SERVICES OF THE NORTH DAKOTA AGRICULTURAL WEATHER NETWORK TO THE AGRICULTURAL SECTOR

Fikri Adnan Akyüz[1], Barbara Mullins, Dallas Morlock, and Nicole Bart
North Dakota State University, Fargo, North Dakota

1. Introduction:

The North Dakota Agricultural Weather Network (NDAWN) has provided necessary supplementation to the National Weather Service (NWS) Automated Surface Observing System (ASOS) network and the Federal Aviation and Administration (FAA) Automated Weather Observing System (AWOS). There are currently two NWS Weather Forecast Offices (WFO), nine ASOS and fourteen AWOS locations in North Dakota.

The state's radically fluctuating weather conditions made it evident that additional near real-time observations are necessary. The NDAWN network consists of 75 automated weather stations distributed across North Dakota and neighboring states (Figure 1). The stations collect basic meteorological data including wind speed and direction, air and soil temperatures, relative humidity, rainfall, atmospheric pressure and solar radiation.

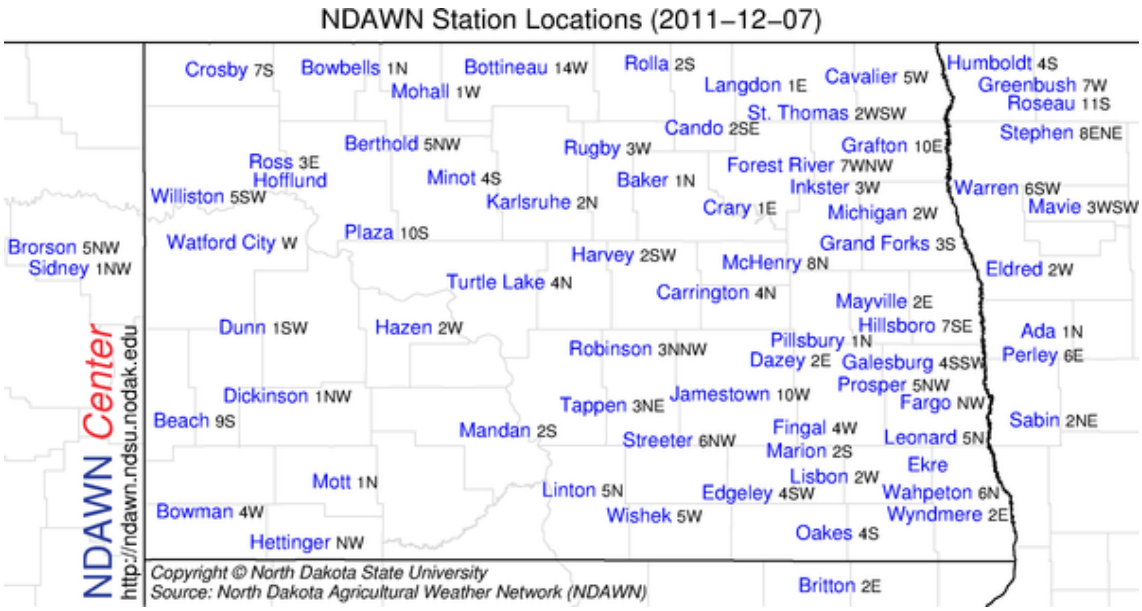

Figure 1. North Dakota Agricultural Weather Network Locations

A 10 foot tripod and Campbell Scientific, Inc. dataloggers are used to support these instruments. The stations also have solar power providing continuous 12v DC power for the data storage and telecommunication telemetry.

[1] Corresponding Author: Adnan Akyüz. 231 Walster Hall, NDSU, Fargo, ND 58102, Adnan.akyuz@ndsu.edu

2. Data Access

The NDAWN network provides agricultural weather information to area growers with crop-specific agricultural applications.

In 2011, Raven™ cell phone modems with Verizon™ wireless access were deployed to communicate with the stations. Currently, 48 stations have been updated with this equipment. With these upgrades producers are now able to view weather data updated every 10 minutes via the web allowing for faster and more detailed weather analysis. All stations will be on cell modem communication by the end of 2014.

3. Quality Assurance

Data quality is very important for the operation of the North Dakota Agricultural Weather Network. In order to prevent erroneous data from being released to the public, two data quality control procedures are completed daily. The High Plains Regional Climate Center (HPRCC) runs a quality assurance program (Hubbard et al. 2005) each morning after downloading the data in order to separate erroneous data, and to estimate missing data.

An additional manual quality assurance is exercised daily during regular business hours by the NDAWN data manager. The NDAWN data manager analyzes all estimated data and the original erroneous data to identify and solve the problem. If the problem is sensor related, the NDAWN network engineer investigates the problem to determine if the sensor needs to be replaced.

4. Agricultural Applications

The weather data collected by the network becomes basic weather parameters to execute certain agricultural application models such as; crop, insect, disease, irrigation scheduler and other models. Many models are currently available on the NDAWN web site (NDAWN, 2014) (Figure 2).

Figure 2. Applications utilizing NDAWN Data

Most of these applications were developed at North Dakota State University (NDSU) with collaborating individuals in their respective fields. Over time the models were tested and fine-tuned to the satisfaction of the producers. As research continues, more models will be developed and added as a valuable resource for agricultural productivity.

5. Economic Impact and Benefits

The utilization of the applications listed in Figure 2 had an estimated economic impact to North Dakota's sugarbeet, potato and small grains grower that was measured in millions of dollars.

In years and locations where risk of Fusarium head blight infection were high, as indicated by the disease forecasting web site, producers responded by timely use of effective fungicides for management, resulting in approximately $26 million return/year to North Dakota producers because of accurate risk prediction and appropriate fungicide use. (McMullen, 2012)

Sugarbeet producers in eastern North Dakota and western Minnesota utilize the NDAWN data for several applications that are designed to better inform the area growers of the existing environmental conditions and to help target optimum timing for applications of herbicide, insecticides and fungicides. One of the potential benefits from utilizing NDAWN data is to reduce the amount of pesticides that the sugarbeet growers use. If growers can eliminate one fungicide application from their cercospora program, they have the potential to save $20/acre on 450,000 acres which equates to $9 million annually.

The American Crystal Sugar Company (ACSC) designed a "Pest Text Alert System" in 2010 that utilizes NDAWN data, applies parameters and sends a text message to growers, company staff and allied industry members (ACSC, 2014). The pest alerts are designed to be an early warning system for the onset of pending disease and insect problems. The overall objective is to provide real time information to maximize effectiveness of pesticide applications.

6. Conclusion

NDAWN is a valuable regional resource of weather data with economic benefits. These data have become a part of the North Dakota climatological archive and will become more valuable as the period of record grows and new models are implemented. The network provides local industry and decision-makers valuable assistance in the timing and proper quantity of needed applications that result in a direct economic and environmental advantage.

7. References

ACSC, 2014: American Crystal Sugar Company. Pest Alert. http://www.crystalsugar.com/agronomy/agtools/pest/default.aspx. Last accessed on June 24, 2014.

Hubbard, K. G., S. Goddard, W. D. Sorensen, N. Wells and A. T. Osugi, 2005: Performance of Quality Assurance Procedures for an Applied Climate Information System. Journal of Atmospheric and Oceanic Technology, pp. 105-112.

McMullen, M., 2012: NDAWN Economic Impact on Small Grains. Personal Assessment. Jan 10, 2012.

NDAWN, 2014: North Dakota Agricultural Weather Network. Applications. http://ndawn.ndsu.nodak.edu/ . Last accessed on June 24, 2014.