



# Welcome to the Workshop



## IRRIGATION SYSTEM ASSESSMENT WORKSHOP

9:00 AM to 5:00 PM - Tuesday, August 22, 2017

Virginia Tech Southern Piedmont Agricultural  
Research and Extension Center (AREC)  
2375 Darvills Road, Blackstone, VA 23824



John Ignosh  
Biological Systems Engineering  
Virginia Cooperative Extension  
Virginia Tech  
Harrisonburg, VA

# Virginia Cooperative Extension

*A partnership of Virginia Tech and Virginia State University*

[www.ext.vt.edu](http://www.ext.vt.edu)

**Thank you to our host:**

Virginia Tech Southern Piedmont Agricultural  
Research and Extension Center (AREC)





**Thank you to our workshop sponsors:**  
**Virginia Tobacco Indemnification and  
Community Revitalization Commission**

**And**

**Virginia Dept of Mines, Minerals and  
Energy**





# **Thank you to our workshop planning team:**



**Don McMoran**

Agriculture and Natural Resources  
Extension Educator & Director  
WSU Skagit County Extension  
Burlington, WA

**Abdelmoneim “Moneim” Mohamed**  
Washington State University- Pullman  
Department of Biological Systems Engineering  
PhD Student/Graduate Research Assistant



**Dr. David Reed**

Extension Agronomist  
Virginia Tech Southern Piedmont Agricultural  
Research and Extension Center

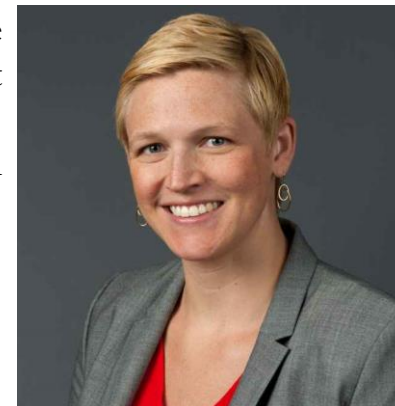
**Mike Parrish**  
Unit Coordinator and Extension Agent,  
Agriculture and Natural Resources - Crop and Soil  
Environmental Science  
Dinwiddie County



**Dr. Troy Peters**

Associate Professor  
Irrigated Agriculture Research and Extension Center  
Biological Systems Engineering, WSU Prosser  
Prosser, WA 99350-8694

**Dr. Julie Shortridge**  
Assistant Professor and Extension Specialist  
Department of Biological Systems Engineering  
Virginia Tech  
Blacksburg, VA 24061



# Thank You to Our Presenters:

- **Mr. Don McMoran**, Washington State University;
- **Mr. Moneim Mohamad**, Washington State University,
- **Dr. Hamid Farahani**, Acting National Water Management Engineer, USDA-NRCS;
- **Ms. Laurette Tucker**, VA-USDA Rural Development;
- **Mr. Derek Hancock**, District Conservationist, VA-NRCS;
- **Mr. Sean Kimmel**, Area Engineer, VA-NRCS;
- **Dr. David Reed**, Extension Agronomist-Tobacco, Southern Piedmont Agricultural Research and Extension Center, Virginia Tech;
- **Dr. Julie Shortridge**, Extension Specialist, Biological Systems Engineering, Virginia Tech & Extension;
- **Mr. Mike Parrish**, Virginia Cooperative Extension;
- **Mr. John Ignosh**, Area Specialist, Biological Systems Engineering, Virginia Cooperative Extension

## Workshop Outline

- **Morning Presentations**
  - Welcome & Introductions
  - Ag Energy Efficiency Initiative, John Ignosh
  - Overview of SPAREC & Irrigation Related Research, Dr. Reed
  - Emerging Interests & Issues on Irrigation from Field, Mike Parrish
  - Irrigation Information & Event, Dr. Shortridge
  - USDA Programs
    - REAP, Laurette Tucker, USDA-Rural Development
    - NRCS Technical & Financial Assistance Programs, Derek Hancock & Sean Kimmel
  - Washington State University, Irrigated Agriculture Research and Extension Center
    - **Water Irrigation Systems Efficiency (W.I.S.E.)** – Don McMoran, WSU
    - Irrigation Systems Evaluation and Management – Moneim Mohamed, WSU
- **Field Assessment Work** (Travelling Gun, Hand-Move Sprinklers, Drip)
- **Lunch**
- **Field Assessment Work** (Travelling Gun, Hand-Move Sprinklers, Drip)
- 4PM –**Assessment Analysis**
- 5PM – **End of Workshop**

# Areas I generally work in....

## Goals:

- Raise awareness and understanding among clientele of new approaches to increase the efficiency of production systems and opportunities to minimize environmental impact
- Relay emerging issues expressed by clientele to research community

## Focus Areas:

1. On-farm energy efficiency
2. Renewable energy conversion technologies
3. Project assessment tools
4. Nutrient management technologies

## **John Ignosh**

Biological Systems Engineering  
Virginia Tech & Virginia Cooperative Extension  
Harrisonburg, VA 22801

[jignosh@vt.edu](mailto:jignosh@vt.edu)





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# 2010-2017: PHASES I & II

## AGRICULTURAL ENERGY EFFICIENCY INITIATIVE



***Program for Southside and Southwest Virginia***

Funded by a 2014 grant from the  
Virginia Tobacco Indemnification and Revitalization Commission  
*and is supported by*  
VCE Community Viability and the  
Virginia Tech Biological Systems Engineering Department

Large project with many different collaborators and agencies:  
DMME, ODEC, USDA-RD, USDA-NRCS, NCIF, and many in  
Extension throughout region and on campus



**Biological Systems  
Engineering**



**Virginia Cooperative Extension**

Virginia Tech • Virginia State University



# On-Farm Energy Efficiency Program

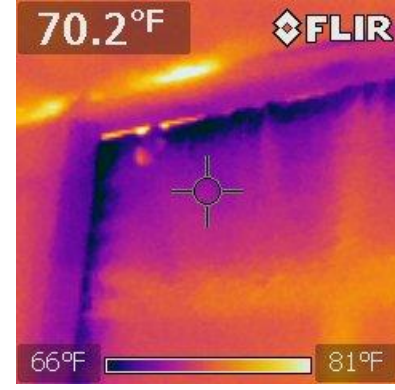
## A Pilot Program for Southside and Southwest Virginia

Virginia Tobacco Indemnification and Revitalization Commission

- In 2007, farmers spent:
  - \$156M in fuel , \$52M in electricity and other utilities, \$208M in total
- A 10% increase in energy efficiency would have produced nearly \$21 million additional income to Virginia farms in 2007

### **How can we find those opportunities?**

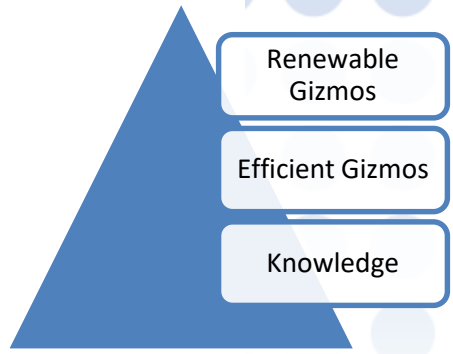
- Provides research-based information related to best management practices concerning energy via Virginia Cooperative Extension workshops, factsheets, webinars, etc.
- Train energy assessors, energy use BMPs, thermography tools, fuel purchasing, etc.
- Secure grant funding from the Virginia Tobacco Indemnification and Community Revitalization Commission (2010-2012)



### 2010 - 2012 Impacts

- 58 energy audits completed
- 19 counties throughout Southside and Southwest Virginia
- Completed energy audit reports have identified farm specific energy conservation measures to save:
  - 1,258,776 (kWh) in electrical usage;
  - 603,315 (gallons) propane fuel;
  - 19,336 (gallons) fuel oil;
  - 63,298 Million BTUs;
  - 4,315 (MTCO<sub>2</sub>e) greenhouse gas emission reductions;
  - \$1,178,917 energy savings
  - Approximately 76% of the recommended energy conservation measures have a payback period shorter than five years.

# General Strategy



## ENERGY ACTION PYRAMID

↑  
**COMPLEXITY AND COST**

### ALTERNATIVE ENERGY

Choices such as installing solar, wind, geothermal, micro hydro or biofuels systems



### EFFICIENCY: Investment in Longer Term Energy Savings

Choices such as:

- Installing energy efficient lighting, fixtures, windows, doors, appliances, and equipment
- Installing water-efficient appliances and fixtures
- Investing in items with Energy Star, EnergyGuide or WaterSense labels
- Insulating homes



### CONSERVATION: Simple Everyday Actions

Behaviors such as:

- Turning off lights, equipment, fans, and appliances when not in use
- Adjusting thermostats in heated or cooled spaces
- Using powerstrips to control for phantom electrical loads
- Caulking and weatherstripping around windows and doors
- Landscaping with native and xeric plants, and utilizing rain water



**ASSESSMENT:** Assess your personal objectives and your energy and water use to determine cost-effective strategies for implementing conservation and efficiency measures and integrating renewable energy systems in your home.

Source:  
[http://www.ces.ncsu.edu/wp-co/Con\\_PyramidRev1.pdf](http://www.ces.ncsu.edu/wp-co/Con_PyramidRev1.pdf)

## ***2014-2017 Agricultural Energy Efficiency Initiative:*** **Energy Audits, Feasibility Studies, and Retrofit/Renewable Implementation**

\$5,000 per program participant funds will be used toward:

- the energy audit process
  - development of a renewable energy feasibility study
  - and/or implementation
- **Energy Audits** - ASABE S612 Farm Energy Audit Criteria (Completed by an NRCS Technical Service Provider), or ASHRAE Level II Energy Audit (completed by a Professional Engineer or Certified Energy Manager), as appropriate for entity type.
  - **Renewable Energy Feasibility Studies** - Producers who completed the energy audit process and, based on the owner's management goals, have **implemented all relevant energy efficiency retrofit opportunities having a simple payback period of less than 5 years**, may then use the cost-share program to partially fund a renewable feasibility study. The feasibility study must **satisfy the criteria for the USDA Rural Development REAP program**, and where appropriate, include a screening model output from **RETScreen Clean Energy Project Analysis Software**.
  - **Implementation Cost-Share Program** - Energy-cost saving opportunities identified in the audit report are eligible for a cost-share from funds remaining in the participant's \$5,000 allocation.
  - **NOTE:** Cost-share percentage increases (from 25% to 50%) with participation in educational programming (either workshops, mailed fact sheets, and later *"Farm Energy 101 Modules"* online content)



# **2014-2017 Agricultural Energy Efficiency Initiative: Agricultural Energy Efficiency Project Workshop Series**

## **Agricultural Energy Efficiency Project Website**

- Energy Resources & Videos

## **Agricultural Energy Efficiency Project Workshop Series**

- Agricultural Production Systems  
(Greenhouses, Tobacco, Dairy, etc.)
- Emergency Backup Power Generation  
Systems
- Renewable Energy Technologies &  
Applications (solar, RETScreen, small wind,  
biomass, etc.)
- Forest Product Industries (Lean  
Manufacturing, etc.)



Sources:  
USDA

<https://www.puc.nh.gov/Sustainable%20Energy/GHGERF%202009%20Grantees.htm>



# Introduction to Ground Source Heat Pumps - April 2015

Virginia Cooperative Extension's Bioenergy Engineering Education Program (BEEP)

Monday, April 13, 2015 from 9:30 AM to 4:30 PM (EDT)

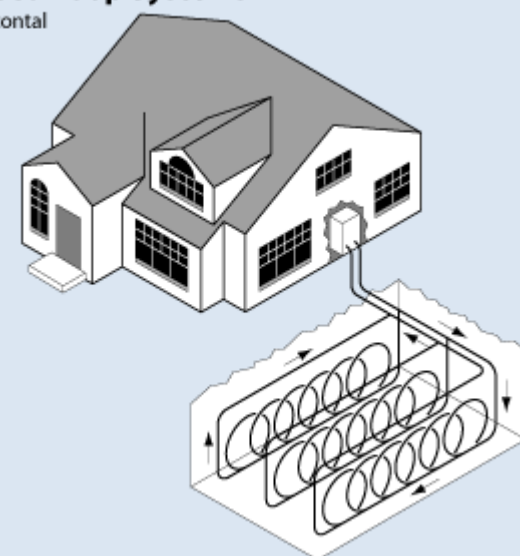
Appomattox, VA

## Ticket Information

TICKET TYPE	SALES END	PRICE	FEE	QUANTITY
Introduction to Ground Source Heat Pumps <a href="#">more info</a>	Apr 10, 2015	\$20.00	\$0.00	1 ▼

## Closed Loop Systems

Horizontal



Home

Newsletter

Centre Overview

Software & Data

Training Material

Clean energy  
project analysis

Energy efficiency

Heating / Cooling

Power

Fuel cell

Gas turbine

Gas turbine -  
combined cycle

Geothermal  
power

Hydro turbine

Ocean current  
power

Other

Photovoltaic

Reciprocating  
engine

Solar thermal  
power

Steam turbine



## WIND TURBINE

Wind turbines produce electricity using the kinetic (renewable) energy from the wind. The energy performance of a wind power system is influenced by a number of factors. For example, these may include resource elements such as the wind speed or wind power density at hub height, the wind shear exponent, the air temperature and the atmospheric pressure. Other factors include design and operation elements such as the wind turbine power capacity and energy curve data, hub height, swept area, number of turbines, array losses, airfoil losses, miscellaneous losses (e.g. parasitic electricity losses, transmission line losses, losses due to low wind energy absorption rate) and the wind turbine availability. Refer to the [Schematic of a Horizontal Axis Wind Turbine](#) for more information.

### Software & Data

The RETScreen Software [Wind Power Model](#) can be used worldwide to evaluate the energy production and savings, costs, emission reductions, financial viability and risk for central-grid, isolated-grid and off-grid wind energy projects, ranging in size from large scale multi-turbine wind farms to small scale single-turbine wind-diesel hybrid systems. The software (available in multiple languages) also includes product, project and climate databases, a detailed user manual, and links to wind [Energy resource maps](#).

[Click here to download RETScreen Suite](#)

### Training material

[RETScreen - Wind Energy Project Analysis - Presentation slides \(1.79 MB\)](#)  
[RETScreen - Wind Energy Project Analysis - Voice & slides - part 1/3 \(2.90 MB\)](#)  
[RETScreen - Wind Energy Project Analysis - Voice & slides - part 2/3 \(1.68 MB\)](#)  
[RETScreen - Wind Energy Project Analysis - Voice & slides - part 3/3 \(1.98 MB\)](#)  
[RETScreen - Wind Energy Project Analysis - Speaker's notes](#)

### e-Textbook / Guides

[RETScreen - Wind Energy Project Analysis - e-Textbook chapter \(675 KB\)](#)  
[RETScreen - Wind Energy Project Model \(Version 3\) - User manual \(937 KB\)](#)

### Case studies / Templates

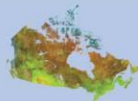
[Power - Wind turbine - 1 kW - Off - grid](#)  
[Power - Wind turbine - 150 kW - Isolated-grid / Canada](#)  
[Power - Wind turbine - 390 kW - Isolated-grid / Canada](#)  
[Power - Wind turbine - 600 kW / Canada](#)  
[Power - Wind turbine - 9,900 kW / Canada](#)  
[Power - Wind turbine - 9,900 kW / Germany](#)

**RETScreen® International**  
Clean Energy Decision Support Centre  
www.retscreen.net

# Clean Energy Project Analysis

RETScreen® Engineering & Cases Textbook

Third Edition



Natural Resources  
Canada

Ressources naturelles  
Canada

Canada

## CHAPTERS



Introduction to Clean Energy Project Analysis

INTRO



Wind Energy Project Analysis

WIND



Small Hydro Project Analysis

HYDRO



Photovoltaic Project Analysis

PV



Combined Heat & Power Project Analysis

CHP



Biomass Heating Project Analysis

BIOH



Solar Air Heating Project Analysis

SAH



Solar Water Heating Project Analysis

SWH



Passive Solar Heating Project Analysis

PSH



Ground-Source Heat Pump Project Analysis

GSHP



# RETScreen - Wind Energy Project Analysis - e-Textbook chapter

**RETScreen® International**

Clean Energy Decision Support Centre

www.retscreenet.com

**CLEAN ENERGY PROJECT ANALYSIS:  
RETSCREEN® ENGINEERING & CASES TEXTBOOK**



CANMET Energy Technology  
Centre - Ressources (CETC)

In collaboration with:



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Natural Resources  
Canada

Ressources naturelles  
Canada

**WIND ENERGY  
PROJECT ANALYSIS  
CHAPTER**

**Agenda: Wind Workshop in Abingdon, VA on March 9<sup>th</sup>, 2015**

Start Time	End Time	Session	Details
9:00 AM	9:50 AM	Introduction	Center for Wind Energy overview, state and federal perspective
9:50 AM	10:00 AM	Break	
10:00 AM	10:50 AM	Wind Mechanics	Wind energy basics, wind flow characteristics, turbine design and components, blade design characteristics
10:50 AM	11:00 AM	Break	
11:00 AM	11:50 AM	Turbine Siting and Permitting	Wind measurement, resource assessment, energy production calculation, turbine siting (AWEA siting guide), local permitting, state permitting
11:50 AM	1:00 PM	Lunch/Technology Exhibit	Showcase BAD, anemometer/wind vanes, AIR turbine, weather stations
1:00 PM	1:50 PM	Wind Economics and Financing	Wind economics, financing options, relevant legislation, REAP overview
1:50 PM	2:00 PM	Break	
2:00 PM	2:40 PM	Case Studies	
2:40 PM	3:00 PM	Q&A	Discussion of successful distributed wind projects across the nation
			Open discussion time

**RETScreen® International**

Clean Energy Decision Support Centre

www.retscreenet.com



**Canada**

# Today's Workshop.....

## IRRIGATION SYSTEM ASSESSMENT WORKSHOP

9:00 AM to 5:00 PM - Tuesday, August 22, 2017

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2375 Darvills Road, Blackstone, VA 23824





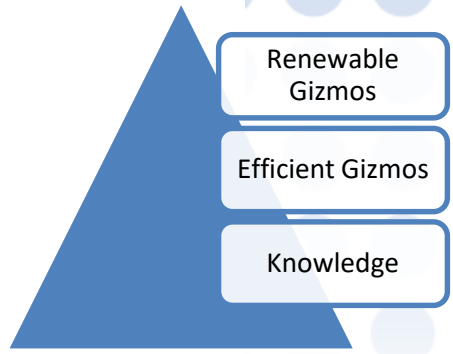
American Society of  
Agricultural and Biological Engineers

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Table 1 – Suggested Components within Major Activities by Farm Enterprises for Audit Assessment

Major Activity	Components	Farm Enterprises							
		Dairy	Swine	Poultry	Beef/ veal	Field crops	Fruit/ vegetables	Aquaculture	Nursery/ Greenhouse
Lighting <sup>1,7,10</sup>	lamps, timers, sensors	X <sup>6</sup>	x	x	x		x	x	X
Ventilation <sup>2,7,10,11</sup>	fans, control system, variable drives, humidity control	x <sup>6</sup>	x	x	x		x	X(aeration)	x <sup>8,9</sup>
Refrigeration <sup>5,7,10</sup>	compressor, evaporator/chiller, motor, insulation	milk, products <sup>6</sup>		eggs			commodity	x	Veg/cut flowers
Milk harvesting <sup>7,10</sup>	pumps, motors, controllers	x <sup>6</sup>							
Controllers <sup>7,10</sup>	master system automation	x	x	x				x	x
Other motors/pumps <sup>3,4,7,10</sup>	Types, compressors	X <sup>6</sup>	x	x	x	x	x	x	x
Water heating <sup>7,10,12</sup>	heater, energy source, insulation, recovery, waterers	x <sup>6</sup>	x	x	x				
Air Heating/Bldg environment <sup>10</sup>	heater, energy source, insulation, recovery, variable drives	x	x	x	x		x		x <sup>8,9</sup>
Drying <sup>10</sup>	energy source, airflow (motors/fans), handling equipment					x			
Waste handling	collection and dispersal equipment/methods	x	x	x	x			x	
Air Cooling	energy source, airflow (motors/fans), control systems, evaporative	x	x	x	x				x <sup>8,9</sup>
Cultural Practices	planting, tilling, harvesting, engine driven equipment					x	x		
Crop/feed Storage					x	x	x	x	x
Water management	wells, reservoir, recycled	x	x	x	x	x	x	x	x
Material handling <sup>7,10</sup>	equipment, motors, pumps	x <sup>6</sup>	x	x	x	x	x	x	x
Irrigation <sup>10</sup>	motors/engines, pumps, power source					x	x		x

# General Strategy



## ENERGY ACTION PYRAMID

↑  
**COMPLEXITY AND COST**

### ALTERNATIVE ENERGY

Choices such as installing solar, wind, geothermal, micro hydro or biofuels systems



### EFFICIENCY: Investment in Longer Term Energy Savings

Choices such as:

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### CONSERVATION: Simple Everyday Actions

Behaviors such as:

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**ASSESSMENT:** Assess your personal objectives and your energy and water use to determine cost-effective strategies for implementing conservation and efficiency measures and integrating renewable energy systems in your home.

Source:  
[http://www.ces.ncsu.edu/wp-co/Con\\_PyramidRev1.pdf](http://www.ces.ncsu.edu/wp-co/Con_PyramidRev1.pdf)



# Workshop Webpage:

## <http://www.aeei.bse.vt.edu/>



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[Program Documents](#)

[Educational Opportunities](#)

[Program Partners](#)

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[Other Financial Incentive Programs](#)

[Energy Project Analysis](#)

[Energy Savings Through Lean Thinking in Forest Products Industri](#)

[Solar Photovoltaics \(PV\)](#)

[Solar Hot Water](#)

[Exploring Virginia-based "Solarize" Project Models](#)

[Solar Farm Workshop for Local Governments and Landowners](#)

[Wind Energy Workshop](#)

[An Introduction to Ground Source Heat Pump Systems \(GSHP\)](#)

## Home

### Agricultural Energy Efficiency Initiative (AEEI):

#### A Farm Energy Program for Southside and Southwest Virginia

*Funded by a 2014 grant from the Virginia Tobacco Indemnification and Revitalization Commission and is supported by VCE Community Viability and the Virginia Tech Biological Systems Engineering Department*

#### ***Here's how the program works...***

Decide that you need an energy assessment of your agricultural or forest product small business operation in order to create a more energy efficient process. Or, if a farm energy audit (ASABE S612 Farm Energy Audit Criteria or ASHRAE Level II) has been completed within the past two years, decide that you are ready to implement the audit's energy efficiency recommendations.

If needed, an energy audit will be scheduled for your facility. Once you receive the report, you will have the opportunity to meet with your Extension

# **Tentative Upcoming events.....**

- Solar Finance & NREL System Advisory Model (SAM) Workshop – Fall TBD
- Solar Photovoltaic Workshops - Wise County VA – Fall October/November

**Please let me know if you're interested in more information**



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- Overview of SPAREC & Irrigation Related Research, Dr. Reed
- Emerging Interests & Issues on Irrigation from Field. Mike Parrish
- Irrigation
- USDA
  - RE
  - NF
- Washi
  - W
  - Irr

**LET'S GET  
STARTED!**

- **Field Assess**

- **Lunch**

- **Field Assessment Work** (Travelling Gun, Hand-Move Sprinklers, Drip)

- 4PM –**Assessment Analysis**

- 5PM – **End of Workshop**

an Kimmel  
Center  
WSU



# IMPORTANT ITEMS

- Did we get your lunch order?
- Did you find the bathrooms?
- **Please fill out the workshop evaluation form, we need your feedback**
- It should get a bit wet & muddy during field work, we have some extra rainjackets and boot covers if you need
- It's HOT in field, PLEASE stay HYDRATED
- No BATHROOMS at field site
- In a minute, we'll ask you to please introduce yourself...
  - Name, where your from, why you're here/irrigation interests?
- Any questions so far?



*Thank you !*

John Ignosh

Area Specialist

Harrisonburg, VA

Email: [jjgnosh@vt.edu](mailto:jjgnosh@vt.edu)

Phone: 540-432-6029 x108



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# Don McMoran

Agriculture and Natural Resources

Extension Educator & Director

WSU Skagit County Extension - Burlington, WA

Don McMoran was born on a 2000 acre diversified potato farm in West Side Mount Vernon, of Skagit County, Washington. He grew up working on the farm including bucking hay bales and moving irrigation pipe all summer long. Working in the fields was long and hard but he grew to appreciate how hard area farmers work to make the valley what it is today. Don completed his Masters Degree in General Agriculture in 1998 with a minor in Spanish and a Masters in Arts and teaching in 2000. After graduating from college Don taught Spanish at Stanwood Middle School for one year before receiving a position with the Skagit Conservation District where he implemented the Conservation Enhancement Reserve Program (CREP). Don is a graduate of the Washington Ag Forestry, class 26. In May of 2006 Don was hired as the WSU Extension Agriculture and Natural Resources Educator for Skagit County, where he assists local farmers and gardeners with their research and extension needs. Don took over as director of WSU Skagit County Extension in 2012. Don has been published in the American Journal of Potato Research, Journal of Extension, Journal of Horticulture, National Association of County Agriculture Agents (NACAA), Pacific Northwest Handbook, Tilth Producers Quarterly, Whatcom Ag Monthly, Read the Dirt and he is responsible for publishing the Annual Skagit Agriculture Statistics. Don was honored by the Washington State Governor with a Building Better Communities Award and received the National Association of County Agricultural Agents achievement award for his work on energy and water conservation in Skagit County.