate	Strong
Metsulfuron	30	Moderate	Strong

Table 3.

Toxicity of herbicides commonly used in natural areas of Florida

	Bobwhite Quail 8-Day Dietary LD50 ^a	Laboratory Rat 96-Hr Oral LD50 ^a	Bluegill Sunfish 96-Hr LC50 ^b
2,4-D amine	>5,620	>1000	524
Aminopyralid	>2250	> 5,000	>100
Fluazifop	>4659 (5-day)	2721 (Female)	0.53
Glyphosate	> 4,640	> 5,000	120
Hexazinone	>10,000	1690	420
Imazamox	>5572	> 5,000	119
Imazapyr	> 5,000	> 5,000	>100
Metsulfuron	>5,620	> 5,000	>150
Triclopyr amine	>10,000	2574	891
Triclopyr ester	9,026	1581	0.87
^a LD50 is the quantity of herbicide that is lethal to 50% of test animals expressed as mg herbicide per kg body wt.			
^b LC50 is the concentration in food (mg/kg) or water (mg/l) required to kill 50% of the population of test animals.			

Table 4.

Control methods for non-native plants in use by land managers in Florida.

AGAUACEAE		
<i>Sansevieria hyacinthoides</i>		Bowstring hemp, Mother-in-law's tongue
	Treatment:	Cut surface, basal stem: 10% Garlon 4 in oil. Addition of 3% Stalker may increase consistency where nontarget vegetation will not be endangered. In sandy soils where a greater potential exists for nontarget damage 15%-25% Roundup can be used but control is less consistent.
	Comments:	Plants often take six to twelve months to die and follow-up applications are necessary. Dense populations may require initial physical removal.
ANACARDIACEAE (Cashew Family)		

<i>Schinus terebinthifolius</i>		Brazilian pepper; Florida holly
	Treatment:	Cut-stump: 50% Garlon 3A or Renovate, 10% Garlon 4, 50%-100% Roundup, Rodeo, or Touchdown Pro. Basal bark: 10%-20% Garlon 4 or undiluted Pathfinder II. Foliar: Garlon 4, Garlon 3A, Renovate, Roundup, Rodeo, Arsenal, or Habitat according label directions. Glyphosate products are less effective when used alone in spring and early summer.
	Comments:	Dioecious; female trees produce enormous quantities of bird-dispersed fruit; seed germinate readily; some people experience allergic reactions to the sap; target only female trees if time, funds, or herbicide limitations are a factor.
APOCYNACEAE (Oleander Family)		
<i>Alstonia macrophylla</i>		Devil tree
<i>Alstonia scholaris</i>		Scholar tree
	Treatment:	Basal bark or cut stump: 50% Garlon 3A or 10% Garlon 4
	Comments:	Both species invade hammocks, pinelands, and disturbed sites; leaves are reportedly toxic to eat; <i>A. macrophylla</i> is becoming widespread in Dade county.
<i>Ochrosia elliptica</i>		<i>Ochrosia; Kopsia</i>
	Treatment:	Basal bark or cut-stump: 50% Garlon 3A.
	Comments:	Fruits are bright red, paired, and reportedly poisonous to eat; often used in coastal landscaping.
ARACEAE (Arum Family)		
<i>Colocasia esculenta</i>		Wild Taro
	Treatment:	Foliar: 1.0% Rodeo, 0.5% Renovate, 0.5% Weedar 64, or 0.5% Habitat + silicone surfactant.
	Comments:	Usually found in aquatic habitats, so only herbicides labeled for aquatic sites can be used. Large corms (underground storage structures) make control very difficult and repeat applications will be necessary.
<i>Syngonium</i>		Nephthytis

<i>podophyllum</i>		
	Treatment:	Manual: hand pull vegetation and remove from site or destroy (place in plastic bags until decomposed). Foliar: 3% Garlon 4. Basal stem: 10% Garlon 4. Multiple treatments are required.
	Comments:	Breaks readily when pulled; roots from nodes; difficult to control; sap is a skin, mouth, and eye irritant; only spreads vegetatively; many populations are the result of discarded landscape material.
<i>Epipremnum pinnatum</i> cv. 'aureum'		Pothos
	Treatment:	Same as nephytis (see above).
	Comments:	Roots at nodes; sap is skin, mouth, and eye irritant; may form extensive groundcover; leaves enlarge considerably when plants climb trees or other support; spreads vegetatively, apparently does not set seed in Florida.
ARALIACEAE (Aralia Family)		
<i>Schefflera actinophylla</i>		Queensland umbrella; Umbrella tree
	Treatment:	Large individuals (>10 inches diameter) have proven extremely difficult to eradicate. Cut stump (recommended): 50% Garlon 3A or 10% Garlon. Basal bark (if a cut-stump treatment is not possible): wide band of 10% Garlon 4 on smaller individuals and 20% Garlon 4 on larger individuals. It may take up to 9 months to kill large trees.
	Comments:	Grows terrestrially or as an epiphyte; invasive in hammocks, particularly wet, rocky sites; bird-dispersed fruits.
ARECACEAE (Palm Family)		
<i>Caryota mitis</i>		Fishtail palm (clumping species)
<i>Caryota urens</i>		Fishtail palm (solitary-trunked species)
	Treatment:	Cut stump: Cut below growing point and treat with 50% Garlon 3A or 10% Garlon 4. Alternatively, Garlon 4 can be applied to the apical bud.
	Comments:	Unlike any other palm genus, the leaves are twice compound; on multipletrunked (clumping) species,

		when one trunk is cut the plant will resprout; fruits abundantly and is a common invasive plant in hammocks; fruit and sap are a skin, mouth, and eye irritant.
<i>Chamaedorea seifrizii</i>		Bamboo palm
	Treatment:	Treat as fishtail palm, above.
	Comments:	Pinnate-leaved, narrow-trunked, clustering species; invades hammocks.
<i>Livistona chinensis</i>		Chinese fan palm
	Treatment:	Manual: hand pull seedlings; cut young specimens at ground level or spray Garlon 4 into the apical bud.
	Comments:	Costapalmate leaves; green, curved, sharp spines along petiole; can be mistaken for <i>Sabal</i> and <i>Thrinax</i> species, but neither of the latter have spines on the petioles; differs from <i>Washingtonia</i> by having green, not brown, spines and lacking threadlike fiber on the leaves.
<i>Phoenix reclinata</i>		Senegal date palm
	Treatment:	Cut stems near ground level and treat with 50% Garlon 3A or 10% Garlon 4 or apply 10% Garlon 4 to meristem.
	Comments:	Common nonnative palm in hammocks, especially near coast; pinnate leaves with straight, sharp spines on petiole.
<i>Ptychosperma elegans</i>		Solitaire palm
	Treatment:	Manual; hand pull seedlings; cut mature trees down at ground level; remove fruiting stems from site.
	Comments:	Pinnate leaves, solitary trunk; commonly invades hammocks; high seed germination; fruit dispersed by birds, raccoons, and opossums; very common in the landscape.
<i>Roystonea regia</i>		Royal palm
	Treatment:	Manual: hand pull seedlings; chainsaw mature trees down near the base.
	Comments:	Commonly escapes into hammocks from landscape trees; best controlled in the seedling stage; Florida royal palm, <i>Roystonea elata</i> is similar and some taxonomists lump these two species together as synonyms; royal palms should only be treated as exotics if it is known that they are invading areas

		outside of their native Florida range; Florida royal palm still occurs as a wild plant in Everglades National park (Royal Palm Hammock), Fakahatchee Strand State Preserve, and Royal Palm Hammock in Collier Seminole State Park in Collier County.
<i>Syagrus romanzoffianum</i> (= <i>Arecastrum romanzoffianum</i>)		Queen palm
	Treatment:	Treat as Royal palm, above.
	Comments:	Pinnate leaves, single trunk; common in the landscape; invasive in hammocks.
<i>Washingtonia robusta</i>		Mexican fan palm, Washingtonia palm
	Treatment:	Manual: hand pull seedlings. Cut young specimens at ground level or spray Garlon 4 into apical bud. Large, mature trees in natural areas will need to be cut down.
	Comments:	Palmate leaves with brown, curved, sharp spines along the petioles; mature trees may retain dead leaves along the trunk; leaves characteristically have brown, threadlike fibers attached; can be mistaken for Chinese fan palm, <i>Livistona chinensis</i> , but the latter has green petiole spines and costapalmate leaves; invades pinelands and disturbed sites.
ASTERACEAE (Aster Family)		
<i>Wedelia trilobata</i>		Wedelia; Dune sunflower
	Treatment:	Foliar: 2%-5% (low volume) Roundup or 0.25%-1.0% Garlon 4, with follow-up treatments as needed.
	Comments:	Trailing species, forming dense groundcover; yellow, daisy-like flowers produced all year; invades a variety of open, sunny habitats, including beaches; often becomes established from discarded landscape material.
BERBERIDACEAE (Barberry family)		
<i>Nandina domestica</i>		Nandina, Heavenly bamboo
	Treatment:	Basal bark: 15% Garlon 4 in mineral oil. Collect and destroy attached fruits.
	Comments:	Naturalized in Gadsden, Jackson, Leon, Wakulla,

		and perhaps other counties.
CACTACEAE (Cactus Family)		
<i>Hylocereus undatus</i> (= <i>Cereuundatus</i>)		Night-blooming cereus
	Treatment:	Manual: hand pull and remove from site if possible; if removal is not feasible, lay the plants out on a plastic tarp and spray them with 10% Garlon 4; 15% Roundup has been successful but it takes much longer for the plants to die.
	Comments:	Vining cactus that climbs and roots to tree trunks; sometimes epiphytic; very showy, fragrant flowers open at night in summertime.
CAPRIFOLIACEAE		
<i>Lonicera japonica</i>		Japanese honeysuckle
	Treatment:	Foliar: 3%-5% Garlon 3A or 1%-3% Roundup.
	Comments:	Twining or trailing woody vine with young stems pubescent. Interrupts succession in once-forested areas by overtopping and smothering young trees, their recruitment to the overstory and can disrupt understory structure forests. May be confused with native honeysuckle, <i>Lonicera sempervirens</i> , and stems of which are not hairy and flowers red with yellow within.
CASUARINACEAE (Beefwood Family)		
<i>Casuarina equisetifolia</i>		Australian pine
<i>Casuarina glauca</i>		Beefwood, Brazilian oak
	Treatment:	Basal bark: 10%-20% Garlon 4. Follow-up herbicide applications may be necessary. Manual: hand pull seedlings.*
	Comments:	Medium-sized tree with glossy, leathery leaves; has been found principally invading coastal areas, including mangrove fringe.
CLUSIACEAE (Pitch-apple Family)		
<i>Calophyllum antillanum</i>		Brazilian beauty-leaf

(= <i>C. Calaba</i> ; <i>C. brasiliense</i> var. <i>antillanum</i>)		
	Treatment:	Basal bark: 10%-20% Garlon 4. Follow-up herbicide applications may be necessary. Manual: hand pull seedlings.
	Comments:	Medium-sized tree with glossy, leathery leaves; has been found principally invading coastal areas, including mangrove fringe.
COMBRETACEAE (Combretum Family)		
<i>Terminalia arjuna</i>		Arjun tree
<i>Terminalia catappa</i>		Indian almond
<i>Terminalia muelleri</i>		Mueller's almond
	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A.
	Comments:	The Indian almond is deciduous and invades coastal habitats, hammocks and disturbed sites; Arjun tree and Mueller's almond invade hammock interiors and margins.
COMMELINACEAE (Spiderwort Family)		
<i>Tradescantia spathacea</i> (= <i>Rhoeo spathacea</i>)		Oyster plant
	Treatment:	Manual: hand pull and remove from site. Foliar: 10% Garlon 4 (low volume) applied to bud.
	Comments:	Succulent with sword-shaped rosettes of leaves, green on upper surface, bright purple on lower surface; highly invasive, forming extensive colonies.
CONVOLVULACEAE (Morning-glory Family)		
<i>Merremia tuberosa</i>		Wood rose
	Treatment:	Foliar: 5% Roundup (low volume). Basal bark: 10% Garlon 4. Cut stem: 50% Garlon 3A or 10% Garlon 4.
	Comments:	Individual plants can cover extensive areas; rarely roots at nodes; bright yellow morning-glory-like

		flowers produced in late fall, fruits profusely in early winter; later December and early January die backs occur; seeds germinate readily.
CRASSULACEAE (Orpine Family)		
<i>Kalanchoe pinnata</i>		Life plant, Live leaf
	Treatment:	Foliar: 5% Roundup. Manual: hand pull. Roundup is an effective treatment because it kills individual leaves that otherwise may produce new plants along leaf margins. Follow-up hand removal of leaves is necessary to prevent leaves from producing new plants.
	Comments:	Often found along edges of natural areas, generally as a result of discarded landscape material.
DIOSCOREACEAE (Yam Family)		
<i>Dioscorea alata</i>		Water yam
<i>Dioscorea bulbifera</i>		Air-potato; Air yam
<i>Dioscorea sansibarensis</i>		West African yam
	Treatment:	Manual: cut vines that are high in trees; cut bulbils and remove from site. Dig up underground tubers if possible. Foliar: 1%-2% Roundup or Touchdown Pro. Cut stem: 10% Garlon 4.
	Comments:	Monocot with heart-shaped leaves; dies back to tubers in winter in response to shortened day length, resprouts in spring from tubers; all three species produce aerial bulbils in late summer, early fall.
EBENACEAE (Ebony Family)		
<i>Diospyros digyna</i> (= <i>D. ebenaster</i>)		Black sapote
	Treatment:	Cut stump: 50% Garlon 3A.
	Comments:	Black bark, shiny alternate leaves; scattered throughout a few hammocks in south Florida; fruits large, edible; green when ripe. Large individuals are difficult to kill.
ELAEAGNACEAE		

(Oleaster family)		
<i>Elaeagnus pungens</i>		Silverthorn
	Treatment:	Basal bark: 15% Garlon 4 in mineral oil.
	Comments:	Naturalized and targeted for removal in Florida Caverns State Park (Jackson County).
EUPHORBIACEAE (Spurge Family)		
<i>Aleurites fordii</i>		Tungoil tree
	Treatment:	Basal bark: 20% Garlon 4.
	Comments:	Found mainly in northern counties to Citrus County.
<i>Bischofia javanica</i>		Bishopwood; toog
	Treatment:	Basal bark: 10%-20% Garlon 4. Frill/girdle (larger trees): 20% Garlon 4. Manual: hand pull seedlings.
	Comments:	Dioecious; compound leaves with three large leaflets; herbicide treatment may cause adventitious roots to form along trunk; female trees produce massive numbers of bird-dispersed fruits that hang in grape-like clusters; target only female trees if time, funds, or herbicide limitations are a factor.
<i>Ricinus communis</i>		Castor bean
	Treatment:	Basal bark or cut stump: 10% Garlon 4. Revisit site several times to pull up seedlings or treat seedlings with 5% Roundup.
	Comments:	High seed germination: seeds extremely poisonous to eat.
FABACEAE (Pea Family)		
<i>Abrus precatorius</i>		Rosary pea
	Treatment:	Basal stem: 10% Garlon 4. Foliar: 5% Roundup (low volume). Remove seed pods if possible. Site must be revisited several times to pull seedlings.
	Comments:	Seeds black and red, highly poisonous.
<i>Acacia auriculiformis</i>		Earleaf acacia
	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A. Addition of 3% Stalker will increase consistency.
	Comments:	A frequent invader of pinelands and disturbed sites.
<i>Adenanthera pavonina</i>		Red sandalwood

	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A or 10% Garlon 4. Manual: small seedlings can be hand pulled.
	Comments:	Can be confused with <i>Albizia lebeck</i> , which has larger leaflets; bark of red sandalwood is typically reddish; produces hard red seeds which seem to persist in soil for up to 5 years.
<i>Albizia lebeck</i>		Woman's tongue; Rattle pod
	Treatment:	Basal bark: 20% Garlon 4 or undiluted Pathfinder II. Cut stump: 50% Garlon 3A or 10% Garlon 4, follow-up treatments necessary for root sprouts with 10% Garlon 4.
		Large, dry, brown pods with few large seeds, mature principally in winter; common in pinelands and hammocks.
<i>Albizia julibrissin</i>		Mimosa
	Treatment:	Basal bark: 15% Garlon 4 or undiluted Pathfinder II.
	Comments:	Apply to 1-2 feet of trunk on larger trees. Trees >3 inches diameter may require retreatment.
<i>Bauhinia forficata</i>		Spiny orchid tree
<i>Bauhinia purpurea</i>		Orchid tree
<i>Bauhinia variegata</i>		Orchid tree
	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A.
	Comments:	All three species invade disturbed sites and the edges of natural areas in Dade County.
<i>Dalbergia sissoo</i>		Indian rosewood
	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A.
	Comments:	Medium to large tree with compound leaves bearing 3 to 5 leaflets; papery seed pods are wind-dispersed; invasive along hammock margin, canopy gaps, and disturbed sites.
<i>Delonix regia</i>		Royal poinciana
	Treatment:	Basal bark: 20% Garlon 4 or undiluted Pathfinder II. Cut stump: 50% Garlon 3A.
	Comments:	Large spreading tree with bi-pinnately compound

		leaves; very popular flowering tree in the landscape; invades hammock margin, canopy gaps and disturbed sites; seeds commonly sprout beneath parent trees.
<i>Leucaena leucocephala</i>		Lead tree, jumble bean
	Treatment:	Difficult to control and variable results have been reported. Basal bark or cut stem: 10%-20% Garlon 4 has been reported to be effective while others report only partial success with higher rates. 25% has been effective on trees <3 inches diameter, while larger trees were not killed. Large trees must be completely girdled for frill/girdle applications. Experimental application of Milestone indicates that basal bark, cut stump, and foliar applications can be effective. Rates have not been refined.
	Comments:	Usually found on edges of natural areas; can be mistaken for native wild tamarind, <i>Lysiloma latisiliquum</i> . A larger band of Garlon 4 is applied to larger trees or those growing in sandy soils.
<i>Mimosa pigra</i> (=M. <i>pelita</i>)		Catclaw mimosa
	Treatment:	Basal bark or cut stump: 30%-50% Garlon 4. Foliar: Repeat applications of 1.5% Roundup or Rodeo or 2%-3% Garlon 3A or Renovate.
	Comments:	Repeated site visits are necessary to control seedlings and prevent further seed production. An estimated ten years are needed for seed bank eradication.
<i>Mucuna pruriens</i>		Cow itch
	Treatment:	Basal bark: 10% Garlon 4, Foliar: 5% Roundup. Manual: hand pull mature vines and seedlings; does not resprout from roots. It is important to continue pulling seedlings until seed bank is exhausted.
	Comments:	Hairs on seed pods cause intense itching.
<i>Pueraria montana</i> (=P. <i>lobata</i>)		Kudzu
	Treatment:	Foliar: When actively growing, at or post bloom, apply 2% Roundup, during early to mid growing season, 2% Garlon 3A.
	Comments:	Follow up treatments are necessary as resprouting

		occurs from root crowns and tubers.
<i>Wisteria sinensis</i>		Chinese wisteria
	Treatment:	Cut stump: 20%-30% Garlon 4 or 100% Garlon 3A.
	Comments:	High-climbing woody vine with showy lavender flowers in spring. Can top and kill mature trees. Legume densely, velvety pubescent compared to the native <i>Wisteria frutescens</i> , with glabrous fruits.
GOODENIACEAE (Goodenia Family)		
<i>Scaevola sericea</i> (= <i>S. frutescens</i> ; <i>S. taccada</i>)		Beach naupaka; Half-flower; Scaevola
	Treatment:	Manual: hand pull, at least fruit, from site whenever possible. Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A or 10% Garlon 4. Foliar: (monocultures) 4% Garlon 4.
	Comments:	Semi-woody shrub with either glabrous or pubescent, somewhat succulent leaves; flowers fan shaped, white or blushed with purple; fruit are white, which helps distinguish it from the black-fruited, native Inkberry, <i>Scaevola plumieri</i> ; seeds of the exotic scaevola are carried by ocean currents where they sprout and colonize beaches and other shoreline habitats. Branches in contact with ground may root. Seed bank lasts one year.
LYGODIACEAE (Climbing fern family)		
<i>Lygodium microphyllum</i>		Old World climbing fern
	Treatment:	Foliar: For ground applications, cut plants that grow high into trees; thoroughly spray foliage to wet with 1%-2% Roundup or Rodeo, 2% Garlon 3A, 1% Plateau, or equivalent of 1-2 ounces Escort XP/100 gallon diluent; light infestations use 2%-4% Roundup or Rodeo (low volume). For aerial application, 7.5 pints Rodeo or 2 ounces Escort XP in sufficient volume and using spray pattern to maximize coverage.
	Comments:	Fern with twining, climbing fronds, leaflets unlobed. The most serious natural area weed in Florida. Land managers should be on constant lookout for it and

		take immediate steps to control it when encountered.
<i>Lygodium japonicum</i>		Japanese climbing fern
	Treatment:	Foliar: 2% Roundup + 5 ounces Escort XP per 100 gallons Do not exceed 40 gallons spray solution per acre.
	Comments:	Fern with twining, climbing fronds, leaflets lobed. Occurs throughout west and north Florida into central Florida. Smothers seedlings of overstory tree species.
MALVACEAE (Mallow Family)		
<i>Hibiscus tiliaceus</i>		Sea hibiscus; Mahoe
	Treatment:	Manual: hand pull seedlings. Basal bark: 10%-20% Garlon 4. Cut stump: 50% Garlon 3A.
	Comments:	Multi-trunked, large, spreading tree with long-petioled, rounded cordate leaves, hibiscus-like yellow flowers turn pink or red with age; seeds float and drift to new coastal habitats; erroneously considered native by some people.
<i>Thespesia populnea</i>		Seaside mahoe; Portia tree
	Treatment:	Manual: seedlings can be hand pulled. Basal bark: 10%-25% Garlon 4. Cut stump: 50% Garlon 3A for cut stump applications.
	Comments:	Multi-trunked, large, spreading tree; heart-shaped leaves with a pronounced driptip; hibiscus-like yellow flowers turn pink or red with age; seeds float and drift to new coastal habitats; erroneously considered native by some people.
MELIACEAE (Mahogany family)		
<i>Melia azedarach</i>		Chinaberry, Pride of India
	Treatment:	Basal bark: 15%-30% Garlon 4. Addition of Stalker may increase consistency. Trees > 3 inches diameter may require retreatment. Cut stump: 30% Garlon 4. Foliar: low volume 1% Arsenal covering 50% of the foliage.
	Comments:	Often shrubby and root-suckering, forming thickets. Fruits poisonous to humans and some other mammals. Most abundantly found in north and west

		Florida but often escaping cultivation in peninsular counties, south to the Keys.
MORACEAE (Mulberry Family)		
<i>Broussonetia papyrifera</i>		Paper mulberry
	Treatment:	Basal bark: 10%-30% Garlon 4. Addition of 3% Stalker will increase consistency.
	Comments:	Large tree with scabrous leaves and reddish-orange balls of flowers. Invades hammocks and disturbed sites; young trees can be mistaken for the native red mulberry, <i>Morus rubra</i> .
<i>Ficus altissima</i>		Lofty fig
<i>Ficus benghalensis</i>		Banyan fig
<i>Ficus microcarpa</i>		Laurel fig
	Treatment:	Basal bark: 10% Garlon 4.
	Comments:	All three species invade the interior and edges of hammocks; often found growing as epiphytes (on trees) or epiliths (on rocks or stone structures); exercise care when treating epiphytic figs to ensure that herbicide does not come in contact with the host tree; members of this genus are very sensitive to Garlon 4; extreme care must be taken when treating any vegetation near the native strangler fig and shortleaf fig; spray that contacts surface roots can kill a large tree.
MYRSINACEAE (Myrsine Family)		
<i>Ardisia elliptica</i> (= <i>Ardisia solanacea</i>)		Shoe-button Ardisia
	Treatment:	Basal bark: 10% Garlon. Cut stump: 50% Garlon 3A. Manual: hand pull seedlings.
	Comments:	Often found in wetter areas; prolific reproduction; closely resembles the native <i>Ardisia escallonioides</i> (Marlberry) but differs in that new growth, petioles, and stem tips are pink to red, and fruit are produced in axillary, not terminal, clusters.
<i>Ardisia crenata</i>		Coral ardisia
	Treatment:	Foliar: 3% Garlon 3A + 1% Plateau, 5% Garlon 4

		(low volume). Basal bark: 10% Garlon 4.
	Comments:	Small shrub, easily recognized by bright shiny leaves, with crenate (scalloped) margins and calluses in the margin notches and persistent bright red (sometimes white) fruits.
MYRTACEAE (Myrtle Family)		
<i>Eugenia uniform</i>		Surinam cherry
	Treatment:	Basal bark: For plants up to ½ inch diameter, 10% Garlon 4. Cut-stump: 50% Garlon 3A or 10% Garlon 4. Seedlings should be hand pulled.
	Comments:	Looks quite similar to native species of <i>Eugenia</i> ; leaves have a distinct odor when crushed.
<i>Melaleuca quinquenervia</i>		Cajeput; Punk tree; Melaleuca
	Treatment:	Manual: seedlings and saplings can be hand pulled, being sure not to break plant off of root system, and removed or placed in piles to help reduce the chance that they will re-root. Foliar: Low volume spot application of 5% Rodeo (seedlings and saplings only). Aerial application of 3 quarts Rodeo + 3 quarts Arsenal + 4 quarts methylated seed oil per acre. Follow-up ground or aerial application may be necessary. Cut stump: 10%-20% Arsenal or Habitat, 50%-100% Roundup or Rodeo, or 40% Roundup or Rodeo + 10% Arsenal or Habitat. Use of imazapyr product provides more consistent results. Frill and girdle: 20%-50% Arsenal or Habitat or 10% Arsenal or Habitat and 40% Roundup or Rodeo. Lower amounts of imazapyr may be effective.
	Comments:	Tall, highly invasive tree in freshwater wetlands; thick, papery bark; extremely high seed production; seeds dispersed by wind following natural or mechanical disturbance.
<i>Psidium guajava</i> <i>Psidium cattleianum</i>		Common guava Strawberry guava
	Treatment:	Basal bark or cut stump: 10% Garlon 4.
	Comments:	Yellow, edible fruits; common invader in disturbed areas, hammock margins and wetlands.
<i>Rhodomyrtus</i>		Downy rosemyrtle

<i>tomentosa</i>		
	Treatment:	Basal bark or cut stump (individual plants): 10%-20% Garlon 4. Re-treatment may be necessary. Foliar: 1% Arsenal + 2% Roundup or 2 quarts Vanquish/acre in 50 gallons spray volume.
	Comments:	A very aggressive evergreen shrub to 6 feet tall found as far north as Pasco County on the west coast. Action should be taken immediately to remove it when found in natural areas. Identified by opposite, simple entire leaves, which are glossy green above, densely soft-hairy below, with three main veins from blade base; round, dark purple fruit with sweet aromatic flesh.
<i>Syzygium cumini</i>		Jambolan plum; Java plum
<i>Syzygium jambos</i>		Rose apple
	Treatment:	Cut stump: 50% Garlon 3A or 10% Garlon 4. Basal bark: 10%-20% Garlon 4 or Pathfinder II.
	Comments:	Large trees, bird- and mammal-dispersed fruits. Mature trees may take up to 9 months to die.
OLEACEAE (Olive Family)		
<i>Jasminum dichotomum</i>		Gold coast jasmine
<i>Jasminum fluminense</i>		Brazilian jasmine
	Treatment:	Cut-stump: 50% Garlon 3A or 10% Garlon 4. Basal bark: 10% Garlon 4. It is helpful to pull runners back to the main stem, cut, and apply Garlon 3A or Garlon 4 to the cut stem. Retreatment of areas is usually necessary. Foliar: 5% Roundup. Manual: newly emerged seedlings can be hand pulled.
	Comments:	Jasmines produce a large number of bird- and mammal-dispersed seeds with very high germination; highly invasive.
<i>Ligustrum lucidum</i>		Glossy privet
<i>Ligustrum sinense</i>		Chinese privet
	Treatment:	Basal Bark or cut stump: 15%-20% Garlon 4 or undiluted Pathfinder II.
	Comments:	<i>L. sinense</i> widespread in northern Florida mesic woods, road shoulders, and farmlands. Invades logged areas, dispersed by mammals, birds, and

		floodwaters.
PASSIFLORACEAE (Passion-flower Family)		
<i>Passiflora edulis</i>		<i>Passiflora edulis</i>
	Treatment:	Basal bark or cut stem: 10% Garlon 4.
	Comments:	Large attractive flower; fruit purple, edible; invasive in hammocks.
PIPERACEAE (Pepper Family)		
<i>Lepianthes peltata</i>		Lepianthes
<i>Piper aduncum</i>		Bamboo piper
<i>Piper auritum</i>		Makulan
	Treatment:	Manual: hand pull when possible (broken roots may resprout); remove entire plant from site. Basal bark: 20% Garlon 4 or undiluted Pathfinder II. Cut stump: 50% Garlon 3A; remove cut stems from the site to avoid resprouting from nodes.
	Comments:	All three of the above species invade hardwood hammocks, especially margins and canopy gaps.
POACEAE (Grass Family)		
<i>Imperata cylindrica</i>		Cogongrass
	Treatment:	Foliar: 3-4 quarts. Roundup Pro, 2-3 quarts. Arsenal, or 0.5 quarts Fusilade peracre. For high volume, spot treatment use 3%-5% Roundup Pro or 0.25%-0.5% Arsenal. Herbicides should be used in combination with burning or tillage for optimum control. See IFAS Publication SS-AGR-52 for additional information.
	Comments:	If not controlled, cogongrass will spread along roadways and into pastures, mining areas, forest land, parks, and other recreation areas. Extensive rhizomes must be eliminated for long term control.
<i>Neyraudia reynaudiana</i>		Burma reed
	Treatment:	Foliar: 1%-3% Roundup. Cut stem: 10% Garlon 4. In areas with surrounding desirable vegetation, the culms can be cut to ground level and sprayed with 5% Roundup when the plant reaches a height of

		approximately 12 to 18 inches (cut stems should be removed from the site). Removing seedheads before treatment will reduce need for follow-up. Responds quickly after fire and should be targeted as soon as new growth reaches 12 to 18 inches. Most native plants will not have resprouted from the fire by the time Burma reed has reached this height, and it can be easily treated with little concern about nontarget damage.
	Comments:	Tall cane grass; extremely invasive in pine rockland habitat and open dry habitats, as well as roadsides, vacant lots, and other disturbed sites; fire tolerant.
<i>Panicum repens</i>		Torpedograss
	Treatment:	Foliar: 0.75% - 1.5% Rodeo and/or 0.5% Habitat, 4 pints Habitat per acre, or 5%Rodeo low volume spot treatment.
	Comments:	Numerous dormant buds associated with extensive rhizomes make this plant extremely difficult to control. Several years of reapplication may be necessary to completely eliminate a population.
<i>Pennisetum purpureum</i>		Napier grass
	Treatment:	Foliar: 1%-3% Roundup. If nontarget damage is a concern, cut stems to ground level and allow sprouts to reach 8-12 inches and treat the same as <i>Neyraudia</i> . Broadcast 3-5 quart/acre Roundup Pro, 2 quart/acre Arsenal, or 1 quart Arsenal and 2 quart Roundup Pro.
	Comments:	Tall cane grass with white stripe down the center of the leaf blade and a fox taillike inflorescence; prefers wetter substrates.
<i>Phyllostachys aurea</i>		Golden Bamboo
	Treatment:	Foliar: Cut mature plants and apply 5% Roundup.
	Comments:	Not a common problem, but once established can spread extensively. Populations should be controlled immediately. Can become established by dumping of yard waste.
RHAMNACEAE (Buckthorn Family)		
<i>Colubrina asiatica</i>		Latherleaf; Asian colubrina
	Treatment:	Basal bark: 10%-20% Garlon 4 or undiluted

		Pathfinder II. Cut-stump: 50% Garlon 3A. Foliar: 3% Garlon 3A or Garlon 4. Follow up for 3 to 4 weeks. Manual: hand pull seedlings.
	Comments:	Sprawling shrub commonly invading coastal habitats; has become a serious pest plant in mangrove/buttonwood habitat and in coastal hardwood forests. Capsules spread by tides and currents. Seeds resemble small pebbles and may be used as crop stones by seed-eating birds, such as doves, and dispersed.
ROSACEAE (Rose Family)		
<i>Rubus albescens</i>		Mysore raspberry
	Treatment:	Cut stem: 50% Garlon 3A or 10% Garlon 4.
	Comments:	Sharp thorns on stems and leaves; arching stems and branches of intact plants root where they touch the ground; seeds bird- and mammal-dispersed.
<i>Eriobotrya japonica</i>		Loquat
	Treatment:	Basal bark: 10% Garlon 4. Cut-stump: 50% Garlon 3A or Garlon 4.
	Comments:	Invasive in hammocks; commonly cultivated for its yellow, fuzzy, edible fruit; seeds spread into natural areas by mammals; exotic, free-flying parrots are known to feed on the fruit as well, and may also be vectors of seeds.
RUBIACEAE (Madder Family)		
<i>Paederia cruddasiana</i>		Sewer vine; skunk vine; Chinese fever vine
	Treatment:	Foliar: 3%-5% Roundup. Basal bark: 10% Garlon 4. Within 2-4 weeks re-treat the area with basal applications of 10% Garlon 4. This second treatment can be time-consuming because many underground runners sprout. The area should continue to be monitored for follow-up treatments.
	Comments:	Climbing vine; related to <i>Paederia foetida</i> , which is established in central Florida; flowers profusely; produces viable seeds.
<i>Paederia foetida</i>		Skunk vine
	Treatment:	Foliar: 1%-3% Garlon 3A, Garlon 4, or 1%-1.5% Plateau to thoroughly wet foliage. Homeowners can use Brush-B-Gon or Brush killer at maximum label

		rates. Cut stem: 10% Garlon 4.
	Comments:	Perennial twining vine from woody rootstock having leaves and stems with disagreeable odor, especially when crushed. Most common in west central Florida, documented northward to Gadsen County and southward to Broward County.
RUTACEAE (Rue Family)		
<i>Murraya paniculata</i>		Orange jessamine
	Treatment:	Manual: hand pull seedlings. Basal bark or cut stump: 10% Garlon 4.
	Comments:	Shrub or small tree with small, glossy, compound leaves that are fragrant when crushed; white, citrus-like, heavily perfumed flowers produced in summertime; small orange fruit are bird dispersed; invasive in hammocks, especially when bordered by residential areas that use this plant in the landscape.
SAPINDACEAE (Soapberry Family)		
<i>Cupaniopsis anacardioides</i>		Carrotwood
	Treatment:	Basal bark: 10%-20% Garlon 4 or undiluted Pathfinder II. Cut stump: 10%-50% Garlon 3A or undiluted Roundup. Frill and girdle: 10%-20% Garlon 4.
	Comments:	Invades interior of hammocks; becoming a popular landscape tree; bird dispersed. Note label restrictions with respect to high-tide mark and use extra caution near mangroves.
SAPOTACEAE (Sapodilla Family)		
<i>Manilkara zapota</i>		Sapodilla
	Treatment:	Hand pull seedlings. Basal bark: 10%-20% Garlon 4, larger trees may require several applications. Cut stump: 50% Garlon 3A.
	Comments:	Large, spreading tree; edible fruit; seeds dispersed by raccoons and opossums; invades hammock interiors.

<i>Pouteria campechiana</i>		Egg fruit; Canistel
	Treatment:	Hand pull seedlings. Basal bark: 10% Garlon 4.
	Comments:	Small to medium tree; yellow, edible fruit; prolific invader of hammocks but local in distribution; fruit eaten by raccoons and opossums.
SOLANACEAE (Nightshade Family)		
<i>Cestrum diurnum</i>		Day jessamine
	Treatment:	Manual: hand pull when possible (if soil disturbance is not an issue). Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A.
	Comments:	Shrub or small tree with small, tubular, very fragrant flowers (in daytime) small purple fruit dispersed by birds.
<i>Solanum tampicense</i>		Wetland nightshade, misleadingly called aquatic soda apple
	Treatment:	Foliar: 1.5% Garlon 3A. Aggressive follow-up treatments are necessary.
	Comments:	An aggressive invader of wetlands and floodplains. Should be eliminated whenever located.
<i>Solanum viarum</i>		Tropical soda apple
	Treatment:	Hand pull and destroy individual plants when practical. Foliar: 1% Garlon 4, 3% Roundup, 0.5% Arsenal, or 5-7 ounces Milestone/acre. Milestone (7 ounces/acre) provides residual control of seedlings.
	Comments:	Destroy fruit and treat plants immediately after detection. Spreads extremely fast. Livestock and wild animals eat fruits and readily disperse seed. For additional information see IFAS publication SS-AGR-58.
VERBENACEAE (Verbena Family)		
<i>Lantana camara</i>		Shrub verbena; Lantana
	Treatment:	Basal bark: 10% Garlon 4. Cut stump: 50% Garlon 3A or 10% Garlon 4.
	Comments:	Shrub with prickly stems and branches; multi-colored flower heads; ripe fruit blue; green unripe fruit highly toxic if eaten; this exotic species should be controlled to help avoid hybridization with the endemic <i>Lantana</i>

		<i>depressa</i> ; typically a plant of roadsides and other disturbed sites but also invades pineland as well as hammock margins; numerous cultivars exist in the nursery trade.

Table 5.

Appendix A: Common Names and Botanical Family Names

Common Name	Botanical Family Name
Air-potato	Dioscoreaceae
Air yam	Dioscoreaceae
Ardisia	Myrsinaceae
Arjun tree	Combretaceae
Asian colubrina	Rhamnaceae
Australian pine	Casuarinaceae
Bamboo palm	Arecaceae
Bamboo piper	Piperaceae
Banyan fig	Moraceae
Beach naupaka	Goodeniaceae
Beefwood	Casuarinaceae
Bishopwood	Euphorbiaceae
Black sapote	Ebenaceae
Bowstring hemp	Agauaceae
Brazilian beauty-leaf	Clusiaceae
Brazilian jasmine	Oleaceae
Brazilian oak	Casuarinaceae
Brazilian pepper	Anacardiaceae
Burma reed	Poaceae
Cajeput	Myrtaceae
Canistel	Sapotaceae
Carrotwood	Sapindaceae

Castor bean	Euphorbiaceae
Catclaw mimosa	Fabaceae
Chinaberry	Meliaceae
Chinese fan palm	Arecaceae
Chinese privet	Oleaceae
Chinese tallow	Euphorbiaceae
Chinese wisteria	Fabaceae
Cogongrass	Poaceae
Coral ardisia	Myrsinaceae
Cow itch	Fabaceae
Day jessamine	Solanaceae
Devil tree	Apocynaceae
Downy rose myrtle	Myrtaceae
Dune sunflower	Asteraceae
Earleaf acacia	Fabaceae
Egg fruit	Sapotaceae
Ficus	Moraceae
Fishtail palm	Arecaceae
Florida holly	Anacardiaceae
Glossy privet	Oleaceae
Gold Coast jasmine	Oleaceae
Golden bamboo	Poaceae
Guava	Myrtaceae
Half-flower	Goodeniaceae
Heavenly bamboo	Berberidaceae
Hunters robe	Araceae
Indian almond	Combretaceae

Indian rosewood	Fabaceae
Jambolan plum	Myrtaceae
Japanese climbing fern	Lygodiaceae
Japanese honeysuckle	Caprifoliaceae
Jasmine	Oleaceae
Java plum	Myrtaceae
Kopsia	Apocynaceae
Lantana	Verbenaceae
Latherleaf	Rhamnaceae
Laurel fig	Moraceae
Lead tree	Fabaceae
Lepianthes	Piperaceae
Life plant	Crassulaceae
Live leaf	Crassulaceae
Lofty fig	Moraceae
Loquat	Rosaceae
Mahoe	Malvaceae
Makulan	Piperaceae
Melaleuca	Myrtaceae
Mexican fan palm	Arecaceae
Mimosa	Fabaceae
Mother-in-laws tongue	Agauaceae
Muellers almond	Combretaceae
Mysore raspberry	Rosaceae
Nandina	Berberidaceae
Napier grass	Poaceae
Nephthytis	Araceae

Night-blooming cereus	Cactaceae
Ochrosia	Apocynaceae
Old World climbing fern	Lygodiaceae
Orange jessamine	Rutaceae
Orchid tree	Fabaceae
Oyster plant	Commelinaceae
Palms	Arecaceae
Paper mulberry	Moraceae
Passion-flower	Passifloraceae
Piper	Piperaceae
Popcorn tree	Euphorbiaceae
Portia tree	Malvaceae
Possum grape	Vitaceae
Pothos	Araceae
Punk tree	Myrtaceae
Queen palm	Arecaceae
Queensland umbrella	Araliaceae
Raspberry	Rosaceae
Red sandalwood	Fabaceae
Rosary pea	Fabaceae
Rose apple	Myrtaceae
Rosewood	Fabaceae
Royal poinciana	Fabaceae
Royal palm	Arecaceae
Sapodilla	Sapotaceae
Scaevola	Goodeniaceae
Schefflera	Araliaceae

Scholar tree	Apocynaceae
Sea hibiscus	Malvaceae
Seaside mahoe	Malvaceae
Senegal date palm	Arecaceae
Sewer vine	Rubiaceae
Shoebuttan ardisia	Myrsinaceae
Silverthorn	Elaeagnaceae
Skunk vine	Rubiaceae
Solitaire palm	Arecaceae
Surinam cherry	Myrtaceae
Toog	Euphorbiaceae
Torpedograss	Poaceae
Tropical soda apple	Solanaceae
Tung oil tree	Euphorbiaceae
Umbrella tree	Araliaceae
Washingtonia palm	Arecaceae
Water yam	Dioscoreaceae
Wedelia	Asteraceae
West African yam	Dioscoreaceae
Wild taro	Araceae
Womans tongue	Fabaceae
Wood rose	Convolvulaceae

Table 6.

Appendix B: Genus Names and Botanical Family Names

Genus Name	Refer to Plant Family
Abrus	Fabaceae
Acacia	Fabaceae
Adenanthera	Fabaceae
Albizia	Fabaceae
Aleurites	Euphorbiaceae

Alstonia	Apocynaceae
Ardisia	Mysinaceae
Bauhinia	Fabaceae
Bischofia	Euphorbiaceae
Broussonetia	Moraceae
Calophyllum	Clusiaceae
Caryota	Arecaceae
Casuarina	Casuarinaceae
Cereus	Cactaceae
Cestrum	Solanaceae
Chamaedorea	Arecaceae
Colocasia	Araceae
Colubrina	Rhamnaceae
Cupaniopsis	Sapindaceae
Dalbergia	Fabaceae
Delonix	Fabaceae
Dioscorea	Dioscoreaceae
Diospyros	Ebenaceae
Elaeagnus	Elaeagnaceae
Epipremnum	Araceae
Eriobotrya	Rosaceae
Eugenia	Myrtaceae
Ficus	Moraceae
Hibiscus	Malvaceae
Hylocereus	Cactaceae
Imperata	Poaceae
Jasminum	Oleaceae
Kalanchoe	Crassulaceae
Lantana	Verbenaceae
Lepianthes	Piperaceae
Leucaena	Fabaceae
Ligustrum	Oleaceae
Livistona	Arecaceae
Lonicera	Caprifoliaceae
Lygodium	Lygodiaceae
Manilkara	Sapotaceae
Melaleuca	Myrtaceae
Melia	Meliaceae
Merremia	Convolvulaceae
Mimosa	Fabaceae
Mucuna	Fabaceae
Murraya	Rutaceae
Nandina	Berberidaceae
Ochosia	Apocynaceae
Neyraudia	Poaceae
Paederia	Rubiaceae
Panicum	Poaceae

Passiflora	Passifloraceae
Pennisetum	Poaceae
Phoenix	Arecaceae
Phylostachis	Poaceae
Piper	Piperaceae
Pouteria	Sapotaceae
Ptychosperma	Arecaceae
Psidium	Myrtaceae
Rhaphidophora	Araceae
Rhodomyrtus	Myrtaceae
Rhoeo	Commelinaceae
Ricinus	Euphorbiaceae
Roystonea	Arecaceae
Rubus	Rosaceae
Sansevieria	Agauaceae
Sapium	Euphorbiaceae
Scaevola	Goodeniaceae
Schefflera	Araliaceae
Schinus	Anacardiaceae
Solanum	Solanaceae
Sphagneticola	Asteraceae
Syagrus	Arecaceae
Syngonium	Araceae
Syzygium	Myrtaceae
Terminalia	Combretaceae
Thespesia	Malvaceae
Tradescantia	Commelinaceae
Washingtonia	Arecaceae
Wedelia	Asteraceae
Wisteria	Fabaceae

Footnotes

1.

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2.

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Pastures J. Walter, Y. Newman, P. Deal, S. Gamble, C. Bateman, D. Mudge, J. Shuffit, E. Jennings, M. Warren. Brevard County Extension, 3615 Lake Dr. Cocoa, Florida 32926

Situation: Smutgrass (*Sporobolus indicus*), a significant weed in bahiagrass (*Paspalum notatum*) pastures reduces forage and per acre beef yields. Effective chemical control treatments exist. These treatments can require significant capital, labor, and equipment in addition to grazing restrictions rendering their incorporation impractical into pasture management rotation. Chemical treatments require the use of herbicides and equipment that emit greenhouse gases or may negatively affect water quality. **Procedure:** A cooperative, multi-agency field study was implemented on 56 acres of a commercial ranch in Central Florida. The objective evaluates combinations of grazing management (mob grazing) and cultural practices for effective control measures. Four replicates of three treatments (burn and graze, mow and graze, and graze only) in a randomized block were imposed in November 2009. Eighteen sampling points per treatment plot (4.5 acres) were established via GIS mapping. The number of plants and basal circumference were recorded at the start of the project and one year later. Head fires were utilized on burn treatments. Rotary mower (8" stubble height) were utilized on mowed blocks. Cattle grazed the entire 56 acres monthly during 3-4 days at 5.5 au/acre, totally 8 grazing events. **Results:** Plants size and numbers were significantly reduced on burn treatments. Previously covered smutgrass areas began infilling with desirable grasses one year post treatment. **Conclusion:** Control burning and mob grazing of smutgrass infested bahiagrass/limpograss pasture in Florida provides effective control. Additional evaluation is needed to capture long term effects control of smutgrass and increase of desirable species.

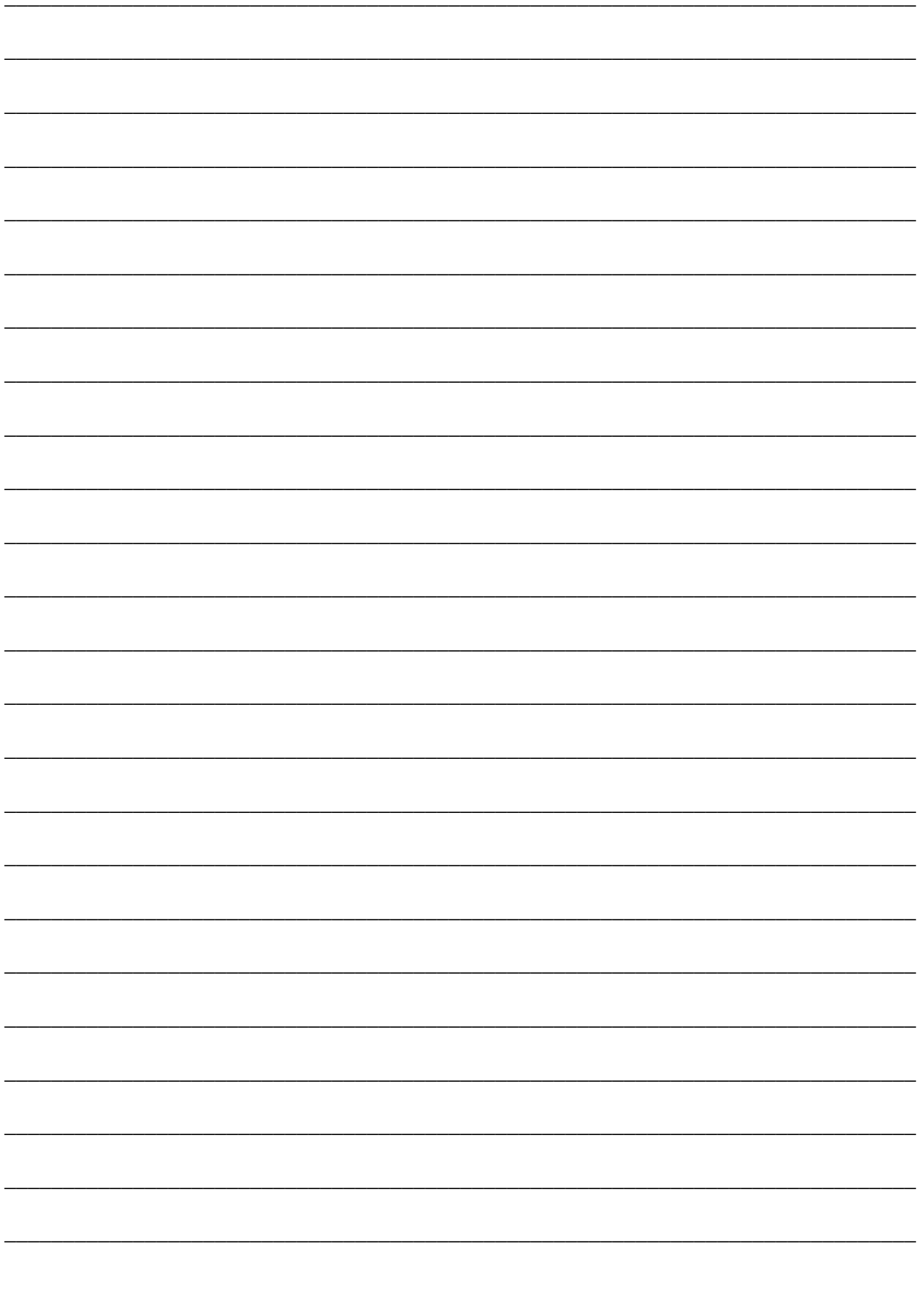
View of field before treatment - 2009



Burn Treatment 6 Months Post Treatment - June 2010



NOTES



**Spring Ranchers Forum
Held at Yarborough Ranches
Central Florida Livestock Agents' Group
March 24, 2011**

Individual Topic Evaluation:	Useful	Somewhat Useful	Not Applicable	No Answer
“Effective Body Condition Scoring of Florida Cattle” Dr. Todd Thrift, Animal Sciences, University of Florida IFAS				
“Cow Condition, Nutrition and Construction ” Dr. Matt Hersom, Animal Sciences, University of Florida IFAS				
“Pasture Recovery in a Rough Year” Dr. Yoana Newman, UF/IFAS, Forage Extension, Agronomy				
“Meat Goat Alternative” Sharon Fox-Gamble, Livestock Agent, Volusia County, CFLAG, UF/IFAS				
“Horse Feeding on a Budget” Megan Brew, Livestock Agent, Lake County, CFLAG, UF/IFAS				
“Feeding the Cow Herd” Mark Warren, Livestock Agent, Flagler County, CFLAG, UF/IFAS				
“Help with Invasive, Exotic Weeds” Dennis Mudge, Livestock Agent, Multi County Agent, CFLAG, UF/IFAS				
“Weeds of Value” Joe Walter, Livestock Agent, Brevard County, CFLAG, UF/IFAS				
How many Spring Ranchers Forums have you attended?				
Overall Program Evaluation:			YES	NO
Was this the first time you attended an Extension Program?				
Did you share last year’s information with anyone?				
Did you improve your animal science skills because of last year’s program?				
Do you have a BMP (Best Management Practices) plan?				
Did you experience an improved economic return because of last year’s program?				
Have you improved your agricultural and environmental skills because of this year’s program?				
If you have attended the Spring Ranchers Forum before, please tell us in what way the knowledge you gained impacted your farming/ranching operation.				
Why do you keep coming to the Spring Ranchers Forum?				
How did you hear about this year’s Spring Ranchers Forum?				

