k-state extension AGRONOMY e-Updates

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1. Using satellite imagery to map the spread of eastern redcedar in Kansas

Redcedar is rapidly increasing in its coverage of grasslands in Kansas, especially in the eastern half of Kansas. The increased coverage of this tree is linked strongly to the lack of fire, which kills the trees when they are younger. Eastern redcedar increased in acreage in Kansas by 210% from 1981 to 1994. In doing so, it gradually takes away productive grazinglands and reduces the amount of income generated by the livestock industry in the state. This industry is vital to the economic wellbeing of our state because, according to USDA's Agricultural Statistics, it produces approximately $6.4 billion of sales annually.

Eastern redcedar in rangeland near Hays. Photo by Kevin Price, K-State Research and Extension.

Still, it is hard to visually notice the spread of eastern redcedar from month-to-month or year-to-year. As a result, it is not the kind of problem that generates immediate alarm among most landowners.

The best way to demonstrate to landowners and others the extent of the spread of eastern redcedar, and the necessity of controlling its spread, is to compare aerial imagery of a given area from many years ago to imagery of the same area today. Sounds simple enough, but in reality there are several issues that have to be overcome before that can be done.

For one thing, what kind of imagery should be used? A simple aerial photograph can be examined, and this is the most common type of imagery available from previous decades. But it is difficult and tedious, if not impossible, to separate out eastern redcedar from other trees and vegetation in a normal photograph using the visible spectrum.

In the Ecology & Agriculture Spatial Analysis Lab at K-State, we have been able to overcome that by analyzing near infrared (NIR) images instead, taken at the correct time of year. During the late fall and winter, there is a significant difference in infrared reflectance between all the deciduous trees and shrubs that have dropped their leaves and eastern redcedar, which is evergreen and therefore is still photosynthetically active later in the fall and resumes photosynthetic activity earlier in the spring than other trees and grasses.

Because of this difference, we can use a technique called “linear spectral unmixing analysis.” We have found this technique can be used with a high degree of accuracy to determine the percent cover of redcedar. This method allows us to estimate the amount of redcedar within each one-fifth acre pixel. This is truly amazing when one realizes that the satellite is orbiting about 500 miles in space, or about the distance from Kansas City to Denver, Colorado. We check the accuracy of our model by using highly detailed color infrared photography that we can acquire using our multispectral digital imaging camera and analyze it using a specialized object-based image analysis software called e-Cognition. We also checked the model during its development by going to the field to take actual measurements on the ground, and comparing the results of the model analysis to what we found on the ground.

Once we knew we could accurately map the geographic distribution of redcedar, we then used the model we developed to go back to 1985 and come forward, mapping the redcedar coverage at approximately 5-year intervals (depending on availability of Landsat Thematic Mapper satellite imagery). This allowed us to visualize the changing distribution of redcedar and determine where it was most rapidly expanding its distribution. We have been able to reconstruct a visual record, which we can quantify, of the distribution and spread of eastern redcedar over certain areas of land.

Why should we be concerned about mapping eastern redcedar at all? Several reasons.

* An increase in redcedar: decreases the productivity of grasslands and reduce the state’s ability to produce livestock; decreases plant and animal biological diversity; changes the way water infiltrates into and runs over the land; changes the way nutrients are cycled within the ecosystem; and many other factors.

* To understand which lands in Kansas are being impacted by this tree species, we need to be able to determine where it is increasing in coverage and how rapidly the increase is taking place.

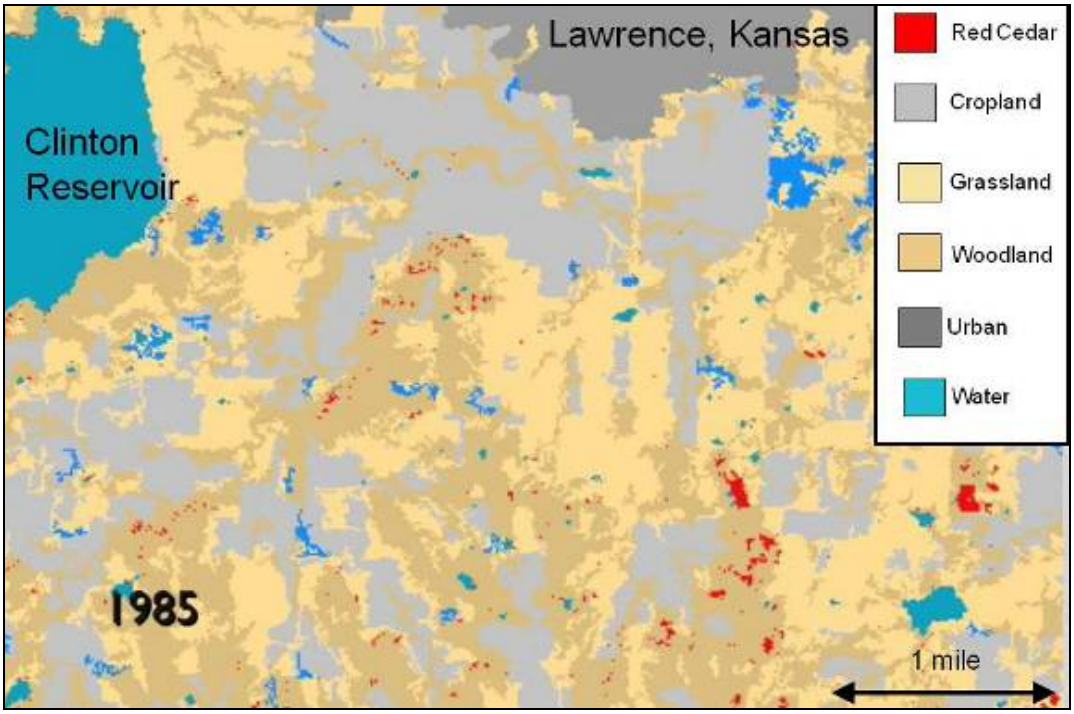
* By linking current distributions of the tree to areas with similar spectral characteristics, soil types, and land use practices, we can better predict which lands are most likely to be invaded next.

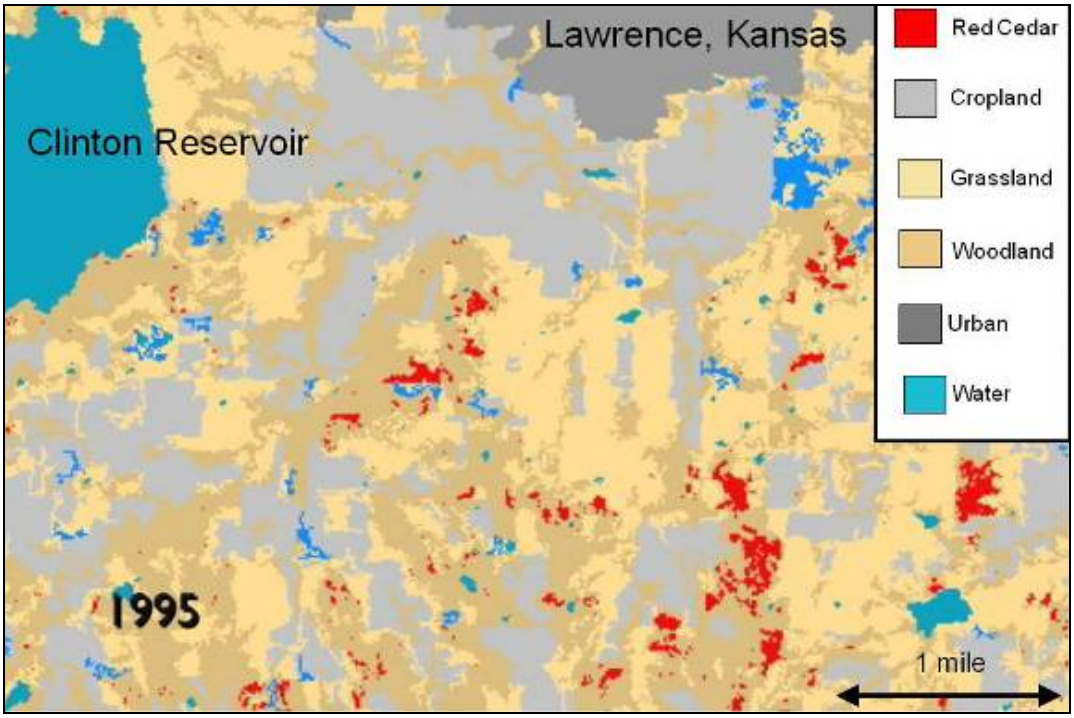
* To refine carbon budget models to determine whether changes in the distribution of eastern redcedar act as a source or a sink for carbon dioxide from the atmosphere.

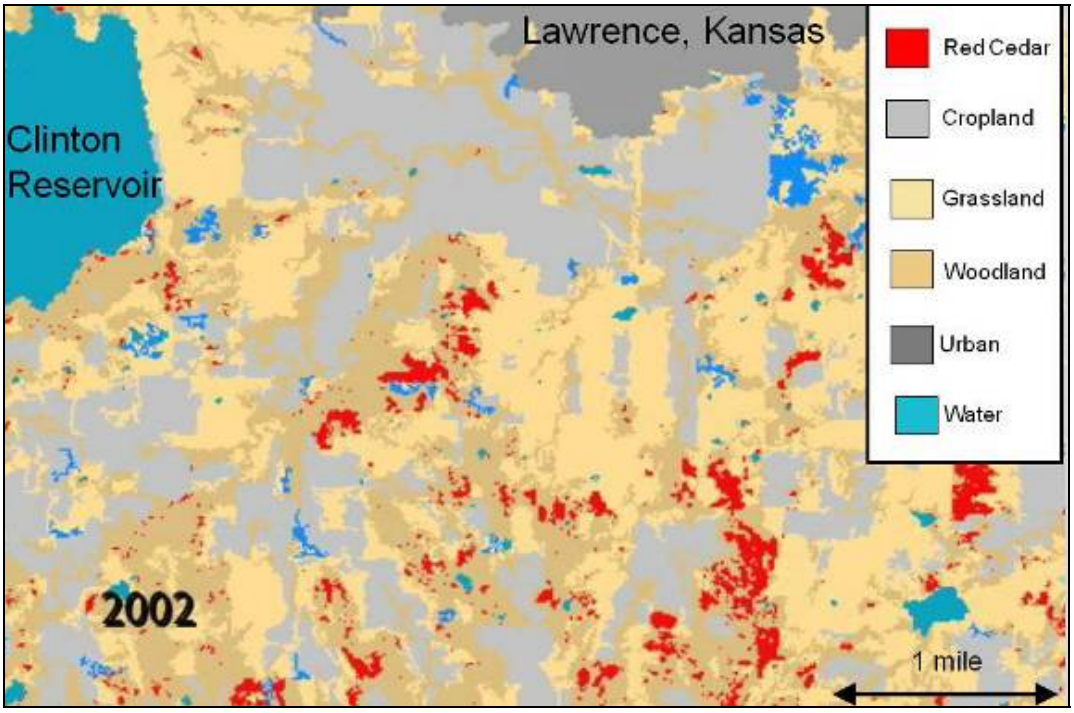
* To help government agencies develop good management plans for controlling eastern redcedar.

Eastern redcedar is not all bad. It can provide good wildlife and livestock cover and nesting habitat for some birds. It is very useful as a windbreak to protect croplands from soil erosion. When used for windbreaks, we can help control its spread by selecting for the male redcedar trees since the male trees do not produce seed. But in eastern Kansas, the uncontrolled spread of eastern redcedar can have implications for soil erosion, soil hydrology, and understory growth.

The following maps of an area in Douglas County demonstrate how we can now map the progression of coverage of eastern redcedar.







The three images above show the progression of eastern redcedar (area in red) in this tract of land in Douglas County from 1985, 1995, and 2002.

This project was funding by NASA and was a joint project between K-State and the University of Kansas.

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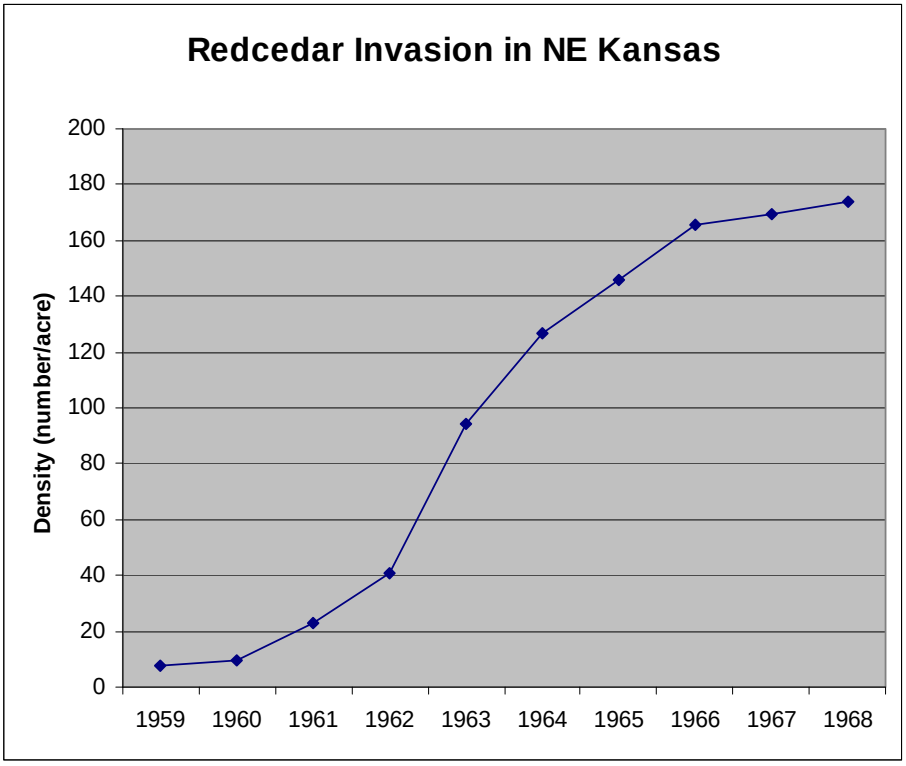
2. Eastern redcedar control on grazinglands

Eastern redcedar infests grazinglands throughout Kansas. It can be especially common on rangeland or pasture that has not been burned for several years. If left uncontrolled, eastern redcedar can completely take over grazinglands, intercepting rainfall and reducing forage production. The annual rate of redcedar invasion can be remarkable. See graph below, taken from an article by Owensby et al. 1973, which shows the increase in density at two locations – one in Riley County and one in Pottawatomie County.



Eastern redcedar is a non-sprouting plant. It does not re-sprout from belowground plant parts like hedge or honey locust. This simplifies the control measures, in some ways. There are three principal methods of controlling eastern redcedar. In order of preference, the methods are:

* Prescribed burning
* Mechanical control
* Chemical control

Prescribed burning

Fire can kill or damage eastern redcedar if there is enough fuel on the grazingland. A normal fire will control redcedars that are less than three to four feet tall. Redcedar normally grows about 6-12 inches a year, so as long as grazingland managers burn every 3 to 4 years, that should keep most or all of the redcedars under control. Fire may not kill the entire plant, but if at least two-thirds or three-fourths of the needles are scorched, the plants will eventually die. If only half or less of the needles are scorched, the plants will probably survive. The most difficult situations are when there is a thick stand of redcedar, or many of the plants are more than four feet tall.

Under these conditions, fire will probably not be acceptably effective. Late summer rest should be used in grazing management to allow accumulation of enough fine fuel to ignite trees when the prescribed burn occurs. Burning can take place just about any time, but February-March might be ideal as trees are dry and seem to ignite easily.

Mechanical control

Redcedars can be killed outright if they are clipped off near ground level, below the first green branch. Where clipping or mowing hasn't been effective, it's because the plants were not cut low enough. Even clipping three inches off the ground may not be low enough in some cases. Managers should try to get as close to ground level as possible. Clipping may be the only way of controlling eastern redcedar that is more than four feet tall. Clipping is sometimes easier to do if the plants have first been burned – even if the plants survived the fire. If the fire was reasonably hot, it will almost always sear off many of the lower branches, which makes it easier to get to when operating a clipper, mower, or chainsaw. Eastern redcedar that is clipped off at ground level will not regrow or re-sprout. Redcedar can be controlled by clipping or mowing at any time of the year.

Chemical control

If the stand of redcedar is too thick to get a good burn (or the manager simply doesn't want to do a prescribed burn) and the plants aren't too big, then chemical control is another alternative. One chemical for eastern redcedar control is picloram, which is contained in Tordon 22K and Surmount. Tordon 22K can be applied as a liquid directly to the soil right at the base of the plant. The label calls for three to four milliliters (cc's), undiluted, per three feet of plant height. This should be applied in April/May or September/October, just prior to a rain if possible. It can also be applied as a foliar spray, in a one percent solution. Surmount is applied as a foliar spray to trees no more than three feet tall, at the rate of three to six pints per acre, in late spring or early summer. Tordon 22K and Surmount are restricted use pesticides.

Other chemical options for eastern redcedar include hexazinone and metsulfuron methyl. Velpar L is a liquid formulation of hexazinone, meant to be applied to the soil at the base of the tree at the rate of two to four milliliters per inch of stem diameter at breast height. Pronone Power Pellets are a dry formulation, applied on the soil at the base of the tree at the rate of one to two pellets per inch of stem diameter. Metsulfuron methyl, e.g. Escort XP, can be applied at the rate of 1-2 oz product/100 gal water as a high-volume treatment for redcedar control.

Summary

Prescribed burning is the method of choice for most instances where eastern redcedar has invaded. Fire is a very effective tool for controlling smaller trees. Larger trees that may survive burning can be mechanically removed. Herbicides are available for treating redcedar, but usually require good spray coverage and will be more effective on smaller trees.

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3. Timing of soil nitrate sampling for row crops

Levels of residual nitrate in the soil profile can often be high, particularly in drier areas of western Kansas. However, with some good yields obtained the last growing season, there may be great uncertainty regarding current levels of residual nitrate this year. Current conditions of profile soil moisture are optimum in many regions of the Great Plains and producers want to make sure nutrient levels are optimum.

A profile nitrate soil sample is an excellent tool to estimate actual levels of residual soil nitrate, and to help adjust N fertilizer rates as needed. When taking samples for nitrate-N analysis, late winter or early spring is a good time to sample. Nitrate levels will fluctuate somewhat through the year, depending on soil temperatures and soil mineralization rates. For row crops, it's best to take the sample when the soil is still cool, before it warms up too much in the spring. This will give producers a good reading on how much nitrogen remains from the previous crop, before mineralization begins to increase nitrate levels as the soil temperature warms to 55 degrees or more.

Having a nitrate-N test analyzed at K-State's Soil Test Lab costs less than $5 per sample. How many samples are needed? That depends on the size of the field and how uniform it is. On a uniform quarter section, producers should take at least one good composite sample, made up of a minimum of 10-15 cores/subsample collected at random from the field. Soil samples for profile N analysis should be dried soon after collection or sent for analysis within 24 hours, to minimize mineralization and the release of additional N from organic matter, and nitrification of ammonium.

The amount of nitrate-N in the soil is not just a function of fertilizer N carryover. The soil also releases a certain amount of N during the summer through the mineralization of soil organic matter and crop residue. Significant amounts of N for plant growth are provided each year through these processes. Environmental conditions play a big role in how much N is mineralized each year. The amount of N available to crops within a field may vary as much as 50 percent or more from year to year, depending on differences in temperature and precipitation.

Because the amount of nitrate-N supplied by the soil is a function of both fertilizer-N carryover and mineralization, producers really need to have their soils tested for both organic matter levels and profile-N. The K-State N recommendation equation includes both organic matter levels and a profile test for nitrate-N as important factors, along with yield potential, cropping history, tillage practices, and other factors.

Regardless of the sampling objectives or requirements, there are some sampling practices that should be followed:

* A consistent sampling depth for all cores should be used. K-State recommendations call for a sampling depth of two feet for the mobile nutrients – nitrogen, sulfur, and chloride.

* When sampling a specific area, a zigzag pattern across the field is better than following planting/tillage pattern to minimize any past non-uniform fertilizer application/tillage effects.

* Unusual spots obvious by plant growth or visual soil color/texture differences should be avoided. If information on these unusual areas is wanted, then a separate composite sample should be taken from these spots.

For additional information on sampling and sample handling procedures, producers can contact their local extension office or the K-State Soil Testing Lab. Soil testing for nitrate-N has much to offer if done properly, but it all starts with the proper soil sample collection procedure – one that meets your objectives.

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4. Topdress nitrogen decisions for very late-planted wheat

Wet weather last fall kept producers out of the fields in several regions of Kansas. Timely planting, as well as proper nitrogen (N) fertilization, were not always possible in many cases. On those very late-planted fields, there will be a range of plant conditions. Some of the wheat may not have emerged yet, some may have just one or two leaves, and most will have little or no tillers yet.

Cold temperatures this winter have burned back the topgrowth in many cases. When considering topdressing N on these fields, producers have to keep in mind the potential for foliar nitrogen burn, and the effect that the combination of foliar burn and stress from cold winter temperatures could have on poorly developed wheat. Under these conditions, appropriate application methods, rates, and nitrogen product can be particularly important.

Producers must keep in mind the yield potential of this wheat. If the wheat was planted a week or so beyond the optimal range of dates and emerged in the fall, its yield potential may be about 10-15 percent less than wheat planted at the optimal time. If the wheat still has not emerged, its yield potential is probably only about 40-60 percent of normal. The ultimate yield potential of wheat depends greatly on moisture and environmental conditions in May. But the main thing to remember right now is that small, late-planted wheat could still have good yield potential and will need sufficient N to realize that potential.

If little or no N was applied in the fall, and the wheat has the potential for 40-50 bushel yields, then producers most recommendations would call for anywhere from 40-60 lbs of N to be applied this spring, depending on how much nitrate-N was in the soil at planting time, the organic matter level of the soil, and other factors. Can this much N be topdressed onto very small wheat without burning it? And if it is burned by the topdress N, will it survive?

It’s possible that the topdress N application will burn the wheat. The risk of damage depends in part on whether and how often the wheat has been burned back by cold weather. All things considered, it is probably a worthwhile risk to apply as much N as needed for optimal yields. There are some things producers can do to minimize the risk of burning the wheat while still applying sufficient N in the topdressing.

Application method. Most topdressing is usually broadcast applied. However, when there is concern about foliar burn, producers can get some benefit from applying the N in a dribble band on 15- to 18-inch centers. In high-residue situations, this can also help to reduce N tie-up, especially where liquid UAN is used.

Source. The typical sources of N used for topdressing wheat are UAN solution and dry urea. Numerous trials by K-State over the years have shown that both are equally effective. In no-till situations, there may be some slight advantage to applying dry urea since it falls to the soil surface and may be less affected by immobilization than broadcast liquid UAN, which tends to get tied up on surface residues. Dribble UAN applications would avoid much of this tie-up on surface crop residues as well. Dribble application of UAN or spreading dry urea would also reduce the amount of physical contact with the plants compared to broadcasting UAN, decreasing the likelihood of foliar burn. Producers often tank-mix UAN with a herbicide and broadcast it. Keep in mind that this application method would significantly increase the risk of foliar burn, and should be avoided for very late-planted, poorly developed wheat.

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