

COWS EAT WEEDS

How to Turn Your Cows Into Weed Managers

Kathy Voth

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This book is dedicated to

My parents
Orie and Donna Voth

Thank you for driving all the way to Montana with me for my very first field tour, for lunches in Boulder, for calling AAA when I locked my keys in the truck and coming to get me when my battery was dead, for building fence and taking it down, for helping me pick weeds and feed cows. Most of all, thank you for being the creative, hard-working, incredibly supportive people you are. You taught me that I could do anything if I just tried and that teamwork makes it possible.

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Peter Williams

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How this book is put together

Sometimes I learn by reading, sometimes by example, and sometimes I just have to jump in and learn from my own experience. So, I figured it was best to put this book together for all three of those people.

If you're the reader, you might read from beginning to end. If you learn better by example, skip through the chapters, looking for the "Lessons from the Field" that I've included throughout the book. They'll show you what I learned along the way. I've also summarized some key lessons from my projects in the chapter "Lessons from the Pasture." If you learn best from your own experience, jump straight to the chapter on "Building a Training Plan." It's a framework to walk you through writing your own training plan. As you work on it, you can come back and read parts of the book as necessary to get you through anything that doesn't seem to be going quite right. I anticipated that you might not start at the beginning and read to the end, but would jump from place to place, focusing on those parts that are most useful to you at a particular time. So feel free to browse!

There are three kinds of men. The one that learns by reading. The few who learn by observation. The rest of them have to pee on the electric fence for themselves.

~ Will Rogers.

A Word About Science

One of my reviewers asked me, "Is this a book about the science of how animals choose what to eat, or is it a "How-To" book?" My answer is that it is "Both" and that surprises me as much as it might surprise friends who have known me for the last fifteen years.

If I have seen farther than others, it is because I was standing on the shoulders of giants.

- Sir Isaac Newton

My life with science hasn't always been comfortable. I have often been frustrated by what sometimes seemed to me to be scientists' preoccupation with achieving order and control and with collecting data and then presenting it in the minutest of detail in their scientific papers. I was less interested in basic science, and much more interested in "getting things done." So - imagine my shock to hear the words **"according to research..."** come out of my mouth very frequently over the last five years!

Somewhere along the way, I began to understand the reasons for the precise language scientists use. It prevents doubt about what they mean, and how much they really know. I began to understand science as a method for collecting information, and being sure of its validity so that we can build upon it, or of highlighting remaining doubts, so we can study them further. The endless citations that once distracted me, now give me an avenue for going back in history, and often point me to sources for additional answers.

But that's not what I like most about science. In this case, what I like most is that it provided me with clues that helped me build a map leading to a new place; one where animals could be trained to eat foods they'd

never eaten before, and in the process do us a tremendous service. The decades of work done by so many dedicated individuals showed me how to build a process that anyone, anywhere can use.

Out of deep respect for these scientists' life's work, and because you may find clues that I've missed, I have included citations in each chapter for the work that led me.

The Beginning of an Idea



The ancestor of every action is a thought.

Ralph Waldo Emerson

*Steer eats rabbit.
Photo by M.F. Wallis DeVries*

My life changed the day I saw this picture

I didn't really know it had changed at the time.

I simply had a thought. That thought became another, and then another.

Ten years later I found myself here, telling everyone that what we've always believed about weeds and cows just isn't so.

I saw this picture while auditing Dr. Fred Provenza's "Plant Herbivore Interactions" class at Utah State University. I was stationed at Utah State University by the Bureau of Land Management as a liaison between the agency and scientists. My job required some travel so I wasn't always able to attend entire classes. The day Fred showed us the picture of the steer eating the rabbit, I had to leave before he could tell us the story behind it.

The whole week I was gone, I thought about the picture every night before I fell asleep. I imagined what a cow might look like as it stalked a rabbit. I wondered how a cow might be quick enough to snatch a rabbit as it peeked from its burrow. It was all a little disturbing.

When I got back to Logan, I checked in with Fred to hear the rest of the story. The steer was part of a study looking at how animals responded to mineral deficiencies. It was one of a herd of steers grazing on phosphorous deficient soils, thus the poor condition you see it in. One day one of the researchers noticed that a steer was eating a dead rabbit it had found in the field. Curious, the researchers threw more dead rabbits into the field and watched as the study herd ate them too. They surmised that the steers were eating the rabbits for the phosphorous in their bones.¹

“Wow!” I thought. “Animals learn what to eat! And they can eat a lot more than I imagined!”

Over the next seven years I read the research being done by Fred and his colleagues at Utah State University. I helped develop opportunities and curriculum to teach the ideas to students in an internship program I worked with, and eventually helped write short descriptions of the principles that described what we know about how animals choose diets and habitats.

Then in 2004, I received a grant in cooperation with Utah State University and the National Park Service to see how we might implement some of the principles to manage weeds. The grant didn’t specifically say that I was going to teach cows to eat weeds. We were going to use management techniques with cattle, and add multi-species grazing using sheep to see if we could have an effect on weeds. But somewhere along the way, the impact of the picture of a steer eating a rabbit finally surfaced. That February, thanks to the support of my friend Ben Bobowski at Grant-Kohrs Ranch, I took the first steps toward developing the techniques for training cows to eat weeds.

It never entered my mind that the cows might not be able to learn to eat weeds. After seven years of looking at the research I knew that animals learned what to eat, and it was simply my job to figure out how to help them learn. I never even knew until much later that a colleague cringed when I showed her my project schedule that included an August Field Day to share the results of my work. She was worried I might not be able to train the cows and I’d have nothing to show.

There was a lot I didn’t know. But, here’s what I did know:

- I knew that animals choose what to eat based on feedback from nutrients and toxins.² So I checked out the nutritional content of my Canada thistle, leafy spurge and spotted knapweed (all equal to alfalfa) and the toxins (almost nothing of real concern in any of them).
- I knew that younger animals were more likely to try new things, and that females pass diet knowledge on to their offspring, so it was obvious that yearling heifers were the right way to start.³
- There was research that said that the more positive experiences with new foods an animal has, the more likely they are to try another new food.⁴ So I decided my trainees should try lots of unfamiliar nutritious foods. I figured that would open their minds and give them a wider picture of what food could be so that when I fed them weeds, it wouldn’t seem so strange.
- From the “rat” literature, courtesy of studies done by B.F. Skinner and his fellow behaviorists, I knew that creatures generalize from one familiar flavor to the next.⁵ So I decided that when I introduced the weeds, I’d add a familiar flavor to encourage them to think, “Hey, this is kind of like something I’ve seen before.”

- Finally, studies show that no creature changes until its circumstances change.⁶ The researchers I worked with described this as “pressure” so I reasoned that a little bit of pressure in the form of a smaller pasture size would encourage my trainees to try the target weeds in pasture.

These were the basics for beginning the project. The basics, along with ongoing support and advice from friends and colleagues, as well as a lot of relentless enthusiasm on my part, carried me through the first attempt to train cows to eat weeds.

Since I was learning as I went, that first training project took much longer than training does today. I didn’t know that cattle can get used to a new feeding routine, and new foods in a matter of days, so I spent the winter months introducing my first herd of 20 heifers to new foods. We were worried about the effects of weeds on weight gain, and that spines and leafy spurge juices might injure the animals. So we weighed the trainees weekly, taking time to check out their mouths, noses, and rear-ends.

Here’s what I learned from that project and all the others that have followed:

Cows avoid weeds because they always have, not because weeds are bad for them.

Animals learn what to eat from their mothers. If your cow didn’t eat weeds, her calf probably won’t either. Weeds are nutritious, often as good as or better than alfalfa, so by getting a young animal over its fear of new things, and then introducing it to weeds, we can change her “culture” so that weeds become part of her normal diet.⁷



Lambs eat what Mom eats in this demonstration.

Weed-eating cows gain weight at rates equal to other pasture grazing cattle.

My first group of trainees gained an average of 4 pounds per day. Other weight gains since have been at or above expected rates.

Leafy spurge does not necessarily cause diarrhea, mouth sores, or internal injuries.

Just like you, I had read the literature and heard the warnings about the potential for the latex sap from leafy spurge burning the skin and mouths of animals eating it and causing them to lose weight from diarrhea. I have seen no evidence of this in the two leafy spurge training projects I have done. My process has been used in Canada and trainers there have told me that their cows do not suffer any harmful side effects either.

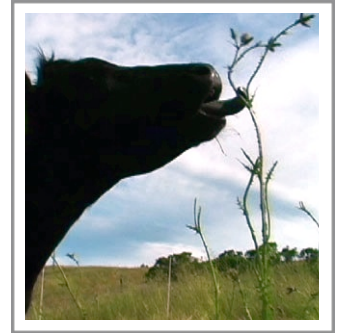


Heifer eats leafy spurge in 2004.

Not one of my trainees has ever had a health related issue from toxins in weeds or their spines or thorns.

We think of spines, thorns and prickly awns as “physical defenses” because they would certainly hurt our tender hands and lips. Some of them certainly have caused harm to cattle. The awns from needlegrass, for example, are made to drill into soil, and they can drill into our clothing or into a cow’s mouth. So it’s important to watch for potential injury.

On the other hand, what the cows have shown me over the last five years is that they are much more capable of dealing with spines and thorns than we would have thought. I have watched cows eat rose bushes, mesquite trees, and Italian thistle with half inch spines, all without flinching or suffering from painful side effects. They just need a little time to figure out how to wrap their tongues around each new thing and pop it in their mouths. Maybe it’s because your cow is covered in the same hide you wear on your hands when you’re working or pulling weeds, so her experience of these things is different.



This heifer enjoys Italian thistle in spite of its 1/2” long spines.

Folks do wonder about effects on meat and milk quality and potential long-term effects of toxins. To date, effects on meat seem to be negligible since the weeds make up only a portion of the animal’s diet. I have not yet worked with dairy cattle. My assumption is that milk is more problematic because flavors seem to transfer to it more readily. I recommend testing flavor before turning an entire herd into weed eaters. As for the long-term effects of toxins, as you’ll find out in the chapter on knowing your weed, I recommend only training animals to eat weeds that cause no harmful effects.

Cattle trained to eat one weed try others on their own

In 2005 I observed that the Grant-Kohrs trainees were eating many plants they would not normally have eaten before training including willow, wild rose, other varieties of brush, musk thistle, and Canada goldenrod. I have since observed other trained animals expanding their diets beyond what I had taught them to eat. Trainees in Marin County, California added bull thistle, sow thistle, poison oak, and coyote bush to their diets. Trainees in Boulder County, Colorado added Canada thistle and musk thistle. It seems that cattle who have gone through the training process have a more “open mind” about what may constitute food.

Cattle continue to eat weeds years after training

Cattle trained to eat distaff and Italian thistle in Marin County, California in 2006 are still eating weeds. In Boulder, Colorado, a herd trained to eat Canada thistle in 2007 continues to eat weeds. Research supports the idea that animals will continue to eat a familiar food for the rest of their lives.

Cows learn from each other

It is not surprising that calves learn from their mothers. This behavior is noted by both research and anecdotal evidence.⁸

Just as importantly, I have also observed this knowledge transfer at work in various projects. In California in 2007 twelve trained cows taught 120 untrained animals of varying ages to eat distaff and Italian thistle. The rancher reports that his entire herd now eats Italian thistle in pasture. In Montana in the summer of 2008, 20

cow-calf pairs at the Woodson Ranch learned to eat Canada thistle from 8 trained heifers, and a herd of steers at Horse Creek Hay and Cattle began eating Canada thistle after simply grazing in a pasture next to a herd of 40 trained heifers. In both Montana examples, animals were grazing at will in large pastures and were eating significant amounts of the target weed. In the Woodson pasture, I took a quick visual estimate. It looked like 80% of the thistle was grazed to the same level as the grass. Of the remaining 20% of the plants, tops and flowers had been removed. Results were similar at Horse Creek Hay and Cattle.⁹

The hardest thing about training a cow to eat a weed is changing our minds.

The history of our war on weeds is long. On this continent we have legislation going back to the 1700s regarding the elimination of weeds. Canada is credited with the first legislation to eradicate a weed: The Canada Thistle Eradication Act of 1865. Our state and local governments add to the list of regulations on weeds every year.

My grandfather's 1934 "Book of Knowledge" gives us a good example of what we've thought about weeds for a long time:

"Agriculture is an eternal war against weeds... It has been said that the weeds of the earth are one of the most formidable agents ever established for man's overthrow. It is only as he conquers them that he rises. Man in the physical sense, is but a weakling, and when he lets nature in the fullness of her powers overtake him, he is well-nigh at her mercy...When man ignores them they rise to the height of their powers."

The only benefit of weeds according to the Book of Knowledge is that we add to our own strength by "vanquishing these bitter foes."¹⁰

With this kind of long history, changing our minds to think of weeds as beneficial is very hard. But if they're nutritious and your cattle are eating them are they really such a nuisance? Perhaps, as we and our cattle become accustomed to seeing them in a new way, we'll change our minds.

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- ¹ Wallis de Vries, M.F. 1994. Foraging in a landscape mosaic: Diet Selection and performance of free-ranging cattle in heathland and riverine grassland. Doctoral Thesis. Agricultural University Wageningen, The Netherlands, 161 pp.
- ² Provenza, F.D., J.J. Villalba, L.E. Dziba, S.B. Atwood, and R.E. Banner. 2003. Linking herbivore experience, varied diets, and plant biochemical diversity. *Small Ruminant Research* 20:257-274
- ³ Provenza, F.D., 2003. Foraging Behavior: Managing to Survive in a World of change. Department of Forest Range and Wildlife Resources, Utah State University. Pg. 44 and 29.
- ⁴ Launchbaugh, K.L., F.D. Provenza, M.J. Werkmeister. 1997. Overcoming food neophobia in domestic ruminants through addition of a familiar flavor and repeated exposure to novel foods. *Applied Animal Behaviour Science* 54:327-334.
- ⁵ Cheney, C.D. E.R. Miller. 1997. Effects of forced flavor exposure on food neophobia. *Applied Animal Behavior Science*. 53:213-217.
- ⁶ Provenza, F.D., J.J. Lynch and C.D. Cheney. 1995. Effects of flavor and food restrictions on the response of sheep to novel foods. *Appl. Anim. Behav. Sci.* 43:83-93.
- ⁷ Photo from "Lambs Eat What Moms Eat" BEHAVE demonstration video
- ⁸ Biquand, S. and V. Biquand-Guyot. 1992. The influence of peers, lineage and environment on food selection of the criollo goat (*Capra hircus*). *Appl. Anim. Behav. Sci.* 34:231-245.
- ⁹ Project report, Melissa Griffiths, 2008, Madison Valley Ranchlands Group Weed Committee
- ¹⁰ The Book of Knowledge. 1934. Vol. 9 pg. 3392 and 3394. The Grolier Society, and Amalgamated Press Limited.

Why Eat Weeds?



Let a man profess to have discovered some new patent powder pimperlimplimp, a single pinch of which being thrown into each corner of a field will kill every bug throughout its whole extent, and the people will listen to him with attention and respect. But tell them of any simple common-sense plan, based upon correct scientific principles, to check and keep within reasonable bounds the foes of the farmer, and they will laugh you to scorn.

Benjamin Walsh, 1866

A weed-pulling volunteer at Chileno Valley Ranch decides to taste distaff thistle.

If you can't beat 'em, you might as well eat 'em!

If you're holding this book, you've probably already decided this is a good idea. I included this chapter because we both know that you're going to run into folks who think you're "a little off," to put it mildly. Here are some stories from other ranchers, and a little ammo/information to share with your neighbors if the going gets tough.

Herbicides aren't working for us!

Did you know that U.S. farmers and ranchers spend an average of \$5 billion every year to control JUST pasture and rangeland weeds, and that losses to production are equal to that amount? Yet, in spite of all our efforts, weed populations continue to spread at an average rate of 14%, an area the size of Delaware, every year.¹ And now we're beginning to accumulate a list of weeds that are becoming herbicide resistant.

Herbicides can also actually INCREASE weeds. In his 2009 paper "Control effort exacerbates invasive-species problem," Matthew Rinella and his colleagues in Montana described the results of their 16 year study on the use of herbicides on native grasslands.² They found that herbicide use reduced, and in some cases, eliminated native forbs, while the invader (leafy spurge) recovered from the spraying. Since their past

research showed that these native forbs provided significant competition to the invader, once they were removed, spurge increased to fill their place. Meanwhile herbicide use resulted in only a temporary increase in grasses.

We've often assumed that by using herbicides we can decrease invaders so that we can increase desirable forage and therefore improve livestock productivity, so Samuel Fuhlendorf and his colleagues at Oklahoma State University decided to test this assumption.³ In 2009 they reported on their 5 year study which found that our assumption is false. Grass production increased more with annual precipitation than with herbicide treatment and average daily weight gain for cattle in the study was the same whether they grazed on sprayed or unsprayed pastures. Their conclusion was: "These results indicate that herbicide to control forbscannot be recommended for increasing forage and livestock production especially in light of the potential for negative impacts on biodiversity and ecosystem services."

So, if herbicides aren't working, isn't it time to try something new? My idea for improving farmer and rancher sustainability is to turn weeds into forage for our livestock and to change our goal to creating biodiverse pastures and rangelands that provide forage and habitat for our livestock and wildlife, and that protect soil and water quality.

By thinking of weeds as forage, and training cows to eat them, we are working with nature's underlying processes and patterns. By grazing them, we reduce weeds' competitive advantage and reduce pressure on other, more traditional forages.

Weeds are nutritious!

Since 2004 when I started training cows to eat weeds, I've been gathering nutritional information on my target species. What I've found is that weeds are very high in nutritional value, often running between 8 and 20% protein.⁴ In addition, it is possible that their longer taproots bring up minerals beneficial to our grazing stock.

High protein weeds can help animals take advantage of other low quality forage that otherwise might not meet their nutritional needs. For example, distaff thistle is green and growing in California when other grasses are dry and brown. Its protein can help ruminants maintain healthy rumen microbes, and those microbes can do a better job of breaking down the cellulose in the dry forage.

Steve Wood, Horse Creek Hay and Cattle, Sheridan, MT trained 40 heifers to eat Canada thistle in 2008

"We've been spraying knapweed for 20 years on this place using a variety of chemicals and we still have it coming back in the same places, and the thistle's the same way. You have control for a short while and then they come back. The seed bank is inexhaustible."



Example of Weeds With 15 - 20% Protein

Canada Thistle	Leafy Spurge
Spotted Knapweed	Russian Thistle
Distaff Thistle	Musk Thistle
Pigweed	Bindweed
Wild licorice	Ragweed

Typical protein values of grasses run between 2 and 11%

Given the variety of forbs/weeds I've observed trained cattle eating, the high nutritional value of the plants they choose compared to grasses, and the fact that research indicates that herbicides may exacerbate our perceived problem while not providing any increase in weight gain for our livestock, I arrive at one question:

If you can't beat them, why not eat them?

In fact, forbs may be just as important a part of our forage base as grass. Five years of observing trainees indicates they also gain weight at expected rates, and in fact, in Marin County, California, weed eating cows gained more weight than their traditional grass-grazing herd mates. **By simply changing our minds about the role of forbs in a pasture based grazing system, we can solve weed problems and maintain or improve cattle productivity.**

They're a plentiful forage!

In addition to being nutritious, weeds are often available when other forages aren't, either because of the time of year or due to drought conditions. Many ranchers in the west also look forward to the early spring and late fall green up of cheat grass, one of our most aggressive annual invaders. During the drought of 1934-1939 Russian thistle provided a large part of the grazing for small ranches and farms. It makes sense when you realize that its digestibility is similar to other forages. ⁵

Grazing weeds is easier and more economical than spraying them!

So far no one anywhere has evidence of having eliminated a weed with pesticides, with insects or with grazing. The problem is that we have a seed bank in the soil that provides new seedlings, and some of each plant always seems to get away. So managing weeds is something like managing the hair on your head. You can get one really great haircut, but don't expect it to last the rest of your life. Chances are good that you're going to need another haircut in a month or two. In the case of weeds, you're always going to have to do something to manage them.



Leo Hogan's cows were trained to eat late season diffuse knapweed and dalmatian toadflax. He said another benefit of training was that the cows were easier to move and handle. "These were the nicest heifers we've ever had. Babe (his brother Albert) used to have to go out in the morning and at 10 at night to check on the heifers during calving season. These he could just call and they'd come right in. If they were having trouble we could walk them into their stalls so easily."



Peggy Rathmann and John Wick at their ranch in Nicasio, California have cows trained to eat distaff and Italian thistle.

"Economically, if you compare the full cost of purchasing and applying Transline to the small cost of training cows to feed themselves on a nutritious plant like distaff -- well, training cows is the smarter move hands down. You can spend a lot of money fighting weeds and causing collateral damage. Transline kills your beneficial nitrogen fixers, too. When you spend a few dollars training your cows how to reap forage benefits from a weed, it's all good, there's no down side."

A Utah State University economist estimates that it costs \$25 to \$30 per acre in equipment and fuel, before you even pay for the spray.⁶ Add to that the time you spend in class or reading about how to apply the latest herbicide, labor for maintaining, prepping and cleaning the sprayer, and your costs continue to mount.

Now compare a lifetime of herbicide application to spending about 8 hours over a few days with a small group of your cows. They teach their calves and herd mates. They walk around your pastures every day, eating your weeds. They even travel easily to places you might not be able to reach with your herbicides, like the undergrowth in forested areas, or ditches, stream banks and pond edges. As long as you have offspring or herd mates of the original trainees, you'll never have to train again. How easy is that?

Take advantage of weeds as additional forage. Look at it this way. If the weeds are increasing by 14% a year on your property, what would it mean to your bottom line just to be able to eat that 14% instead of spending time and money to mow or spray it?

Can cows eliminate weeds?

It all depends on your goals, what you think of weeds, and how much time you want to spend managing your animals.

It's clear that grazing can change vegetation production. For example, the way we managed our grazing in the early 1900s helped to reduce populations of perennial grasses in some parts of North America, even when that wasn't our intent. We simply grazed the same area too often, to too short a stubble height, until the plant could no longer compete.

It's that kind of grazing that will also help us control weeds. There are all kinds of studies indicating that yes, grazing can, at a minimum, reduce the vigor and spread of weeds. For example, scientists found that grazing diffuse knapweed in the bolting stage reduced the number of plants by 50% and reduced seed set by 50% as well.⁷ In fact, most grazing prescriptions for weeds focus on preventing seed set by grazing multiple times in a season. If this works with your animal and vegetation management goals, then it's a potential avenue for eliminating your weed. Just be sure that the forage you'd like to protect isn't being damaged in the process. If a little less intensive management plan suits your goals and the time you have available, don't despair. It will just take a little bit longer for your weed population to change to meet your goals.

Some cows from the Lunny's G Ranch on Point Reyes National Seashore were trained to eat Distaff and Italian Thistle in 2006. Only Italian thistle grows on the home ranch where the herd spends the majority of its time.



"The whole herd is eating Italian thistle and I'm having a hard time finding it anywhere on the ranch now."

Kevin Lunny, 2009

In May of 2009, Justin Meissner of the NRCS in Roundup, Montana worked with a rancher to teach his cattle to eat dalmatian toadflax. He invited two skeptical ranchers to watch on the day the trainees were turned into their trial pasture to begin grazing the weed. Justin says they told him:



"We thought you were crazy for considering this. But after seeing this we'd like to try it on our places."

Justin says, "We just can't spray this stuff, there's too much of it. I was optimistic, but this blew my expectations away."

When our “War On Weeds” isn’t working, can we give peace a chance?

Grazing can be a useful tool for reducing the amount of money you have to spend managing your vegetation, and may even give you a chance to reevaluate whether you’re really interested in carrying on a war that man hasn’t won for generations. Maybe once we see it’s possible for cattle to fatten and prosper on a diet high in forbs, and we’ve turned weeds into forage, we can consider grazing for biodiversity instead of grass.

What we’re talking about here is two changes in our thinking habits. First, we are thinking differently about what cows eat. It’s not just grass anymore. Second, instead of thinking of our cows as a product we work for, we’re going to think of our cows as a tool that can work for us, and in the process also become a product. Let’s use our cows to turn weeds into forage. Let’s make lemonade out of our lemons!

It is the food which you furnish to your mind that determines the whole character of your life.

Emmett Fox

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- ¹ Pimentel David, Lori Lach, Rodolfo Zuniga, and Doug Morrison. 2000. "Environmental and Economic Costs of Nonindigenous Species in the U.S." *Bioscience* 50, no. 1. p. 53-65.
- ² Rinella, M.J., B.D. Maxwell, P.K. Fay, T. Weaver and R.L. Sheley. 2009. Control effort exacerbates invasive-species problem. *Ecological Applications*. 19(1), 2009, pp. 155-162.
- ³ Fuhlendorf, S.D., D.M. Engle, C.M. O'Meilia, J.R. Weir, D.C. Cummings. 2009. Does herbicide weed control increase livestock production on non-equilibrium rangeland? *Agriculture, Ecosystems and Environment*. Volume 132: Issues 1-2, July 2009.
- ⁴ Voth, K.S. 2009. Demonstrating how trained, weed-eating cattle train herd mates as a tool to enhance weed management. GLCI Final Report. Available at: <http://www.livestockforlandscapes.com/GLCI.htm>
- ⁵ Cave, H.W., W.He. Riddell, J.S. Hughes. 1935. The digestibility and feeding value of russian thistle hay. Kansas Agricultural Experiment Station, Manhattan. Contribution No. 103, Department of Dairy Husbandry, and No. 194, Department of Chemistry.
- ⁶ Pers. comm. Richard Beard, extension agent, Utah State University.
- ⁷ Beck, G.K., LR Rittenhouse. 1998. The influence of cattle grazing on the population dynamics of diffuse knapweed. Boulder County Parks and Open Space Final Report. Available at: http://ci.boulder.co.us/files/openspace/pdf_gis/IndependentResearchReports/4140_Beck_George_Influence.pdf

Frequently Asked Questions



*The power to question is the basis
of all human progress.*

Indira Ghandi

*One of my Boulder County trainees
checking to see what I might have for her.
Photo by Rita Gordon*

How do you teach a cow?

1. Make sure your target weed is safe to eat.
2. Choose a manageable number of young, healthy females to teach.
3. Get your trainees used to trying new things by giving them a different, nutritious, unfamiliar food morning and afternoon for 4 days. On the fifth day skip the morning feeding and then feed weeds in the afternoon.

How long does it take to teach a cow?

In general, my training process it can take as little as 5 days to get a cow to try a new weed and after 7 days she will eat it plain. I've run into a few cows and a few weeds that have challenged me, but the process has never taken longer than 10 days total.

Cows need to practice in trial pastures to learn how to bite off different kinds of weeds. It seems that thinner weeds, like spotted knapweed or diffuse knapweed are easier for them to learn how to eat. They usually graze them successfully the first day in pasture.

Bushier weeds or plants with spines, like thistles, take a bit longer. Trainees begin by biting off stem ends and larger leaves at the bottom. Over time, they can get good at eating the entire plant.

Don't the spines and prickles on the plant hurt the cow?

Based on my observations of cows grazing in pasture, it seems that their noses, tongues and bodies are not as sensitive as ours to these kinds of things, or they are better protected than ours. Cows seem to not be bothered by the spines and prickles when they put their heads down into a patch of weeds to get at the grass, though I would have avoided the same patch because I could feel the spines through my heavy jeans. They also seem very relaxed when biting off and chewing a spiny stem.

We have checked the cows' bodies and mouths and have found no sores or cuts. Trainees have had no illnesses or health problems associated with eating spines or prickles.



*Cow eating cactus in Oro Valley, AZ
Photo by Jerry Rickard*

Why don't you just use goats?

Using cows instead of goats is good because:

- Unlike goats, cows are not escape artists, so they require less fencing and less human attention. This makes cows less expensive to manage.
- Cows can eat almost anything a goat can eat.
- There is a stronger market for beef than for goat meat so more people raise them. Though the number of people eating goat meat in the U.S. is increasing the marketing and distribution structures are not as developed.
- It's easier to train a cow to eat a weed than it is to get a rancher to convert to raising goats.

Can I just spray my fields with molasses?

Before you turn your fields into a sticky mess spraying molasses on them to get the cows to eat the weeds, consider this. Our experiment called "Is Molasses the Silver Bullet?" found that cows who did not have the four days of training to get them over their fear of trying new things ate very few molasses-sprayed weeds. In fact the control group ate only 2 oz. of distaff sprayed with molasses, while trained cows ate 81 oz.

I don't recommend spraying molasses. In fact, I have begun doing the training without molasses because it doesn't seem to be necessary. Cows have learned to eat weeds just as well without using molasses.

If the plants have toxins, won't the cows be poisoned?

It's highly unlikely that a cow will be poisoned. All plants have toxins, but very few have such high levels of toxins that they are poisonous.

Since animals have no food safety labels, they use their internal feedback mechanisms to decide how much of a food to eat. They start by eating small amounts of something new and depending on what they experience they increase or decrease the amount they eat.

You can poison a cow by starving it on to plants, or putting it in a field where it has nothing but one plant to eat. But if you let the animals slowly increase and decrease what it eats and mix a variety of plants, your animals will be safe.

If I train my cows to eat weeds are they more likely to eat poisonous plants?

Cows that have been introduced to one new weed often become more open-minded about what constitutes forage, so they do try other plants that they've never eaten before. That means that it is possible that they will try plants that are not as safe for them to eat. Fortunately, the feedback mechanism described in the question above is working in our favor. No matter what new plant our trainees try, they will try it slowly first, experience the feedback, and their bodies will tell them whether or not to continue eating that plant.

The dose of the toxin is very important and if animals have a great deal of variety to choose from, it is less likely that they will eat a "poisonous" plant in amounts large enough to cause them harm. That said, there are some plants for which I would change my grazing management. I would try not to focus my trainees on grazing areas high in larkspur in the middle of summer. I would also try to avoid areas high in locoweed. Locoweed toxins do not produce nausea in animals, so it is difficult for their bodies' feedback mechanisms to function properly.

All substances are poisonous, there is none that is not a poison; the right dose differentiates a poison from a remedy.

- Philippus Aureolus Paracelsus

My experience with "open-minded" cows indicates that they do eat some things that I would have thought harmful to them. For example, in 2009 Boulder County trainees had a huge variety of weeds in pasture and they actually chose to eat Plains Milkweed, something that we would ordinarily be a little concerned about. However, the large variety of forages in their diet meant that they were eating very little of the milkweed overall. Thus, they never ate enough to get a harmful dose.

Can dairy cows eat weeds?

The same principles apply to all creatures, including dairy cows, so dairy cows can learn to eat weeds. One factor to pay attention to when working with dairy cows is the possible change in flavor caused by grazing different kinds of forages. As you know, cows that have grazed onions can give onion flavored milk. This is because some toxins are lipophilic (attaching to fat) and milk has a lot of fat.

If dairy cows are grazing a wide variety of forages in pasture, it is likely that the effect of flavorful toxins will be diluted and will have little if any effect on the milk's flavor. If your milk mixes with milk from other dairies, flavors will be further diluted. Just the same though, you might want to experiment and see how you like the results.

Can cows eradicate weeds?

There are several different answers to this question depending on how you manage your animals and on how you define a weed. Choose from the following:

**Maybe we should also ask
“What weed have we EVER eradicated?”**

- If you continue to graze in your usual manner, cows may not be able to do any more than simply prevent further spread of the plant.
- If you modify how and when you graze, and if you repeatedly graze the weed during the same grazing season, you may be able to eradicate it over time.
- The need for eradication depends on your management goals. Questions you might ask yourself include:
 - If a “weed” becomes a forage, how would I choose to manage it? Would I want to take advantage of it as a forage during seasons of drought when it is the only green, growing thing?
 - How does this plant fit within my other goals for my property such as water quality and wildlife habitat protection, productivity and sustainability?

Researchers have done many studies on how grazing can impact weeds and have noted success in reducing populations using this tool. One of the ranchers I worked with in Marin County, California has also had success. Some of his cows learned to eat Italian thistle starting in 2006. Today the whole herd has learned to eat the weed and he says he has very little of it left on his ranch.

What are the long-term effects of weed-eating on the cows?

To date we are not aware of any negative effects on the animals who have eaten the target weeds. Animals have gained weight at or above expected rates, they have bred back, and have had healthy calves. Since all plants contain toxins, and since animals have evolved to deal with a wide variety of toxins, I lean towards it being unlikely that any long-term effects will be found. There are plants that have toxins that could cause long-term effects on livestock. I do not recommend including those kinds of plants in a training program.

Well it may work some places, but why do you think it will work at my place?

The steps I use to train animals are based on universal principles about how animals choose what to eat, and about information based on plants and the chemicals they contain. We know that your animals will learn in the same way that animals learn everywhere and we know that if you have a nutritious plant, it can become forage for your animals.

In the last five years I have completed 11 different projects in 7 different vegetation types. In all cases, the process worked smoothly. The only changes I made were based on herd and individual cow differences. The type of vegetation I was working in made no difference to the training process. That's also how I know it will work wherever you live.

Is Kathy a Kook?

A fellow called me one day because he wanted to know more about my work and the training process. I talked to him for an hour. He seemed to like what he heard, and then he asked me:

"But what about the Kook factor? Do people think you're a Kook?"

I had to laugh, because it's true. Some people do think I'm a kook. On the other hand, who's kookier? The person who keeps spraying weeds year after year without making progress, or the person who decides to think outside the box and create a new tool that turns weeds into something useful?



Thanks for reading these free chapters!

To purchase the book visit:

<http://www.livestockforlandscapes.com/cowseatweedsbook.htm>

If you have questions, contact Kathy Voth:

kvoth@livestockforlandscapes.com.

I look forward to hearing about your success teaching cows to eat weeds!