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PARTENARIAT CANADIEN pour l'AGRICULTURE

NB Weather Mapping for Intensive Crop Management

The objective of this project is to establish a province-wide weather monitoring network to support environmentally sustainable crop production management practices through crop and variety selection and integrated pest management programs.

After the installation of new stations in 2020, the combined NBDAAF and NBSCIA weather station network now includes 62 Davis Vantage Pro weather stations. The 2021 season provided the first opportunity to test data import and mapping for the entire network.

Technical issues related to the operation/function and set-tings of the stations required significant manual intervention on the part of NBDAAF staff to ensure accuracy. An updated platform by Davis requires manual intervention by NBSCIA personnel to format the data from the newest NBSCIA managed stations to enable import to the NBDAAF's Potato Crop, Weather and Pest Information portal for export to the Arc GIS database for interpolation and map presentation. NBDAAF and NBSCIA have purchased replacement parts to upgrade the oldest stations in the network to ensure all stations are recording and report-ing for 2022.

This enhanced weather station network will provide New Brunswick farmers another valuable tool to manage climate change initiatives to remain competitive in an increasingly global market demanding environmentally sustainably produced commodities. Data provided by the network will pro-vide critical information to support 4R Nutrient manage-ment and reference key weather parameters over future years.

Month ending accumulations for CHU, GDD and rainfall for all stations are available in **map format on the NBSCIA website**. The NB Potato Crop, Weather and Pest Information portal is available on the **NBDAAF website**.

Cartographie météorologique du N.-B. pour la gestion des cultures intensives

L'objectif de ce projet est d'établir un réseau de surveillance météorologique à l'échelle de la province pour soutenir des pratiques de gestion de la production végétale écologique-ment durables grâce à la sélection des cultures et des varié-tés et à des programmes intégrés de lutte antiparasitaire.

Après l'installation de nouvelles stations en 2020, le réseau combiné de stations météorologiques Ministère de l'Agriculture, de l'Aquaculture et des Pêches du Nouveau-Brunswick (FAAANB) et l'AASCNB comprend désor-mais 62 stations météorologiques Davis Vantage Pro. La saison 2021 a été la première occasion de tester l'importa-tion et la cartographie des données pour l'ensemble du ré-seau.

Les problèmes techniques liés au fonctionnement/à la fonc-tion et aux réglages des stations ont nécessité une interven-tion manuelle importante de la part du personnel de la FAAANB pour assurer la précision. Une plate-forme mise à jour par Davis nécessite une intervention manuelle du personnel de l'AASCNB pour formater les données des nouvelles stations gérées par l'AASCNB afin de permettre l'importation vers le portail d'informations sur les cultures de pommes de terre, les conditions météorologiques et les ravageurs de la FAANB pour l'exportation vers la base de données Arc SIG pour l'interpolation et la présentation de la carte.

FAANB et l'AASCNB ont acheté des pièces de rechange pour mettre à niveau les stations les plus anciennes du ré-seau afin de s'assurer que toutes les stations enregistrent et signalent pour 2022.

Ce réseau amélioré de stations météorologiques fournira aux agriculteurs du Nouveau-Brunswick un autre outil pré-cieux pour gérer les initiatives de lutte contre les change-ments climatiques afin de rester compétitifs sur un marché de plus en plus mondial exigeant des produits de base pro-duits de manière écologiquement durable. Les données fournies par le réseau fourniront des informations essen-tielles pour soutenir la gestion des nutriments 4R et référen-cer les principaux paramètres météorologiques au cours des années à venir.

Les cumuls de fin de mois pour CHU, GDD et les précipi-tations pour toutes les stations sont disponibles sous forme de carte sur le site Web de l'AASCNB : https://www.nbscia.ca/weather-maps/#nb2021. Le portail d'infor-mation sur les cultures de pommes de terre, les conditions météorologiques et les ravageurs du Nouveau-Brunswick est disponible sur le site Web de la FAANB.

Interim Report:

- 1. Project title and number. C1819-0977-Y4 NB Weather Mapping for Intensive Crop Management
- <u>Project leader and collaborators</u>: Ray Carmichael, MSc. Ag., NBSCIA Club Agrologist will managed project activities and reporting, with support from other NBSCIA regional coordinators. The NBDAAF collaborator is David Wattie, Integrated Pest Management Specialist, Wicklow Regional Office. Bill Jones, exp, Halifax, provides contracted GIS advice and mapping support.
- <u>Summary</u>: NBSCIA has completed a series of projects (EMP15-003-3: NBSCIA Agricultural Geomatics Service),C1819-0557: Climate Mapping for Intensive Crop Production and C1819-0977 NB Agricultural Weather Network and C1819-0977-Y2,3 and 4 NB Agricultural Weather Network for Intensive Crop Management to expand the number of Davis weather stations throughout the Province and enable export of the PAT data from the NB Potato Crop, Weather and Pest Information portal (http://agri.gnb.ca/010-001/WebServiceData.aspx) in a GIS compatible format.

The objective of this project activity is to establish a Province wide weather monitoring network to support environmentally sustainable crop production management practices through crop and variety selection and integrated pest management programs

Due to the COVID-19 pandemic during 2020 delivery and installation of the additional stations was delayed until September, completing a combined network of 62 Davis Vantage Pro weather stations. Therefore the 2021 season provided the first opportunity to test data import and mapping for the entire network.

NBSCIA members and other station hosts were provided station Ids enabling them to access the Davis Weatherlink app on smart phones and read real time weather conditions at a particular station location. This was a very popular feature, particularly for determining wind speed for spraying decisions.

Technical issues related to the operation or function and settings of the stations required significant manual intervention on the part of NBDAAF staff to insure accuracy. An updated platform by Davies requires manual intervention by NBSCIA personnel to format the data from the newest NBSCIA managed stations to enable import to the PAT NB Potato Crop, Weather and Pest Information portal for export to the Arc GIS database for interpolation and map presentation.

NBDAAF and NBSCIA have purchased replacement parts to upgrade the oldest stations in the network to insure all stations are recording and reporting for 2022.

As a consequence of the infrequent and limited data available two deliverables were not satisfactorily accomplished as planned: 1) improved definition and understanding of the heat unit rating for corn and soybean, in relation to physiological maturity in New Brunswick and 2) assessment of existing models for forecasting occurrence and severity of crop pests.

Month ending accumulations for CHU, GDD and rainfall for all stations were posted in a map format to the NBSCIA website: <u>https://www.nbscia.ca/weather-maps/#nb2021</u>

This enhanced weather station network will provide New Brunswick farmers another valuable tool to manage climate change initiatives to remain competitive in an increasingly global market

demanding environmentally sustainably produced commodities. Data provided by the network will provide critical information to support 4R Nutrient management and reference key weather parameters over future years.

4. <u>Introduction</u>: In areas of significant crop production where demand warrants, there are commercial service providers for climate monitoring and pest risk forecasting such as Weather INnovations Consulting LP (WIN), Chatham, ON. WIN's environmental monitoring network encompasses Ontario, Manitoba, Saskatchewan, Michigan and Western Europe. The New Brunswick agricultural community and diverse microclimates is not large enough to attract commercial service providers such as WIN.

The NBDAAF Potato Analysis Tool (PAT) network was established to provide data collection from a series of weather stations that monitor temperature, relative humidity, rain, wind, solar radiation, leaf wetness and soil temperature and moisture to better manage late blight in potatoes. The NBSCIA has a number of like stations (make and model) located outside the "potato belt" area with similar capability that can be incorporated with the NB Potato Crop Weather and Pest Information to provide a Province wide Agriculture Weather network (NB Ag Weather Network) to assist in production management decisions and benchmark climate changes going forward.

NBSCIA has completed a series of projects (EMP15-003-3: NBSCIA Agricultural Geomatics Service), C1819-0557: Climate Mapping for Intensive Crop Production and C1819-0977 NB Agricultural Weather Network and C1819-0977-Y2 NB Agricultural Weather Network for Intensive Crop Management to expand the number of Davis weather stations throughout the Province and enable export of the PAT data from the NB Potato Crop, Weather and Pest Information portal https://agri.gnb.ca/010-001/Index.aspx?lang=en in a GIS compatible format https://www.nbscia.ca/weather-maps/#nb2021. C1819-0977-Y3 NB Agricultural Weather Network for Intensive Crop Management focused on perfecting data transfer within the network to create the maps and a significant maintain and upgrade stations.

This enhanced weather station network will provide New Brunswick farmers another valuable tool to manage climate change initiatives to remain competitive in an increasingly global market demanding environmentally sustainably produced commodities. Data provided by the network will provide critical information to support 4R Nutrient management and reference key weather parameters over future years.

- 5. <u>Project Objective</u>: To establish and maintain a Province wide weather monitoring network to support environmentally sustainable crop production management practices through crop and variety selection and integrated pest management programs.
- <u>Project Deliverable(s)</u>: An expanded weather station network, upgraded station capability, improved annual and in-season maintenance to support the establishment of an NB Agricultural Weather network.

Specific deliverables for this project activity will be to:

- provide real time access to all individual stations, using the Davis Weather Link delivery model for the georeferenced climate maps (<u>https://www.weatherlink.com/</u>) by producers to facilitate local real time weather checks to support crop growth and pest modeling for crop scouting and IPM programs
- improved definition and understanding of the heat unit rating for corn and soybean, in relation to physiological maturity in New Brunswick
- assessment of existing phenology models for forecasting occurrence and severity of crop pests

• rainfall and heat unit bench mark maps to monitor climate change

Project results will assist producers in evaluating the environmental and climate change risks associated with their operations, acquire knowledge and technical resource tools to address these risks and help them implement adjustments to manage such risks.

Accurate predictive models for pest alerts to a field scale will enable the farmers to undertake more timely pesticide applications, hence reduce the environmental load improving sustainability.

7. Results and Discussion:

The locations of the 62 network stations are identified in Illustration 1, below.

Compounding the COVID 19 pandemic during 2020 which delayed delivery and installation of all the stations until September, the early season (May) Public Health Guidelines established to manage the spread COVID-19 impeded the ability of staff to service the stations and insure proper operation prior to start of the season. As a consequence the data transmitted automatically to the NB Potato Crop, Weather and Pest Information portal was inconsistent (Table 1, below).

When stations are malfunctioning and data is not downloaded automatically, considerable manual intervention is required to input and verify the data. This is compounded by the fact that the newest Davis stations have to be the individually downloaded by a NBSCIA coordinator from the Davies cloud link. The NBSCIA station data is then combined with the Web Service data for export to the Arc GIS for interpolation by the GIS contractor and map presentation in .pdf format posted on the NBSCIA web site.

The manual manipulation by NBDAAF to verify and format missing station data for download into the Web Service is cumbersome, tedious and time consuming. Combined with the manual input still required on the part of NBSCIA the process limits the usefulness for time sensitive crop management and predictive modelling.

NBDAAF and NBSCIA have purchased replacement parts to upgrade the oldest stations in the network to insure all stations are recording and reporting for 2022. Regular work planning meetings lead by the NBDAAF Potato Development Centre Director have been established to facilitate coordination between the two organizations.

As a consequence of the challenges previously outlined, two deliverables were not satisfactorily accomplished: 1) improved definition and understanding of the heat unit rating for corn and soybean, in relation to physiological maturity in New Brunswick and 2) assessment of existing models for forecasting occurrence and severity of crop pests.

NBSCIA and NBDAAF station hosts were provided station Ids enabling them to access the Davis Weatherlink app on smart phones and read real time weather conditions at a particular location. This is a very popular feature for many, particularly for determining wind speed for spraying decisions and planning field operations.

Recognizing that the resolution or scale of interpolated surfaces generated from the weather station data varies with: (1) the locations of the weather stations, and (2) the spatial distribution of the stations. The further apart the stations are and/or the more unevenly they are spaced the greater the grid cell size required (or the smaller the scale). Month ending summaries for GDD, CHU and Rainfall were prepared and posted on the NBSCIA website for 2021

<u>https://www.nbscia.ca/weather-maps/#nb2021</u>. It should be noted that station by station reporting varies during the course of the season impacting the integrity of the interpolated maps from month to month and year to year. However staff have manually verified the data used for mapping and general trends are considered valid. CHU, GDD and Rainfall for the 2021 season are illustrated in Figures 2, 3 and 4 respectively. Year to year comparisons are available on the NBSCIA website.

Conclusions:

Given the manual effort involved on the part of NBSCIA and NBDAAF staff the preparation of weather maps more frequently than monthly is logistically difficult for time sensitive intensive crop management for predictive pest modelling. However, with the renewed effort by NBDAAF and NBSCIA it may become a reality.

After interpolation the mapped data has the potential to improve the definition and understanding of the microclimatic heat unit ratings applied to significant agricultural crops and improve integrated pest management and environmentally sustainable production practices. Adding soil temperature and moisture parameters would support efforts to new or enhanced cropping strategies reduce GHG emissions and monitor the impact of climate change.

Looking forward to 2030 and beyond an expanded NB Ag Weather Network will serve as a reference or bench mark for monitoring extreme weather events, attributed to climate change, within New Brunswick.

Providing open access to all sixty-two stations will enable real time decision making by producers in support of environmentally sustainable crop production.

Additional project work will be necessary to provide:

- a) improved definition and understanding of the heat unit rating for corn and soybean, in relation to physiological maturity in New Brunswick
- b) assessment of existing crop and pest growth models for forecasting occurrence and severity of crop pests
- c) rainfall and heat unit bench mark maps to monitor climate change
- d) increased soil moisture and temperature mapping will support improved nitrogen management from organic and inorganic sources

8. Required next steps

a) The NBDAAF, Wicklow Office continues to manage the Potato Analysis Tool (PAT) central network and provide ongoing operational overview, data verification for all 62 stations currently available.

b) Preparation of a formal working arrangement between NBSCIA and NBDAAF to insure timely and effective maintenance and operation of all network stations.

c) Development of an improved (less manual intervention) electronic delivery model for the georeferenced climate maps and predictive pest models to enable weekly publication and or custom requests.

d) Identification and assessment of various existing phenology models for forecasting crop growth and the occurrence and severity of crop disease and insect pest infestations.

d) Provide real time access to all individual stations, using the Davis Weather Link (<u>https://www.weatherlink.com/</u>), by producers to facilitate local real time weather checks to support work planning and intensive crop management practices.

e) Upgrade soil temperature and moisture capacity within the existing network.

f) Adjust the CHU accumulation formula start date to May1 to be consistent with Ontario for corn and soybeans.

9. <u>Communication</u>: Provincial weather maps for CHU, GDD and rainfall were posted to the NBSCIA website and delivered by email upon request.

Customized maps for individual growers can be prepared and forwarded directly by email from the NBSCIAA Geomatics Centre.

Table 1: Stations Automatically Providing Data to the NB Potato Crop, Weather and Pest Information portal													
All Available Stations		May/June 10		June 30/July 9		July31/Aug 11		Aug31/Sept 8		Sept30/Oct 6		Oct/Dec3	
Owner	StationId	StationId	D031_CHU	StationId	D061_CHU	StationId	D092_CHU	StationId	D123_CHU	StationId	D153_CHU	StationId	D184_CHU
NBAg-PNB	36	36	148	36	771	36	1384	36	2148	36	2600	36	2790
NBAg-PNB	40	40	76	40	622	40		40		40			
NBAg-PNB	41	45	175	45	787	45	1398	45	2143	45			
NBAg-PNB	45	52	148	52		52	1419	52	2175	52	2668		
NBAg-PNB	47	53		53		53		53	2214	53	2721		
NBAg-PNB	52	55	155	55	770	55		55	2126	55	2578	52	2888
NBAg-PNB	53	56	143	56	768	56	1382	56	2129	56	2598	53	2944
NBAg-PNB	55	57	180	57	887	57		57		57			
NBAg-PNB	56	58		58	592	58	1266	58		58		56	2795
NBAg-PNB	57	59	139	59	770	59	1382	59	2143	59	2621		
NBAg-PNB	58	60		60	678	60	1324	60	2104	60	2614		
NBAg-PNB	59	62	161	62	818	62	1481	62	2256	62	2770	59	2833
NBAg-PNB	60	63		63		63		63		63		60	2836
NBAg-PNB	62	65		65		65		65		65		62	3009
NBAg-PNB	63	66		66		66		66		66			
NBAg-PNB	65	67	187	67	814	67		67		67			
NBAg-PNB	66	69	152	69		69	1449	69	2211	69	2712		
NBAg-PNB	67	70	168	70		70		70		70			
NBAg-PNB	69	72	179	72	809	72		72	2179	72	2629	69	2939
NBAg-PNB	70	73		73		73		73	2293	73	2819	72	2813
NBAg-PNB	72	74	145	74		74		74		74		73	3065
NBAg-PNB	73	75		75	872	75	1523	75	2309	75	2824	75	3074
NBAg-PNB	74	76	188	76	822	76	1444	76	2193	76	2663		
NBSCIA	75	79	161	79		79		79	2240	79	2746		
NBAg-PNB	76	80	9	80	585	80	1178	80	1907	80	2325	76	2865
NBAg-PNB	79	82	159	82		82		82		82		79	2975
NBAg-PNB	80	83		83		83		83		83		80	2495
NBAg-PNB	81	84	148	84		84		84		84			
NBAg-PNB	82	86		86		86		86		86			
NBAg-PNB	83	89		89		89		89		89			
NBSCIA_19	84	90	211	90		90	1591	90	2382	90		84	3022

		May/June 10		June 30/July 9		July31/Aug 11		Aug31/Sept 8		Sept30/Oct 6		Oct/Dec3	
Owner	StationId	StationId	D031_CHU	StationId	D061_CHU	StationId	D092_CHU	StationId	D123_CHU	StationId	D153_CHU	StationId	D184_CHU
NBSCIA_19	86	91	102	91		91	1337	91	2084	91	2555		
NBSCIA	89	92		92		92	1531	92	2299	92	2823		
NBSCIA	90	93		93		93		93		93			
NBSCIA	91	94		94		94		94		94			
NBSCIA	92	95	10	95		95	1191	95	1891	95			
NBSCIA	93	96		96		96		96		96			
NBSCIA	94	97	220	97	917	97	1605	97	2396	97	2956		
NBSCIA	95	98		98		98		98		98			
NBSCIA	96	99	222	99		99	1596	99		99			
NBSCIA	97	100		100		100	1455	100	2207	100	2793		
NBSCIA	98	101	25	101	691	101	1363	101		101	2679		
NBSCIA_19	99	102		102		102	1338	102	2100	102	2635		
NBSCIA_19	100	104	149	104	798	104	1447	104	2198	104	2723		
NBSCIA_19	101	105		105	750	105	1418	105	2155	105	2674		
NBSCIA_19	102	106		106	819	106		106		106			
NBSCIA_19	104	107		107	798	107	1239	107	1994	107	2557		
NBSCIA_19		109		109	750	108		108		108			
NBSCIA_19	105	106	199			109		109	2155	109			
NBSCIA_19	106	107	231			110		110		110			
NBSCIA_19	107	109				111		111	1994	111			
NBSCIA_20	109					112		112		112			
NBSCIA	112		250	112		113		113		113			
NBSCIA_20	113			113		114		114		114			
NBSCIA_20	115			115		115		115		115			
NBSCIA_20	116			116									
NBSCIA_20	117			117									
NBSCIA_20	118			118									
NBSCIA_20	119			119									
NBSCIA_20	120			120									
NBSCIA_21	121			121									
NBSCIA_21	122			122									



Illustration 2: October 30, 2021 CHU Accumulation



Illustration 3: October 30, 2021 GDD Accumulation



Illustration 4: October 30, 2021 Rainfall Accumulation (mm.)

