WESTERN EXTENSION RISK MANAGEMENT EDUCATION

2018 Education Projects **Application**

Decreasing winter chill: risks and implications for Northwest tree-fruit producers.

Project Number: 13654

Amount Requested: $49,892

Submission Date: Pending

Project Director

Kirti Rajagopalan
Assistant Research Professor
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Co-Project Director(s)

Vincent Jones
Professor
Washington State University
WSU-Tree Fruit Res. & Ext. Center
1100 N. Western Ave.
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Project Overview

Washington State is the #1 producer of tree-fruit (apples, pears, and sweet cherries) in the U.S. Accumulation of sufficient winter chill hours - number of hours below a certain temperature threshold - is a necessary condition for these trees to come out of winter dormancy and produce fruit. While insufficient winter chill has not been an issue in the state historically, with increasingly warm winters, it is emerging as a potential production risk. Given the multi-year investment and planning horizon of these perennial tree-fruit systems, it is critical for producers to understand this emerging climate-variability related risk and associated management implications. This is also a direct fit with the climate-variability priority area of this call.

We propose to create a web-based tool, developed in collaboration with a producer/industry advisory group, and disseminated through a workshop, webinar, and a durable recorded training product. These outputs will allow at least 150 tree-fruit producers in Washington State to a) understand and analyze the risk of potential decreases to winter chill, b) understand options for managing this risk based on practices in other regions with relatively warmer winters, and c) be better prepared to address this emerging potential risk and consider it in their long-term planning.

Producer Demand

Producer demand is evidenced as follows.

1) We have 4 tree-fruit producer/industry members (Hannah Walters, Garrett Bishop, Byron Phillips, and Mike Willett) who have expressed interest in the educational material, and are collaborating with us in an advisory role. Mike Willett is also the manager of the Washington Tree-Fruit Research Commission, which represents the industry.

2) In 2016, Washington State University's Center for Sustaining Agriculture and Natural Resources conducted a workshop in which 82 producers, agricultural professionals, researchers, and agencies gathered to prioritize actions needed relating to climate variability, change and agriculture. This workshop identified adaptation issues for specialty crops, including insufficient winter chill and other impacts, as a priority.

3) We have an ongoing relationship with a broad user-base that has demonstrated a strong demand for tree-fruit risk-management tools. Roughly 225 decision makers use the existing WSU- Tree Fruit Decision Aid System (DAS) on a regular basis, and surveys have indicated that 81% of them also share this information with others, thus expanding the reach of information dissemination. By making our information accessible in DAS, we are able to reach out to this interested user-base.

Proposed Results

What Producers Will Understand, Analyze, Develop, Decide or Implement

Proposed Result	Topic	Producer action	When measured	Est #	How will you verify?
1. Producers increase their awareness of the extent of emerging production risk (and associated uncertainties) in Washington State due to reduced winter chills.	Transition to new production systems	Understand	At the six workshops (120 participants) Jan-March 2019 and at the webinar (30 participants) one month after the workshops.	150	Pre-workshop/webinar and post-workshop/webinar survey instrument.
2. Producers identify tree-fruit growing regions in the Western U.S. (outside Washington state) where current winter chills are analogous to the emerging risk in Washington State.	Transition to new production systems	Understand	At the six workshops (120 participants) Jan-March 2019, and at the webinar (30 participants) one month after the workshop.	150	Pre-workshop/webinar and post-workshop/webinar survey instruments.
3. Producers review a list of management and production system options used by producers to manager lower winter chills.	Transition to new production systems	Analyze	At the six workshops (120 participants) Jan-March 2019, and at the webinar (30 participants) one month after the workshop.	150	Pre-workshop/webinar and post-workshop/webinar survey instrument.
4. Based on awareness of risks and management implications, producers brainstorm and collectively create a list of potential gaps and challenges in managing this emerging risk.	Transition to new production systems	Develop	At the six workshops (120 participants) Jan-March 2019.	120	A written compilation of discussion and ideas generated is created.
5. Producers increase their awareness of emerging production risks in Washington State due to reduced winter chills, and analyze management options through self-learning.	Transition to new production systems	Analyze	At the 18th month (last month) of the project.	20	Online survey of users who accessed video training-material for self-training.

Project Steps

What project team does	What participants do	When measured	Estimated # of participants
1. Create an online tool with a user-friendly interface that allows producers to educate themselves on risks and implications of decreasing winter chills. Results from three different chill models will be the basis of the visualizations.	The stakeholder advisory group will provide feedback related to the look and feel of the educational tool, and how visualizations can be made more intuitive and informative as related to their risk management needs.	12/31/2018	4
2. Create and add winter chill analog visualizations to the online tool. This would identify historical locations whose current winter chill risks resemble emerging risks in various regions of Washington State.	Stakeholder advisory group provides feedback.	12/31/2018	4
3. Through literature review, catalog the suite of management options tree-fruit producers in analogous regions use to manage risks due to insufficient winter chilling.	Stakeholder advisory group reviews, revises and expands this catalog of options based on their knowledge, and experience.	1/15/2019	4
4. Develop a “how to use the tool” training presentation/video.	Stakeholder advisory group provides feedback.	1/15/2019	4
5. Plan and coordinate 6 workshops. The workshops will provide training to the participants on how to navigate the website on their own and gain insights for making risk management decisions. We will also get feedback on the training process, and use it to make improvements for the webinar and recorded training material. Evaluation surveys will be administered at the beginning and end of the workshop.	Participate and get trained on using the tool and provide feedback on whether the training material was appropriate. Collectively brainstorm and expand the risk-management catalog, and develop a list of gaps and challenges in being prepared to effectively address any emerging risks due to insufficient winter chill.	3/31/2019	120
6. Plan, coordinate, and record a webinar. Evaluation surveys will be administered at the beginning and end of the webinar.	Participate.	4/30/2019	30
7. Survey users who visited the education tool website between May 2019 and September 2019, and accessed the online tool and recorded training video for self-training.	Respond to online survey.	9/15/2019	15

Project Results Narrative

Tree fruit require sufficient exposure to cold winter temperatures to break out of winter dormancy. Insufficient winter chill leads to reduced bud break, prolonged bloom time with exposure to detrimental conditions, asynchronous bloom periods that reduces pollination, and reduced foliation. These in turn result in reduced fruit yield and quality, both of which have a direct impact on production risks for tree-fruit growers, and economic viability of tree-fruit production. These risks might need to be addressed by switching to cultivars that are better adapted, or by managing variability through practices such as evaporating cooling, chemically induced bud break, orchard management practices, all of which have an economic impact through increased production costs.

Increasingly warmer winters are leading to decreased winter chill and potential for risks associated with insufficient chill. Given the economic implications, we propose to create an online tool that helps producers understand this emerging risk and consider it in long-term planning. The tool will take commonly used winter chill models and apply them to historical climate observations (1970 to 2017) and near-term climate projections to create interactive maps and visualizations that communicate risks. Climate projections from 2020 to 2050 will be considered—the typical 30-year investment decision horizon in perennial tree-fruit production systems. The geographic scope will be tree-fruit growing areas in Washington State. The tool will also use statistical techniques to identify regions outside Washington State (in Western US) that currently have winter chill risks similar to emerging risks in Washington State. These analogous regions will allow producers to analyze how other regions have currently adapted to risks (through cultivar selection or management) to ensure economic viability. The tool will include a list of risk-management options adopted by tree-fruit producers in these analogous regions.

Our primary target audience is tree-fruit growers/consultants who are current users of the WSU Tree Fruit Decision Aid System (DAS). With training, this group is comfortable using online tools for risk education, and small in-person workshops have been a successful training method. We will use a combination of workshops and webinar for training. Workshops will allow producers to collectively analyze information provided by the tool and develop a list of gaps and challenges in being prepared to effectively address emerging production risks. The webinars, on the other hand, will be a cost-effective way to reach a broader audience base and create a durable training product that can be accessed anytime by anyone interested.

Audience Emphasis

You may indicate up to three specific audiences that your project will target.

- Specialty crop producers

Review Past Projects

We reviewed the past ERME *completed* projects (all regions) and did not find any that addressed emerging production risks associated with warmer temperatures. This proposed project is unique in that aspect. Although *ongoing*, one of the 2017 projects relates to "Building Climate Resilience via Agroecology and Learning Networks". Our approach of identifying analog locations lends itself well to creating producer learning networks across analogous locations. It can facilitate risk-management information transfer among the right network of locations (and producers within them) that can benefit from learning from each other's risk-management experiences. Although building these networks is out of the scope of our current project, there could be potential to build synergies in the future.

Additional Regions

No additional regions selected.

Organizational Capacity

We are a team with expertise and prior experience in decision support, stakeholder engagement, and strong relationships with the agricultural community in the Northwest U.S. The two units leading this effort are the Center for Sustaining Agriculture and Natural Resource (CSANR), and WSU Tree Fruit Research and Extension Center (TFREC), both of which have engaged directly with the region's agricultural producers for several years.

TFREC is a multidisciplinary center focused on solving problems in tree-fruit production, and works closely with the region's tree-fruit producers. The WSU-Tree Fruit Decision Aid System (DAS) - with 225+ users- is the premier source of time-sensitive management decision-making input for the Washington State tree-fruit industry. PIs Jones and Chambers have disseminated over 150 workshops, presentations, extension publications on DAS in recent years. Additionally, PI Kalcsits' research program has helped tree-fruit producers manage and reduce sunburn risks.

PIs Rajagopalan and Stockle currently lead multiple ongoing efforts to develop web-based tools that convey risks associated with climate variability for various aspects of agricultural production. CSANR that has strong relations with agricultural stakeholders, and has gained recognition for innovative leadership and successful implementation of problem-solving research and extension programming, including the USDA CREES Partnership Award for Innovative Program Models. CSANR also has personnel trained in program evaluation, and has implemented numerous evaluations of learning and impact of extension activities, ranging from in-person workshops to digital webinars.

We have also assembled a project stakeholder advisory group comprising industry

representatives, to help tailor material to audience needs and encourage participation.

Project Team

Dr. Ute Chambers
Washington State University
uchambers@wsu.edu
(509) 663-8181
Role: Dr. Ute Chambers is the manager and educator for the WSU Tree-Fruit Decision Aid System (DAS). In this project, she will draw on her extensive outreach and training experience with tree-fruit producers, and lead the design and delivery of workshops, webinars, and survey instruments that evaluate producer learning outcomes.

Dr. Lee Kalcsits
Washington State University
lee.kalcsits@wsu.edu
(509) 663-8181
Role: Dr. Lee Kalcsits is an expert in tree-fruit physiology and abiotic stress. He has built relationships with Washington State tree-fruit producers through his research focusing on reducing detrimental effects of abiotic stresses on tree fruit. In this project, he will help verify appropriateness of winter chill models, and help catalog varietal suitability and management options for producers to address emerging production risks due to insufficient winter chill.

Dr. Vincent Jones
Washington State University
vpjones@wsu.edu
(509) 663-8181
Role: As the director of the WSU Tree-Fruit Decision Aid System (DAS), Dr. Jones has built extensive relationships with tree-fruit producers in the Pacific Northwest U.S., many of whom are DAS users. Dr. Jones will co-direct this project, and be the project liaison to producers and other tree-fruit industry stakeholders. He will also supervise the development of training materials for the online tool, based on his extensive experience creating similar materials for DAS.

Dr. Claudio Stockle
Washington State University
stockle@wsu.edu
(509)335-3826
Role: Dr. Stockle is an expert in bio-physical crop modeling and is involved in multiple ongoing efforts characterizing the impacts of climate variability on crop production. In this project, Dr. Stockle will help co-supervise the programming of winter chill models into the online tool.

Dr. Kirti Rajagopalan
Washington State University
kirtir@wsu.edu
(515)450-7142
Role: Dr. Rajagopalan is involved in multiple ongoing efforts developing online tools that convey risks associated with climate variability and change on agricultural production in the Pacific Northwest U.S. These include conveying risks through spatial analogs that help view emerging risks through a historical context and experiences of peers. As Project Director, Dr. Rajagopalan will be responsible for overall project management, and supervising a programmer who will develop the online tool.

Project Collaborators

Hannah Walters
Stemilt Growers LLC.
Hannah.Walters@Stemilt.com
(509) 663-1451
Role: Stemilt Growers LLC. is one of the large tree-fruit producers in Washington State. Hannah Walters will be part of the project's stakeholder advisory group that interacts with the project team on an ongoing basis to co-develop the contents of the educational tool and training material. The advisory group with help ensure that the project outputs result in useful and actionable information that directly address producer risk-management needs in an intuitive way.

Garrett Bishop
G.S. Long Co., Inc.
GarrettB@gslong.com
(509) 731-6186
Role: G.S. Long Co., Inc. provides a wide spectrum of agricultural and crop consulting services to the tree-fruit industry. Garrett Bishop will be part of the project's stakeholder advisory group that interacts with the project team on an ongoing basis to co-develop the contents of the educational tool and training material. The advisory group with help ensure that the project outputs result in useful and actionable information that directly address producer risk-management needs in an intuitive way.

Byron Phillips
Valent USA LLC.
Byron.Phillips@valent.com
509) 699-8043
Role: Valent USA LLC. provides agricultural services and consulting to the tree-fruit industry. Byron Phillips will be part of the project's stakeholder advisory group that interacts with the project team on an ongoing basis to co-develop the contents of the educational tool and training material. The advisory group with help ensure that the project outputs result in useful and actionable information that directly address producer risk-management needs in an intuitive way.

Mike Willett
Washington State Tree Fruit Research Commission
willett@treefruitresearch.com
(509)665-8271
Role: The Washington State Tree Fruit Research Commission comprises nine commissioners who are active tree-fruit growers or have a substantial interest in the production of tree fruit. Mike Willett is the manager of the Commission, and will represent the tree-fruit industry in our project's stakeholder advisory board. The advisory group will interact with the project team on an ongoing basis to co-develop the contents of the educational tool and training material. The advisory group with help ensure that the project outputs result in useful and actionable information that directly address producer risk-management needs in an intuitive way.

Tools and Curriculum

Educational Tools

We have two educational tools that will be developed as part of this project: a) an online tool, and b) accompanying training material on how to use, analyze, and interpret the tool to inform risk-management decision making.

The online tool will have interactive user-friendly visualizations to effectively convey a) timing and magnitude of emerging risks due to decreasing winter-chill, b) implications for risk management, c) identification of analog locations outside Washington State where current risks are similar to emerging risks in Washington State, and d) a catalog of risk management alternatives based on a literature review. Three commonly used chill models (the Chilling Hours model, the Utah Model, and the Dynamic Model) will be applied to historical climate observations (1970 to 2017) and near-term (2020-2050) climate projections from 10 different model/representative concentration pathway combinations to quantify risks and associated uncertainties. The near-term projection time-frame (2020-2050) is chosen to be reflective of the 20 to 30-year investment planning horizon of perennial tree-fruit systems. The look and feel of the visualizations will be co-developed with input from the stakeholder advisory group to ensure that the information is useful and actionable from a producer risk-management perspective. The website will be developed using the R-Shiny platform for integration with another tree-fruit risk-

management tool currently under development by our group (related to changing pest pressures under climate variability and change), so that all information is co-located for easy access by the target audience.

Delivery Mechanism

The tool will be delivered as part of two existing online portals—CSANR's Climate Visualization Tool for Ag (ongoing effort), and the WSU-Tree Fruit Decision Aid System (DAS). Given that DAS is extensively used by the Washington tree-fruit industry, piggybacking on it will help us reach the target audience and improve the likelihood of ongoing product use. DAS works on a paid subscription model, and therefore we also provide the tool through CSANR's Climate Visualization Tool for Ag so there is free access for anyone that is interested in the tool.

A two-pronged approach will be used for creating and delivering training material to be used in conjunction with the tool. Interactions with the stakeholder advisory group will inform development of a "how to use the online tool" training material for hand-on training at workshops. Feedback from workshops will be then be used to inform video training material that will be used in the webinar, and made available in the tool website as a durable training product that users can continue to access for self-learning.

Workshops will be offered to interested grower and consultant groups at a time and location of their choosing. We are aiming to reach stakeholders at 6 workshops during January-March 2019 with approximately 20 participants per session in the areas of Omak, Manson, Wenatchee, Yakima, Tri-Cities, and Prosser - the major tree-fruit growing regions of Washington State. Workshop material will be tailored to fit into 2 hours. The suggested participant count per workshop, locations, and duration of workshop, are based on what has worked well with prior workshops we have offered for this target audience. In addition to hand-on training, the in-person workshops will be used as a platform to allow producers to interact in small-groups, expand the catalog of risk-management options and collectively identify the gaps and challenges in being prepared to effectively address any emerging risks due to insufficient winter chill. Results from workshop discussions will help inform webinar outputs, as well as identify next steps for research and extension. While workshops allow for in-depth in-person interactions, we will also design and conduct a webinar to reach a higher number of individuals in a cost-effective way. The webinar will be recorded to create a durable extension product that will be available on-demand, when stakeholders want to learn more about the topic.

Evaluation of producer learning outcomes

Expected producer learning outcomes range from *understanding* and *analyzing* risks to *developing* a plan for potential opportunities and challenges in addressing insufficient winter chill risks. Evaluation of "*understanding*" and "*analyzing*" outcomes with be through survey instruments. These surveys will be administered at the beginning and end of workshops and the webinar with a view to measure the impact of the educational tool in terms of changing knowledge, as well as developing preparedness for managing emerging risks. Given that we are

creating a video training product for self-learning, we will also gather contact information for users accessing the training video, and administer an online evaluation survey in the 18th (last) month of the project for these users. Given the 18 month nature of the project and the longer-term planning horizon for this risk, it will be infeasible to measure actual adoption of these risk-management options in the project's time-frame.

Wide applicability

While this project is restricted in scope to winter chill risk in tree-fruit growing areas of Washington State, the methods and online tool framework are generic and easily extendable to include other regions in the continental U.S. as well as to other form of risks associated with climate variability and change.

Final Checklist

Application Due Date

Thursday, November 16, 2017 at 5:00 PM (Pacific)

Submission Checklist

Save and Exit lets you save your application and continue working on it later.

Print and review your application before you submit it. You can do this by clicking the **View PDF** button on the left side of your screen.

Click Submit to submit your application to be reviewed.

Amount Requested

Amount Requested:	49,892
Do you have institutional approval?:	Yes
Are you applying for funding for this project, or essentially the same project, elsewhere or have you received funding for this project previously?:	No

If yes, identify the agency or source of other funds, the amounts, and whether funding is pending or received.

Budget Narrative

Section A and B ($30,797)

Salaries and fringe benefits (Total 3.73 calendar months including time commitments of all key personnel and other personnel for a total of $30,797. Individual time commitments, salary and benefit rates are listed below)

Personnel	Months	Monthly salary	Fringe benefit rate	Total salary plus benefits
Key personnel				
Kirti Rajagopalan (Overall project management and programmer supervision for online tool development)	0.5	$5833	31.5%	$3912
Vince Jones (Producer and industry liaison)	0.08	$12445	27.9%	$1194
Lee Kalcsits (Chill model evaluation, and cataloging of risk management alternatives)	0.35	$7842	27.4%	$3496
Ute Chambers (Training material, workshop and webinar development)	0.5	$5652	32%	$3807
Claudio Stockle (co-supervise the programming of winter chill models into the online tool)	0.04	$22,097	29.1%	$1141
Other personnel				
Programmer (Tool development)	2	$5833	31.5%	$15,345
Staff support(Webinar and survey delivery)	0.26	$4573	56.7%	$1902

Section D ($6000)

Domestic Travel ($6000)

At $375 per travel, this includes travel for 2 members of the project team to travel to 6

workshops (6*2*$375 = $4500), and 4 members of the stakeholder advisory group to travel to one in-person meeting with the project team (4*$375 = $1500). Per travel budget of $375 is based on a 420 mile round trip (Pullman, WA to Omak, WA) @ $0.535 in mileage costs per mile, $51 in per Diem, and $100 for overnight stay at government rates.

Section F (Other Direct Costs) ($2800)

1) Material and Supplies costs of $1200 include costs for server and storage space to host the data and the online tool.

2) Honorarium of $400 for each member of the stakeholder advisory group (4 members @$400 each = $1600) for ongoing interactions through the project. This involves collaborations to co-develop the visualizations in the online tool, training material for the broader producer audience, and general feedback in making sure the tools and training material we create are useful and actionable for producer risk-management.

TOTAL DIRECT COSTS = $39,597

Section H ($10,295)

INDIRECT COSTS at a rate 26% of TOTAL DIRECT COSTS = $10,295

TOTAL PROJECT COST = $39,597 + $10,295 = $49,892

ERME Budget Form

		Totals ($)
Section A, Senior/Key Person		13550
Section B, Other Personnel		17247
Total Number Other Personnel	2	
Total Salary, Wages and Fringe Benefits (A+B)		30797
Section C, Equipment		Not Allowable
Section D, Travel		6000
1. Domestic	6000	
2. Foreign	Not Allowable	
Section E, Participant/Trainee Support Costs		Not Allowable
Section F, Other Direct Costs		2800
1. Materials and Supplies	1200	
2. Publication Costs	Not Allowable	
3. Consultant Services		
4. ADP/Computer Services	Not Allowable	
5. Subawards/Consortium/Contractual Costs		
6. Equipment or Facility Rental/User Fees		
7. Alterations and Renovations	Not Allowable	
8. Other 1	1600	
9. Other 2		
10. Other 3		
Section G, Direct Costs (A thru F)		39597
Section H, Indirect Costs		10295
Section I, Total Direct and Indirect Costs (G + H)		49892
Section J, Fee		Not Allowable

APPLICATION FOR FEDERAL ASSISTANCE

SF 424 (R&R)

2. DATE SUBMITTED	Applicant Identifier
11/16/2017	13654
3. DATE RECEIVED BY STATE	**State Application Identifier**

1. * TYPE OF SUBMISSION

☐ Pre-application ☑ Application
☐ Changed/Corrected Application

4. Federal

5. APPLICANT INFORMATION *** Organizational DUNS:** 04-148-5301

* Legal Name: Washington State University

Department: | Division:

* Street1: Room 280 Lighty | Street2: PO Box 641060

* City: Pullman | County: Whitman | * State: WA | * ZIP Code: 99164

* Country: USA

Person to be contacted on matters involving this application

Prefix:	* First Name:	Middle Name:	* Last Name:	Suffix:
	Kirti		Rajagopalan	

* Phone Number: 5154507142 | Fax Number: | Email: kirtir@wsu.edu

6. * EMPLOYER IDENTIFICATION *(EIN) or (TIN):*

91-6001108

7. * TYPE OF APPLICANT:

Public/State Controlled Institution of Higher Education

Other (Specify):

8. * TYPE OF APPLICATION: ☑ New

☐ Resubmission ☐ Renewal ☐ Continuation ☐ Revision

Small Business Organization Type

☐ Women Owned ☐ Socially and Economically Disadvantaged

If Revision, mark appropriate box(es).

☐ A. Increase Award ☐ B. Decrease Award ☐ C. Increase Duration

☐ D. Decrease Duration ☐ E. Other *(specify)*:

9. * NAME OF FEDERAL AGENCY:

USDA NIFA

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER:

10.500

TITLE: USDA NIFA

* Is this application being submitted to other agencies? Yes ☐ No ☑

What other Agencies?

11. * DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

Decreasing winter chills: risks and implications for Northwest tree-fruit producers

12. * AREAS AFFECTED BY PROJECT *(cities, counties, states, etc.)*

Washington State

13. PROPOSED PROJECT:

* Start Date: April 1, 2018 | * Ending Date: September 30, 2019

14. CONGRESSIONAL DISTRICTS OF:

a. * Applicant: WA-005 | b. * Project: WA-005

15. PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR CONTACT INFORMATION

Prefix:	* First Name:	Middle Name:	* Last Name:	Suffix:
	Kirti		Rajagopalan	

Position/Title: Assistant Research Professor | * Organization Name: Washington State University

Department: Center for Sustaining Agriculture a | Division:

* Street1: 1265 Hannah St | Street2:

* City: Pullman | County: Whitman | * State: WA | * ZIP Code: 99163

* Country: USA

* Phone Number: 5154507142 | Fax Number: | * Email: kirtir@wsu.edu

OMB Number: 4040-0001

Expiration Date: 04/30/2008

16. ESTIMATED PROJECT FUNDING

a. * Total Estimated Project Funding	49892.00
b. * Total Federal & Non-Federal Funds	49892.00
c. * Estimated Program Income	0

17. * IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES ☐ THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE:

b. NO ☑ PROGRAM IS NOT COVERED BY E.O. 12372; OR

☐ PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

18. By signing this application, I certify (1) to the statements contained in the list of certifications* and (2) that the statements herein are true, complete and accurate to the best of my knowledge. I also provide the required assurances * and agree to comply with any resulting terms if I accept an award. I am aware that any false, fictitious, or fraudulent statements or claims may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

☑ *** I agree**

**** The list of certifications and assurances, or an Internet site where you may obtain this list, is contained in the announcement or agency specific instructions.***

19. Authorized Representative

Prefix:	* First Name:	Middle Name:	* Last Name:	Suffix:
	Dan		Nordquist	

* Position/Title:	AVP/Director	* Organization:	Washington State University
Department:	Research Support & Operations	Division:	
* Street1:	Room 280 Lighty	Street2:	PO Box 641060

* City:	Pullman	County:	Whitman	* State: WA	* ZIP Code: 99164
* Country:	USA				
* Phone Number:	(509) 335-9661	Fax Number:	(509) 335-0890	* Email:	orso@wsu.edu

*** Signature of Authorized Representative** Dan Nordquist

*** Date Signed** 11/16/2017

20. Pre-application Add Attachment | Delete Attachment | View Attachment

OMB Number: 4040-0001

Expiration Date: 04/30/2008

Dr. Shannon Neibergs
Director
Western Extension Risk Management Education

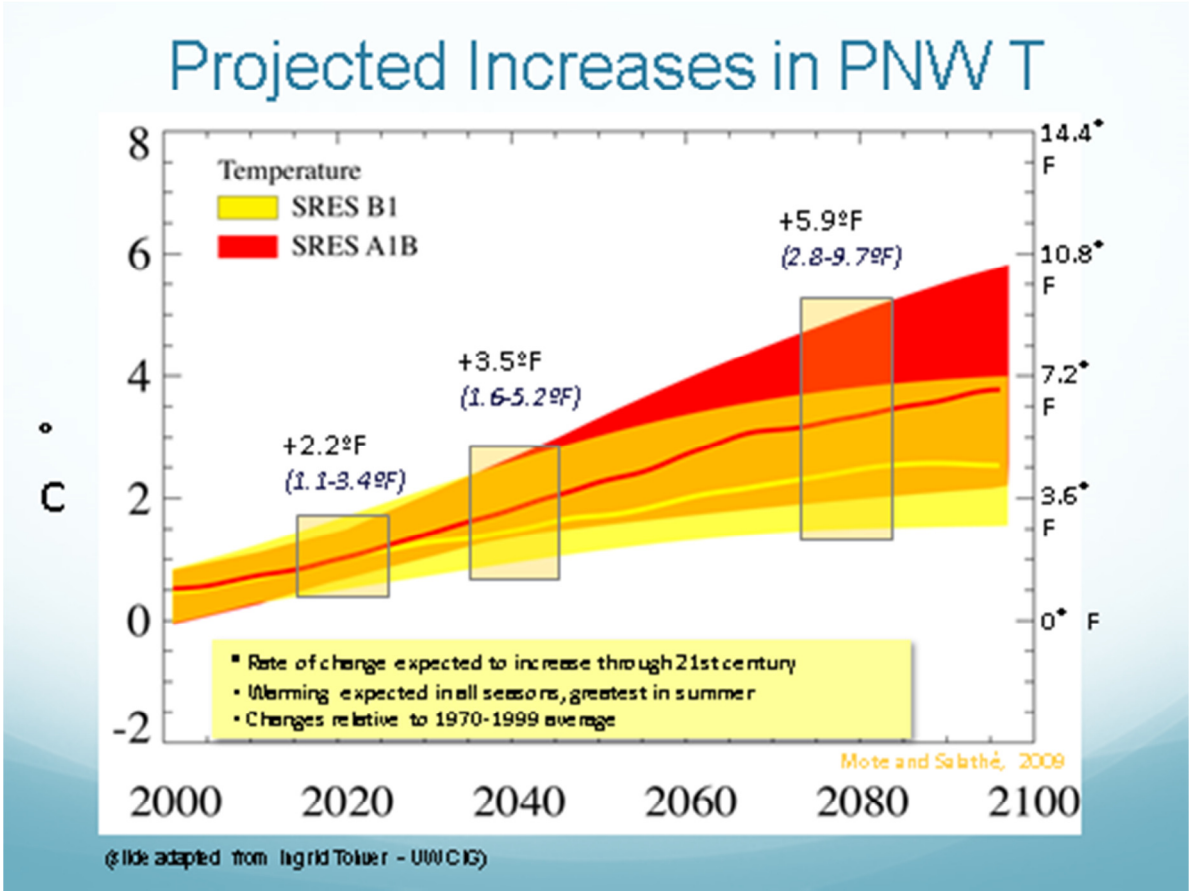
November 7, 2017

Dear Dr. Neibergs,

I am happy to collaborate on the project "Decreasing Winter Chill: Risks and Implications for the Northwest Tree Fruit Industry" with the associated team members.

This project will help to bring needed information and risk assessments to our tree-fruit industry as it relates to winter chill. As warmer winters become more frequent, I have increasing concern about the risks for our industry from insufficient winter chill. I have witnessed first-hand the effects of insufficient chill on deciduous tree crops in California.

Both the Washington State of Knowledge Report from the University of Washington Climate Impacts Group in 2013 and the Northwest Climate Assessment Report from the Oregon Climate Change Research Institute, also in 2013, have modeled significant temperature increases that could dramatically reduce future winter chill for our pome and stone fruit crops in the Pacific Northwest:



The prospect of having the ability to learn and utilize data from other areas in the U.S. that have similar winter chill risks would be of great value to me.

As a partner, I agree to collaborate as a member of the project's advisory group and help ensure that the educational material communicates risks and implications in a way that is useful for producers. I am an active user of the WSU Tree Fruit Decision Aid System and am excited to see efforts to develop new, relevant risk management information.

I recognize that this collaboration does not provide any funding for me or my organization, other than an honorarium for my involvement.

Best Regards,

Byron Phillips

National Crop Specialist – Tree Fruit
Valent USA, LLC
325 Canyon Creek Drive
Wenatchee, WA 98801
(509) 699-8043
Fax: (925) 817-5939
byron.phillips@valent.com

November 6, 2017

Dr. Shannon Neibergs
Director
Western Extension Risk Management Education

Dear Dr. Neibergs,

I am happy to collaborate on the project "Decreasing Winter Chill: Risks and Implications for the Northwest Tree Fruit Industry" and the associated team members. This project will help to bring needed information and risk assessments to our tree-fruit industry as it relates to winter chill. As warmer winters become more frequent, I have increasing interests about the risks for our industry from insufficient winter chill. The prospect of having the ability to learn and utilize data from other areas in the U.S. that have winter chill risks would be of great value.

As a partner, I agree to collaborate as a member of the project's advisory group and help ensure that the educational material communicates risks and implications in a way that is useful for producers. I am excited to see efforts to develop new, relevant risk management information for WSU Tree Fruit Decision Aid System users.

I recognize that this collaboration does not provide any funding for myself or my organization, other than an honorarium for my involvement.

Sincerely,

Garrett E. Bishop

Garrett Bishop

G.S. Long Co., Inc.
Research Specialist

Dr. Shannon Neibergs
Director
Western Extension Risk Management Education

November 5, 2017

Dear Dr. Neibergs,

I writing to inform you of my willingness to collaborate with Vince, Kirti, Lee, and the team on the project "Decreasing winter chill: risks and implications for the Northwest tree fruit industry". From my perspective as a grower in North-Central Washington, insufficient winter chills is an issue we have not had to plan for in the past. It is an emerging issue that is starting to manifest in some areas (with warmer winters), and being aware of the risks and their implications will help us be better prepared to address them. The idea of using analogs to learn from locations that have experienced these risks is appealing.

As a collaborative partner, I agree to be part of the project's advisory group and help ensure that the educational material communicates risks and implications in a way that is actionable for producers. I am an active user of the WSU Tree Fruit Decision Aid System and am excited to see efforts to develop new, relevant risk management information for producers.

I recognize that this collaboration does not provide any funding for myself or my organization, other than a honorarium for my involvement.

Sincerely,

Hannah Welker Nov 9, 2017

WASHINGTON STATE UNIVERSITY

November 13, 2017

Dr. Shannon Neibergs
Director
Washington State University Extension
Western Extension Risk Management Education Center
103A Hulbert Hall
PO Box 646210
Pullman, WA 99164-6210

Dear Dr. Neibergs,

This is the letter of commitment on behalf of the team from Washington State University for the proposal "Decreasing winter chill: risks and implications for the Northwest tree-fruit industry" (Application Number 13654). The following key personnel commit to the roles detailed in this letter.

1) Kirti Rajagopalan
Assistant Research Professor
Center for Sustaining Agriculture and Natural Resources
Washington State University
Role: Dr. Rajagopalan is involved in multiple ongoing efforts developing online tools that convey risks associated with climate variability and change on agricultural production in the Pacific Northwest U.S. These include conveying risks through spatial analogs that help view emerging risks through a historical context and experiences of peers. As Project Director, Dr. Rajagopalan will be responsible for overall project management, and supervising a programmer who will develop the online tool.

2) Vincent Jones
Professor – Tree Fruit Research and Extension Center
Director – WSU Tree Fruit Decision Aid System
Washington State University
Role: As the director of the WSU Tree-Fruit Decision Aid System (DAS), Dr. Jones has built extensive relationships with tree-fruit producers in the Pacific Northwest U.S., many of whom are DAS users. Dr. Jones will co-direct this project, and be the project liaison to producers and other tree-fruit industry stakeholders. He will also supervise the development of training materials for the online tool, based on his extensive experience creating similar materials for DAS.

3) Claudio Stockle
Professor
Biological Systems Engineering
Washington State University
Role: Dr. Stockle is an expert in bio-physical crop modeling and is involved in multiple ongoing efforts characterizing the impacts of climate variability on crop production. In this project, Dr. Stockle will help co-supervise the programming of winter chill models into the online tool.

4) Lee Kalcsits
Assistant Professor
WSU Tree Fruit Research and Extension Center
Washington State University
Role: Dr. Lee Kalcsits is an expert in tree-fruit physiology and abiotic stress. He has built relationships with Washington State tree-fruit producers through his research focusing on reducing detrimental effects of abiotic stresses on tree fruit. In this project, he will help verify appropriateness of winter chill models, and help catalog varietal suitability and management options for producers to address emerging production risks due to insufficient winter chill.

5) Ute Chambers
Manager and Educator
WSU - Tree Fruit Decision Aid System
Washington State University
Role: Dr. Chambers is the manager and educator for the WSU Tree-Fruit Decision Aid System (DAS). In this project, she will draw on her extensive outreach and training experience with tree-fruit producers, and lead the design and delivery of workshops, webinars, and survey instruments that evaluate producer learning-outcomes.

Sincerely,

Kirti Rajagopalan
Assistant Research Professor
Center for Sustaining Agriculture and Natural Resources
Washington State University
Pullman, WA 99164
Email: kirtir@wsu.edu
Phone: (515) 450-7142

November 15, 2017

Dr. Shannon Neibergs
Director
Western Extension Risk Management Education
Washington State University
222 N. Havana
Spokane, WA 99202

Dear Dr. Neibergs,

I am happy to collaborate with Vince, Kirti, Lee, and the team on the project "Decreasing winter chill: risks and implications for the Northwest tree fruit industry". This is an emerging area of concern in our region given recent warmer winters. The development of educational materials for producers would be both timely and useful. This is especially critical because of the multi-year investment horizon of tree-fruit production systems. Information related to relative winter chill risks across multiple varieties of tree-fruit will a) help inform investment decision making, b) prepare us for yearly management implications we might need to ensure economic viability, c) and become an increasing factor for consideration in the development of decision aid tools for horticultural management decision-making.

As a collaborative partner, I agree to be part of the project's advisory group and help fine tune educational material content, and broaden awareness and use of the material. We have had ongoing partnerships with Washington State University's Tree-Fruit Research and Extension Center for several years. The WSU's Agricultural Weather Network and Decision Aid System for pest management are both actively used by the industry and will play a role in how this information would be used by producers. The Washington Tree Fruit Research Commission is currently providing funding for a number of these decision tools and we are excited to take the partnership further through this project.

I recognize that this collaboration does not provide any funding for myself or my organization.

Sincerely,

WASHINGTON TREE FRUIT RESEARCH COMMISSION

Michael J. Willett
Manager