



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-212

Proposal Title: Reducing Plastic Pollution with Biodegradable Erosion Control Products

Project Manager Information

Name: Riley Gordon

Organization: Agricultural Utilization Research Institute

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Email: rgordon@auri.org

Project Basic Information

Project Summary: Utilization of Industrial Hemp to create biodegradable alternatives to plastic-based erosion and sediment control products.

Funds Requested: \$227,000

Proposed Project Completion: 2024-06-30

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Erosion and sediment control are required on construction projects to protect surface waters from pollution and resulting eutrophication. The Minnesota Department of Transportation (MnDOT) installs enough erosion and sediment control products to protect 1,100 acres from erosion and prevent 125,000 tons of sediment from entering surface waters each year. These significant water quality benefits are tainted by the fact that many of these products are made of plastic, a pollutant of emerging concern. Since these products are intended for temporary use, MnDOT construction projects cause over 30 tons of plastic to be landfilled or remain on the landscape, inevitably degrading into micro-plastics. One of MnDOT's sustainability goals is to reduce the use of plastic by requiring biodegradable erosion and sediment controls. However, the state cannot specify products that do not exist and manufacturers cannot be expected to develop products that are not specified. Seed money is needed to demonstrate that biodegradable alternatives can be produced so that the state can start specifying them and manufacturers can start producing them. This project looks to provide a clear path to long-term public-private industry partnerships to ensure without additional grant dollars there are ongoing environmental benefits for decades to come.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

This proposal will establish a unique public-public-private partnership between AURI, MnDOT and regional private industry to develop methods to produce biodegradable erosion control products made from regionally grown feedstocks such as hemp. The project will receive technical support from the Minnesota Department of Agriculture and Minnesota Department of Natural Resources. Project partners will seek input from regional biomass growers (including tribal hemp producers), manufacturers, and installation contractors to guide the effort. The team will then develop methods of processing hemp fibers into biodegradable prototypes of erosion control blankets, hydraulic mulch, sediment control logs, and silt fence. These prototypes will be evaluated through laboratory and field testing. After demonstrating that biodegradable erosion control products are possible, MnDOT can phase in specifications to allow their use. The environmental benefits will be amplified in several ways. The use of these products will extend far beyond state construction projects because MnDOT specifications are also used by local government and private construction projects. Such widespread use will expand opportunities for local hemp production, which is more sustainable than other row crop production. Strong interest by other state DOT's, who face similar obstacles, indicates that what is developed in Minnesota will eventually become adopted nationwide.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

- Eliminating a significant source of microplastics in soil and water by replacing single use plastic materials with locally grown biodegradable products
- Proof of concept that biodegradable alternatives to plastic erosion and sediment control products can meet or exceed current specifications
- Development and sharing of methods for processing industrial hemp into functional erosion and sediment control products
- Expanded opportunities for hemp production, which offers significantly greater water quality, soil erosion and CO2 sequestration benefits than other crops
- Facilitation of partnerships with growers and manufacturers to encourage ongoing product development and further innovation which will support both the environment and economy

Activities and Milestones

Activity 1: Develop Methods of Processing Hemp Stalks into Prototype Erosion and Sediment control products

Activity Budget: \$123,075

Activity Description:

AURI will collaborate with manufacturers of erosion control blankets, hydraulic mulch (hydroseeding), sediment control logs and silt fence in order to identify the technical specifications of fibers and yarns necessary to meet state and manufacturer specifications. AURI will then network with textile/fabric experts and manufacturers in order to understand the steps and specifications necessary to achieve a hemp yarn that can be spun or woven into a prototype product. With key variables identified, AURI will source hemp stalks from Minnesota growers and/or tribes and conduct separation work at the Waseca lab and selected private partner sites. Stalks will be processed using AURI's new decorticator and the resulting fiber and hurd will be analyzed for cleanliness and quality. The research and purchase of a fiber cleaning device under this activity will be used to achieve fiber quality necessary for yarn spinning. AURI will then work with selected manufacturer partners in order to transform decorticated and cleaned hemp fibers and hurds into end-product prototypes. Product blends with other agricultural fibers will be explored throughout.

Activity Milestones:

Description	Completion Date
Identify Process for decorticating hemp fiber of necessary quality for use in Erosion Control Products	2022-03-31
Identify process for twisting yarns of sufficient quantity and quality to create woven materials	2022-06-30
Prototypes of Hydraulic Erosion Spray and Erosion Control Blanket	2022-12-31
Sediment Control Log and Silt Fence Prototypes	2023-06-30

Activity 2: Testing yarns, fabrics, and fill materials (loose and blanket materials) in laboratory and field demonstrations to evaluate against performance standards

Activity Budget: \$64,550

Activity Description:

MnDOT will coordinate testing of the prototype fabrics, erosion control and sediment control products which are produced through AURI's decortication and identified manufacturer partners. The products will be tested using standardized ASTM testing methods. MnDOT will coordinate and manage the field demonstrations of the prototypes compared to the current standard product, in a standardized setting.

Activity Milestones:

Description	Completion Date
ASTM standards lab testing of yarns, fabrics and fill materials to evaluate performance	2023-12-31
Field demonstrations of prototype products to evaluate installation, performance, service life, and bio-degradation characteristics	2024-03-31
Report of lab and field-testing results	2024-06-30

Activity 3: Collaboration with growers, manufacturers, and contractors to inform product and business development and disseminate findings to the public

Activity Budget: \$39,375

Activity Description:

AURI and MnDOT will work with product manufacturers, hemp growers and applicators to support the development and commercialization of these bio-based products. Through AURI and MnDOT driven networking and events, the findings will be shared and disseminated with various industry groups. Another dissemination effort will include the development of a one-page fact sheet which highlights the project and product specs developed. MDA will support the efforts of MnDOT and AURI to promote the use of hemp as an alternative to plastic materials in roadside restoration materials. MDA will also provide regular updates on project development and results to hemp licensees, hemp organizations, and agricultural commodity groups throughout Minnesota.

Activity Milestones:

Description	Completion Date
Field Day to promote project findings to public audience	2024-06-30
Development of 1-page fact sheet summarizing various product specifications, manufacturing process and key benefits	2024-06-30
Presentation of project findings at specific team selected events	2024-06-30
Ongoing manufacturer and grower collaboration and networking to inform product and business development	2024-06-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Riley Gordon	AURI	Riley will serve as the lead Principal Investigator. He will be the primary contact for the project. Riley will oversee all technical project tasks including decortication of fiber to meet specs, prototype development, lab and field testing as well as the presentation and dissemination of results through multiple channels.	Yes
Harold Stanislawski	AURI	Harold will be the co-lead on the project for AURI. Harold is a project development director at AURI and has significant connections in the hemp industry. Harold will serve as the lead on the business development and networking components of the project.	Yes
Alan Doering	AURI	Alan is AURI senior Coproduct scientist, and operates the lab in Waseca where the fiber decortication equipment is housed. Alan will be a primary operator of the equipment and will be supporting the project by producing decorticated, cleaned and carded hemp fibers.	Yes
Abel Tekeste	AURI	Abel is a laboratory technician at the Coproducts lab in Waseca. Abel will provide laboratory assistance in producing the decorticated, cleaned and carded hemp fiber. The decortication equipment requires several people to operate at any given time and Abel's role in operation of this equipment will be critical	Yes
Matthew Leiphon	AURI	Matthew will be the lead project manager. He will ensure all project tasks and deliverables are completed in a timely manner, and on budget. He will coordinate team meetings periodically throughout the project in order to maintain oversight and keep everyone connected and focused on the milestones.	Yes
Erik Evans	AURI	Erik is AURI's communications director. Erik will serve the project by aiding in the development of one page fact sheets and presentation materials. Erik will also be the primary editor and packager of any final reporting documents back to the LCCMR.	Yes
Peter Leete	Department of Natural Resources (MnDOT Liason)	Peter is a Transportation Hydrologist for the DNR. Peter will provide any technical support needed along the way from the DNR. He will be the contact for the DNR providing industry connections and overall advocacy for the project.	No
Anthony Cortilet	Minnesota Department of Agriculture	Anthony will be the primary contact at the MDA providing industry and grower connections, as well as overall advocacy of the project. Having a primary involvement in the industrial hemp program at the MDA, Tony will provide a valuable resource to this projects third activity, surrounding dissemination and state collaborations	No
Ken Graeve	Minnesota Department of Transportation	Ken will oversee all of MnDOT's activities on this project. Ken will plan and coordinate all lab and field testing of the prototype products, and also guide the development of products, to ensure that MnDOT's standards are being considered throughout. MnDOT is providing In-Kind support to project for Kens time.	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

This project will develop prototype products to demonstrate how industrial hemp can be processed to create biodegradable erosion and sediment control products. The testing will evaluate the various prototype products abilities to meet or exceed current specifications. This will enable MnDOT to update specifications for biodegradable erosion and sediment control products. Growers and manufacturers will be able to use the processing methods developed by this

project to produce products that meet or exceed the updated specifications. The long-term implementation will be sustained by market mechanisms.

Project Manager and Organization Qualifications

Project Manager Name: Riley Gordon

Job Title: AURI Engineer

Provide description of the project manager’s qualifications to manage the proposed project.

Riley Gordon graduated with honors from Brandon University with a Bachelor of Science degree in Physics (Mathematics minor) in the spring of 2014. Then, in 2017 he completed a degree program at the University of Minnesota—Twin Cities, obtaining a bachelor’s degree in Civil Engineering with an Environmental Emphasis in water related topics. Coinciding with his time at the U of M, Riley interned with a Civil Engineering consulting firm, working in both Intelligent Transportation Systems and Water Resources groups.

As an engineer, Riley applies the skills he gained through both his education and related industry experience to assist in AURI’s broad range of projects and initiatives. He primarily works out of the Coproducts lab in Waseca, MN, but also applies his skillsets by delving into projects related to all four of the focus areas that encompass AURI’s work. Riley is the principal investigator leading AURI’s efforts on two currently funded LCCMR grants entitled ‘Using Perennial Grain Crops in Wellhead Protection Areas to Protect Groundwater’ and ‘Accelerating Perennial Crop Production to Prevent Nitrate Leaching’. AURI’s areas of work on these grants are primarily focused on process, product and supply chain development of Intermediate Wheatgrass (Kernza) grain in Minnesota.

Organization: Agricultural Utilization Research Institute

Organization Description:

The Agricultural Utilization Research Institute (AURI) helps foster long-term economic benefit for Minnesota through value-added agricultural products. It accomplishes this mission by helping develop new uses for agricultural products through science and technology, while collaborating with businesses and entrepreneurs to bring ideas to reality. AURI provides a broad range of services including hands-on scientific technical assistance and technology transfer, a network of resources, and the applied research necessary to generate ideas for new ag-based products and processes and to help move them to market. With labs specific to analytical chemistry, coproducts, food, meat, and microbiology, as well as staff experienced in science, technology and innovation processes, AURI is a one-of-a-kind resource that aids Minnesota businesses looking to create more value for the state’s agricultural products. Riley Gordon, AURI Engineer, is the lead Principal Investigator assisted by Harold Stanislawski, project development director. AURI has been a trusted partner on multiple other LCCMR funded grants, however, this is the first true AURI lead project. AURI is uniquely positioned with their new decortication equipment and hemp industry connections to strongly support this project. With close MnDOT and private industry partnerships and interest, AURI feels this project proposes to address a promising opportunity.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
AURI Engineer		Principal Investigator			27.27%	0.21		\$24,750
AURI Senior Coproduct Scientist and Coproduct Lab Technician		Primary Operation of AURI Decorticator and Cleaning and Carding of Fibers			27.27%	0.1		\$11,000
AURI Project Development Director		Co-lead of project and head of business development, networking and project collaboration efforts			27.27%	0.18		\$20,625
AURI Project Manager		Continually track project progress and oversee that completion of deliverables meet timelines and project stays on budget			27.27%	0.06		\$6,600
AURI Communications Director		Aid in the development of one page fact sheet and presentation materials. Lead editor and packager of final report			27.27%	0.02		\$3,300
AURI Outreach and AURI Connects Team		Plan, organize and execute a field day showcasing the developed processes and prototype products developed			27.27%	0.07		\$8,250
							Sub Total	\$74,525
Contracts and Services								
TBD	Professional or Technical Service Contract	Initial Lab Testing of Prototype Products. Pricing obtained from MnDOT. -Hydraulic Mulch: \$500/prototype product * 3 Products -Erosion Control Blanket: \$3,500/prototype product * 3 Products -Silt Fence: \$2,500/ prototype product * 3 Products -Sediment Control Log: \$4,500/ prototype product * 3 Products				0.29		\$33,000
TBD	Professional or Technical	Full-scale field testing to meet specifications and prototype product installation in-field by				0.23		\$26,000

	Service Contract	contractors --Erosion Control Blanket - \$11,500 (breakdown of testing can be provided upon request) --Sediment Control Log - \$4,500 (breakdown of testing can be provided upon request) Prototype product installations by contractors - \$10,000						
TBD	Professional or Technical Service Contract	Erosion Control Product Prototype Development (based on quotes gathered from private contacts) - Mat Development: \$450/hour *10 hours = \$4,500 - Hydraulic Mulch Development: \$150/hour (100 sy of 3 different hemp fiber inclusions) * 6 hours = \$900 - Sediment Control log and silt fencing development = \$350/hr * 10hrs = \$3500				0.08		\$8,900
TBD	Professional or Technical Service Contract	Hemp yarn Development (based on quotes gathered from private industry contacts) 200lb of yarn at \$25/lb				0.04		\$5,000
							Sub Total	\$72,900
Equipment, Tools, and Supplies								
	Equipment	Stand with casters for spare AURI conveyor to be used as decorticator feeding device	AURI's decorticator also requires hand feeding of stalks. Looking at the quantities of material that will be run through the machine on this project will require a lot of man hours, at the current relatively slow throughput. The number one piece of advice that AURI has been given from the manufacturer to increase the throughput of the machine, is to					\$4,875

			extend the feeding conveyor of the decorticator. AURI currently has an extra conveyor which originally came with their decorticator in storage, that is not being used. This conveyor would work excellent to increase the throughput to match with the types of volumes that will be required under this project. We are including a request to have a stand with casters made for this conveyor, which will add an additional 6 feet of feeding length to the decorticator, increasing throughput and significantly reducing man hours on the project.					
	Equipment	1 Stationary Bale Unroller	A bale unroller will be purchased in order to safely and efficiently prepare biomass to be fed into the decorticator. Stalks will be delivered in large round bales, which will need to be disassembled and properly aligned before feeding into the decorticator. This equipment will streamline this process, saving significant man hours and increasing the safety of the operation.					\$5,000
							Sub Total	\$9,875
Capital Expenditures								
		Carding Device	Carding equipment to clean and align hemp fibers into a roving quality necessary for yarn production					\$55,000
							Sub Total	\$55,000
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								

	Miles/ Meals/ Lodging	Travel to prototype development and product testing sites for AURI Engineer (from Lakeville) and Project Development Director (from Fergus Falls) - (2X trip to yarn development site, 4X trips to erosion and sediment product manufacturer, 2X trips to MNRoad site in Albertville) 460 miles x 2; 460 miles x 4; 460 miles x 2 @ \$0.575/mile = \$2150; Lodging (4 nights hotel stays) - \$700; Meals and Incidentals (\$50/day for standard areas) - \$400	Oversee yarn and prototype development efforts, develop personal relationships with key partners and gather pertinent information and pictures for reporting out						\$3,250
	Miles/ Meals/ Lodging	2 trips per year for AURI Engineer (from Lakeville) and Project Development Director (from Fergus Falls) - 460 miles x 2 total trips per year x \$.575/mile = \$550; 2 hotel stays/year = \$350; 2 people x 2 days of meals of incidentals (one in twin cities and one standard areas) = \$250	Travel for networking with collaborators to inform business and product development						\$3,450
	Miles/ Meals/ Lodging	AURI Staff Field Day Travel - 3 AURI Staff to travel to field day in Waseca. 2 from Twin Cities, 1 from Fergus Falls. Mileage = 800 miles x \$.575/mile = \$475. 1 nights hotel (\$175). 3 x standard Meals and Incidentals (\$50/day) = \$150	AURI communications, event planning and business development staff attendance at field day						\$800
	Miles/ Meals/ Lodging	Meals and Incidentals - 3 x \$71/day (rounded) = \$225; Lodging - 3 hotel stays - \$525; Mileage - 350 miles x 3 events x \$.575/mile = \$600	Travel to three in-state related industry conferences to disseminate project findings and grow interest and collaborations						\$1,350
								Sub Total	\$8,850
Travel Outside Minnesota									
	Miles/ Meals/ Lodging	Meals and Incidentals - \$71/day x 2 days per event x 2 events = \$300; Lodging - 2 nights hotel - \$350; round trip Travel (mileage or flight + car rental) - \$600 x 2 trips = \$1200	Travel to two out of state conferences to disseminate project findings and grow interest.	X					\$1,850
								Sub Total	\$1,850
Printing and Publication									
	Printing	500 fact sheets + other handout materials	Printing of one page fact sheets and presentation materials for field day						\$500
								Sub Total	\$500

Other Expenses								
		10 bales of hemp stalks - \$50/bale	Various Hemp stalk samples for decortication					\$500
		20 product shipments - \$50/shipment	Hemp Fiber shipping to yarn spinners and prototype development groups					\$1,000
		Field day associated costs	Field day resources					\$500
		Miscellaneous Supplies - \$1500	Miscellaneous Supplies throughout project- Shipping containers, wearable lab supplies, Dust masks, gloves, goggles, etc.					\$1,500
							Sub Total	\$3,500
							Grand Total	\$227,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel Outside Minnesota	Miles/Meals/Lodging	Meals and Incidentals - \$71/day x 2 days per event x 2 events = \$300; Lodging - 2 nights hotel - \$350; round trip Travel (mileage or flight + car rental) - \$600 x 2 trips = \$1200	The team is requesting 2 instances of out of state travel for the purpose of project results dissemination in year 3. Specific conferences are to be determined, but the team is looking at such conferences as the International Erosion Control Association event and National Hemp Industry events as potential options.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	MnDOT In-kind cost share of unrecovered ICR (100hrs/yr at \$60/hr - (\$45/hr salary + \$15/hr fringe)	MnDOT will supply in-kind hours for lab and field testing of prototype products as well as reporting out of the results. In addition, they will provide ongoing support and guidance of product development	Secured	\$18,000
			State Sub Total	\$18,000
Non-State				
			Non State Sub Total	-
			Funds Total	\$18,000

Attachments

Required Attachments

Visual Component

File: [a2a37497-36a.pdf](#)

Alternate Text for Visual Component

The visual showcases the project opportunity to be explored, which is replacing plastics in soil and erosion control products with biodegradable materials, such as industrial hemp.

Project Partners include the Agricultural Utilization Research Institute, Minnesota Department of Transportation, Minnesota Department of Agriculture and the Minnesota Department of Transportation. Several contracted partners that currently produce erosion and sediment control products will also be key participants on the project, aiding in prototype development, although none are specifically called out here.

Project Outcomes:

Technical Development of Erosion Control Product prototypes utilizing Industrial Hemp as a replacement for plastic components

Complete lab and field testing required to evaluate that various prototype products meet or exceed current specifications, allowing MnDOT and other agencies the option to source these biodegradable products for wide scale adoption in MN

Soil and Erosion Control Product Opportunity Space in MN

- Erosion control blanket (all types): 1,558,000 square yards/year (State roads)
- Hydraulic Erosion control applications (all types): 1,180,000 pounds/year (State roads)
- Silt fence (all types): 287,000 linear feet/year (State roads)
- Sediment control logs (all types): 441,000 linear feet/year (State roads)
- Estimated \$30.1 million spent each year on erosion control products on local and state roads in Minnesota

*All ASTM standard product lab testing will be conducted through MnDOT, and field tests of the prototypes will take place at the MNRoad facility in Albertville, MN

Photos include:

- AURI's decortication equipment used to separate hemp fibers from the inner woody core (hurd)
- Hemp stalk photo showcasing the two streams to be separated through decortication
- Carding equipment to be purchased to clean and produce a roving from decorticated fiber. Carded fiber in a roving is required in order to be fed into spinning equipment and
 - explore woven material product opportunities
- Yarn twisting and weaving equipment which is held by contracted partners will be used to explore creating prototypes of sediment control log skins and silt fencing
- Some examples of the types of soil and erosion control products which are to be targeted to replace plastics with biodegradable hemp fibers and hurds. Specifically shown
 - are Erosion Control Blankets and Sediment Control Logs

Financial Capacity

File: [cd950332-0ae.pdf](#)

Board Resolution or Letter

Title	File
AURI Board Resolution	a9a4062a-f7d.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

No

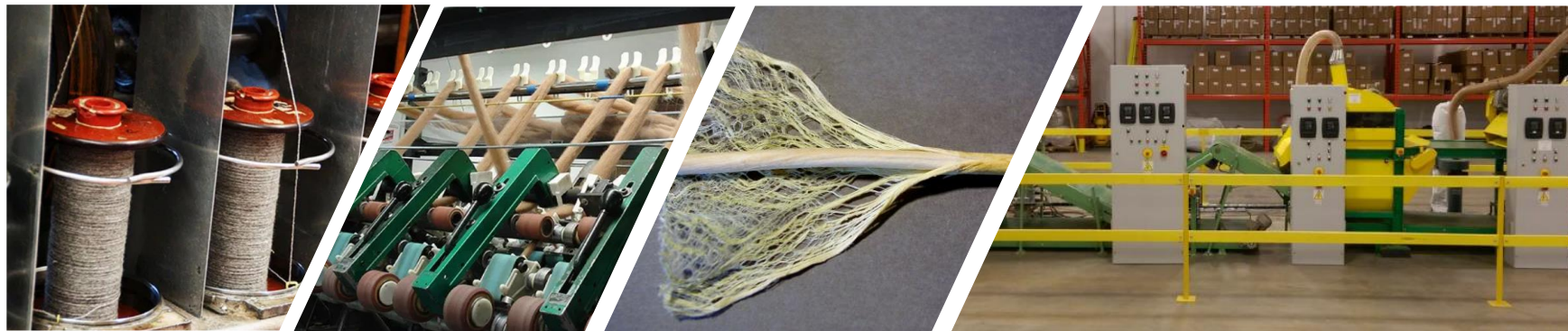
Research Partners
And Supporters:



Reducing Plastic Pollution with Biodegradable Erosion Control Products

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Outcomes:

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