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## Impact of Tropical Storm Irene on Vermont Agriculture

Vern Grubinger, University of Vermont Extension

January 5, 2012

On August 28, 2011, Tropical Storm Irene deposited up to a foot of rain as it traveled along the spine of Vermont's Green Mountains. Rainfall was heaviest in central and southern counties. Soils were already saturated from previous rainfall and the next day creeks, streams and rivers were overwhelmed resulting in widespread flooding, erosion and damage to crops and property.

Overall impact on farms. According to figures compiled by the USDA's Farm Service Agency (FSA) Vermont office, 476 farms were impacted by Irene with a total of over 7,200 acres of hay, over 6,000 acres of corn, some 1,750 acres of pasture, over 1,400 acres of sugarbush, nearly 600 acres of vegetables and fruits, and 225 acres of soybeans. There was damage to farmland reported on nearly 9,100 acres (Appendix A). Damage was reported from every county, although it was minimal in Grand Isle and Essex. The intensity of the flood ranged from fast-moving waters moving debris and soil to slow moving water that simply covered fields and crops for a short time. Unofficial estimates place economic losses by farms at about \$20 million.

Food safety. While there have been many other floods in the State in recent years, these have been localized to a county or two. Just this past spring, in May 2011, severe flooding occurred in Chittenden and Washington County. Historically, vegetable growers have destroyed tender crops such as leafy greens after a flood crop but have allowed more durable storage crops to mature and then harvested them, washing thoroughly prior to sale. Irene changed that. It was a statewide flooding event with far greater than normal risk of water contamination due to the large number of sewage treatment plants, septic systems and hazardous waste sites that were underwater.

After consultation with the U.S. Food and Drug Administration, the Vermont Agency of Agriculture determined that flooded produce is considered adulterated under the Food, Drug and Cosmetic Act thus prohibiting sale of edible crops that had come in contact with flood waters in any way, for any length of time. Growers were alerted to this fact and as a result approximately \$2 million in vegetable crops were not harvested and/or destroyed. There was considerable push-back from growers on this ruling, asking for scientific evidence for it. A search of the literature found a variety of studies showing microbial contamination of flood water, and many studies demonstrating microbial food safety risks in fresh produce, but no studies directly linking flooding to food safety risks in fresh produce. Further, very few food safety studies focus on the storage crops that had to be destroyed after Irene.

Food testing. To try and understand the extent of the risk posed by flooded produce, paired groups of flooded and unflooded vegetable samples were collected from commercial farms. A total of seven paired groups of carrots, potatoes and/or winter squash were selected from farms in northwest, central and southeastern Vermont and sent on ice via overnight mail to a laboratory in Texas specializing in testing for food contaminants. A comprehensive assay of heavy metals, hydrocarbons, PCBs, pesticides and PCBs was conducted on each sample, as well as analysis for some pathogenic bacteria such as E. coli and Salmonella, with funding provided by the High Meadows Fund of the Vermont Community Foundation.

Although the sample size was too small to provide statistically valid data, the results do suggest that contamination was not ubiquitous. Of the 9 heavy metals analyzed (arsenic, antimony, bismuth, cadmium, copper, lead, mercury, nickel and silver) only copper was detected, and it was present at extremely low levels in every sample, ranging from 0.49 ppm to 1.62 ppm in flooded samples and from 0.59 ppm to 2.06 ppm in unflooded samples.

Of the 33 organochlorine pesticides analyzed for, there were no detections in any flooded or unflooded samples; of the 32 polycyclic aromatic hydrocarbons analyzed for there were 3 samples with extremely low levels detected: one unflooded sample had 2.4 parts per billion (ppb); one flooded sample had 2.3 ppb, and another flooded sample had two detections, one at 2.3 ppb and the other at 2.1 ppb. The limits of detection are 2.0 ppb so these appear to be 'background' levels of hydrocarbons.

With regard to microbial pathogens, Salmonella was not detected in any of the samples and generic E.coli was detected in 2 flooded samples and in 2 unflooded samples.

Feed safety. Flooding of crops caused immediate feed losses on thousands of acres of hay, pasture, and corn that were washed away or flattened from excessive winds and flooding waters. In other fields, silt was deposited. The amount of silt left on crops varied widely from field to field. In corn, silt contamination was much worse for silage than for grain production since most of the soil was trapped on lower parts of the plant.

Normal corn silage has about 3% to 5.5% ash but flood-damaged silage measured thus far is 4% to 22% ash. There is little data that documents how high levels of ash in feed will impact livestock productivity. Flooded fields downstream from waste water treatment plants, dumps, gas stations, etc. may potentially have silt deposited that is high in heavy metals. Forage analyses from flooded corn fields include a few samples with extremely high iron concentrations in the feed. Iron toxicity can cause diarrhea, metabolic acidosis, hypothermia, and reduced gain and feed intake in livestock. Farmers are urged to conduct heavy metal testing of flooded forage.

In flooded corn that was left standing, water passing over plants raised the risk of fungal growth and mycotoxin production, which can be dangerous, even lethal, to cows. With the Agency of Agriculture laboratory destroyed by flooding, University of Vermont Extension set up facilities for mycotoxin testing and a sampling protocol was developed for farmers to monitor the quality of the stored flooded feed. In addition, recommendations were developed and distributed to farmers explaining how to store flooded feed, how to treat flooded feed to favor good ensiling. Given this comprehensive approach, and the significant financial threat that loss of feed posed to dairy farmers, the Agency of Agriculture was able to get the FDA to allow the possibility of feeding flooded produce to livestock, which they normally prohibit.

Results of feed testing for mycotoxins to date have been variable. There have been no detectable levels of aflatoxins which are carcinogens and regulated by the FDA. There have been a handful of reports of mycotoxin infected feed however no harmful levels have been found thus far. Continued feed testing at the UVM Extension lab will provide farmers with a quick and cost effective way to test forages for harmful toxins.

Soil contamination. After Irene, the University of Vermont Agricultural Testing Lab provided free soil testing of flooded farms fields, including heavy metals (cadmium, copper, chromium, nickel, lead, zinc). Of the 155 samples of flooded farm soils analyzed, there were no detections of elevated heavy metal levels. In fact, the maximum levels detected did not approach 'high' levels in any of the samples.

Soil samples were collected from 14 farms all across Vermont (one in western MA) and sent to Endyne Labs, Inc. in Williston VT for total petroleum hydrocarbon (TPH) analysis, with funding from University of Vermont Extension. The TPH test screens for a wide variety of fossil fuels including gasoline, diesel, and oils.

Eight farms submitted paired samples, from flooded and unflooded fields. Two of the flooded fields had TPH detected, at 3.5 and 6 ppm; four of the unflooded fields had TPH detected, at 4.5 to 11 ppm. Six farms submitted flooded soil samples only; 4 of these had detections, ranging from 4.5 to 11 ppm. The limit of detection is 3 ppm so the detections appear to be 'background' levels.

Testing for microbial contamination is far more complicated, and thus impractical for several reasons. Unlike abiotic contaminants, 1) there is likely to be very uneven distribution of microbial populations across a field so a very large number of samples is needed to generate meaningful data; 2) sample collection and handling methods have a large effect on test results; 3) laboratory procedures are costlier; 4) there are many species and strains of potential pathogens that could/should be tested for; and 5) the normal background levels for the pathogens of greatest concern are unknown.

A variety of studies show that soil-borne microbial pathogens decline over time, so any risks to human health posed by Irene's flooding should be greatly reduced by next spring.

Impact on organic farms and their certification. Vermont Organic Farmers (VOF) is the primary certification organization in Vermont. VOF has asked all certified organic producers to report any instances of potential contamination. Throughout the fall, VOF surveyed its 584 farmers/processors to ascertain the extent of damage from Irene.

To date, 460 certified producers have responded and 120 farms reported damage from either high winds or flooding. About 3,000 acres were affected with losses approaching \$4 million. VOF will follow up with on-site inspections of all impacted farms in the spring of 2012 and is consulting with other organizations throughout the state to determine reasonable policies moving forward.

The National Organic Program allows for "background levels of naturally occurring synthetic chemicals that are present in the soil or present in organically produced agricultural products that are below established tolerances." Products are excluded from being sold as organic "when residue testing detects prohibited substances at levels that are greater than 5 percent of the EPA's tolerance." Considering that pre-flood background level data for the various substances that may have been deposited on organic fields are not available, and that the EPA has not established tolerance levels for all substances that may be found, and that all flooded produce was prohibited from sale by the FDA, VOF and their Review Committee has thus far not considered revoking the organic certification of any certified producer impacted by the flooding.

Crop insurance coverage for flooded farms. There are 537 farms in Vermont that have federally-subsidized crop insurance through the USDA Risk Management Agency (RMA) on a total of 76,000 acres. As of Dec. 12, 2011, \$4.67 million had been paid out to Vermont farms in 2011, the vast majority for corn losses, plus some soybean and apple losses.

Crop insurance is only available for major commodities; other crops can be covered by NAP, the Non Insured Crop Disaster Assistance Program administered by FSA. About 30% of the 7,200 acres of hay damaged by Irene are eligible for NAP payment, as are about 18% of the 600 acres of vegetables and fruits affected. NAP is designed to cover a percentage of losses over 50% of the established yield, at established prices. Additional monies may be forthcoming to farms through SURE, the Supplemental Revenue Assistance program.

The FSA also has the Emergency Conservation Program (ECP) that can cost share up to 75% of the restoration cost on damaged land. To date 200 applications have been received for work on 9,100 acres of land and Vermont FSA has requested \$4 million from its Washington office to fund these requests.

Disaster relief grants and loans. Immediate action was taken to provide financial support for farmers in need following Irene. A variety of fund sources, large and small, were promptly publicized and monies were dispersed quickly and efficiently. Monies came in from local and national donors.

The Intervale Center Farmers Recovery Fund raised \$129,000 to aid the farms in the Intervale, all of which were flooded; \$62,000 has been dispersed to date. NOFA-VT's Farmer Emergency Fund has made 29 grants totaling \$127,700 and 6 zero interest loans totaling \$20,000. The Vermont Farm Fund at the Center for an Agricultural Economy received \$182,000 in donations in support of its small scale, zero-interest disaster relief loans and to date has loaned out \$80,000 in five and ten-thousand dollar loans.

The Vermont Agricultural Credit Corp. made 34 Tropical Storm Irene low-interest loans for a total of \$1.2 million, and 7 applications are in process. VACC will continue accepting applications for the immediate future rather than ending the program as planned on 12/31.

The Vermont Community Foundation and Agency of Agriculture established the Vermont Farm Disaster Relief Fund, which has received applications from 210 farmers and has awarded grants to 171 farmers totaling \$1.5 million. As of December 22, total contributions received or pledged to the fund exceeded \$2.2 million.

*Data compiled by Vern Grubinger, University of Vermont Extension, with assistance from: Heather Darby and Ginger Nickerson, University of Vermont Extension; Bob Paquin, Vermont Farm Service Agency; Chuck Ross, Vermont Agency of Agriculture; Pam Smith, University of Vermont Extension/USDA Risk Management Agency; and Gregg Stevens, NOFA-VT.*

Appendix A - Tropical Storm Irene Damage Reports  
 12/29/2011  
 USDA, FSA Vermont State Office

<b>STATE TOTALS:</b>	
Producers Impacted:	476
Corn acres damaged:	6065
Soybean acres damaged:	225
Hay acres damaged:	7268 (30% NAP)
Fruit/Vegetable acres damaged:	596 (18% NAP)
Pasture acres damaged:	1752
Maple acres wind damaged:	1402
Acres of Land damage:	9093 (ECP – 191)

**INDIVIDUAL REPORTS BY COUNTY:**

<b>ADDISON:</b>	
Producers impacted:	41
Corn acres damaged:	941
Hay acres damaged:	1266
Fruit/Vegetable acres damaged: apples:	110
Pasture acres damaged:	1168
Acres of land damage:	60

<b>BENNINGTON:</b>	
Producers impacted:	27
Corn acres damaged:	110
Hay acres damaged:	175
Fruit/Vegetable acres damaged:	10
Pasture acres damaged:	38
Acres of land damage:	383

<b>CALEDONIA:</b>	
Producers impacted:	14
Corn acres damaged:	56
Hay acres damaged:	38
Fruit/Vegetable acres damaged:	14
Acres of land damage:	52

<b>CHITTENDEN:</b>	
Producers impacted:	38
Corn acres damaged:	1429
Hay acres damaged:	542
Soybean acres damaged:	200
Fruit/Vegetable acres damaged:	101
Pasture acres damaged:	104
Acres of land damage:	507

<b>ESSEX:</b>	
Producers impacted:	4
Corn acres damaged:	135
Hay acres damaged:	70

<b>FRANKLIN:</b>	
Producers impacted:	43
Corn acres damaged:	571
Hay acres damaged:	465
Soybean acres damaged:	25
Fruit/Vegetable acres damaged:	24
Maple acres wind damaged:	792

<b>GRAND ISLE:</b>	
Producers impacted:	3
Corn acres damaged:	21
Fruit/Vegetable acres damaged: apples:	??

<b>LAMOILLE:</b>	
Producers impacted:	21
Corn acres damaged:	352
Hay acres damaged:	89
Fruit/Vegetable acres damaged:	15
Maple acres wind damaged:	610
Acres of land damage:	281

<b>ORANGE:</b>	
Producers impacted:	23
Corn acres damaged:	117
Hay acres damaged:	347
Fruit/Vegetable acres damaged:	4
Pasture acres damaged:	56
Acres of land damage:	943

<b>ORLEANS:</b>	
Producers impacted:	10
Corn acres damaged:	60
Hay acres damaged:	94
Pasture acres damaged:	8
Acres of land damage:	15

<b>RUTLAND:</b>	
Producers impacted:	92
Corn acres damaged:	1140
Hay acres damaged:	1438
Fruit/Vegetable acres damaged:	75
Pasture acres damaged:	192
Acres of land damage:	4020

<b>WASHINGTON:</b>	
Producers impacted:	42
Corn acres damaged:	485
Hay acres damaged:	626
Fruit/Vegetable acres damaged:	65
Pasture acres damaged:	122
Acres of land damage:	1035

<b>WINDHAM:</b>	
Producers impacted:	42
Corn acres damaged:	139
Hay acres damaged:	281
Fruit/Vegetable acres damaged:	109
Pasture acres damaged:	31
Acres of land damage:	138

<b>WINDSOR:</b>	
Producers impacted:	76
Corn acres damaged:	509
Hay acres damaged:	1574
Fruit/Vegetable acres damaged:	69
Pasture acres damaged:	33