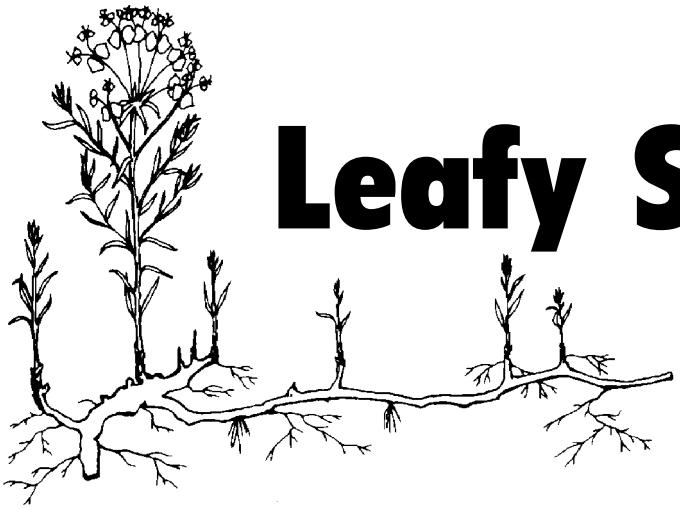

Leafy Spurge *News*

Agricultural Experiment Station
NDSU Extension Service
North Dakota State University, Fargo, ND 58105

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From the Editor's Desk

We have had only two issues this year, the main reason being lack of input from the field. I hope that things will pick up in 2003!

There are some interesting items in this issue, including two letters to the editor. Jill Miller from TEAM Leafy Spurge, in Sydney Montana, has provided some very interesting information that will be of benefit to many of you and it is free. You can't beat a bargain like that. There is a good summary of the leafy spurge situation in Canada by Bill Houston. I hope to get more articles from our Canadian friends as we can all benefit by sharing information. There is no Leafy Spurge Honoree in this issue, but we will have one in the May 2003 issue.

Once again I ask for your support for I need articles and items that I can put in future issues. I report the news and information, I cannot make it, so please send them to me via e-mail, regular mail, floppies—makes no difference as long as **YOU** send them!

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Two Hundred Years' War?

The battle for control of ecological niches continues on North American rangeland between exotic and native species. The invaders are numerous but one of the most firmly rooted non-native is leafy spurge *(Euphorbia esula).* The war was initiated unintentionally when leafy spurge seed landed at Massachusetts in 1827 presumably in the ballast of a ship. Leafy spurge was first identified in Canada in 1889. The weed has grown to be a large problem, economically and ecologically. For example, it costs Manitoba $19 million annually in direct and secondary impacts according to the Manitoba Leafy Spurge Stakeholders Group. Leafy spurge is an ecological concern because it replaces native plants and their associated species, thus reducing biodiversity.

PFRA Background

The Prairie Farm Rehabilitation Administration (PFRA), a branch of Agriculture and Agri-Food Canada, are one of the groups battling this yellow scourge. PFRA manages 2.2 million acres in 87 Community Pastures across western Canada. Over 80% of the pasture area is dominated by native vegetation and the remainder has been seeded to introduced forages. The objectives of the PFRA Community Pasture Program are to conserve this natural resource and to provide grazing for local farmers and ranchers. Leafy spurge is present on 16 of those pastures and is a threat to the Pasture Program by reducing ecological diversity and the carrying capacity for cattle. PFRA has used a variety of methods to try and control leafy spurge. Prior to 1990, herbicides were the main weapon used. In the early 1990's, PFRA recognized

War continued on page 2

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War continued from page 1

that it was losing the battle and decided to try other approaches.

Sheep

Since sheep can graze leafy spurge without any negative impacts it was one of the approaches used. PFRA contracted the Saskatchewan Sheep Development Board to provide biological control of leafy spurge at the Elbow Pasture in central Saskatchewan. Elbow pasture has the most leafy spurge of any PFRA pasture, an estimated 3000 acres. The soil texture at Elbow and the surrounding area is very sandy, unfortunately this seems to be one of spurge's favorite niches. On average, there has been about 1200 sheep grazing at Elbow for 115 days from mid-May until the beginning of September. A "two-pass" system has been used because of the early flowering nature of leafy spurge. In central Saskatchewan, the first appearance of leafy spurge flowers ranges from early to late May. Using the "two-pass" system, sheep are herded by a shepherd so that they graze a leafy spurge plant twice; during the first pass the flower bud is nipped off while the second pass results in leaves being stripped off.

Control with Sheep

The results were quite positive as sheep grazing has reduced leafy spurge density at Elbow pasture.
The density of leafy spurge in the first few years of the project, 1991-93, was 80 to 100 stems per m^2. In 1999 and 2000 the density was 20 to 50 stems per m^2, a reduction of more than 50%.

Stocking Rates

Stocking rates for cattle in the fields where sheep have been used as bio-control agents were 13% higher after sheep grazing was implemented (average stocking rate for cattle from 1994 to 2000) than before (average stocking rate from 1984 to 1990). The stocking rate increase is 32%, if sheep are considered in the stocking rates for the same periods.

Beetles

Leafy spurge beetles were also enlisted in this battle. These beetles were originally collected from Eastern Europe, where leafy spurge is native, and are one of the natural enemies of leafy spurge. Thirty-four releases of beetles *(Apthona nigriscutis* and *A. cyparissiae)* were made on ten PFRA pastures in 1994. In 1997 and 1998, beetles that perform better on moister sites *(A. lacertosa* and *A. czwallinae)* were released on PFRA pastures. These beetles were provided complimentary by the United States Department of Agriculture.

Control with Beetles

The cover of leafy spurge at Elbow has been reduced from 50-70% in 1994-95 on the sites where beetles were released in 1994 to less than 10% cover in 2000.

Integrated approach

An integrated control project was initiated by PFRA in 1997 with sheep grazing in the spring, leafy spurge beetles emerging in the summer, and a herbicide (Plateau) applied in September. Results showed that the integrated control treatment did not provide more effective control than either the sheep or beetle treatments, which contradicts some of the latest research suggesting that an integrated approach is the most effective method to control leafy spurge. Although a confounding factor may be that sheep grazing was initiated in 1997 on the integrated site whereas it was initiated in 1991 on the sites where sheep grazing was applied alone. An interesting observation, in the integrated treatment there was an incredible flush of seedlings 19-22 months after the herbicide application. This phenomenon should be explored further as it might prove to be the 'Achilles heel' for spurge. Stimulating the leafy spurge seed bank in this manner and then controlling it in the more vulnerable seedling stage may be an effective control method.

Future

Land managers need to ensure they are on the lookout for new infestations of leafy spurge, as prevention is the best cure. Where leafy spurge has already gained a foothold, I think we need more — more sheep, more beetles, and more attempts to integrate appropriate control measures, including the use of fire. I do believe that an integrated approach is needed: integrating tools and groups. We need more cooperative ventures such as Team Leafy Spurge and the Manitoba Leafy Spurge Stakeholders Group to win this war!

Bill Houston
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Letters To The Editor

Dear Leafy Spurge News:

Coping with Leafy Spurge – A New Experience

We are transplants from Minnesota and know how devastating noxious weeds can be (Purple Loosestrife and Eurasian Milfoil). We just bought a home on 21 acres, in Silver Bow County, MT, that spent most of the last two years in the foreclosure process. When we bought the property it was still covered in snow and we had no idea what we were getting for sure. Well we took possession and the snow melted and now we have spurge and knapweed. This is a new process for me and I am anxious to do what I can do and learn as much as I can learn. I talked to the local weed coordinator, but he was "too busy" right now, so am trying to learn and do as much as I can.

The problem currently on our property is limited to a swale and is obviously spreading out (I am guessing it is covers two acres or less presently). There are some additional very localized small areas. The weed coordinator told me because I did not have an applicator's license that there was little I could do until fall, when I could use plateau. Every day I look out there and I shutter because I know it is spreading and I need help. I hope this is what you currently need to know. I will keep you posted as I learn and do more.

Thanks,

Diana Ericson
PO Box 238
Wise River, MT 59762

Dear Leafy Spurge News:

Better Control of Spurge in Stutsman County

During our spring sprayer schools, Bill Ragan (Stutsman County Weed Officer) told me an interesting story. He usually hires about 8 people for his spray crews each summer, but this year he only has 3 or 4 (not sure). When I asked him about it he said he doesn't need as many any more because his chemical use is down by about 1/3 plus he does a lot of fall spraying with Plateau. took it to mean a lot of leafy spurge is not there anymore.

This sounds like a success story to me for the newsletter and you may want to contact Bill for the details.
He can be reached at:

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TEAM Leafy Spurge Produces Video Documentary

TEAM Leafy Spurge recently produced its own documentary entitled *"Purging Spurge: Corralling an Ecological Bandit"* in partnership with Prairie Public Broadcasting, Inc., which aired this past summer. The 30-minute documentary focuses on grassland health and the impact of invasive weeds like leafy spurge on the ecosystem. Its aim was, and is, to increase public awareness and to bring all segments of society on board to help control invasive weeds. In addition, TEAM Leafy Spurge encourages the use of integrated pest management techniques as economical and environmentally friendly options for controlling weeds. After debuting on North Dakota's Prairie Public Television on Tuesday, June 25, 2002, videotapes of the documentary are now being distributed to weed and pest workers across the Western United States.

In announcing the videotape distribution, TEAM Leafy Spurge director, Gerry Anderson, noted, "This is a great informational tool for everyone to learn about the need for weed control in the rural environment. We encourage those receiving this tape to share it in their community as it is ideal for use in the classroom, libraries and at community events."

TEAM Leafy Spurge's goal is to research, develop and demonstrate ecologically based Integrated Pest Management strategies that can be used to achieve effective, affordable and sustainable leafy spurge control, and to provide a variety of educational resources on that same topic.

Video continued on page 4

TEAM Leafy Spurge Introduces Grazing CD

TEAM Leafy Spurge (TLS) announces its newest release, the *Multi-species Grazing and Leafy Spurge* informational resource CD. Using sheep as a management tool is a proven management option for controlling leafy spurge and this resource includes the "how-to" information every rancher needs to include multi-species grazing as a component in their weed management program.

Second in TLS's integrated pest management resource series pairing "how-to" manuals and informational CDs, the *Multi-species Grazing and Leafy Spurge* CD includes an electronic version of its companion manual, a photo gallery, a narrated PowerPoint presentation, an extended bibliography, TEAM Leafy Spurge posters, publications and other resources.

This most recent CD also incorporates thirteen in-depth reports from North Dakota State University's Department of Agricultural Economics. TEAM Leafy Spurge — a U.S. Department of Agriculture, Agricultural Research Service area-wide integrated pest management program — commissioned many of these reports, which focus on leafy spurge, grazing management, economic concerns, and land manager perceptions.

Multi-species grazing can be used alone or integrated with other techniques for a more well-rounded, efficient control program. Gerry Anderson, TEAM Leafy Spurge's director, noted: "Multi-species grazing or sheep grazing must be considered as an option for leafy spurge control and this product aids the land manager in evaluating and planning a multi-species grazing control program. The multi-species grazing CD is as valuable in its own right as the *Biological Control of Leafy Spurge* CD." The latter was the first CD issued in the IPM series, with more than 42,000 distributed to date.

This latest CD is now available for distribution. Its partner manual was first published in June 2001, with ten thousand manuals distributed the first year. The third set in the IPM series will focus on herbicide control of leafy spurge. That how-to manual is now available.

The *Multi-species Grazing and Leafy Spurge* CD and other components of the integrated pest management series, along with additional TEAM Leafy Spurge informational products, are available by contacting USDA-ARS Northern Plains Agricultural Research Laboratory, 1500 North Central Ave., Sidney, MT 59270; phone 406/433-2020; fax 406/433-5038. Some products are also available on the Internet at www.team.ars.usda.gov and all can be ordered by emailing teamls@sidney.ars.usda.gov.

Funded by the USDA-ARS and managed cooperatively with the USDA-Animal and Plant Health Inspection Service, TEAM Leafy Spurge explores biologically based IPM strategies and stresses partnerships, teamwork and a cooperative approach to solving the leafy spurge problem. TEAM members include state and federal agencies, state Cooperative Extension Services, land grant universities, weed managers, county and other local entities, and private landowners and ranchers.

Jill Miller

Video continued from page 3

In addition to the video, other products available from TEAM Leafy Spurge are, *"Purge Spurge: Leafy Spurge Database 4.0"* and a series of how-to manuals and CD-ROMs on the integrated pest management of leafy spurge. The first manual/CD set, entitled *"Biological Control of Leafy Spurge,"* gives detailed information regarding the use of insects to control leafy spurge infestations. Second in the series, *"Multi-species Grazing and Leafy Spurge"* integrates grazing animals, such as sheep with cattle, to help reduce leafy spurge densities. Production on the third set in the series, *"Herbicide Control of Leafy Spurge"* is complete. Available now, the how-to manual on herbicides provides information on proper herbicide use, including calibration techniques for spray equipment, a general overview of the variety of herbicides available for use against leafy spurge, and how to use herbicides with other pest management strategies.

If you are interested in any of the materials listed above, please contact the USDA-ARS Northern Plains Agricultural Research Laboratory, 1500 North Central Avenue in Sidney, MT, or phone 406 433-2020. You may also email teamls@sidney.ars.usda.gov or visit TEAM Leafy Spurge's website at http://www.team.ars.usda.gov for many of these publications and further information on leafy spurge.

Funded by USDA-Agricultural Research Service and managed cooperatively with the USDA-Animal and Plant Health Inspection Service, TEAM Leafy Spurge stresses partnerships, teamwork and a cooperative approach to solving the leafy spurge problem. TEAM members include state and federal agencies, state Cooperative Extension Services, land grant universities, weed managers, county and other local entities, and private landowners and ranchers.

Jill Miller

TEAM Leafy Spurge Releases Newest IPM Manual: *Herbicide Control of Leafy Spurge*

TEAM Leafy Spurge has announced publication of its third "how-to" manual on leafy spurge management, entitled *Herbicide Control of Leafy Spurge.* The latest manual to be published in TEAM Leafy Spurge's integrated pest management series on leafy spurge, the 40-page *Herbicide Control of Leafy Spurge* can aid producers in evaluating and selecting a herbicide management plan tailored to their needs. The manual is easy to read and its small size is practical and convenient in the field.

The herbicide control manual covers the basics, including a leafy spurge summary, herbicide overviews, sprayer calibration, the economics of herbicide use, and useful integrated pest management strategies incorporating herbicides with other control tools. A unique feature of this manual is an informational chart listing common leafy spurge herbicides, their application rates, time of application, potential level of control and precautions for their use.

Herbicides continue to be a popular, but expensive, tool for controlling leafy spurge; consequently they are most frequently used to stamp out small patches and to restrict the spread of larger infestations. Herbicides have also been integrated successfully with other management techniques, including grazing and biological control. However, before using herbicides land managers must first determine which management option or combination of options is suitable economically and environmentally for tackling their leafy spurge infestation. This manual helps them make that determination.

Developed by TEAM Leafy Spurge, the manual was authored by leafy spurge herbicide expert, Dr. Rod Lym of North Dakota State University-Fargo and coauthored by Dr. Chad Prosser of Theodore Roosevelt National Park-Medora, ND; Celestine Duncan of Weed Management Services-Helena, MT; Dr. Dean Bangsund of North Dakota State University Department of Agricultural Economics-Fargo; and Dr. Gerry Anderson, Northern Plains Agricultural Research Laboratory, Sidney, MT.

"TEAM Leafy Spurge is eager to disseminate this herbicide information because of its importance to any land manager with leafy spurge infestations," said TLS's program director, Gerry Anderson. "It can aid the land manager in choosing an economical and an ecologically safe strategy for incorporating herbicides into their leafy spurge management plan."

Two earlier manuals in the IPM series, *Biological Control of Leafy Spurge* and *Multi-species Grazing and Leafy Spurge,* were matched with their own informational resource CD-ROMs. This manual will follow suit with its individual resource CD, *Herbicide Control of Leafy Spurge,* currently under development and scheduled to become available later this winter. That CD will feature an electronic version of its namesake manual, a photo gallery, a narrated PowerPoint presentation, and other TEAM Leafy Spurge publications.

The *Herbicide Control of Leafy Spurge* manual, along with other products of TEAM Leafy Spurge, are available by contacting Northern Plains Agricultural Research Laboratory, P.O. Box 463, Sidney, MT 59270; 406-433-2020; fax 406-433-5038. For faster service, you may also order through the TEAM Leafy Spurge website at www.team.ars.usda.gov or by email to teamls@sidney.ars.usda.gov.

TEAM Leafy Spurge is a six-year IPM research and demonstration project funded and led by the USDA-ARS in partnership with the USDA-Animal and Plant Health Inspection Service. Its goal is to provide landowners and land managers with proven IPM strategies for leafy spurge control

Jill Miller

Biological Control of Leafy Spurge on the Medora Ranger District of the Dakota Prairie Grasslands

The Medora Ranger District biological control program began in 1989 with cooperative agreement between the Forest Service (FS) and USDA/APHIS. This cooperative agreement was to establish and maintain a field biological insectary for the propagation of biological control agents to control leafy spurge. Three release sites were established using *Apthona nigriscutis* and *Apthona czwalinae* on the Medora Ranger District. One of three sites contained the *Apthona nigriscutis* and the other two sites contained the *Apthona czwalinae,* which originated in Canada.

In 1991 the Medora Ranger District entered into an agreement with the USDA/ARS in Sidney, MT to increase the number of releases of biological control agents; primarily *Apthona nigriscutis, Apthona flava, Apthona czwalinae,* and *Apthona lacertosa* species. Releases were made in a "Core" area of leafy spurge infestation (area of the heaviest infestation). This "Core" area was located primarily in the following watershed areas: Andrews Creek, Knutson Creek, Little Wannagan, and Wannagan Creek (West of the south of Theodore Roosevelt National Park). Insect numbers released per site, however, were small (200-500/site) and were slow to reach populations that would support collections. Much knowledge was gained by these efforts specifically, which species proliferated and showed signs of controlling leafy spurge.

By 1995 these initial release sites supported populations large enough to collect from and establish an additional forty-three new sites with the majority of the insects being *Apthona nigriscutis.* In 1996 collections of *Apthona czwalinae/lacertosa* mix were made from a Valley City, ND site in sufficient numbers to release thirty-seven sites within the "Core" area. Insect numbers per release site were significantly greater than previous release sites. Nineteen ninety six also included setting up field days for the Grazing Associations (Medora, Little Missouri, and Horse Creek), in which their members could collect biological control agents to redistribute on infestations within their grazing allotments (Private and Federal land) (Table 1). In 1996 and 1997 *Apthona nigriscutis* was the primary biological control agent collected and redistributed. After 1998 the primary biological control agent collected at field days shifted to *Apthona czwalinae/lacertosa.* By 1998 significant numbers were available for collection, redistribution, and to set up new insectaries outside the "Core" area.

From 1999 through 2002 *Apthona czwalinae* and *lacertosa* populations soared providing numbers to significantly increase the number of release sites into the thousands. Not only was the insect population growing, the control of leafy spurge was evident. Buffalo Gap Campground was just one of the areas where significant reductions were noticeable. Sixty-three acres of the 195 acre campground were infested with leafy spurge in 1992 and by 2001 leafy spurge was reduced to thirty-four acres, a reduction of 46% (Table 2). A visual inspection of the Buffalo Gap Campground in 2002 estimated the reduction to be between 85 and 95%. Similar results were being found on grazing allotments in the Medora Ranger District. In two grazing allotments in the "Core"

Table 1. Collection and bio-control release sites on the Medora Ranger District from 1994 through 2002.

	Field Day	Association Received*	Sites Released By FS
1994			90
1995			43
1996	1.1 million	0.63 million	44
1997	1.3 million	0.94 million	22
1998	1.2 million	0.73 million	52
1999	2.8 million	2.00 million	215
2000	7.7 million	1.36 million	1,027
2001	11.8 million	1.70 million	1,807
2002	4.0 million	N/A**	1,009
Total	29.9 million	7.36 million	4,309

*Number of Insects collected by Grazing Associations and released on federal and private ground.
**Open collection for Grazing Association members.

Table 2. Examples of the effect bio-control insects have had on the Medora Ranger District leafy spurge infestation from 1992 to 2002. Data was processed using GPS and GIS data.

	1992	2002	% Reduction
Buffalo Gap Campgrounds	63 ac	34 ac	46*
Allotment 169	585 ac	367 ac	37
Allotment 251	894 ac	274 ac	69

*Percent reduction of leafy spurge is greater (85 to 95%) than reported based on visual site inspections, and before & after pictures taken of leafy spurge infested sites.

area, leafy spurge infestations were initially mapped in 1992 and remapped on Federal Land in 2002, and showed a reduction in leafy spurge infestation of 37 and 69% on the two allotments (Table 2.).

A partnership agreement with the Rocky Mountain Elk Foundation and the conservation practice with the Medora Grazing Association provided additional funding to hire seasonal personnel in 2001 and 2002. This provided for a dedicated "Bug Crew" which significantly aided the establishment of large numbers of release sites.

The reduction of leafy spurge on the Medora Ranger District through the use of biological control agents has been very successful. It has been a group effort involving Federal, State, County agencies, and the members of the three grazing associations working together.

Dennis Hilliard, Dean Williams, Jack D. Dahl
Medora Ranger District
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Problem continued from back page

germination at times when it would be disadvantageous to the plant, such as in the early fall in the Northern Great Plains. The production of designer herbicides may seem unrealistic. However, in time and with necessary resources, it may be possible to exploit the vast and rapidly developing technologies used for producing designer cancer drugs to develop designer growth regulators for weeds like leafy spurge.

What we learn from leafy spurge should be applicable to other plants as well. Many weeds and crops appear to have similar genes and signals for controlling growth and dormancy. Data from the recently completed rice genome sequencing project revealed that approximately 80% of the genes in the model dicot plant *Arabidopsis thaliana* have recognizable counterparts in rice. Thus, treatments developed to control seed germination in leafy spurge, might be easily modified for controlling germination in other weeds like wild oat and Canada thistle. These treatments may also be easily modified to ensure even and complete germination of barley and bean seeds.

Unfortunately, controlling germination of seeds is only half the battle when it comes to controlling leafy spurge. Leafy spurge is equally capable of regrowth from the thousands of shoot buds located on its roots and crown. These buds are often too deep to be effected by burning or herbicide treatment. Thus, to fully control leafy spurge, we must also understand the biology of the root and crown buds of this tenacious weed. But that is another story....

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The Perpetual Problem: Dormancy in Leafy Spurge

Dormancy of seeds and vegetative buds is the primary reason leafy spurge reappears in places years after presumed eradication. A study by Bowes and Thomas from the Weed Investigation Section, Agriculture Canada in 1978 indicated that viable seeds remained in the soil for at least 8 years following successive treatments with picloram. Selleck and others studied seeds from leafy spurge in Saskatchewan and found that they could be kept viable for at least 13 years under non-germinating conditions. Although Wolters and others at the USDA Forest Service demonstrated that burning could kill 95% of the seeds on the ground and could greatly decrease the probability that a patch will reestablished itself from seed reserves, the potential number of seeds present make it likely that some will survive. It is these survivors that can bring a "dead patch" back to life.

Understanding how some seeds remain viable, and yet not germinate when many seeds from the same plant have long since sprouted, is a mystery worth pursuing. Recent studies by Foley at the USDA/ARS in Fargo, ND have determined the primary component regulating leafy spurge seed germination is the seed coat. He found that if the seed coat was removed, nearly all of the seeds would germinate at essentially the same time. Thus, we now know that differences in the seed coat controls dormancy of leafy spurge seeds. However, we still don't know what these differences are or how they are perceived by the embryo.

To help answer the question of how the seed coat controls germination, we have focused on identifying genes that act to regulate growth and development in leafy spurge. These genes are essential for seed germination, and are not "turned on" in dormant seeds until they get the signal that it is time to grow. We have cloned a number of these genes and are beginning to use them to identify the signals generated by the seed coat. Once the genes required for generating, sensing, and transmitting the dormancy regulating signals are identified, it should be possible to develop treatments that specifically interfere with the process. Such treatments may be designed to prevent germination all together, or to induce

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