

Introduction

This manual has been developed as a study guide for the Florida State Fair Skillathon which is part of the Champion Youth Program. The topic for this year's Skillathon is **Nutrition and Feeding Management**.

The Florida State Fair recognizes that agricultural education instructors, 4H agents, YLPA representatives, parents, and leaders provide the traditional and logical instructional link between youth, their livestock projects and current trends in the animal agriculture industry. **PLEASE NOTE:** This manual is provided as a **study guide** for the skillathon competition and should be used as an additional aid to ongoing educational programs.

Sections are labeled **Junior, Intermediate or Senior**, to help exhibitors and educators identify which materials are required for each age level.

Juniors (age 8-10 as of September 1, 2022)

- Animal Nutrition
- Digestive Anatomy
- Feed Identification

Intermediates (age 11-13 as of September 1, 2022)

- all of the above plus 2 of the three...
- Digestive tract functions
- Feed Classification and ID
- Feed Tag Analysis

Seniors (age 14 and over as of September 1, 2022)

- all of the above plus 2 of the three...
- Evaluating and Selecting Feeds
 - Poisonous Plants
- Common Nutritional Disorder
 - Processing Feed

For more information, websites are listed throughout text.

GOOD LUCK!

Animal Nutrition

What an animal eats, how it is digested, absorbed, utilized and what is excreted are the essence of *nutrition*. Good nutrition is basic to good health and production. Proper feeding requires knowledge of nutrients in feedstuffs available to the producer and the nutrient needs of their animals. It also includes an understanding of animal behavior and a management strategy that allows the animals to consume all that is required without causing digestive upset. Though general rules of thumb are helpful, each situation may require adjustments in order to optimize growth and production.

Nutrients are substances in the diet that support normal body functions. Some nutrients can be manufactured in the animal's body and are classified as *dietary non-essential*. *Dietary essential* nutrients must be provided in the ration. Nutrients can be classified into six groups: *water, carbohydrates, fats (lipids), proteins, vitamins and minerals*.

Water is the most essential nutrient and is involved in all body functions. It is the most abundant and therefore the cheapest nutrient. Animals receive water from drinking as well as from feeds that contain water. An animal that is not receiving enough water will not eat well. Factors which affect an animal's water consumption are the animal's size, dry matter intake, environmental temperature, humidity, and water quality.

Proteins function as the basic structural unit of the animal body and in metabolism. Protein is the main component of the organs and soft structures of the animal body with the exception of water. The dietary requirement for protein is highest in young, growing animals. All proteins are composed of simple units called amino acids. The particular amino acids in a protein determine the quality of that protein. Protein is one of the most expensive portions of the diet.

Carbohydrates are organic compounds formed in plants by the process of photosynthesis. They constitute about 75% of the dry weight of plants and grain. Carbohydrates serve as a source of energy in the body. A surplus of carbohydrates is transformed into fat and stored.

Fats function much like carbohydrates in that they serve as a source of energy. Fats produce more energy than carbohydrates when digested, therefore a smaller amount is required to serve the same function.

Vitamins are essential for the development of normal tissue and necessary for metabolic activity. They are effective in the animal body in small amounts. When not eaten correctly and in the right amounts, a specific deficiency disease can result or toxicity may result if eaten in extremely high amounts. Vitamins are classified as being either fat soluble (A, D, E, K) or water soluble (B complex & C).

Minerals are inorganic, solid, crystalline chemical elements. They are classified as being either macro (Ca, P, Na, Cl, K, Mg & S) meaning found in high concentrations or micro minerals (Cr, Co, Cu, F, Fe, I, Mn, Mo, Ni, Se, Si, & Zn) meaning found in trace amounts. Calcium makes up nearly 50% of the total body mineral, phosphorus composes 25%, and other minerals make up the remaining 25%. Minerals function in protein synthesis, oxygen transport, and in skeletal formation and maintenance.

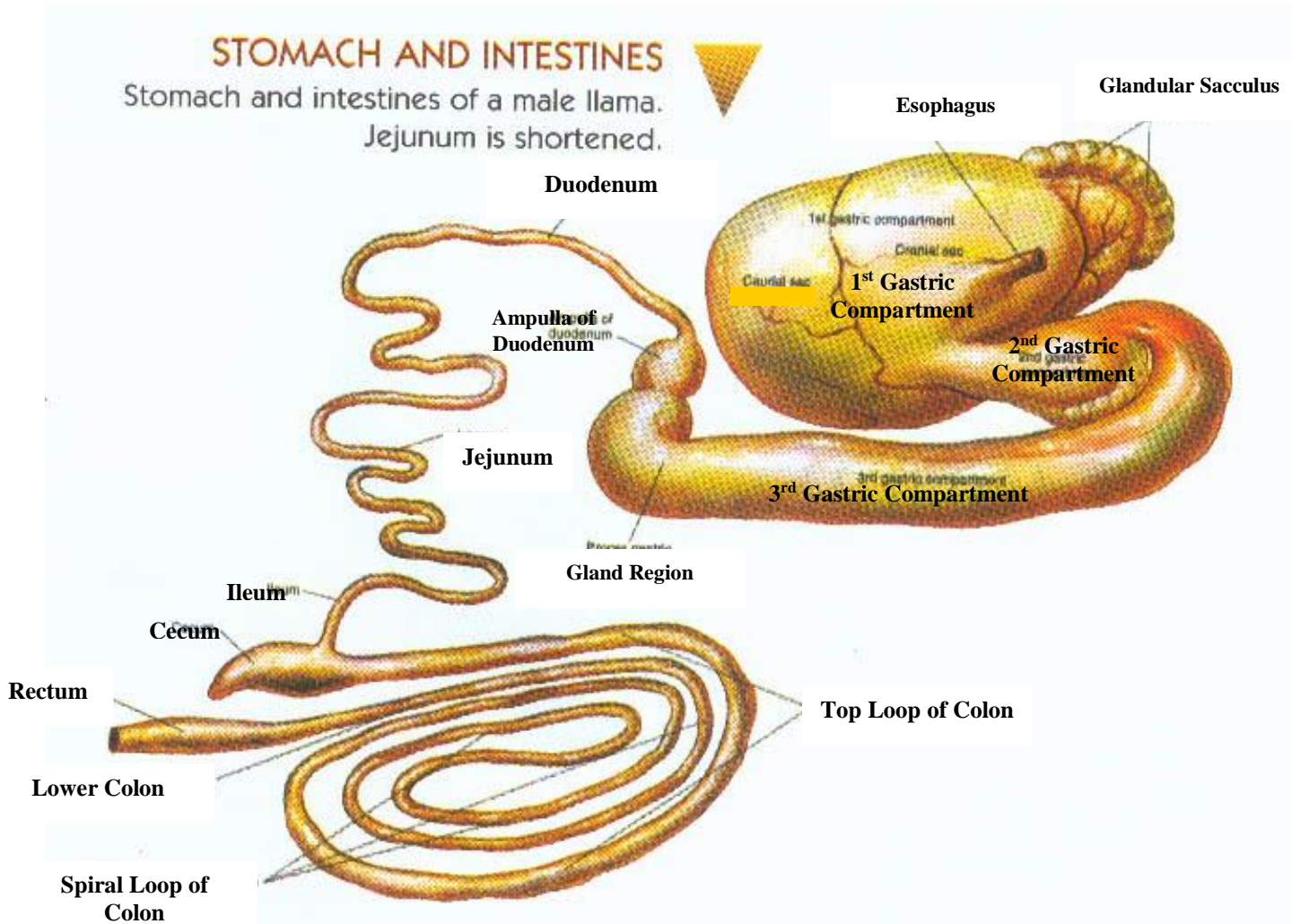
Specific nutrient requirements vary between species but also between individuals. Factors such as weight, environmental temperature, and level of production must be considered when determining optimum nutrient levels in a ration. Though it is tempting to provide more than enough as insurance, some nutrients cause problems (toxicity) if fed in excess. Also, the feeding of livestock accounts for 45-75% of production costs so overfeeding shrinks profits. Too much of a good thing is not good.

https://secure.lamaregistry.com/downloads/Brochures/06_feeding.pdf

Digestive Anatomy

Junior, Intermediate and Senior

You are what you eat sounds silly but is somewhat true. Farm animals are grouped by what they eat, which is based on the type of digestive system they possess. *Herbivores* are vegetarians (cattle, sheep, goats, rabbits, camelids). *Carnivores* are flesh eaters (dogs). *Omnivores* eat both flesh and plants (pigs, chickens, humans). Based on the digestive system, animals are grouped as *monogastric* or *simple stomach* (pig), *polygastric* or *ruminant* (cattle, sheep, goats, llamas), *avian* (chickens), or *pseudo-ruminants* with a functional cecum (rabbits). Understanding the digestive system is fundamental to selecting the proper feeds and feeding system for your animal.



<http://www.mereckvetmanual.com> – Search “Management of Llamas and Alpacas – ‘Feeding and Nutrition’ & ‘Gastrointestinal Diseases’
<http://www.shagbarkridge.com>; go to – “Vet Corner”

The oral cavity and esophagus of South American camelids are unremarkable. The stomach has 3 distinct compartments that do not correlate directly with the 4 chambers of the ruminant stomach. The remarkable features of the small and large intestines are the short mesentery of the small intestine, which results in a coiled appearance, and the freely moveable spiral colon. The spiral colon is generally a flat single spiral, although variations include a double spiral or corkscrew appearance. Torsions at the base of the spiral colon occasionally occur.

Digestive Function

Intermediate and Senior

The physical and chemical changes of feed within the gastrointestinal tract that allow nutrients to be released and absorbed into the body are called digestion. There are significant differences in the digestive processes between species. The type of digestive system an animal has determines what the animal can successfully use as feed. Complicated feed (forage) requires a complicated digestive tract (ruminant). The steps in digestion include: prehension (gathering), mastication (chewing), salivation, deglutition (swallowing), microbial, enzymatic and chemical breakdown, absorption of nutrients, defecation, and micturition (urination).

Modified Ruminants

Mouth - upper dental pad, lower incisors and both upper and lower molar teeth used in prehension, mastication, and salivation.

Esophagus - hollow muscular tube that transports ingesta from the mouth to the stomach

1st Gastric Compartment (Rumen) – Fermentation, absorption of water

2nd Gastric Compartment (Omasum) – Fermentation, absorption of water

3rd Gastric Compartment (Abomasums) – Absorption of water and solutes

Small Intestine-Pancreatic and intestinal juices break down proteins and carbohydrates while bile from the liver breaks down fats. The first section (duodenum) is involved in digestion, and the next two sections (jejunum & ileum) are actively involved in nutrient absorption. (11.5 - 12 m in length)

Large Intestine-Mainly absorbs water and end products of microbial digestion. The cecum has little function in ruminants. The colon is the site for water resorption and storage reservoir of undigested material which pass out of the rectum as feces. (7.5 m in length)

<http://www.mazuri.com> ' Nutrition & Education Resources and Products. (Llama and/or alpaca)
<https://www.kalmbachfeeds.com/> and <https://bluebonnetfeeds.com/>

Junior, Intermediate and Senior

Feed Classification and Identification

The “stuff” fed to animals in order to meet their nutritional needs are called feeds. We generally group feeds into **roughages** (high fiber, >18% CF (Crude Fiber), less digestible) and **concentrates** (low fiber, <18% CF, more readily digestible). There are 8 international feed classes that are based on content and use.

1. Dry forages and roughages - cut and cured products with >18%CF like hay, straw, corn cobs, shells and hulls, paper, wood by-products and stover.
2. Pasture, range plants and forages fed fresh - all forages not cut or cut and fed fresh.
3. Silages and haylages - ensiled forages like corn, alfalfa and grass.

4. Energy feeds - products with <20% CP(Crude Protein) and <18%CF like cereal grains (corn, oats, wheat), mill byproducts, beet and citrus pulp, molasses, animal, marine and vegetable fats, nuts, roots and tubers.
5. Protein supplements - products with >20% CP(Crude Protein) or more protein from animal origin as well as oil meals like gluten, legume seeds, milling by-products of grains, brewery and distillery by-products, yeast, non-protein nitrogen.
6. Mineral supplements – Examples: salt, calcium, phosphorous
7. Vitamin supplements – Examples: A,D,K,E, B-complex
8. Non-nutritive additives - supplements such as antimicrobials, antifungals, antibiotics, antioxidants, probiotics, buffers, coloring material, flavors, hormones and medicines.

Most youth purchase livestock feeds that are a “complete ration” however, it is helpful to know what may go into those bags of feed. Google search these topics below, to study feed ingredients listed in #1-8 above, so you are able to visually identify those ingredients typically used in livestock complete feed rations.

1. Feedstuff identification cards/Quizlet

<https://quizlet.com/22837845/feed-stuff-identification-flash-cards/>

2. Long ridge Stockman's Feed Identification

<https://www.proprofs.com/quiz-school/story.php?title=long-ridge-stockmans-feed-identification-quiz>

3 Feedpedia - <https://www.feedipedia.org/>

Feed Tag Analysis

Intermediate and Senior

It is required by law that all commercial feed products carry a proper label. In order to know what you are getting for your money, you should be able to read and understand the information on a feed tag. Some of the information included will be: net weight in pounds, company brand name (trade name), product name (class or use), product type (textured, pelleted, extruded, etc.) purpose statement, warning or cautions, active drug ingredient (when applicable), guaranteed analysis (protein, fat, fiber, etc.), feed ingredients in order of content, company name and address, detailed use directions, other feeds (suggestions for other feeds in the total program). Go to the feed store and look at the tags on several types of feeds and determine which feeds are best suited to your program and which are the best value in terms of nutrients per \$. Be prepared to interpret the information on a feed tag.

Guaranteed Analysis:

Crude Protein: not less than __%. If all of the protein is not from “natural” ingredients a statement such as, “this includes not more than X% equivalent protein from non-protein nitrogen” must be added. (i.e. urea)

Crude Fat: not less than __%, typically 1 to 3%. Fat contributes 2.25 times the energy as carbohydrates. Increased crude fat levels can decrease digestion of forages (e.g., hays and grasses), can be added to the diet in hot weather to maintain energy level when intake decreases

Crude Fiber: not more than __%. The higher this figure, the lower the digestibility energy of the feed; The price should reflect this lesser energy, but frequently does not.

Some manufactures also show minimum/maximum quantities of calcium and phosphorus and other macro and micro minerals. Units of vitamins A and D may also be shown; such figures are not required by AAFCO (Association of American Feed Control Officials)

Ingredients listing on the tag does not necessarily identify individual feedstuffs. Instead, it uses *categories* of feedstuffs, e.g., *grains products* (such as corn, oats, barley, wheat), *processed grain by-products* (bran, brewers grain, hominy), *plant protein products* (soybean meal, cottonseed meal, etc.), *molasses products* (cane or beet molasses, dehydrated molasses, wood molasses), and *forage products* (alfalfa meal or leaf meal). The phrase, *roughage products*, identifies the presence of cottonseed hulls or other types of hulls or ground hays. This total must be shown as a percentage of the feed. Their presence will cause the crude fiber guarantee to be abnormally high (16-26% or more) and, as indicated above, lowers the digestible energy content.

The tag will also list sources of minerals, any preservatives used, and any vitamin supplements present or used.

The fictitious tag below is included to encourage you to think about what information is actually available on the feed tag and to consider what it means to you in your feeding program.

Show Stopper Feed

GUARANTEED ANALYSIS

Crude Protein, Minimum	32.0%
(This includes not more than 11.3% equivalent crude protein from non-protein nitrogen)	
Crude Fat, Minimum	2.0%
Crude Fiber, Maximum	7.5%
Calcium (Ca), Minimum	1.3%
Calcium (Ca), Maximum	2.3%
Phosphorus (P), Minimum	0.9%
Iodine (I), Minimum	0.00015%
Salt (NaCl), Minimum	1.0%
Salt (NaCl), Maximum	2.0%

INGREDIENTS

Ground Newspapers, Ground Uncooked Turkey Feathers, Ammonium Nitrate, Super Phosphate, Tincture of Iodine, Used Crankcase Oil, Hardwood Sawdust, Ground Marble Chips, Vitamin A & D Oil, Ground Shoes (without Rubber Soles), Barber Shop Sweepings, Salt.

Manufactured By: LEAST IN THE EAST

Selling Directions: For price conscious feeders who are not interested in results.

Evaluating and Selecting Feeds

Seniors

It is easy to look at the price of feed per bag and assume that lower cost is the same as higher value. Spend time thinking about your feeding management situation and the types of

feeds you have available. Be prepared to judge the relative value of feeds for various scenarios.

There are several methods to assess the value of a feed.

1. Physical evaluation of feedstuff: Does it look good and smell good? Is it free of dust and mold? Is it fresh? Can you see indicators of quality such as high stem to leaf ratio in hays or a high percentage of corn in a finishing ration?

2. Cost per unit of nutrients: This requires some analysis and calculations but it is not difficult.

Example:

Product	Soy Bean Meal	Linseed Meal
Crude Protein	44%	35%
Cost	\$9.40 per 100 Pounds	\$5.50 per 100 pounds

To solve this problem you must determine the value of each feedstuff for protein:

- Do this by dividing the cost by the pounds of protein

* Using the percentage of protein only will work if comparing two bags with the same weight. If you are comparing, for example, a 50 lb. bag and a 100 lb. bag, you must first make the conversion from % protein to lbs/ protein by multiplying the % protein by the total pounds. See instructions below.

Soy bean Meal: $44\% \times 100 \text{ lbs.} = 44 \text{ lbs. protein}$
 $\$9.40 / 44 \text{ lbs.} = \$0.21 \text{ per pound of Crude Protein}$

Linseed Meal: $35\% \times 100 \text{ lbs.} = 35 \text{ lbs. protein}$
 $\$5.50 / 35 \text{ lbs. protein} = \$0.16 \text{ per Pound of Crude Protein}$

Another way is to look at productivity. If you must feed your animal twice as many pounds of a low cost, but low protein feed to achieve 100 pounds of gain, it may be more cost effective to pay for a higher price but feed less total pounds.

Example:

Let's look at the feed stuffs from above but add in rate of gain expected for each feed.

Product	Soy Bean Meal	Linseed Meal
Crude Protein	44%	35%
Cost	\$9.40 per 100 Pounds	\$5.50 per 100 pounds
Rate of Gain	1 pound of gain per 4 pounds of feed	1 pound of gain per 7 pounds of feed

Solve for cost per pound of gain.

- First, determine cost per pound of feed

Soy Bean Meal $\$9.40/100 \text{ pounds} = .94 \text{ cents/pound}$

Linseed Meal $\$5.50/100\text{pounds} = .55 \text{ cents/pound}$

- Next, determine cost per pound of gain

Soy Bean Meal: $.94 \text{ cents/pound} \times 4 \text{ pounds feed/pound gain} = \$3.76/\text{pound of gain}$

Linseed Meal: $.55 \text{ cents/pound} \times 7 \text{ pounds feed/pound gain} = \$3.85/\text{pound of gain}$

On a cost of gain basis Soy Bean Meal is Cheaper

3. There are a number of chemical analyses that are carried out on feeds by the companies that produce them.

4. One of the most often used methods is to do your own feeding trials. You probably already do this without thinking about it. If you run into problems one year, you make adjustments the next year. With limited numbers of animals, this is a slow, often costly process.

Poisonous Plants

Seniors

There are many plants which are harmful to alpacas and llamas. A common misconception-toxic plants don't taste good-animals will not eat them! Healthy animals may be more resistant to minor toxic ingestions. Certain conditions will favor the ingestion of poisonous plants; example: cold weather, drought, and herbicides. Remember, plants vary with seasons and plant populations change with time causing plant identification to be tricky. When identifying plants always look high and low, from ground covers to vines high in trees. Remember to also check landscape plants as possible sources of toxicity.

Below is a list of information on some poisonous plants, their locations and the signs that your animal may have ingested the plant. Check the websites listed below to see these and other plants toxic to camelids.

<https://extadmin.ifas.ufl.edu/media/extadminifasufledu/cflag/image/docs/pdfs/spring-ranchers-forum/2013/Mudge.pdf>

<http://merckvetmanual>, "Range Plants of North America"

Caring for Llamas, A Health Management Guide, 3rd Edition, by Claire Hoffman, DVM

Plant	Location(s)	Signs
Azalea	Ornamental	Loss of appetite, muscle twitches, bloating, vomiting
Black Locust	Fence rows, around dwellings	Depression, poor appetite, diarrhea, paralysis
Bracken fern	Upland pastures, abandoned fields, forested and burned over areas	cumulative poison in fresh or dry plants, internal hemorrhages
Castor Bean	Ornamental	Seeds toxic, severe diarrhea
Chinaberry	Along fence rows and waste areas	Fruit of tree most poisonous, attacks nervous system, can cause paralysis
Jimson weed or Loco weed	Waste areas, trampled pastures, roadsides, can grow most areas	Weakness, staggering delirium dilated pupils, and coma
Lantana	Wild and Ornamental plant	Skin lesions and bloody diarrhea
Milkweed	Stream beds, irrigation canals	Resinoid toxicity. Dangerous in hay. Generally distasteful.
Nightshade	Woods, fence rows, waste areas, roadsides	Weakness, vomiting, Glycoalkaloid toxicity
Oleander	Domestic shrub or tree, roadside plantings	Difficulty breathing, colic, diarrhea, blue membranes of mouth, heart failure
Pigweed	Roadside, pastures, barnyards	toxic if eaten in large quantities, respiratory distress, weakness, lack of coordination, coma
Pokeweed	Native to southern US	Roots most poisonous, vomiting, convulsions follow

Prunus spp. Wild and Black Cherry	Grown throughout US	Seeds, leaves and bark are poisonous, twitching, spasms, difficult breathing, coma and rapid death.
Quercus spp.(Oak)	In most regions and habitats	Gallotannin poisoning, Young Buds and shoots in large quantities consumed. Abdominal pains, constipation, extreme thirst
Yellow Jessamine	Open woods and thickets	Alkaloid toxicity. Muscular weakness, dilation of pupils, dizziness, convulsions

**Examples of Plant Photos
Pigweed**



Azalea



Common Nutritional Disorders

Seniors

<u>Disorder</u>	<u>Chief Cause</u>
Grass tetany	Mg deficiency (ruminants)
Pancreatitis	Zn deficiency
Rickets	Ca, P, or vitamin D deficiency (young animals)
Anemia	Fe, Cu, vitamin B ₁₂ , or folic acid deficiency
Enterotoxemia (overeating disease)	Rapid growth of Clostridium perfringens after overeating
Photosensitization	Some feeds or forages or accumulation of metabolites
Bloat	Legume, succulent forages causing slime producing bacteria to increase and slime causes trapping of gas.
Anorexia	Colic, dental pain, arthritis of the jaw hinge, gastritis, central nervous system injury, and anemia
Dysphagia	Ulcer in esophagus, esophageal obstruction, stomach overload, bloat, rabies or cleft palate
Abdominal Distention	Overweight, excess gas or excess fluids
Colic	Too much acid from C-1 may produce a direct inflammation of the gastric mucosa
Gastric Overload	Excess grain consumption

<http://merckvetmanual>, Gastrointestinal diseases or specific search of disorder

Processing Feeds

Seniors

Because feed constitutes a major portion of the cost of intensive animal production, it is very important that a diet have the right nutrient content and be in a form that will encourage consumption without excessive feed waste. Feeds are often processed by mechanical, chemical or thermal methods in order to alter the physical form or particle size to prevent spoilage, isolate certain parts of the seed or plant, to improve palatability and digestibility, or sometimes to inactivate toxins. Occasionally feed is processed to improve handling, like chopped hay. Some methods include: roller mill cracking, grinding, steam-rolled and steam-flaked, pelleting, extruding, popping, drying and cubing. Obviously there are costs associated with processing so the improvements in productivity must offset price increases.

Some sites to acquire more information about this topic,
www.rdequipmentco.com – “Equipment used for processing”

www.YouTube.com – “How is animal feed made?”

www.YouTube.com – “Animal Feed Processing”

For more information and brochures -

<https://secure.lamaregistry.com/registry-services/request-brochures.php>