



Coping with Drought: Evaluating the Economics of Livestock Producers' Options

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Introduction

Coping with the consequences of drought is costly for livestock producers. This article focuses on beef cattle and other livestock that use pasture as the main source of feed. Options will vary from farm-to-farm but in each case one of these options is likely to be less expensive than the others. Options include buying various types of forages and feedstuffs, reducing animal numbers, or some combination. The discussion that follows is intended to show how different options can be evaluated, using information from the NCSU enterprise budgets as examples. These options include buying hay, using abandoned row crops or row crop residues, stockpiling, growing winter annuals, selling livestock, and selling the whole herd. The livestock examples used in this article are for beef cattle but these procedures can be used for other types of pasture-based livestock.

Where to start? Begin by developing a feed budget for the current herd. A feed budget is an estimate of the amount of feed that will be required to carry the animals through a feeding period of a certain length. Feed requirements depend on number of animals, their daily forage intake needs, their daily energy, protein and mineral needs, and the length of feeding period. The animal performance goals you have set (such as daily gain and body condition) affect these requirements. In a summer drought situation it may be prudent to develop two feed budgets: Plan A if it rains and there is good fall grass growth, and Plan B if it stays dry and feed must be procured to carry livestock through until spring.

The second step is to assess current feed inventories, if any, and then to determine additional feed needs, including forages and supplementary feeds. The third step is to identify what feeds are available and the last step is to "run the numbers" and see which one is least costly. The fourth step is to see if reducing livestock numbers is less costly than procuring feed to maintain current numbers.

Here is an example of a feed budget to carry a herd of brood cows through a fall and winter feeding period. There are 50 brood cows with an estimated average daily intake of 25 lb. of dry matter per day. The normal time spring pastures are available is six-

and-a-half months away, 200 days. So, if you maintain the herd at its current size it will take $[50 \text{ cows} \times 25 \text{ lb per day} \times 200 \text{ day}] / 2000 = 125$ tons of dry matter. In addition, the budget calculations should consider the daily nutrient needs of the cattle in terms of energy, protein and minerals.

Note this feed budget is calculated on a dry matter basis because that is the part of the diet containing the nutrients animals need. All feeds contain some water, so an allowance must be made for this when thinking about the actual amounts of a particular feed on an “as fed” basis. Some examples of typical dry matter (DM) content are: Hay ~ 85% DM; pasture ~ 20 to 25% DM, corn silage ~ 35% DM; ground corn ~ 88% DM. Converting all feeds to a dry matter basis allows for a more accurate assessment and comparison of cost and value.

Some feed, whether grown or bought, will be lost and not eaten. These losses may occur during harvesting, storage or feeding and they add to total feed costs. Actual losses depend on the crop and type of harvesting, storage and feeding system. Harvesting losses can vary from 5 to 50% of the amount of harvestable production, storage losses from 5 to 20%, and feeding losses from 5 to 15%. Estimates of combined losses from all sources are from a minimum of 15% up to 50% of the initial amount of harvestable production. So, for example, hay bought or made at \$80/ton with a 30% loss effectively costs \$115/ton for the hay actually eaten by the animals!

Considerations for bought feeds include the type, fiber content (usually from forage crops), content of the major nutrients -- energy and protein -- and minerals. The true cost of any feed includes: The purchase price, including transportation to the farm; harvesting cost if a standing crop, including losses; storage cost, including losses; feeding out cost, including losses; and dry matter content. Feeds with a high fiber content include hays, silages, row crop residues, and some of the higher fiber byproduct feeds. Supplementary feeds include grains, oilseed meals, byproduct feeds and minerals. Some low quality forages may require supplementation. The important cost to estimate is the total ration cost of what the animals actually eat, including forages and any supplements.

Depending upon the estimated expense of the various feeding options, it may be less costly to reduce animal numbers instead, including selling or removing animals. Selling calves early, selling off replacement heifers, reducing the number of cows, and selling the entire herd are all options to consider. Animals may be relocated using contract grazing or contract raising arrangements. Cattle may be grown out through retained ownership. Selected options are discussed in more detail in the following sections.

Buying or Procuring Feed

Identify the alternative feeds available. Compare individual feeds of the same type -- among forages and among grains & byproducts -- and combine them to meet animal needs. RelVal and FeedVal are spreadsheets that compare the value of the energy and

protein content of various feeds relative to corn and soybean meal prices. They are available at your North Carolina county extension office. FeedVal is available on line at: http://www.ag-econ.ncsu.edu/extension/Ag_budgets.html. However, these programs and rules of thumb for estimating values relative to the price of corn and/or soybean meal are only intended as screening tools to help identify the most promising alternative feeds. The key factor is total ration costs, including losses and feeding out costs. Losses and feeding costs are high for forages but vary by type. Include costs and losses arising from harvesting, including grazing management; storing, and feeding out.

Buying Hay

Costs to consider include the purchase price or cost delivered to the farm, storage losses, if any, feeding losses, feeding out costs. Convert costs to a dry matter basis for comparing alternative feeds. For example:

- If the purchase price, delivered, is \$150 per ton, with an 85% dry matter content, the cost per ton of dry matter is \$176 per ton of DM
- If storage and feeding losses are 15% then the effective cost of the hay is \$176 per ton as fed and \$207 per ton of DM
- If feeding out cost is \$13 per bale, at three bales per ton, the cost is \$39 per ton
- The total cost of this bought hay is \$215 per ton as fed, or \$253 per ton of DM.

Standing Crops and Crop Residues

What is a standing crop worth? If the crop producer is looking to make a profit, the livestock producer would need to pay at least the value of the crop to the crop farmer. If it is a harvestable as corn, beans, etc. then the value to the owner is the net income from harvesting and selling the crop and the residual value of the residue (plus any insurance payments). If the crop material is residue or an abandoned crop not worth harvesting, then the only value to the owner is any fertilizer and organic matter contribution to the following crop.

There are three aspects to consider when valuing the potential fertilizer value to the grower; the nutrients in the stalks (stover) or hay, the availability of these nutrients to following crops and the cost of replacing the nutrients so yields of following crops are not reduced. The NCSU Soil Fact sheet *Nutrient Removal by Crops in North Carolina* provides estimates of the nitrogen, phosphorus and potassium content of various crops and parts of crops such as corn stover. Baling stover and harvesting soybeans for hay will not remove all of the nutrients from the field and conservation program rules require leaving at least 30% residue or ground cover. Therefore, the nutrient values in this publication have been converted to a per bushel or per ton basis in Table 1. Note that these values are quoted on a dry matter basis so the value in the actual crop material as harvested will be lower because of the moisture content.

Table 1. Nitrogen, phosphate and potash content of selected crops, dry matter basis

Crop	Nitrogen	P₂O₅	K₂O
Corn grain, per bushel	0.9	0.35	0.27

Corn stalks (stover), per ton	22	8	32
Soybeans for hay	45	10	25

If all of the crop material was left in the field, the nutrients would be returned to the soil but not all nutrients would be available to the following crop. Estimates vary but we can use 50% availability as a reasonable estimate for many situations. However, there may be cases when some of the nutrients in the crop residue would not be needed or used by a following crop, for example, if a soil has a very high phosphorus index. The type of crop to follow may affect the nutrient needs and cost as well, for example, soybeans should not need added nitrogen. The cost of replacing any nutrients by increasing the amount of fertilizer is the economic cost of removing stover or soybean hay. This cost will depend on the type of nutrient (N, P or K), the amount of each to be replaced, the source and cost of each nutrient, and the application costs of the fertilizer.

Organic matter may contribute to the development of the following crop, especially on light, low organic matter soils. However, this contribution is difficult to measure and value.

Crop residues are likely to have a lower feed value than a crop with some crop remaining (ears of corn or beans in the pod). The maximum value to the livestock owner of any crop material used as a forage source is the cost of next best alternative feed, net of handling costs. If the value of the crop or crop residue to the crop farmer is less than the cost of the livestock producer's next best alternative source of feed then there is room for negotiating a price acceptable to both.

Baling Cost

The cost of baling crop residue must be considered, whether this is done by the crop farmer or by the livestock owner. The NCSU Hay Making Budgets estimate the cost of cutting, working and baling small square bales at \$76 per ton of dry matter, or \$65/ton hay as made. The estimated cost of large round bales is \$64 per ton of dry matter or \$54/ton hay as made. Baling crop residues likely affects these costs somewhat but there is little information available. The spreadsheet versions of these budgets allow the user to modify these costs to suit their circumstances, including baling other materials like corn stalks. The budgets only include the actual hay making operation. Add the cost of the hay crop or the crop residue to get the total cost of the baled crop at harvest. When planning, consider the risk of rain damage and field losses on the cost of the baled material.

The NCSU Hay Making Budgets estimate full economic costs, not financial costs. Costs include:

- Operating costs of inputs -- fuel, fertilizer, chemicals, labor, seed, interest
- Fixed costs -- a share of the depreciation, interest, taxes, and insurance costs of machinery and buildings investments
- Opportunity costs of family labor and equity capital at prevailing wage and interest rates.

These costs include moving bales off the field to nearby storage but not the cost of stacking, covering, etc. or feeding out. Yield estimates are included to derive costs per ton of dry matter. A breakdown of the baling costs are shown in Table 2.

Table 2. NCSU hay making budget costs per ton of dry matter

Item	Large Round	Small Square
Operating cost	\$23	\$27
Fixed cost	\$22	\$26
Labor	\$19	\$23
Total cost/ton DM	\$64	\$76
Cost per ton as fed, hay at 85% dry matter	\$54	\$65

Other forage enterprise budgets are available and may include harvesting cost. NCSU budgets do NOT include the costs of storage and feeding losses, feeding out the forage to animals, farm overhead, or land charges. Transportation cost should be added to this to arrive at a delivered cost to the cattle producer.

Forage Feeding Out Costs

Feeding out costs should be considered when estimating total feed costs because these can be significant, particularly if a livestock owner places a value on his or her time or employees must be paid. An example of the estimated cost using a 2006 model year 75 horse power tractor and a bale spear for feeding hay includes annual ownership costs of \$6.08 per hour and operating expenses of \$10.50 for a total cost of \$16.58 per hour. Add labor at a cost of, say, \$9.00 per hour and the total cost is \$25.58 per hour. If you use the tractor for 30 minutes to put out hay the feeding out cost is approximately \$13.

Total Cost of Baled Forage

Table 3 summarizes the total cost of acquiring, harvesting and feeding corn stalks on an as fed and a dry matter basis under three assumptions about the cost of acquiring the corn stalks. Total cost is shown on both an as fed and on a dry matter basis. Clearly, the total cost is substantial and it would be prudent to consider alternatives, including grazing the corn stalks, fall stockpiling and winter grazing.

Using the various values of the stalks listed in Table 3, plus the cost of baling, results in costs of \$54, \$69 or \$84 per ton in the field. If there are three bales to a ton, the corresponding cost per bale is \$18, \$23 or \$28 per bale. When transportation cost (at \$10 in this example), feeding out costs, and storage and feeding losses are considered,

the total cost of forage eaten by cattle varies from \$121 to \$156 per ton as fed. If the residue is baled at 80% moisture, the actual cost on a dry matter basis is \$151 to \$196 per ton

Table 3. Cost of buying, baling and feeding corn stalks, per ton.

Item	Corn Stalks	Corn Stalks	Corn Stalks
Cost of crop residue	\$0	\$15	\$30
Hay making cost per ton	\$54	\$54	\$54
Transportation	\$10	\$10	\$10
Feeding out cost per ton	\$39	\$39	\$39
Storage & feeding loss	15%	15%	15%
Total cost as fed	\$121	\$139	\$156
Total cost as DM, at 80% DM as fed	\$151	\$173	\$196

Grazing Management Cost

Grazing is an alternative to mechanical harvesting and feeding a crop residue if fencing and water are in place. Managing cattle on grazing incurs cost too, in the form of time and equipment to move livestock. For example, the estimated cost of owning and operating a ¾ ton pickup truck is \$15.76 per hour and adding labor at \$9.00 brings the total cost to \$24.76. If moving cattle takes 30 minutes, the cost is approximately \$12 per move.

The total cost of moving cattle increases if the crop is strip grazed or cattle are moved frequently. However, there is less waste with rationing and frequent moves. Cattle intake may be increased from 50% of the available feed to 75%. This can be a lower cost alternative if the amount of forage to graze is limited and stored feed is the alternative. For example, if 20 acres of corn stalks can be rented for \$30 per acre and has two tons of usable stover the cost is \$600 for 40 tons. If cattle are just turned in they might only use 20 tons compared to 30 tons under strip grazing. If the additional 10 tons of grazed forage reduces purchases and feeding of 10 more tons of baled stover at \$173 (from Table 3) the savings are \$1,730, which would pay the cost for many trips to move fence and cattle.

Fall and Winter Grazing

Other fall and winter forage options, weather permitting, include stockpiled fescue, a fall hay cutting and winter annuals such as rye and/or ryegrass for grazing. A fall fertilizer application is the only cost of producing grass from a perennial pasture like fescue. If the fall growth is stockpiled and grazed there will be the added cost of managing the

grazing. If a fall cutting of hay is made there will be the added cost of making the hay and feeding it out. Growing a winter annual will incur the cost of growing the crop and managing it for grazing.

Table 4 shows the estimated production cost for the three types of forage, based on the example costs discussed previously. Grazing management and feeding out costs are not included in this table but are discussed below. Stockpiling and winter grazing are both considerably cheaper to produce than the alternatives discussed previously but are weather dependent and may not be feasible for other reasons.

Table 4. Fall and winter forage production costs, per acre and per ton of dry matter.

Item	Stockpile	Fall hay	Winter Annual
Operating cost	\$35	\$58	\$127
Fixed cost	--	\$22	\$11
Labor	--	\$19	\$11
Total cost	\$35	\$99	\$149
Production, tons of dry matter per acre	1	1	2.5
Cost per ton of dry matter produced	\$35	\$99	\$60

Total Ration Costs

The key question is what does the total daily feed ration cost? Yields and quality are different for different forages so it is necessary to figure the nutritional needs of the animal to achieve desired level of animal performances and then figure the total ration cost, including supplementary feeds, minerals, etc. In the previous example with 50 cows needing 25 lb of dry matter a day for a 200-day feeding period required 125 tons of dry matter. Table 5 shows cost estimates comparing three alternatives based on:

- Corn stalks at an initial cost of \$15 per ton of dry matter, baled by the cattle producer and fed along with some supplementary feed like corn gluten feed,
- Bought hay at \$150 per ton that requires no supplement
- A combination of one-third stockpiled fescue and two-thirds winter annual, grazed, with cattle moved twice a week.

In this example, total costs for the 200-day feeding period range from over \$34,000 for hay feeding to less than \$10,000 under grazing with normal yields. Corn stover costs less than hay feeding by approximately 30% but the cost is still high at over \$24,000. The total cost per cow is \$685 for the hay feeding option and \$483 for corn stover. The corresponding costs per cow per day were \$3.42 and \$2.41, a savings of \$1.01. Additional feed costs of this magnitude are likely to take several years to recoup with

normal profits. This is a fairly extreme example, but it illustrates vividly the need to evaluate the costs of various alternatives.

Table 5. An example comparison of the cost of alternative feeds

Item	Corn Stalks	Bought hay	Stockpile + annuals
	\$	\$	\$
Forage cost	17,250	31,625	8,613
Feeding out	2,080	2,600	684
Supplementary feed cost	3,500	0	0
Feeding supplement	1,300	0	0
Total cost	24,130	34,225	9,297
Cost per cow	483	685	186
Cost per day	121	171	46
Cost per cow per day	2.41	3.42	0.93

Animal Performance

One final consideration is that animal performance affects production & income, for example, daily gain, milk production, body condition. If animal performance is expected to be different on different rations, figure the differences in both income and cost, e.g., as income over feed cost. In this situation, choose using a partial budget to determine the most profitable (smallest loss). The change in profit is the sum of differences (+ or –) in forage costs (operating & fixed costs), other feed costs, and income. For cow-calf operations, look at whole-farm, year-round effects.

Reducing Livestock Numbers

As the feed examples show, coping with drought by buying or procuring feed is an expensive proposition, so it is necessary to consider changes in livestock numbers in addition to, or instead of, this approach. Reducing numbers economizes on available feed resources and reduces the need for purchased feed. Options include removing some or all animals by selling or relocating them. Animals to sell might include market livestock, replacements, selected breeding stock, or the whole herd. Relocating animals might be possible through contract grazing, contract raising or retained ownership. The economic consequences of some of these options are evaluated below.

Hold 'em or Fold 'em?

Selling feeder calves earlier than normal reduces the pressure on feed supplies but may also reduce net income. Projecting the net profit from keeping feeder cattle depends on estimated weight gain, changes in cattle prices and added feed and other operating costs.

For example, if you have 550 lb. steer calves in mid-August and the current price is \$1.15 per lb, the animals are worth \$633 per head today, on average. If you keep these animals for two months and they gain 75 lb you now have 625 lb animals. Heavier animals sell at a lower price per pound. Cattle prices usually (but not always) fall from early August until late October or early November. There may be a general shift in cattle prices, up or down, that can offset or add to this seasonal decline. Current (August 23rd, 2007) futures prices for feeder cattle suggest prices will weaken. Other factors that can change the cattle outlook include unexpected changes in any of the significant supply and demand factors, such as weather, forage supplies and quality, crop and feed prices, cattle supplies, and government policy changes. All of these affect prices and are a source of the volatility that cattle producer have always had to cope with. If you expect 625 lb cattle prices to be, say, \$1.08 per lb then this animal is worth \$675 per head and you have added \$42 in value. The key question is whether you can make money from this projected gain under the current feed situation. Project feed and other operating costs and compare these with the expected increase in value to estimate profitability of selling feeder calves now or later.

A second option is to sell your replacement heifer calves. The cost of raising replacement heifers is greater than many people think. Even in normal times it may be more economical to buy rather than raise heifers. Table 6 shows examples of heifer raising costs based on university enterprise budgets and representative prices. Under the current feed situation, if you must buy feed for heifers, the cost would be raised significantly.

Table 6. Heifer replacement costs.

Item	Beef MO, 2005	Beef KS, 2006	Dairy NC, 2005
Start Weight	540 lb	550 lb	90 lb
Value of calf	\$599	\$681	\$200
Operating cost	\$438	\$538	\$995
Fixed cost	\$28	\$44	\$184
Labor	\$50	\$54	\$224
Total Cost	\$1,087	\$1,317	\$1,580

A third option is to reduce cow numbers. The goal would be to preserve the most productive animals as the basis for rebuilding the herd later. However, this approach reduces revenue because there are fewer calves in the next calf crop. It reduces some out-of-pocket costs but not all and it does not reduce fixed costs (asset ownership

costs) or overhead costs. It also reduces labor requirements and costs, either as the time spent by family members or hired labor to be paid. Overall, net income likely will be reduced.

Table 7 is an example based on the NCSU beef-cow enterprise budget developed in 2006. This budget is for a 50-cow herd under representative costs and returns. These costs and returns were re-estimated for a 30 cow herd on the same land base, assuming feed is available to support this number of animals but not 50 cows. Operating expenses and revenue were reduced in proportion. Fixed costs, by definition, are unchanged and labor requirement is reduced by 10 percent. Feed prices were NOT adjusted from 2006 levels. Profit, as measured by returns to land, management and farm overhead, is negative in both cases but the 30 cow herd situation has a \$3,311 greater loss. This change, \$3,311, represents the “cost” of this strategy. If the alternative is to buy, bale and feed corn stalks for the 20 cows then, based on Table 5, the cost would be \$9,652.

Table 7. Cow-calf costs and returns at two herd sizes.

Item	50 cows	30 cows
Revenue	\$26,961	\$16,177
Operating cost	\$26,277	\$18,961
Fixed cost	\$9,222	\$9,222
Labor cost	\$2,250	\$2,093
Total cost	\$37,749	\$30,275
Net Returns to land, management and overhead	-\$10,788	-\$14,099

Selling the Herd and Ceasing Production

Cow-calf profit margins are slim on the average and are non-existent for some producers. Table 8 shows actual financial results for a group of Minnesota cow-calf producers in 2005. Comparable information is not available for North Carolina producers but there is little reason to expect the situation here to be much different. This suggests that producers should assess the past and expected future profitability of their cattle operations as part of their drought management planning. For some, selling the entire herd may be the most appropriate option. Factors to consider include:

- Past financial performance
- The estimated cost of coping with the drought
- Expectations about future cattle prices, cost of production and profitability. In particular, it is likely that energy, fertilizer, and feed costs will continue to cost more than they have historically

- Age, health and family circumstances, including who long the principal operator of the farm plans to continue with a cattle enterprise
- Options for the farm if the livestock are sold and the financial implications of each option.

Table 8. Financial performance for cow-calf operations, Minnesota, 2005

Item	Low Profit	Average	High Profit
Revenue	\$463	\$613	\$742
Operating cost	\$415	\$371	\$340
Fixed & O/H cost	\$130	\$81	\$60
Total cost	\$545	\$452	\$399
Labor & Management charge	\$80	\$72	\$73
Net Return	-\$161	\$89	\$271

Selling the Herd and Restocking Later

How much would it cost to sell now and repopulate the herd, say, next year? 50 cows sold now with similar cattle bought back at, say, a \$300 per head difference means \$15,000 in added cost. Compare this to the loss of income from calf sales, net of projected feed and other costs. Only the most profitable herds facing extremely high feed costs are likely to benefit from this option.

Other issues

Other issues to consider include financing the cost of providing feed and income tax management.

The costs used in the above examples are full economic costs and actual cash expenses would be somewhat smaller. Nevertheless, the cash costs are likely to be significant and loans or credit may be needed. Loans must be repaid. Disaster assistance loans typically offer lower interest rates but these are still loans to be repaid. Develop financial projections to ensure the cattle operation is financially viable and capable of repaying these loans from future profits and cash flow.

The IRS has two special rules covering unusually large sales of livestock caused by drought (or other weather disasters) that might provide some tax benefits. One rule applies to adult animals held for breeding, dairy or draft purposes and allows any taxable gains on sales over and above normal sales to be deferred. If livestock producer replaces the livestock within two years with like-kind animals (i.e. beef cows for beef cows) the original sale may become a non-taxed event. The second provision allows income to be deferred. It applies to unusually large sales of any type of

livestock, market or breeding, but only applies if the area in which the producer operates his livestock business has been declared a federal disaster area due to weather conditions. The producer's principal business must be farming as defined by the IRS rules and the individual must use the cash method of accounting. Producers must request to be treated under the appropriate rule and must provide documentation of livestock numbers, income and the weather problem. Additional information is available in an article, "Income Tax Issues of Weather Related Sales of Livestock," written by Guido van der Hoeven and distributed to NCCES county extension offices

Concluding Comments

Coping with the effects of the drought is a balancing act involving feed options, livestock options and economics to achieve the goals of the family and farm enterprise. The discussion in this article shows how economics fits into the farming decisions. The examples are intended to show the factors to consider and the process of evaluating the financial impacts of various alternatives and are NOT intended to represent recommendations or "the answer."

In summary, cattle must be properly fed to achieve short- and long-term production goals. Land, labor and management resources vary from farm to farm, so there is no one-size-fits-all strategy. Develop a feed budget to figure animals' feed needs in terms of dry matter and nutrients. Producers should consider all options, including:

- Buying or procuring quantities of feed with adequate fiber, energy, protein and minerals. Evaluate the feasibility and profitability of alternatives including buying and harvesting standing crops or crop residues, growing fall pasture and winter annuals, and buying forages, by-products, or other feeds,
- Reducing animal numbers, including selling the whole herd,
- A combination of strategies.

Evaluate the economic consequences of the available options. Measure forage costs at the animal's mouth, including production, storage, harvesting, and feeding costs and losses. Estimate total feed cost, including supplements. Include any effects on animal performance and income using partial budgeting. Similarly, evaluate the financial effects of reducing animal numbers. The financial impacts of different options can differ widely – pencil it out! There is a lot of money at stake here and taking short cuts on decision making could prove very costly.

Spreadsheet versions of the NCSU beef and forage budgets are one tool producers and their advisors can use to "run the numbers". Published enterprise budgets are guidelines only and farm situations vary widely. They can be used as a template to figure cost of production. For planning purposes, published budgets should be used as a guide and always modified with farm specific information. NCSU beef budgets include cow-calf, backgrounding, summer grazing, pasture finishing, conventional finishing, and pre-conditioning. Forage budgets include perennial and annual grasses, hay making,

and silages. There are nine dairy heifer budgets. These are available as print and spreadsheet versions on line at:

http://www.ag-econ.ncsu.edu/extension/Ag_budgets.html

All of this pencil pushing is work but remember “If it’s easy, fun or can be done from the seat of a tractor, there ain’t no money in it” (a quote from an anonymous cowboy).

Resources:

NC Department of Agriculture and consumer Services, Ag Drought Resource Information web page

<http://www.agr.state.nc.us/drought/>

NC State University, Department of Agricultural and Resource Economics, Extension web page

<http://www.ag-econ.ncsu.edu/extension.htm>

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