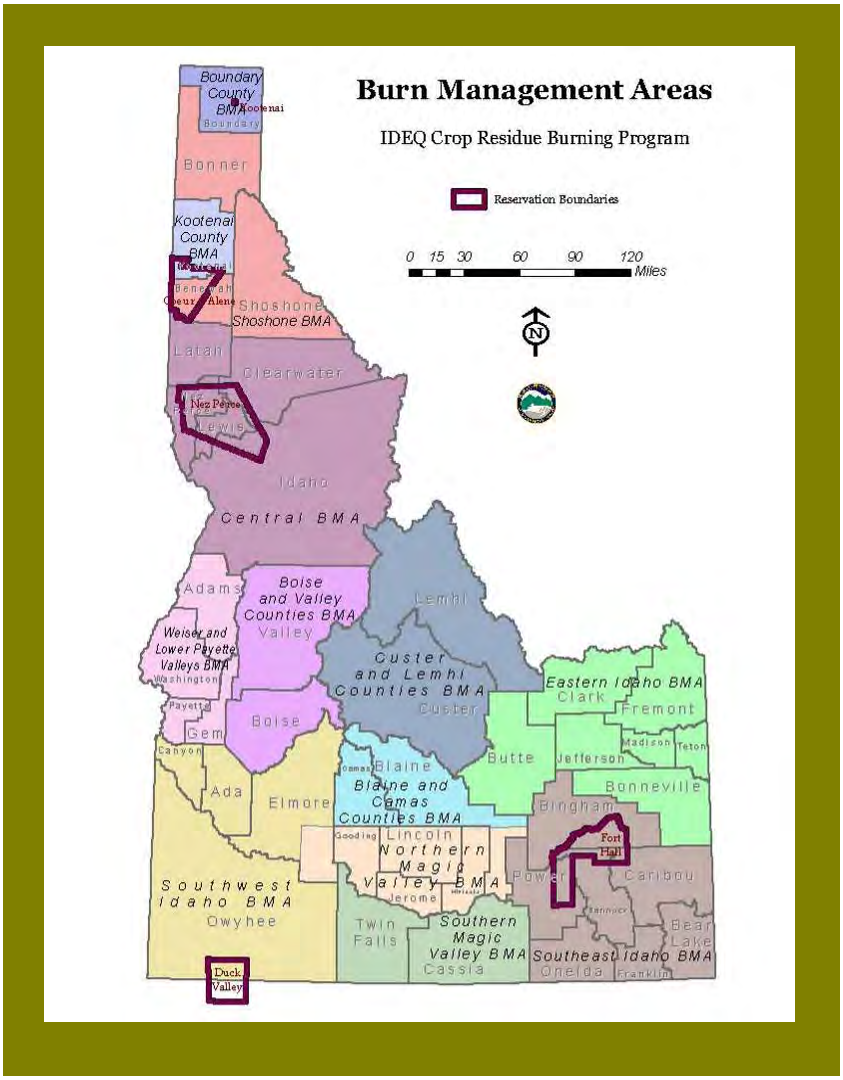
Crop Residue Burning Program

2009 Annual Report



Idaho Department of Environmental Quality

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1. Introduction

This report reviews and analyzes the Idaho Department of Environmental Quality's (DEQ's) Crop Residue Burning (CRB) program for the spring and fall 2009 burn seasons. DEQ is required, by rule (IDAPA 58.01.01.622.02), to prepare an annual report that includes, at a minimum, an analysis of the causes of any exceedance of the program-defined concentration limits and an assessment of the circumstances associated with any reported endangerment to human health associated with a burn. This report also includes planned program improvements necessary to prevent future exceedances of the program-defined concentration limits.

This report only presents information specific to the 2009 burn seasons, defined as February – June, and July – November. For a more complete description of the program, please refer to the 2008 Annual Report (DEQ 2009, available on the DEQ Web site at *http://www.deq.idaho.gov/air/prog_issues/burning/crop_residue_burning.cfm#annual08*).

2. Program Updates

DEQ updated the CRB program based on recommendations presented in the 2008 Annual Report. These improvements were reviewed and endorsed by the CRB Advisory Committee. Other than these updates, the CRB program remains the same. This section summarizes the status of those recommended changes.

Apply ozone criteria to the Southwest Idaho and Weiser and Lower Payette Valleys Burn Management Areas' Burn Decisions

The Treasure Valley is currently at risk of non-attainment status for ozone, which means being out of compliance with the federal health-based standard for ozone. Ozone is created by a chemical reaction between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of heat and strong sunlight. Both NO_x and VOCs are emitted during field burning. For this reason, DEQ considers ozone levels very closely when making burn decisions. During the late summer and early fall burn season, ozone is nearly always the pollutant of concern in southwest Idaho.

In the 2009 burn season, the Treasure Valley air quality index (AQI) forecast was applied to all areas within the boundaries of the Treasure Valley Airshed, (Figure 4, page 24). The airshed includes parts or all of Ada, Canyon, Gem, Washington, Payette, and Owyhee Counties.

Modify burn decision process and communication

During 2009, DEQ implemented an improved burn decision process, which consisted of making a preliminary burn decision the day before (acres per county only) and a final burn decision the morning of the burn (acres per county and specific field approvals). This provided needed flexibility for both DEQ and growers. DEQ also implemented a process in which the number of approved acres could be increased or decreased during the burn day depending on air quality and smoke dispersion.

Include pastures in the CRB program and allow some burning of hay bales (under very strict requirements) within the CRB program

DEQ successfully incorporated the burning of pastures, broken bales and small weed spots within a field into the CRB program for the 2009 burn seasons.

Improve permit conditions

The following three permit conditions were standard on all permits:

- Public roadway safety – The permittee shall have adequate measures readily available to ensure the burn does not create a hazard for travel on a public roadway. The permittee shall consult with local law enforcement officials in order to determine which measures are adequate to ensure roadway safety. The permittee shall maintain documentation of this consultation with the local law enforcement agency, including recommended safety measures.
- Fire safety measures – The permittee shall prevent the burn from escaping control. The permittee shall consult with the local fire authority to determine which measures are adequate to prevent open burning from escaping the permittee's control. The permittee shall maintain documentation of the consultation with the local fire authority, including the recommended safety measures.
- Protection of institutions with sensitive populations – Burning is not allowed if winds are expected to carry the smoke toward institution(s) with sensitive populations.

Make outreach to and evaluate impacts to institutions with sensitive populations

Prior to the 2009 fall burn season, DEQ mailed flyers to all institutions with sensitive populations in Idaho explaining the CRB program and how DEQ will protect them. DEQ also surveyed those institutions located within 5 miles of actual crop residue burns during the fall season. Results are located in section 4.1.3.

Development of best management practices for burning

DEQ continues to develop best management practices (BMP) for burning under the CRB program. These best management practices focus on residue load, stubble height, and ignition techniques (method and number of people). This BMP will help improve burns smoke management.

Develop test for grower training and require 90% correct answers

DEQ updated the grower training and developed a test. At this point, the growers take the test during the live training. The test is self-graded by the grower and a group discussion is used to review the test questions and answers. DEQ decided that a pass/fail test should be implemented in stages.

Record CRB burns into the Western Governors Association Fire Emissions Tracking System (WRAPFets)

All CRB approved burns are now displayed on this system. WRAPFets provides a single location for tracking all burning that occurs in the western states. This single location helps DEQ manage impacts from all smoke in each airshed.

Consolidation of CRB permits with burn permits from Idaho Department of Lands

DEQ was not able to accomplish this recommendation. This change turned out to be more complicated than first anticipated. More research and coordination with IDL and other rural fire districts is needed. DEQ is currently gathering information regarding all local ordinances pertaining to open burning. DEQ is also contacting all the fire districts to gather information on open burning permit requirements.

Improved process for enhanced documentation

DEQ refined this process to better evaluate crop residue burning impacts on Idaho airsheds. DEQ adjusted the averaging time for the ambient monitoring data evaluation that takes places before, during, and after a burn; and developed a process for evaluating impacts from CRB on ozone in critical airsheds. DEQ also revised the internal guidance and forms for this process to help ensure statewide consistency.

A pre-burn sheet is required when burning will be approved and the following concentrations occur:

- The rolling 4-hour average $PM_{2.5}$ value equals or exceeds 22 $\mu g/m^3$ any time within 6 hours before the final burn decision is made, or
- The rolling 24-hour average $PM_{2.5}$ value equals or exceeds 16 $\mu g/m^3$ any time within 6 hours prior to the final burn decision is made.

A post-burn sheet is required when burning has occurred and the following concentrations also occurred:

- The 1-hour average $PM_{2.5}$ value equals or exceeds 64 $\mu g/m^3$ any time from the approved ignition time through 10pm the day of the burn, or
- The rolling 4-hour average $PM_{2.5}$ value equals or exceeds 32 $\mu g/m^3$ any time from the approved ignition time through 10pm the day of the burn, or
- The rolling 24-hour average $PM_{2.5}$ value equals or exceeds 26 $\mu g/m^3$ any time from the approved ignition time through 10pm the day of the burn, or
- The rolling 8-hour average for ozone equals or exceeds 56 ppb any time from the approved ignition time through 10pm the day of the burn.

Define/refine roles and responsibilities

Before the fall 2009 burn season, DEQ developed and implemented a certification course for all DEQ staff involved in the CRB program, including the seasonal field staff. This course covered the burn approval process; use of the administrative tools, laptops, and handheld field equipment; documentation of field observations; fire weather; and smoke dispersion. All DEQ staff involved in the CRB program were required to obtain this certification before the fall burn season.

Improve complaint process and documentation

All complaints received that were or might have been about the crop residue burning program were entered into the DEQ complaint tracking system. This helps DEQ to distinguish among complaints about smoke from CRB and those related to smoke from other sources.

Improve documentation of field observations

The CRB Operating Guide was updated to address this issue. For the most part, documentation of field observations was included in a central location in an electronic format. DEQ uses the field observations to improve burn decisions.

Improve cellular communications for northern Idaho

DEQ switched cellular providers for the all northern Idaho Burn Management Areas (BMAs). Cellular communications were much improved in the Central BMA; however, DEQ is still having some difficulty in the Boundary County BMA.

3. Outreach for 2009 Burn Seasons

Outreach remains an important component of the CRB program. DEQ's outreach effort continued to have two main objectives: public awareness and grower education. Much of the same set of outreach activities used in 2008 were used in 2009, such as distributing brochures; providing telephone hotlines, Web sites and email list service; and direct communication with fire and sheriff departments. Please refer to the 2008 annual report (DEQ 2009, available on the DEQ Web site at *http://www.deq.idaho.gov/air/prog_issues/burning/crop_residue_burning.cfm#annual08*) for details. Only the differences are discussed here.

3.1 Statewide

During 2009, DEQ focused on contacting institutions with sensitive populations and educating them about the CRB program. Prior to the fall burn season, DEQ mailed a letter and informational flyer to each of these institutions within Idaho. This informational flyer focused on how the CRB program was designed to protect the institution from adverse impacts from smoke resulting from crop residue burning. The flyer also included the toll-free hotline phone number. After the fall burn season, DEQ undertook a survey targeting those institutions located within 5 miles of an actual crop residue burn. The purpose of the survey was to determine if the institutions were aware of DEQ's CRB program and more importantly to determine if they were adversely impacted by smoke generated from agricultural burning. Many sensitive populations were visited in person by DEQ staff in an effort to obtain timely information from them and to provide them with a face to relate with the CRB program. Results of this survey are presented in Section 4.1.3.

3.2 North Idaho

Grower Meetings and Assistance

One of the main goals of any successful environmental management program is compliance. To promote compliance, it is necessary to educate those who are regulated. DEQ focused on educational activities in 2009 and provided growers with many different methods for achieving compliance with the new CRB program. Throughout the spring and summer, emails were distributed to the growers informing them of program changes that were expected for the fall 2009 burn season. Each grower was also notified of upcoming informational/training opportunities in their area. A series of workshops were held to enhance DEQ's communication with the growers, to inform growers of programmatic changes, and to provide growers with a

chance to obtain the necessary training prior to the burn season. These workshops were held during July in Grangeville, Moscow, and Bonners Ferry. Growers were notified of how the new changes may affect them and their ability to comply with the CRB program.

The workshops provided growers with the opportunity to see how the new updates to DEQ's Web site, such as the revised post-burn reporting, streamlined some processes. They also allowed the growers to see how much money was left in their account from 2008. DEQ also explained that the final burn decisions for each particular burn day would be finalized later in the morning to accommodate the unusual weather conditions in certain areas – this was provided to the growers per their request and to improve smoke management techniques identified by DEQ.

Throughout the burn season, many growers visited local DEQ offices where DEQ staff walked them through the permitting and training process. DEQ also provided help over the phone and in person to others who could provide the same information to other growers in their community. Daily emails were disseminated to all growers registered in the program so each person would be provided with up-to-date information. This transparency led to fewer phone calls from the growers asking when they could get a chance to burn in the future.

One of the most effective outreach methods this year was on-site field assistance. This assistance was aimed at discussing different burning techniques to ensure safe and quick burning, thus minimizing potential health impacts and increasing the numbers of fields that could be ignited on optimal burn days. Experience has shown that smoke from a field that is properly ignited with multiple burners, when the appropriate safety measures are in place, is much less likely to lose heat (creating "cold smoke") that can drop back to the ground. This "cold smoke" often stays at ground level and creates the potential to negatively affect air quality. It was DEQ's goal to minimize this type of smoke behavior, so Smoke Coordinators emphasized the importance of good burning techniques that maximize vertical lift of smoke columns.

One positive example of this emphasis and outreach was documented on a 135-acre field near Potlatch, Idaho. In past years, the grower burned the field with one igniter. Therefore, it would take a significant amount of time (more than three hours) to completely burn the field, which led to smoke impacts due to wind shifts. This year, multiple igniters created a hotter burn, which led to better plume rise in a shorter duration. Approximately one hour after the burn had been completed, the winds shifted once again; nevertheless, the smoke had already dispersed from the area. If the field had been burned using one igniter, smoke would most likely have impacted Potlatch.

Contrary to the example above, it was also recognized that by slowly strip-firing a field over a 2-3 hour time, less smoke is produced per unit of time. If properly conducted, this method of burning can also be stopped quickly if wind shifts take place. If mixing heights are low and wind speeds are low, then this method may be better than burning an entire field quickly because this method creates less potential for a large smoke column to collapse. These two examples are excellent reminders of why coordination and field experience are essential.

A second series of workshops took place in October and November, in which DEQ staff reminded growers of their responsibilities. These workshops gave growers opportunities to provide DEQ with recommended ways to improve the program. A few questions and concerns

were voiced at the workshops. First, growers were concerned about their ability to continuously meet the permit requirement to protect safety on public roadways, especially roads that carry a large volume of traffic (i.e., US Highway 95). Confusion surrounding the fact that different roads have different jurisdictions and authorities was identified. Also, the growers do not have an understanding about what types of signs to use to warn motorists of potential visibility concerns. DEQ intends to consult with the appropriate public safety agencies during the winter and will communicate their findings back to the growers. Other individuals were concerned because they felt that there were not enough burn days provided that would have enabled more burning to take place.

Growers also believed that the program could benefit from having on-site coordinators to the fields sooner.

Models are good at predicting upper air mesoscale conditions. The detracting quality of models is that microscale predictions are hard to accurately foresee and the timing of diurnal wind shifts or the arrival times of fronts can easily vary by an hour. Therefore, if ideal burn conditions can be identified sooner, then burning can take place sooner — which leads to the potential for more efficient burning and better smoke management.

3.3 South Idaho

Billboards

DEQ placed 24 billboards throughout southern Idaho in areas where crop residue burning occurred. Each billboard went up the last week of July or the first week of August. Each remained up for at least six weeks and in some cases longer, depending on whether the billboards were leased to other customers at the end of the six-week period. There were two types of billboard messages, one oriented for public awareness and the other for grower awareness. The public awareness billboards presented the CRB hotline number. The strategy was to reach the general public while they are in transit. With an outdoor billboard campaign reaching the smaller, more rural- and agricultural-based communities, DEQ generated awareness about the CRB program. DEQ estimated that on a daily basis, 25% of adults age 18 and older would be exposed to the message. In many cases, where there was one main road through a community, DEQ expected more than 50% of the adult population to be exposed to messages. Table 1 shows the number of billboards located in each area.

Table 1. CRB Billboard Locations

Burn Management Area	Market	Number of Billboards in the Area
Southwest Idaho	Parma	2
	Mountain Home	2
Weiser and Lower Payette	Weiser	2
	Payette	2
Southern MagicValley	Twin Falls	2
	Buhl	2
	Kimberley	2
	Burley	2
Northern Magic Valley	Jerome	3
	Rupert	2

Burn Management Area	Market	Number of Billboards in the Area
Eastern Idaho	Idaho Falls	2
	Rexburg	1
	Rigby	1

Training

In-person training sessions were provided throughout southern Idaho, in 20 separate training locations, as listed in
Table 2. DEQ staff also provided numerous grower trainings one-on-one in person or over the phone.

Table 2. DEQ "in-person" training locations

City	DEQ Burn Management Area
Emmett	Weiser and Lower Payette
Weiser	Weiser and Lower Payette
Caldwell	Southwest Idaho
Pocatello	Southeast Idaho
Meridian	Southwest Idaho
Parma	Southwest Idaho
Burley	Southern Magic Valley
Ashton	Eastern Idaho
Idaho Falls	Eastern Idaho
Preston	Southeast Idaho
Twin Falls	Southern Magic Valley
Soda Springs	Southeast Idaho
Malad	Southeast Idaho
American Falls	Southeast Idaho
Paris	Southeast Idaho
Rexburg	Eastern Idaho
New Plymouth	Weiser and Lower Payette
Gooding	Northern Magic Valley
Blackfoot	Southeast Idaho
Rupert	Northern Magic Valley

Radio campaign – Northern and Southern Magic Valley

The purpose of the radio campaign in the Magic Valley was to reach the agricultural community and general public. Radio stations ran approximately 750 free public service announcements (PSAs) about CRB and broadcast four live interviews.

There were four different PSAs aired on the nine local radio stations that are listed, along with their formats, in Table 3. These stations are heard throughout the Magic Valley. The 30-second PSAs aired approximately 13 times a day from August until November. The DEQ Twin Falls regional office staff discussed the CRB program in four live interviews on two radio stations, Ag Radio Network 1270 AM and KBAR 1230 AM. On Ag Radio Network, 20-minute live

interviews were aired in February, July, and October. On KBAR, one 20-minute live interview was broadcast in June.

Table 3. Radio Campaign Details

Station	Station Type
KMVX (FM)	80s, 90s, and now popular
KAWZ (FM)	Christian Radio
KCIR (FM)	Christian Rock
KLIX (AM)	News and Talk Radio
IROC (FM)	Rock and Roll
KYUN (FM)	Sports Radio
KIKX (FM)	Pop Rock
KTFI (AM)	Talk Radio
Independent Ag Network (AM)	Agriculture Talk Radio

Grower Meetings

A series of presentations other than trainings were given in conjunction with the University of Idaho Living on the Land program, which is aimed at small acreage farmers. DEQ also held an open Crop Residue Burning Symposium hosted by the Canyon County Farm Bureau to provide a venue for growers and the public to learn about, or to provide feedback about, the CRB program. DEQ worked with the County Weed Superintendents in Washington and Payette Counties to distribute information to growers on the CRB program.

County Fairs – Northern and Southern Magic Valley

DEQ hosted booths at the Twin Falls, Cassia, Lincoln, Minidoka, and Jerome county fairs, which provided opportunities to reach and educate the public and growers concerning crop residue burning. The booths were staffed by DEQ representatives during evenings, and brochures were made available when the booths were unattended.

4. Analysis of the Burn Seasons

Analysis of the burn seasons includes consideration of the overall air quality impacts, complaints, compliance and enforcement, and monitoring for each area.

For management of the CRB program, Idaho is divided into 13 burn management areas (BMAs), based on similarity of meteorological and topographical conditions as well as proximity to DEQ regional offices. The 13 BMAs are delineated in Figure 1.

A summary of the 2009 burn seasons for each BMA is presented in the following section. These summaries include area geography; acreage acres burned; and daily burn decisions and air quality. In three of the BMAs—the Shoshone County BMA, the Custer and Lemhi Counties BMA, and the Boise and Valley Counties BMA—no fields were burned for the 2009 burn seasons. Therefore, these BMAs are not discussed further.

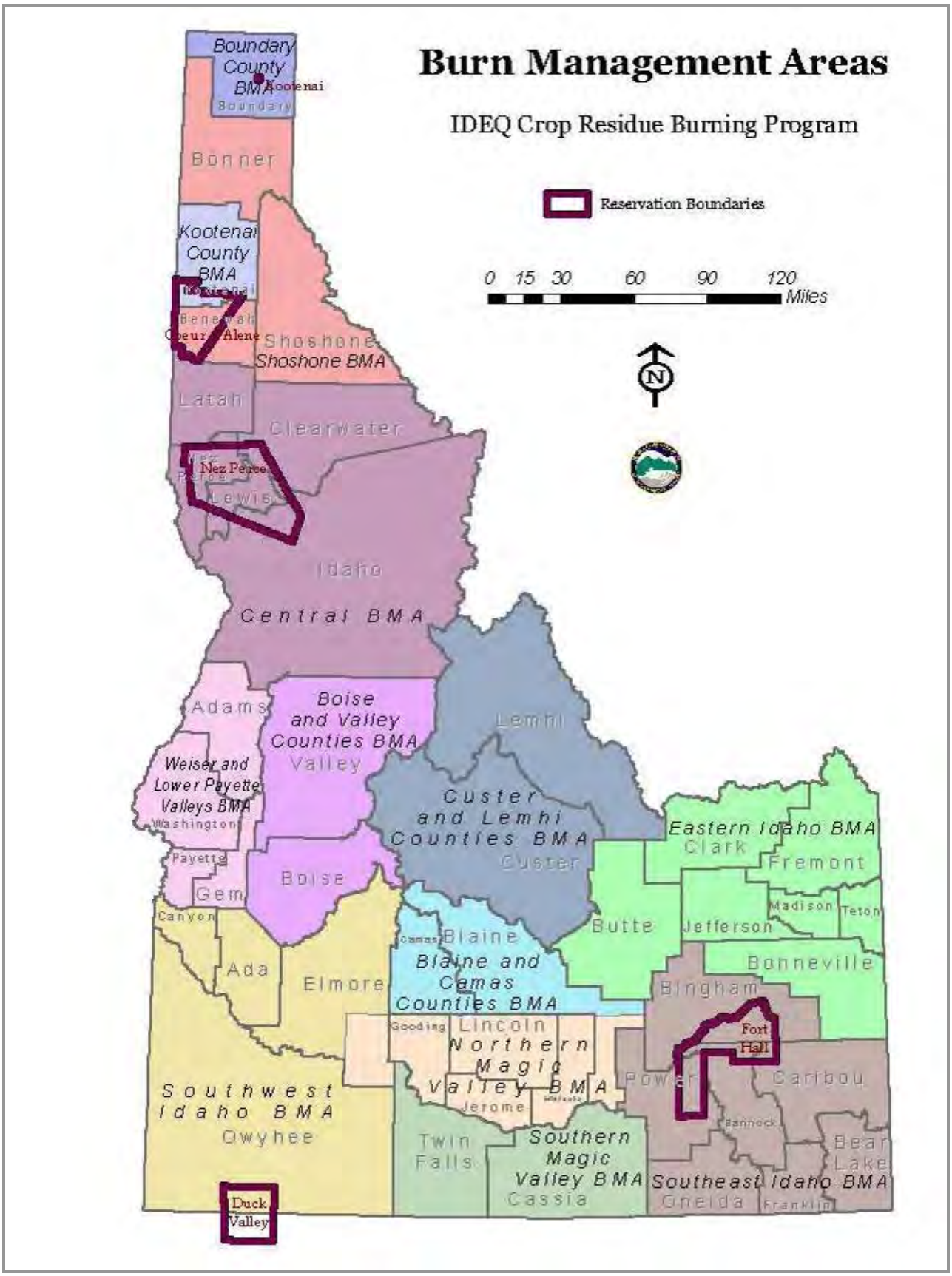

Figure 1. The 13 burn management areas for the crop residue burning program.

4.1 Overall Air Quality Impacts

Discussion of overall air quality impacts includes sections on compliance, enhanced documentation, and institutions with sensitive populations.

4.1.1 Compliance with Program Concentration Limits

The CRB program must comply with the following program concentration limits, based on DEQ monitoring:

- 1-hour $PM_{2.5}$ (64 µg/m^3) – on 12 calendar days, values above the limit were recorded
- 24-hour $PM_{2.5}$ (26.25 µg/m^3) – on 1 calendar day, a value above the limit was recorded
- 8-hour ozone (0.056 ppm) – on 51 calendar days, values above the limit were recorded

There were many instances in which DEQ monitors recorded values that exceeded the program concentration limits, as identified in this section. However, only those instances when DEQ determined that smoke from crop residue burning was reasonably expected to be the cause are evaluated in detail. When determining whether crop residue burning was reasonably expected to be the cause, DEQ evaluated both the location and the time of the burn in relation to the monitored value. Burning under the CRB Program could be reasonably expected to be the cause only when both of the following items were true:

- An approved crop residue burn occurred the day of or day prior to the value being recorded on the monitor, and
- Wind direction and proximity of the burn(s) indicated that smoke from the CRB Program was the cause of the exceedance.

Table 4 lists monitor-recorded $PM_{2.5}$ values that exceeded program concentration limits but DEQ determined were not reasonably expected to be caused by burning under the CRB Program, along with the date of each occurrence. Table 5 lists high-ozone days that were not reasonably expected to be caused by burning under the CRB program.

Table 4. 2009 $PM_{2.5}$ monitor-recorded values that exceeded program concentration limits but were not caused by burning under the CRB Program

Date	Monitor	Value	Time*	Averaging Period
March 12	Twin Falls $PM_{2.5}$	109.1 µg/m^3	03:00	1-hour average
March 19	Pocatello $PM_{2.5}$	66.5 µg/m^3	12:00	1-hour average
March 21	Pocatello $PM_{2.5}$	78.2µg/m^3	12:00	1-hour average
April 19	Pocatello $PM_{2.5}$	66.8 µg/m^3	11:00	1-hour average
May 29	Nampa Fire Station $PM_{2.5}$	75.3 µg/m^3	03:00	1-hour average
July 3	Nampa Fire Station $PM_{2.5}$	96.9 µg/m^3	07:00	1-hour average
July 4	Nampa Fire Station $PM_{2.5}$	314.0 µg/m^3	22:00	1-hour average
July 5	Nampa Fire Station $PM_{2.5}$	123.3 µg/m^3	00:00	1-hour average
July 12	Pocatello $PM_{2.5}$	69.9 µg/m^3	11:00	1-hour average
August 6	Pocatello $PM_{2.5}$	102.9 µg/m^3	11:00	1-hour average
March 3	Twin Falls $PM_{2.5}$	28.6 µg/m^3	N/A	24-hour average

* Times are expressed on a 24-hour basis. So, for example, 03:00 is 3:00 am, 12:00 is noon, and 22:00 is 10:00 pm.

Table 5. Treasure Valley high-ozone days not caused by burning under the CRB Program

May 5	July 17	August 1	September 5
May 23	July 18	August 2	September 13
—	July 19	August 3	September 17
July 2	July 20	August 4	September 19
July 3	July 21	August 5	September 24
July 4	July 22	August 20	September 25
July 5	July 23	August 21	September 27
July 6	July 24	August 22	September 28
July 11	July 26	August 25	—
July 12	July 28	August 26	—
July 14	July 29	August 27	—
July 15	July 30	August 28	—
July 16	July 31	August 30	—

There was only one day in 2009 when monitor-recorded values exceeded the 1-hour $PM_{2.5}$ program concentration limit that required a post-burn evaluation to determine whether burning under the CRB program caused the exceedances.

April 20 – 1-hour rolling average for $PM_{2.5}$ in Pocatello:

April 20 was a burn day for the Southeast Idaho BMA. The data in Table 6, showing a spike in hourly $PM_{2.5}$ concentrations from the Pocatello monitor on April 20, indicate that this spike was caused by a localized emission source near the monitor, not by crop residue burning. On April 20, a 15-acre field was approved for a window of one and a half hours from 10:30 am through noon. The field was located approximately 26 miles ENE of the Pocatello monitor along the I-15 corridor. During this time period, winds were observed from the SSW carrying smoke NNW parallel to I-15 toward Idaho Falls. The Idaho Falls monitor did not show spikes related to this burn. Due to the location of the Pocatello monitor, the monitor is subject to emissions that may come from railroad activities, diesel truck/heavy equipment operations, or a local industrial source. There appears to be a daily pattern of $PM_{2.5}$ concentration spikes between the hours of 11:00 and 14:00 attributed to these surrounding sources.

Table 6. $PM_{2.5}$ values recorded on the Pocatello monitor during the morning of April, 20, 2009.

April 20 Hour*	**$PM_{2.5}$ $\mu g/m^3$ (24-hour)**
14:00	0.0
13:00	0.0
12:00	69.6
11:00	69.9
10:00	64.7
9:00	34.9
8:00	0.2

* Time is expressed on a 24-hour basis. So, for example, 14:00 is 2:00 pm, 12:00 is noon, and 8:00 is 8:00 am.

4.1.2 Enhanced Documentation

As stated in Section 2, DEQ updated the enhanced documentation process during 2009. DEQ used the same process as described in Section 4.1.1 for determining whether or not smoke from crop residue burning was reasonably expected to impact or have impacted the monitor. In those cases, enhanced documentation would be required.

North Idaho

No enhanced documentation was necessary based on the post-burn requirements outlined in section 4.1.1. There were many days throughout 2009 wherein air quality was slightly degraded due to nocturnal inversions, prescribed burning, local meteorological conditions, etc. These air quality trends are tracked closely and on days when burning occurred, for which pre-burn enhanced documentation might have been required, the conditions are summarized below.

April 21 – 4-hour rolling average for $PM_{2.5}$ in Kendrick
During the morning of April 21, 2009, PM2.5 concentrations were elevated in the early morning hours. Based on meteorological conditions and proximity of the proposed burning, a decision was made to allow burning of 27 acres in Latah County, approximately 20 miles northwest of Kendrick. Another 111 acres were also proposed for burning, of which 91 acres were actually burned, approximately 45 miles southeast of Kendrick. Winds were forecast out of the west-southwest and west and ventilation was forecast to be good.

April 24 – 4-hour rolling average for $PM_{2.5}$ in Potlatch
During the morning of April 24, 2009, PM2.5 concentrations were elevated in the early morning hours. Based on meteorological conditions and proximity of the proposed burning, a decision to burn 20 acres in Idaho County was made because the burn was approximately 55 miles southeast of Potlatch.

August 25 – 4-hour rolling average for $PM_{2.5}$ in Moscow
During the morning of August 25, 2009, PM2.5 concentrations were elevated in the early morning hours. Based on meteorological conditions and proximity of proposed burning, a decision to burn 29 acres in Latah County was made because the burn was approximately 15 miles northeast of Moscow. Other burning took place in Nez Perce County and Idaho County, but other monitoring data was analyzed for these burns. Winds were out of the west during the Latah County burn.

September 8, 9, and 10 – 4-hour rolling average for $PM_{2.5}$ in Moscow
During the week of September 7, 2009 through September 11, 2009, monitoring data from the Moscow monitor was not valid due to a malfunction. On September 8, 2009, no burning occurred in Latah County. On September 9, 2009, approximately 71 acres were burned northeast of Potlatch for which the nephelometer located in Potlatch provided DEQ staff with more localized data. On September 10, 2009, 60 acres were reportedly burned approximately 3 miles to the north of Genesee. A DEQ field coordinator was on-site, winds were out of the west, and no smoke impacts were observed or reported.

September 28 – 4-hour rolling average for $PM_{2.5}$ in Genesee
During the early morning hours of September 28, 2009, PM2.5 concentrations were elevated. Other regional air quality data was analyzed and it appeared that the elevated concentrations were localized to the Genesee area. A decision was made to allow burning of approximately 725 acres in Latah County, based on trending air quality data in Genesee and lower concentrations in

Kendrick, Moscow, and Potlatch. A 95-acre field in the Conservation Reserve Program (CRP), approximately 4 miles to the northeast of Genesee, was burned. Winds were out of the southwest, west, and northwest. The remaining 630 acres (10 fields) burned were west and east of Potlatch, east of Moscow, and north and east of Kendrick. An additional 718 acres (16 fields) were burned in Clearwater, Idaho, and Nez Perce Counties on this day. Overall, ventilation and wind direction resulted in one of the largest burn days of the 2009 burn season, in terms of both number of acres and number of fields burned.

October 13 – 4-hour rolling average for $PM_{2.5}$ in Lewiston

During the morning of October 13, 2009, PM2.5 concentrations were elevated in the early morning hours. Burning was approved north of Moscow; therefore, DEQ staff evaluated monitoring data from Moscow and Potlatch. Winds were out of the southeast and no smoke impacts were observed or reported.

November 4 and 5 – Grangeville monitor not operating properly

On November 4, 2009, 296 acres were burned in Idaho County. On the following day, 105 acres was burned in Idaho County. A field coordinator was present at the burns and no smoke impacts were observed or reported.

South Idaho

March 13 – 4-hour rolling average for $PM_{2.5}$ at Nampa monitor

The 4-hour rolling average for $PM_{2.5}$ exceeded the trigger level for pre-burn documentation 2 hours before the approved ignition time on one occasion during the spring burn season. The Nampa hourly monitoring data indicates that there is a pattern of diurnal spikes that is attributed to the urban location of the monitor. This spike is expected at this time on a daily basis during the spring. One field with 25 acres was approved and burned in Canyon County on this day.

August 24, September 4 and 15 – 8-hour rolling average for ozone

- August 24 – Burning occurred within 3-5 miles of the Weiser area, within 3 miles north of New Plymouth, 5 miles south of Homedale, and 3 miles southwest of Marsing. A total of 236 acres were approved and 202 acres were burned. The forecasted AQI was 46 (54 ppb) and the actual AQI was 49 (58 ppb). During the time burning was approved, winds were observed prevailing from the east to northeast taking smoke southwest of the Treasure Valley. For the duration of the evening after burning was completed, winds were observed to continue prevailing from the east and southeast. Approved burns did not directly contribute to elevated ozone concentrations.

- September 4 – Burning occurred within 5 miles east of Weiser, and within 3 miles north and 3 miles south of Parma. A total of 220 acres were approved and 32 acres were burned. The forecasted AQI was 46 (54 ppb) and the actual AQI was 48 (57 ppb). During the time burning was approved, winds were observed prevailing from the north to north west taking. For the duration of the evening after burning was completed, winds were observed to be light and variable. Considering the size and location of the burns, approved burns did not directly contribute to elevated ozone concentrations.

- September 15 – Burning occurred within 5 miles east of Weiser, within 3 miles north and 3 miles south of Parma. A total of 458 acres were approved and 74 acres were burned. The forecasted AQI was 46 (54 ppb) and the actual AQI was 50 (59 ppb). During the time burning was approved, winds were observed prevailing from the west to northwest taking. For the

duration of the evening after burning was completed, winds were observed to be light and variable. Considering the size and location of the burns, approved burns did not directly contribute to elevated ozone concentrations.

July 28 – 8-hour rolling average for ozone
On July 28, two fields totaling 25 acres were approved to burn in the Emmett area. The forecasted ozone concentration was 54 ppb for July 28. Forecasted weather conditions were calling for surface winds from the north to northwest around 5 to 10 mph and temperatures in the upper 80s to low 90s. Observed weather conditions showed winds 5 to 10 miles per hour from the north to northwest shifting to the west in the late afternoon and temperatures were in the upper mid 80s to lower 90s. A monitor that had been inoperable came back online on the afternoon of July 27 but had not yet recorded enough data to support a forecast AQI for July 28; the actual concentration for July 28 was 63 ppb.

Considering the location and the size of the burns, smoke effects would have been seen at the ITD monitor first. During July 28, the monitor that the AQI and the burn decision were based upon, recorded an actual ozone concentration of 54 ppb for July 28, indicating that approved burns did not directly contribute to elevated ozone concentrations.

April 8 – 24-hour rolling average for $PM_{2.5}$ at Pocatello monitor
Evaluation of the non-quality assured monitoring data showed that at 1:00 pm Pacific Daylight Time (PDT), the 24-hr $PM_{2.5}$ rolling average reached 16.7 $\mu g/m^3$ based on data that had not been quality-assured. This value initially triggered enhanced documentation, however, when calculating the rolling 24-hour average with quality-assured monitoring data, the highest value recorded was 14.8 $\mu g/m^3$. Enhanced documentation was not required.

4.1.3 Institutions with Sensitive Populations

North Idaho

DEQ sent flyers directly to all the sensitive populations throughout the state, to inform them that there is now a CRB program, tell them about the program requirements for protection of public health, and provide an outline of the program's special consideration for these institutions. Some DEQ staff were able to visit some sensitive populations in person during the burn season.

In some of the areas where large scale burning occurs, each sensitive population was identified and interviewed. In other parts of the region where burning was less dense, a representative population was determined and used to evaluate potential impacts. In areas where little or no burning took place, Smoke Coordinators conducted few or no interviews.

After the brochures had been mailed, DEQ followed up with the affected institutions within 5 miles of approved burns with a phone survey. The survey was intended to remind institutions with sensitive populations that there is a program regulating crop residue burning and to determine if the institutions had incurred impacts at any point during the burn seasons.

The survey was comprised of six questions relating to crop residue burning. The most evident findings were that most people interviewed reported that they did not receive DEQ's information pamphlet in the spring/summer of 2009 and they did not know what number to call in case of a smoke impact. A few employees at the school districts remembered receiving the pamphlet and toll-free hotline number, but most people were unaware of the information contained in the

brochure. Because of this, the Smoke Coordinators took this time, during the contact made for the survey, to educate and provide these citizens with up-to-date information.

The majority of respondents stated that 2009 and/or the last two years did not seem as smoky as usual. This could be due to the decreased wildland fire activity. However, a few people stated that agricultural smoke did not impact their communities this year, but they know of many past events in which smoke inundated their schools, hospitals, houses, etc. All respondents stated that they did not register a complaint although some occasionally smelled smoke. School districts also stated that they did not receive any smoke complaints from parents or students; therefore, it was determined that there was no need to call the toll-free hotline.

Overall, most people surveyed were neutral or positive in their comments with regard to how the CRB program was implemented. However, three people voiced their concerns with agricultural field burning in general. One person, with asthma, stated that if the smoke gets too bad then her health condition becomes a life or death situation. The Smoke Coordinator informed this citizen about how DEQ uses meteorology to make decisions and provided a business card so the citizen could make a personal contact in case of a future smoke impact.

The other two concerned respondents who worked at an assisted living facility and requested that all agricultural burning be ceased. The Smoke Coordinator provided his contact information and explained the CRB program, emphasizing DEQ's commitment to protecting public health. It appeared that both employees kept people inside and closed the windows during smoke events. All three people who voiced their concerns about the program mentioned that the smoke was not as bad this year as it used to be in the past.

South Idaho

DEQ contacted 1,060 institutions with sensitive populations in South Idaho. Approximately 8% of those surveyed reported they received flyers DEQ had sent regarding the CRB program. Discussion revealed that of those 8%, approximately 40% were actually remembering a survey that was sent from DEQ by the emissions inventory group, not the CRB program. Less than 1% responded that they had been affected by smoke, only two people surveyed stated the incidents were reported; eight responders attributed smoke to ditch burning or burning of leaf piles and eight responded that smoke was farm-related. No one had any reports of health issues, only annoyance.

About 4% of the sensitive populations were not surveyed because they did not respond. Less than 1% of the survey records contained an incomplete phone number or no phone number, and 2.5% of the records contained phone numbers that were either discontinued, invalid, or fax numbers. DEQ attempted to call back 5% of the sensitive populations in our survey group with no response.

4.2 Complaints

Complaint response remains a critical part of any smoke management program. Like information from ambient monitoring, or meteorological data, complaints provide smoke managers with information that can help them understand how the public regards program implementation. DEQ did not focus on the number of complaints, but rather their location and content, and used information from the complaints to improve future burn decisions.

As discussed in the public outreach section above, DEQ used a familiar toll-free hotline number for the public to submit questions, comments, and complaints. DEQ, in cooperation with the Nez Perce and the Coeur d'Alene Tribes, used a contractor to answer the calls. Brief information from each contact made on the hotline was immediately e-mailed to all CRB staff throughout Idaho. Complaints received through the hotline answered by the contractor included non-CRB related complaints as well. The following information was collected from the callers:

- Name
- Phone number
- Call back requested?
- City
- State
- County
- Do you see smoke from your location?
- Is smoke at ground level?
- Brief description of the problem

DEQ also received questions, comments, and complaints in the regional offices. The majority of these complaints were entered into DEQ's Complaint Tracking System. However, some complaints and DEQ's responses were recorded using other methods, such as in field notes. In all cases, CRB-related complaints initially received by the hotline and referred to the regional office were also entered into DEQ's Complaint Tracking System by regional office staff. Table 7 summarizes the number of calls received on the hotline for 2009, and Table 8 shows the number of total complaints and how many of them were CRB-related for each area.

Table 7. Summary of calls to the CRB hotline in 2009

Month	Number Of Callers That Listened to the Answering Message	Number of Callers That Hung Up After the Answering Message	Number Of Callers That Selected "Speak With an Operator"*	Number Of Callers That Selected "Nez Perce Tribe Burn Decision"	Number Of Callers That Selected "North Idaho Burn Decision"	Number Of Callers That Selected "South Idaho Burn Decision"
January	6	6	0	0	0	0
February	11	11	0	0	0	0
March	16	0	2	0	0	0
April	13	6	1	0	0	0
May	4	0	0	0	0	0
June	10	4	0	0	0	0
July	23	14	4	0	0	0
August	65	12	27	46	1	0
September	60	7	48	54	85	38
October	164	7	7	52	59	16
November	43	2	2	20	6	0
December	0	0	0	0	0	54
OVERALL TOTALS	**332**	**28**	**91**	**172**	**151**	**108**

* Callers who chose to speak with an operator could register a complaint, ask a question, or make a comment, which was then immediately communicated by e-mail to pre-identified staff.

Table 8. Summary of complaints received in 2009

BMA	Total Complaints	CRB Related	Other	Not Verified	Comments
Central	19	4	15		
Kootenai County	17				
Boundary County	23	11	12		
Southwest Idaho	2	1			
Weiser and Lower Payette Valleys	1			1	Upon investigation, no smoke was visible and source could not be identified.
Blaine and Camas	0				
Southern Magic Valley	2	1		1	
Northern Magic Valley	4	1	3		
Southeast Idaho	2		2		
Eastern Idaho	0				
TOTAL	**70**	**18**	**32**	**2**	

4.3 Compliance and Enforcement

DEQ's existing compliance and enforcement program for the air quality division is used for the CRB program. DEQ continued to focus on compliance assistance during 2009. DEQ's goal for 2009 was to continue to educate the growers about their permits and requirements and help then ensure compliance. In those instances where enforcement was appropriate, DEQ continued to use both informal and formal enforcement tools. 11 potential violations of the CRB rule were forwarded to the Enforcement Coordinator in the Air Quality Division. Of those, 1 case was dropped because it was determined to be a legal weed control burn; 2 cases were issued consent orders with no penalty; and 8 cases were issued consent orders with penalties. A total of $10,594 was collected in penalties for violations of the CRB rule that occurred in 2009.

4.4 CRB Ambient Air Quality Monitoring Network

DEQ continued to operate the CRB $PM_{2.5}$ monitors during 2009. The only change to the CRB monitoring network was to move the monitor previously located in Clearwater, Idaho to Genesee, Idaho.

Figure 2 and Figure 3 show the locations of the DEQ, Coeur d'Alene, Kootenai, and Nez Perce Tribes $PM_{2.5}$ monitors in the northern Idaho BMAs. Figure 4 shows the $PM_{2.5}$ monitor locations in the southern BMAs.

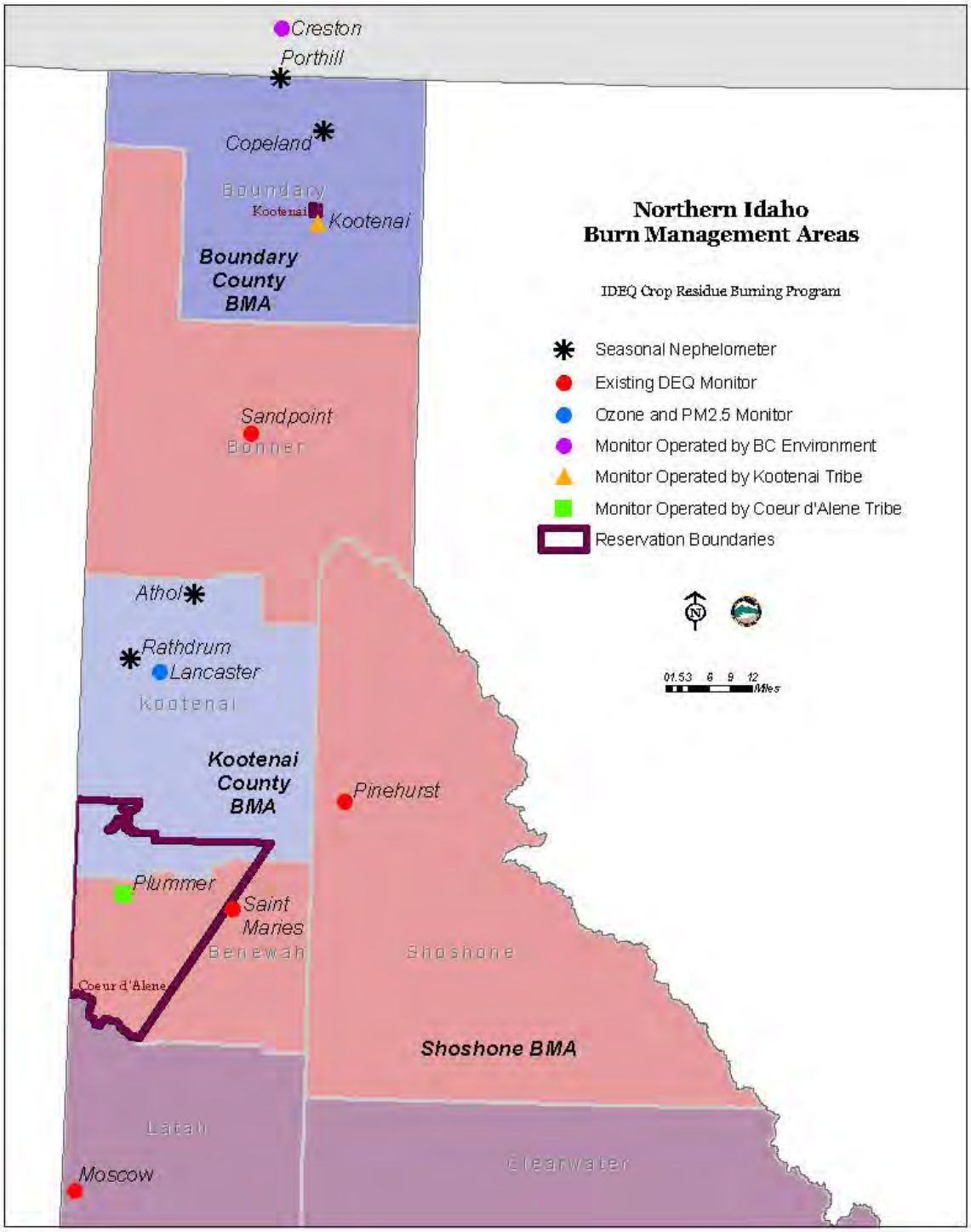

Figure 2. $PM_{2.5}$ monitor locations for northern Idaho Burn Management Areas.

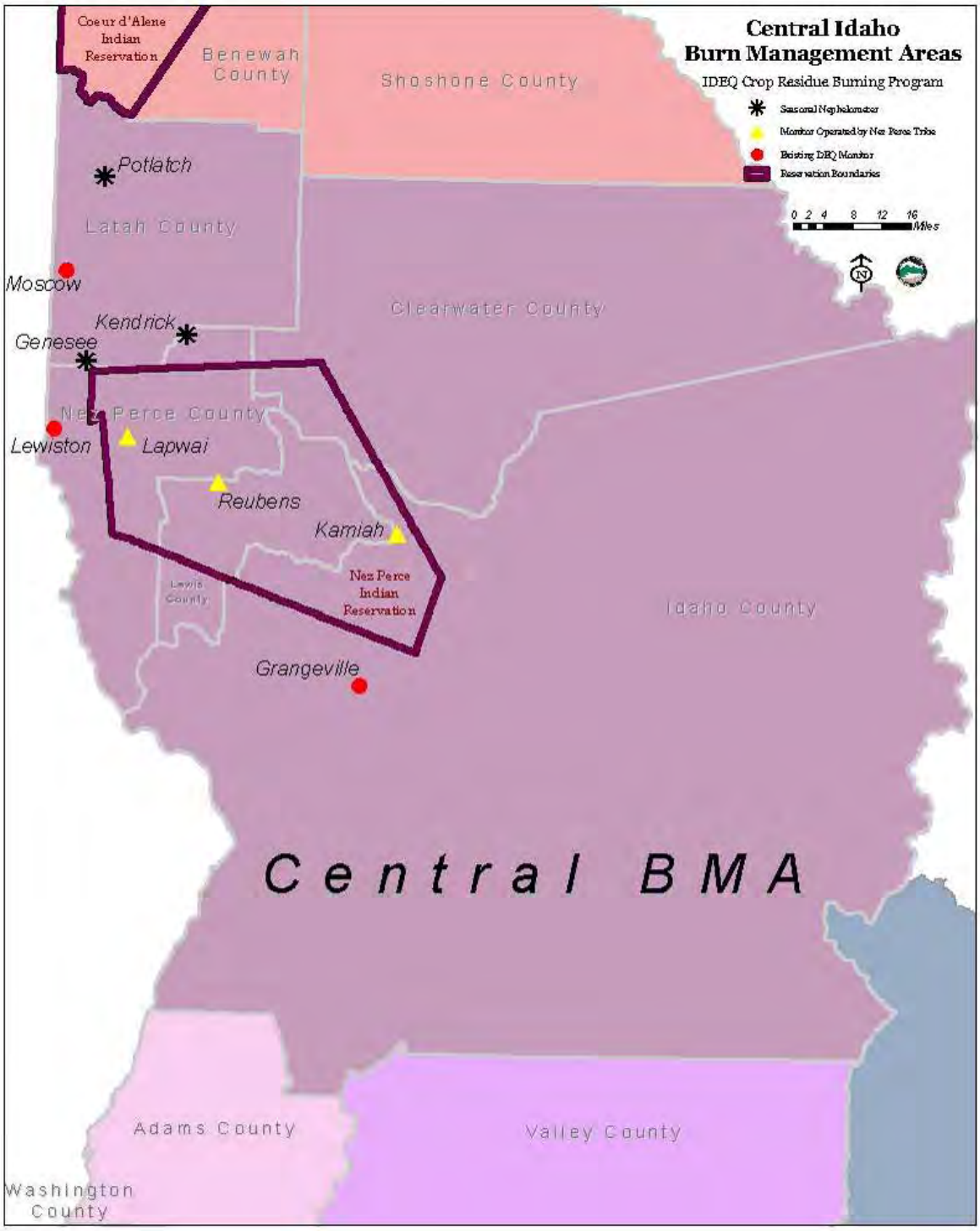

Figure 3. $PM_{2.5}$ monitor locations for the Central Burn Management Area.

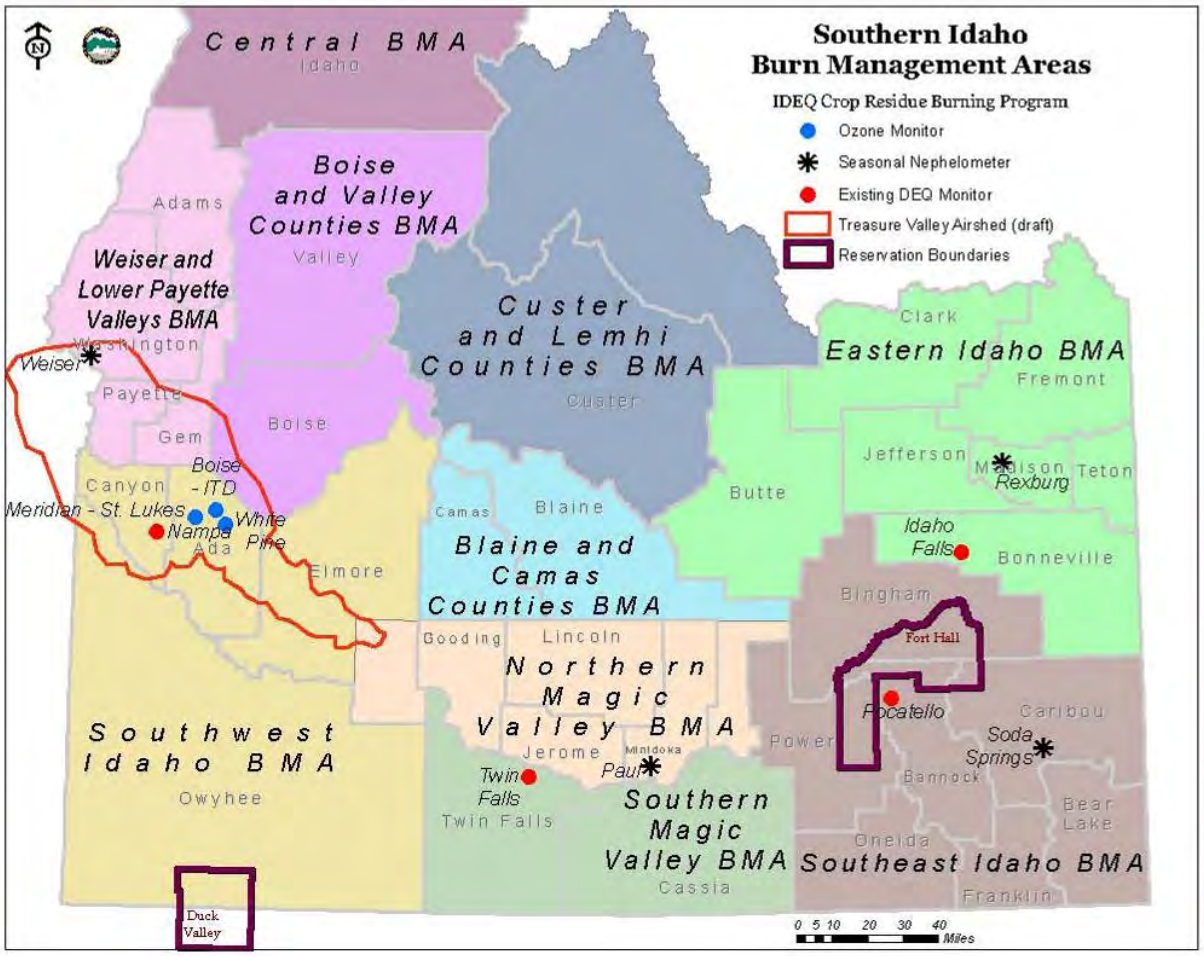

Figure 4. $PM_{2.5}$ monitor locations for southern Idaho Burn Management Areas.

4.5 Northern Idaho Summaries

Crop residue burning in northern Idaho occurred in the Boundary County, Kootenai County, and Central Burn Management Areas (BMAs). Crop residue burning in northern Idaho took place over a 10-month period between February 2009 and November 2009. For discussion purposes, however, this report characterizes two separate burn seasons; the spring burn season started in late February and ended in mid-June, and the fall season began in early July and continued into November. Overall, burning in northern Idaho increased by approximately 2,000 acres from 2008 and it is expected that newer farming practices (i.e., direct seeding) and tighter profit margins for the farmers will lead to more burning in 2010.

Over 2 million acres are farmed each year in northern Idaho. The agricultural fields in the 10 northern counties are geographically and topographically diverse, ranging in elevation from 1,000 to 4,500 feet above sea level. Productive agricultural fields vary in elevation by up to 3,000 feet over distances of less than 30 miles. Therefore, the length of growing season affects what types of crop are planted in a given area. For agricultural fields that are located at high elevations (3,000 - 4,000 feet), the short growing season limits crop choices.

Field characteristics throughout northern Idaho vary dramatically (i.e., flat, hilly, mountainous, etc.). Many fields are adjacent to steep river canyons or timber, which pose their own unique challenges when burning. The majority of the fields in Boundary County are confined to a

narrow river valley surrounded by mountains rising to over 5,000 feet on the east and west. DEQ is continually learning how all of these factors influence the direction smoke travels. Field observations, burn experience, and forecast models are essential for learning and implementing proper crop residue burning techniques.

Northern Idaho has an ideal climate for growing certain types of agricultural crops and grasses. Approximately 90% of the world's Kentucky blue grass seed is grown in the Pacific Northwest; wherein a tremendous amount of this grass seed is exported to developing countries. Almost all of the turf grass that is annually burned in Idaho is in the northern portion of the State. One disadvantage of turf grass production is the heavy residue that is left over after the harvest of grass seed creates a lot of smoke especially when compared to a light-residue grain stubble field. However, turf grass fields are generally in production for ten or more years which is good for minimizing, often reversing, soil erosion.

Soil types across north Idaho are well suited for various crops. Timber soil with high clay content is highly erodible and is best suited with turf grass or forage production. On the other side of the soil spectrum, the silt loam soils in portions of the Camas Prairie and Kootenai County are so rich and fertile that they are ideal for growing high yielding grasses that economically compete well with cereal grains.

Nonetheless, cereal grains account for the largest portion of planted acres. Wheat and barley grow well under the dry land conditions of northern Idaho where annual rainfall averages are between 12 and 30 inches. Historically, grain stubble was plowed back into the ground, thus restoring nutrients and making it easier to plant the subsequent crop. The relatively new practice of direct seeding minimizes land disturbances, which means the grower must properly manage the residue that is left on the field after harvest. If burning does not occasionally occur, residue buildup can cause disease to infest the field. Burning minimizes these potential risks.

Another long-term agronomic practice in northern Idaho involves crop rotation. Legumes play a crucial role in this rotation, as evidenced by the Lentil Festival on the Palouse that has been taking place for over 20 years. Lentils and other legumes fixate nitrogen back into the ground for the following crop—usually cereal grain. This limits the amount of nitrogen-based fertilizer that needs to be applied, which saves the grower operational costs and curbs the impact of nitrogen on drinking water supplies and other bodies of water.

Forage (commonly referred to as hay) crops are another substantial part of the economy in northern Idaho. These crops are often grown on less fertile ground or are rotated in and out of production. Other rotational crops include oil seeds that have long vigorous tap roots that break up compacted sub soils; therefore, the ground becomes more aerated and nutrients are more easily absorbed into the next crop.

Grasses grown under the Conservation Reserve Program, commonly referred to as CRP, are also common in north central Idaho. Lands managed under the CRP are often burned one time during their 10-year contracts with the Natural Resources Conservation Service (NRCS). Burning is intended to improve the health of the stand by reducing the residue that builds up on the ground over time. The residue loading on CRP land can vary greatly because grass height can be from less than two feet to more than six feet.

4.5.1 Northern Idaho Meteorology Summary

This section provides a brief summary of the meteorological conditions in northern Idaho for the 2009 spring and fall burn seasons. When growers notify DEQ that they are ready to burn the residue off their fields, DEQ staff follows a series of analytical steps to determine if burning can occur on any subsequent weekday (excluding Holidays). Wind data and other meteorological information from a variety of sources on the Internet are considered, as well as from the aforementioned monitoring sites that are operated by DEQ.

4.5.1.1 Spring Burn Season

In northern Idaho, the spring season generally provides for better meteorological conditions with regard to smoke dispersion. Spring also provides a more opportune timeframe for conducting large-scale burning because there is usually not as much competition for airshed space. Another advantage of burning in the spring versus the fall is smoke density. Due to decomposition of the fuels that takes place over the winter, spring burning produces less smoke as less fuel is being consumed.

The disadvantage is that north Idaho growers' main harvest season is during the summer months. Additionally, the majority of crops are planted in the fall (i.e., fall wheat). These agronomic factors compel growers to favor fall burning over spring burning. The fact that relatively few acres are burned in the spring provides for easier smoke coordination during this time frame.

February

Despite many burn requests from growers in early February; the first burn day of 2009 in northern Idaho was February 24. During the month of February, northern Idaho experienced normal temperatures and below normal precipitation. The majority of the precipitation events occurred in the early and later parts of the month, resulting in more suitable burn conditions in the middle of the month. Due to snow and rain events and/or high fuel moisture, burning was limited during the month of February.

March

In March, temperatures were below average throughout northern Idaho and the above-average amount of precipitation limited potential burn days. Due to persistent cold fronts from the Pacific Ocean, thousands of acres of crops could not be planted in the spring. It rained on more than 20 separate days throughout much of the Idaho Panhandle and north-central Idaho. Depending on location, precipitation was approximately one to two inches above normal, making March the wettest month of 2009.

April

The month of April began with a high-pressure system over the region that slowly shifted into a series of low-pressure systems. April experienced several cold fronts as a result of unstable moist air. Unstable conditions and the mixing of transport winds caused an increase in surface winds which limited burning on some days. However, these unstable conditions also provided opportunity for growers to burn the residue of their crops. April's meteorological conditions, coupled with the drying of the fields provided many opportunities to have successful burn days. In fact, more fields and more acreage were burned in April than any other month in the spring.

May
May began with above normal temperatures and an upper level flow that brought in warmer and drier conditions for northern Idaho. A cold moist air mass from Canada dropped into the Boundary BMA, which limited burning there. In the Central BMA, a cold front brought several days of precipitation that halted burning during the early part of May. Field conditions remained moist through much of the month, but all requested fields were approved and successfully burned with the exception of one. May ended with a high pressure system over the Central BMA which raised temperatures and provided the opportunity for the last burn requested in May to be completed in June.

June
Temperatures and precipitation totals were close to average throughout northern Idaho in June. A system from the west brought scattered showers and thunderstorms into the area during the second week of June. This system was followed by a high pressure ridge that allowed the remaining field to be burned during the middle of the month.

4.5.1.2 Fall Burn Season

Gary Bennett of Bennett Fire Weather Services provided the following discussion regarding the meteorology for the fall burn season, July through October. Mr. Bennett is the Meteorological Contractor for DEQ and for other smoke management agencies throughout Idaho. DEQ staff prepared the November meteorology summary for northern Idaho.

Many of the graphic images used to illustrate meteorological conditions during the fall burn season represent conditions either near the surface (ground level) or some distance above the surface. Distances above the surface are expressed in millibars, which are units of atmospheric pressure, not of linear distance. The images were produced using the computer-based modeling system known as MM5 (the full name of MM5 is Fifth-Generation NCAR / Penn State Mesoscale Model).

July
July 2009 brought the beginning of the CRB fall burn season; with practice burn decision processes occurring on July 16 and 17. Operational weather forecasts began the third week of July starting on Monday the 20th. During this first week of CRB summer/fall season, high pressure and dry conditions prevailed over northern Idaho. Meteorological conditions for crop residue burning were optimum as both mixing heights and transport winds were good. The high pressure ridge was west of northern Idaho during much of the first week leaving the region under a subsiding northwest to northerly flow aloft. Wild fires, again this year, were at a minimum as the storm track was predominantly over British Columbia. By late in the first week we saw a rather strong “marine push” that developed over eastern Washington and northern Idaho. In response, the high pressure ridge moved east into western Montana along with the warmest air. Marine air intrusions are common during the “summer” months after the warm high pressure ridge moves east of northern Idaho. Figure 5 clearly shows the impact of the cooler marine air into eastern Washington and northern Idaho.

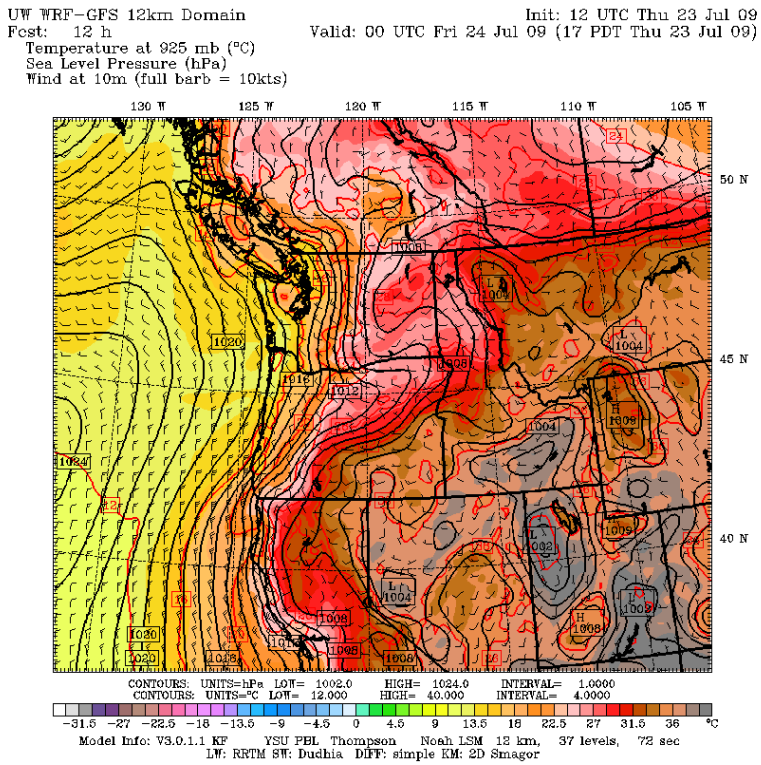

Figure 5. Surface level MM5 graphic for July 23, 2009.

This marine push was induced by a small upper low traversing southern British Columbia and forcing the upper level high-pressure ridge east over Montana. The upper trough moved east during the first active summer burn season weekend. By the following Monday, July 27, strong higher pressure was again building strongly off the west coast. This high pressure ridge would remain the dominant weather feature over northern Idaho for the entire week and through the remainder of July.

August

There was a complex weather pattern over northern Idaho for the first few days of August as a flat high pressure ridge was over the northern Idaho airsheds while an upper low had settled just off the northern California coast. There was also an upper trough sliding south through British Columbia. This trough eventually moved east into Montana, leaving just a few sprinkles over the Boundary County airshed in its wake.

The remainder of the first week of August brought a weakened upper low off the California coast that weakened and drifted east toward southern Idaho. This weather pattern left northern Idaho in an easterly wind pattern aloft as the flow around the low was southeast. This is normally an excellent weather pattern for scattered thunderstorms over much of northern Idaho and eastern Washington.

Figure 6 and Figure 7 illustrate the upper low movement very well. The high pressure ridge that is off the west coast would eventually flop over into northern Idaho later in the week. The upper-level low eventually weakened and moved northeast across central Idaho and into western

Montana. This upper low would produce rain across most of the northern Idaho airsheds both Thursday and Friday, August 6 and 7, bringing two-day rain totals that were over an inch and a quarter at Lewiston, over an inch at Pullman, and less than a half-inch farther north. Bonners Ferry received just less than two-tenths of an inch from this system.

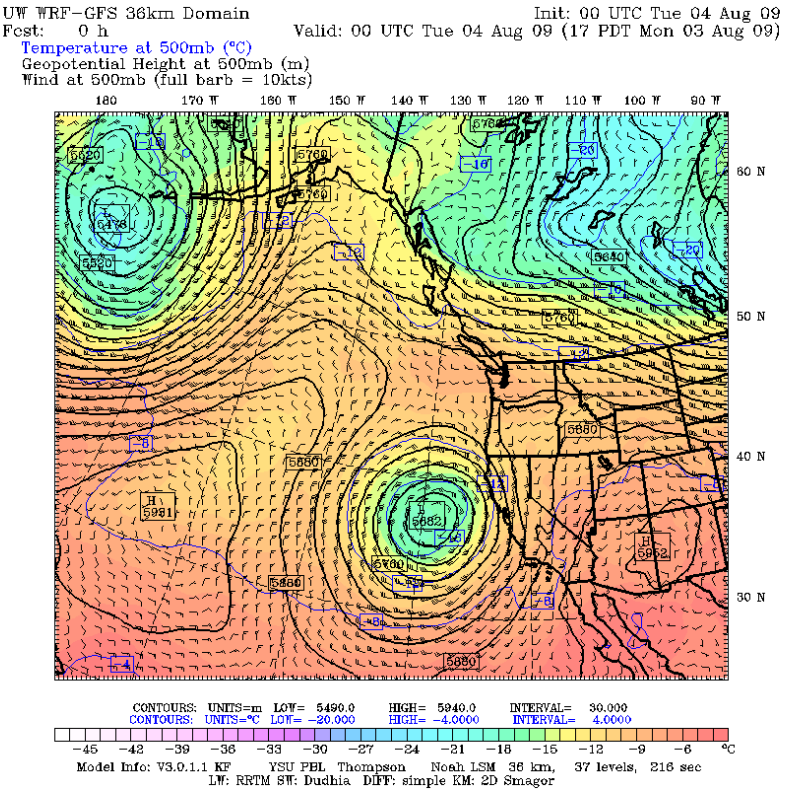

Figure 6. 500 millibar MM5 graphic for August 3, 2009.

During the second week of August, the cold and unstable low had weakened and moved east into Montana. The weather pattern over northern Idaho was now showing signs of being a progressive pattern that would ultimately continue for much of the summer months that remained. The weather pattern remained unsettled with scattered showers across many airsheds for the second week of August. Figure 7 shows another trough moving over northern Idaho that would again be strong enough to produce scattered showers and leave most airsheds receiving measurable rain once again. Rainfall amounts were generally less than a tenth of an inch from this other Pacific storm.

By Friday, August 14 in the second week, high pressure started rebuilding off the west coast and into the Gulf of Alaska. This would begin a drying period for all of northern Idaho that continued through much of the third and fourth weeks of August. The lack of measurable rain during this period combined with very warm summertime temperatures would finally dry up the fields as well as the soils. Fuel and soil moistures would make burning available to all northern Idaho airsheds by Monday, August 17.

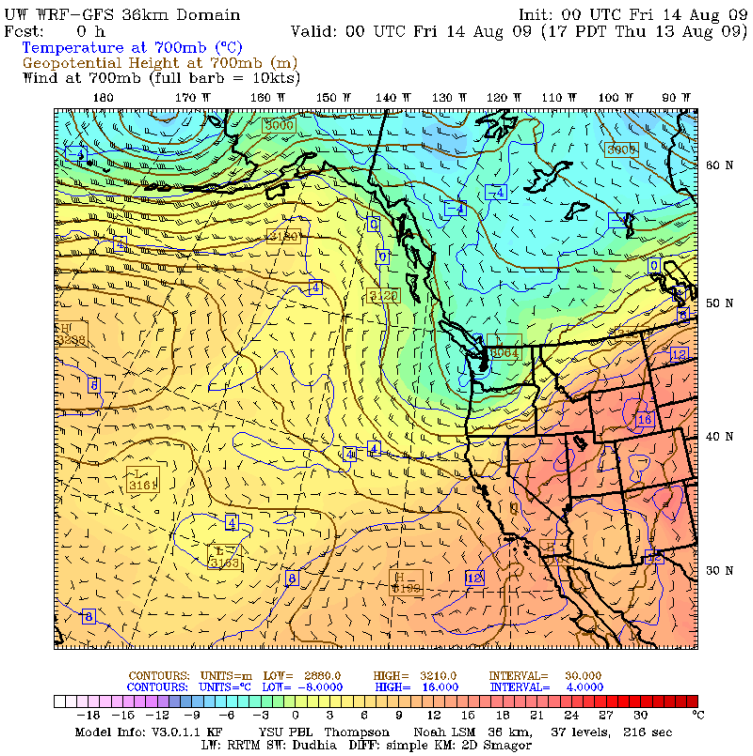

Figure 7. 700 millibar MM5 graphic for August 13, 2009.

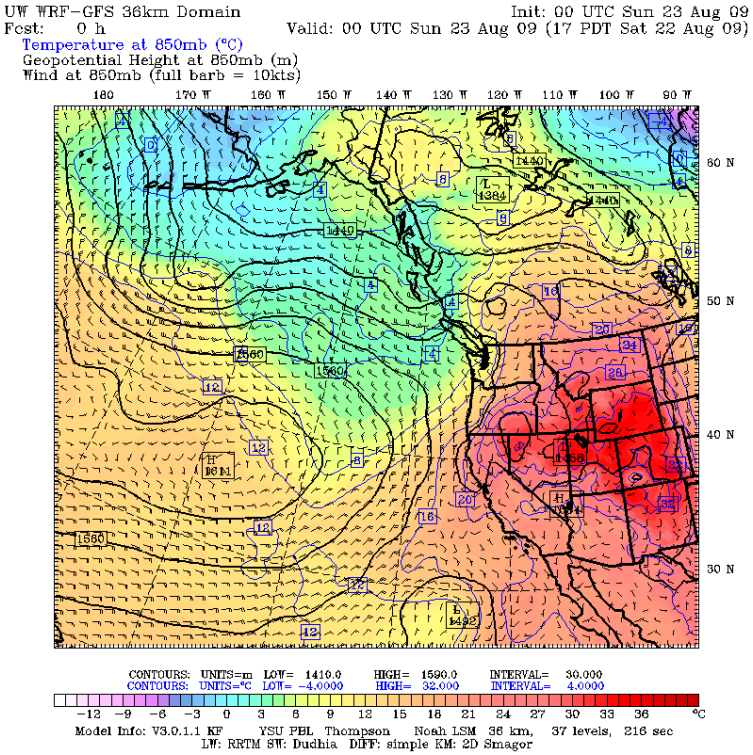

Figure 8. 850 millibar MM5 graphic for August 22, 2009.

The high-pressure ridge would direct Pacific storms to the north and east of northern Idaho during the 10-day period from August 17 to 27. There were days when the high pressure was directly overhead that became poor burning days because mixing aloft and at the surface were marginal even though mixing heights were ample.

Another Pacific storm raced across the Inland northwest later in the month, once again dampening the fields and slowing burning efforts over most northern Idaho airsheds for the first week of September. Figure 9 illustrates the incoming upper level Pacific storm just moving onto the Washington coast on August 28.

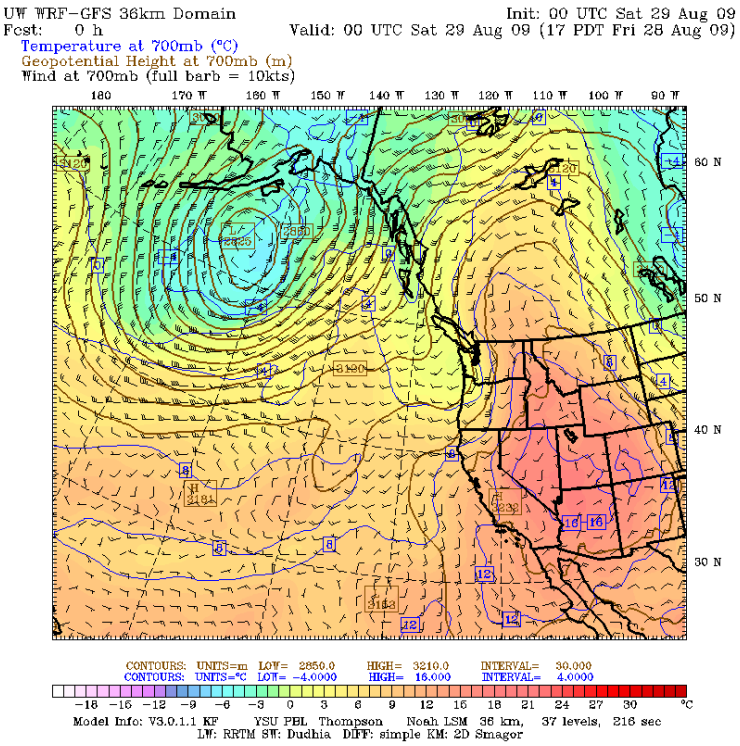

Figure 9. 700 millibar MM5 graphic for August 28, 2009.

September

Weather through the first week of September allowed fields to dry out once again as high pressure continued to build off the west coast in the northeast Pacific. This weather pattern kept northern Idaho dry through much of the month of September. There was only one day when measurable rain was recorded at Lewiston and various weather stations over the Clearwater Airshed and as far north as Potlatch. The northern airsheds did receive rain on a couple of other days. Figure 10 shows the general rain day for all of northern Idaho and a strong Pacific storm moved inland on September 6 and 7. Northern Idaho received most of the rain, but southern air sheds did receive some rain, generally less than a tenth of an inch.

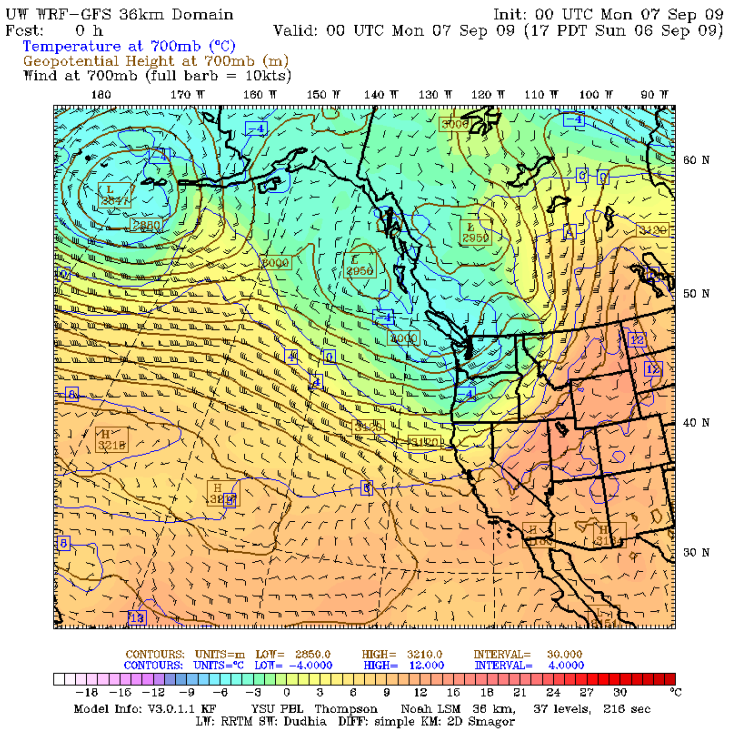

Figure 10. 700 millibar MM5 graphic for September 6, 2009.

Figure 11 shows the higher pressure over northern Idaho. This high pressure remained stationary for most of the rest of September.

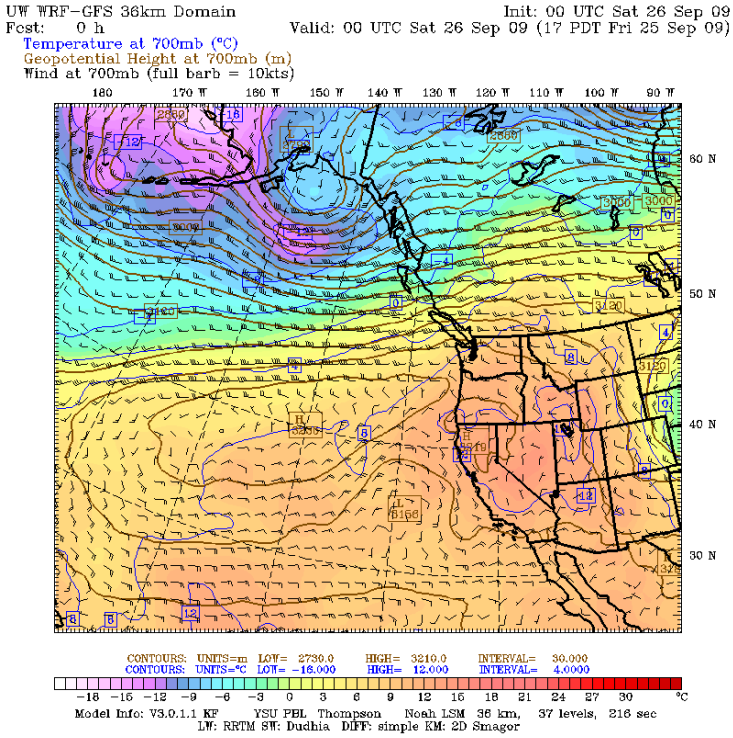

Figure 11. 700 millibar MM5 graphic for September 25, 2009.

The storm track had moved north over British Columbia, leaving northern Idaho in a generally dry pattern. There were a couple of days when the jet stream did sag south as Pacific storms zipped across southern British Columbia, leaving scattered showers from Interstate 90 north. These storms came in during the third week of September and restricted burning in northern Idaho.

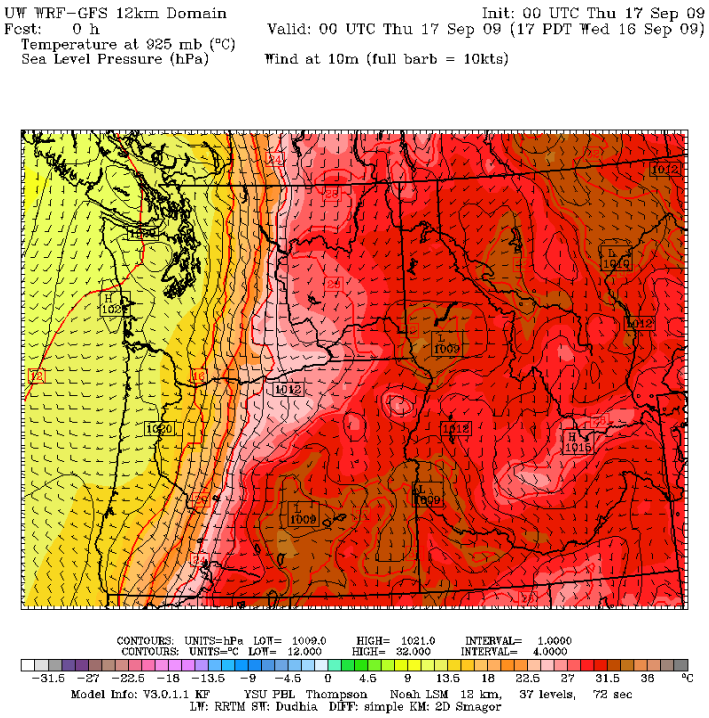

Figure 12. Surface level MM5 graphic for September 16, 2009.

Figure 12 and Figure 13, for September 16, show the warm air mass over the northern Idaho airsheds produced by an incoming weak surface front.

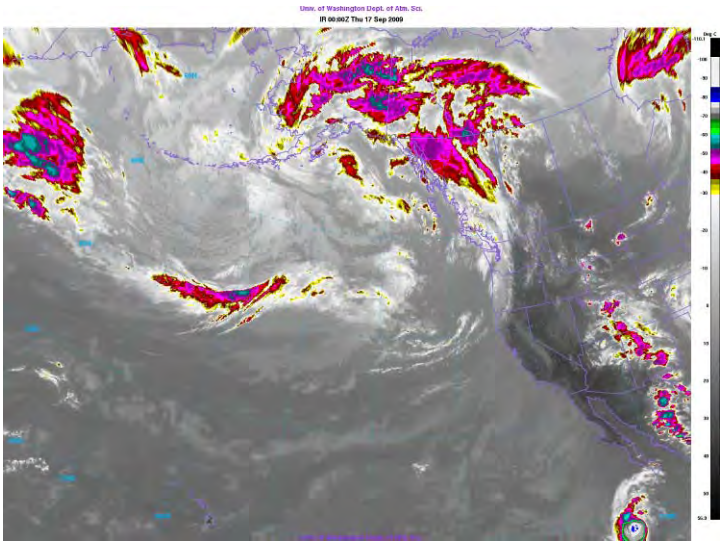

Figure 13. Satellite image for September 16, 2009.

This is an example of a day when ample surface and low-level mixing is evident due to the mechanical effects of the approaching surface front. This also was a day when northern Idaho did receive some showers late in the day, which limited burning.

By late in the month of September, we started to see a change in the dominant high pressure ridge over northern Idaho and we were swinging back into a progressive weather pattern as the jet stream was beginning to show signs of moving south.

October

As October field burning started, another cold and unstable upper level low and trough were digging into southern British Columbia. This cold air mass would set the weather pattern in place for the rest of the 2009 CRB season for northern Idaho. Figure 14, for October 1, shows the cold air over central British Columbia while higher pressure is building into the Gulf of Alaska. Bonners Ferry received over a half-inch of rain from this incoming storm, while lesser amounts fell farther south.

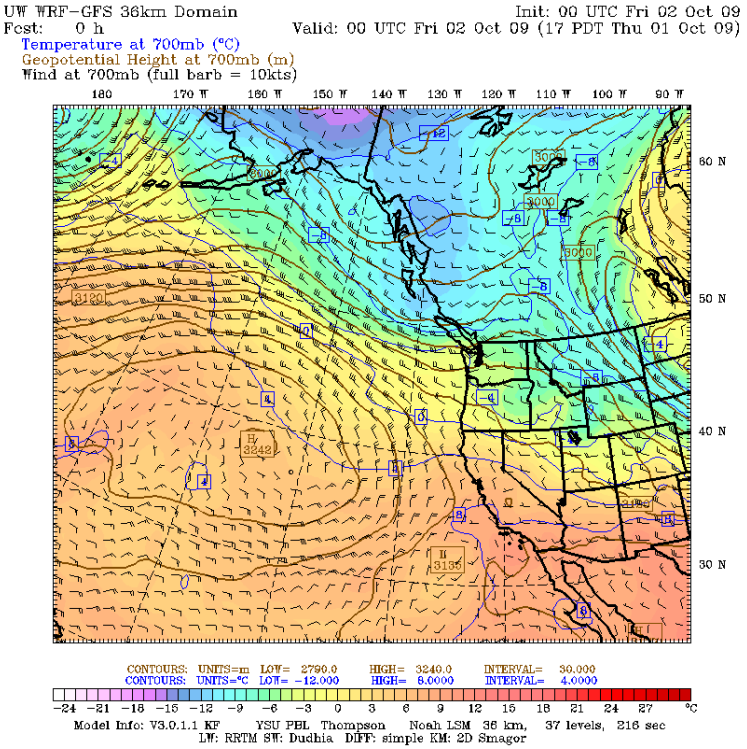

Figure 14. 700 millibar MM5 graphic for October 1, 2009.

By the second week of October, a very cold air mass had settled into and over northern Idaho. Figure 15 depicts the jet stream aloft over northern Idaho as the cold air mass digs south through Alberta, Canada. This cold air mass indicated that the end of the 2009 CRB season was near. By October 6, burning in Boundary County had concluded for the season due to fuel and soil moisture. The remainder of October continued the progressive weather pattern. Rain and snow fell again on October13 and 14..

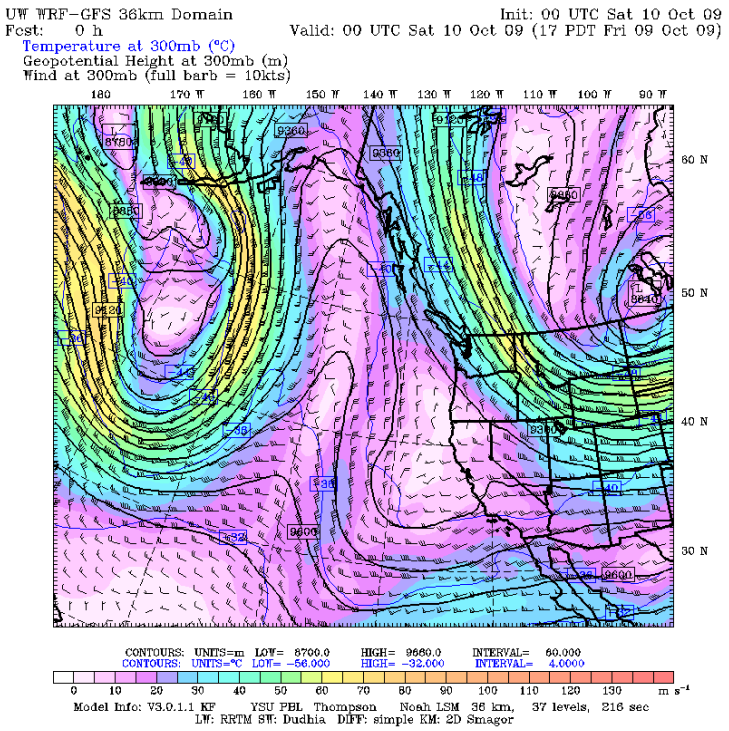

Figure 15. 300 millibar MM5 graphic for October 9, 2009.

November

In November, above-normal temperatures and below-normal precipitation amounts were reported throughout northern Idaho. Burning occurred during the first week of November in Latah, Nez Perce, and Idaho Counties. Conditions during the first week of November were calm with reported monthly high temperatures for Nez Perce County. The stable start to the month was followed by a series of Pacific storm systems that brought windy conditions and rain/snow events. These cool and moist conditions closed the window of opportunity for crop residue burning in northern Idaho for the remainder of 2009.

4.5.2 Central Burn Management Area

The Central BMA was originally created to manage burning throughout the entire Clearwater Airshed. However, during the 2009 burn season, DEQ determined that burn locations were best identified by county and the proximity to cities or towns. A daily burn decision was provided to the public which identified the county, acreage, and the general location of the burn areas. DEQ determined which fields were allowed to be burned based on field location, crop type, and proximity to human habitation(s). Field aspect, elevation, and other stationary factors are routinely considered as well. In fact, elevation differential and climate provide the Central BMA with the longest burn season of any BMA in Idaho, with 2009 burning that began in February and ended in November.

4.5.2.1 Area Geography

The Central BMA, also known as the Clearwater Airshed, includes the Idaho counties of Latah, Nez Perce, Lewis, Idaho, and Clearwater. In addition, the Nez Perce Indian Reservation is located within the area and transects each of these counties except for Latah County. This Central BMA is commonly referred to as north-central Idaho and is the southern portion of the north Idaho Panhandle. The topography in the Central BMA is diverse with high mountains in Latah, Clearwater, and Idaho Counties, valleys and steep canyons in Nez Perce County, and a centrally located high land agricultural area that intersects all counties except for Latah County.

Latah County is generally characterized by low-elevation mountains bordering the county to the north that gently turn into the rolling hills of the Palouse Prairie. A large amount of burning in Latah County occurs on the Palouse Prairie at elevations around 2,500 -3,000 feet. Burning is generally in the north and south-central parts of Latah County. The multi-county area including southeast Latah County, northeast Nez Perce County, and southwest Clearwater County is another area where a lot of burning occurs. Latah County is populated with many different towns, in addition to sensitive populations, requiring a high degree of sophistication to properly manage smoke.

Steep canyons and valleys make up a majority of the topography in Nez Perce County with a small portion of northern Nez Perce County being comprised mainly of flat agricultural terrain. The Nez Perce Indian Reservation transects the eastern portion of Nez Perce County, which limits the number of crop residue burns that are managed by the State of Idaho. Burning generally occurs southeast of Lewiston and to the north/northeast of Lewiston north of the Clearwater River. Burning in northern Nez Perce County is similar to burning in southern Latah County. The Clearwater River and other river valleys in Nez Perce County create diurnal wind shifts throughout the burn season. These diurnal flows often bring smoke into the valley from surrounding areas and further restrict burning in the valley.

Lewis County borders Nez Perce County and is primarily on the Nez Perce Indian Reservation. Topography in Lewis County is similar to the Camas Prairie around Grangeville. A majority of the fields burned in Lewis County are on the Nez Perce Indian Reservation with a small southern section managed by the State of Idaho.

Clearwater County, located east of Latah County and north of Idaho County, contains a mixture of low-elevation mountains and prairie. Burning occurs primarily on the Weippe Prairie which is flat agricultural terrain that is bordered to the west by steep canyons and drainages. The canyons to the west can create challenging burn days that limit burning when winds are out of the east. However, the small population base and no identified sensitive populations on the Weippe Prairie allow for less restrictive burning throughout the burn season. The majority of the fields burned in the county are at elevations around 3,000 - 3,300 feet.

Idaho County is the largest county in Idaho but has a relatively centralized population base. Burning occurs mainly on the Camas Prairie, where the population is approximately 200,000, including the communities of Cottonwood and Grangeville. Topography on the Camas Prairie is generally flat with low-elevation mountains and steep river canyons to the east and southwest. The Camas Prairie is a higher elevation area (3,300 - 4,500 feet). There are several sensitive populations within the Camas Prairie that can make burning challenging.

In summary, managing smoke in areas with many different micro-profiles, in a relatively small area, is very difficult. Sophisticated smoke management is required for north central Idaho due to different topographical profiles and the proximity of communities to fields burned, including the following specific factors:

- Challenges related to localized weather conditions
- Approximately 55% of the burning occurs within 5 miles of a sensitive population
- Many small towns are near areas where burning occurs regularly
- The Nez Perce Tribe's land, where many agricultural fields are burned throughout the year, transects much of the Clearwater Airshed

Great care must be exercised when burning in these areas. Additionally, it is important to communicate where burning will occur to ensure that each sub-airshed is protected.

4.5.2.2 Acres Burned

In the Central BMA, a total of 24,694 acres were approved for crop residue burning in the 2009 burn season(s). Of the total acreage approved, 19,269 acres (78%) were burned on 56 approved burn days. The difference in acres approved versus burned was due to many reasons. Some acreages were approved on multiple burn days, but only burned once. Some growers also chose not to burn after they paid their fees and were approved. The tables below summarize the burning that took place in the Central BMA.

The Central BMA accounts for approximately 35% of the total burning in the State of Idaho's CRB Program. Table 9 summarizes the number of acres registered, paid for, and burned in north-central Idaho. More than 1,800 additional acres were burned in 2009 than in 2008, which was a 10% increase.

Based on the number of acres burned in 2009, the Central BMA was home to four of the seven counties with the greatest amount burned; more acres were burned in Idaho County than in any other county in Idaho. Idaho County also saw the largest increase from 2008 in acres burned, resulting in an increase of almost 30% to a total of nearly 7,500 acres.

Table 9. 2009 CRB Summary for the Central BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	23,169
Paid Acres	21,867
Burned Acres	19,269
Percent completed	88%

Table 10 illustrates the crop types that were burned in the Central BMA in 2009. While approximately 700 fewer acres of turf grass were burned in 2009 than in 2008, which was a 14% reduction, approximately 1,850 additional acres of cereal grain, a 16% increase, were burned. It is likely that both of these trends will continue in the near-term due to low demand for grass seed. Also, CRP burning increased by about 450 acres, or 126%, from 2008 to 2009. In summary, more than 300 fields were burned in the Central BMA with the fields ranging in size from less than one acre to more than 550 acres.

Table 10. Summary of acres burned by crop and burn season

Crop Type	Burned Acres	
	Spring	Fall
CRP	113	693
Cereal Grain	1,516	11,876
Legumes	0	1
Other	67	546
Turf Grass	0	4,457
TOTAL	1696	17573

4.5.2.3 Daily Burn Decisions and Air Quality

There were 56 days when DEQ issued a final burn approval in the Central BMA; however, burning only occurred on 52 of them. The four days when burning was approved but not conducted were due to various reasons including equipment failure, overnight precipitation, and unexpected wind direction. On two occasions, the growers also chose not to burn on that day. These factors did not create a backlog and all approved acreages that were not burned on the day originally approved were burned later if the grower decided to do so.

Table 11 summarizes the number of burn and no-burn days by county as well as reasons for days with no burning in the Central BMA. Latah County burned on 30 different burn days followed by Idaho, Nez Perce, Clearwater, and Lewis Counties. In 2009, there were 25 additional burn days than there were in 2008. This was primarily a result of the 14 burn days that took place in the spring of 2009 because spring burning did not occur the previous year. Almost 2,000 acres was able to burn in the spring. The lack of regional and local wildfires also provided for an additional 11 burn days in the summer and fall months of 2009.

Table 11. Reasons for no-burn decisions by county, Central BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
LATAH	30	25	4	11	1	13	4	"Other Reasons" include holidays and days when growers were not ready.
CLEARWATER	13	61	1	4	1	6	2	
LEWIS	3	73	0	6	1	3	2	
NEZ PERCE	14	57	0	4	4	7	2	
IDAHO	26	33	4	9	1	12	3	

Appendix A contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Central BMA.

4.5.3 Kootenai County Burn Management Area

4.5.3.1 Area Geography

The Kootenai County BMA includes the Rathdrum Prairie and Rose Lake areas. The Rathdrum Prairie is an area of mixed irrigated and non-irrigated agricultural fields and other rural land in Kootenai County. The Rathdrum Prairie is bordered to the north by the city of Rathdrum, to the east by the city of Hayden, and to the south by the cities of Post Falls and Coeur d'Alene. The grass fields located on the prairie are nearly surrounded with urbanized cities and growing rural residential communities. The Rose Lake area is on the eastern edge of Kootenai County and includes the Chain Lakes area that follows the Coeur d'Alene River as it flows into Lake Coeur d'Alene. These factors make it very difficult for a smoke manager to predict how smoke will move from the fields and whether it will disperse quickly, in order to choose times of minimal impact to the public.

4.5.3.2 Acres Burned

A total of 460 acres were burned, which represents about 98% of the acres registered (see Table 12). The summary of acres burned by crop type and burn season is presented in Table 13.

Table 12. 2009 CRB summary for the Kootenai County BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	471
Paid Acres	471
Burned Acres	460

Table 13. Summary of acres burned by crop and burn season

Crop Type	Burned Acres	
	Spring	Fall
Other	0	8
Turf Grass	0	452

4.5.3.3 Daily Burn Decisions and Air Quality

The Rathdrum Prairie burns were conducted with little or no impacts recorded by the monitoring network. Due to the location of the burning on the Rathdrum Prairie relative to surrounding residences, proper ignition techniques were important to ensure potential smoke impacts were minimized. Also, it was very important to verify wind conditions in the field prior to ignition. The use of modeling data can approximate field conditions, but it is essential to confirm ground level wind direction as well as upper air movement. Field observations by DEQ staff are also routinely used to characterize smoke management success or failures.

There were nine burn days during the fall 2009 CRB Season in the Kootenai BMA. Burning did not occur on other days primarily due to the lack of requests. Table 14 below summarizes the number of burn and no-burn days and the reasons for days with no burning.

Table 14. Reasons for no-burn decisions by county, Kootenai BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
KOOTENAI	9	52	1	7	7	9	3	"Other Reasons" include holidays and days when the growers were not ready.

Appendix B contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Kootenai County BMA.

4.5.4 Boundary County Burn Management Area

The majority of the CRB activity in Boundary County occurs in the Kootenai River Valley bottom lands. The Kootenai River Valley is the major agricultural area in Boundary County, with rich farmland along the flat river bottoms and adjacent benches.

4.5.4.1 Area Geography

The Selkirk Range is located on the west side and creates a dramatic valley boundary, rising more than 3,000 feet above the valley floor within one mile of the western edge of the valley. The mountain peaks are at 6,000 to 6,800 feet throughout the north/south-oriented range. The eastern boundary is similar to the western boundary, with ridge tops at 4,000 to 6,000 feet. These geographic features have a strong influence on the local weather patterns and play a significant role in smoke management. The primary smoke management challenge in Boundary County continues to be the impact terrain has on localized weather and on smoke dispersion. The Kootenai River Valley, where most of the burning occurs, has steep drainages that create localized gap winds and wind patterns. The Kootenai River runs from east to west as it passes through the city of Bonners Ferry and then turns to the north/northwest as it flows approximately 25 miles up to British Columbia.

4.5.4.2 Acres Burned

In the Boundary County BMA, 18 burn days were declared and used by growers between January 1, 2009 and October 8, 2009. A total of 4,660 acres were burned (see Table 15). The summary of acres burned by crop type and burn season is presented in Table 16.

Table 15. 2009 CRB summary for the Boundary County BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	7,716
Paid Acres	6,950
Burned Acres	4,660

Table 16. Summary of acres burned by crop and burn season

Crop Type	Burned Acres	
	Spring	Fall
Cereal Grain	440	3,400
Other	270	120
Turf Grass	215	215

4.5.4.3 Daily Burn Decisions and Air Quality

There were 18 burn days during the fall of the 2009 CRB Season in the Boundary BMA. Burning did not occur on other days primarily due to lack of requests. Table 17 summarizes the number of burn and no-burn days along with the reasons for days with no burning.

Table 17. Reasons for no-burn decisions by county, Boundary County BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
BOUNDARY	18	46	0	7	2	13	2	"Other Reasons" include holidays and days when the growers were not ready.

Appendix C contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Boundary County BMA.

4.6 Southern Idaho Summaries

DEQ is expecting an increase in total number of acres burned in 2010 due in part to agricultural soil management practices, growing season, and program awareness. This is true even though there has been a decrease in cereal grain crops nationwide; the United States Department of Agriculture reported that 1,760,000 acres of wheat and barley were harvested for 2009, down 8% from 2008 (National Agricultural Statistics Service 2009).

During 2009, a total of 30,327 acres were burned, up by 177% from 2008,

Most burning occurred in the Snake River Plain ecoregion of southern Idaho. The Snake River Plain is characterized by plains and low hills. It is considerably lower and less rugged than the surrounding ecoregions. Crop residue burning occurred in six of nine BMAs along the Snake River Plain. Approved crop residue burning may occur year-round, but the typical burning seasons are mid-March through mid-May and mid-July through mid-October. Growers generally will spot-burn throughout the calendar year, depending on crop types and noxious weed infestations.

4.6.1 Southern Idaho Meteorology Summary

The following sections provide summaries of meteorological conditions for each of the months included in the spring burn season (March – May) and the fall burn season (July – October) for southern Idaho.

4.6.1.1 Spring Burn Season

Similar to the typical situation in northern Idaho, the spring season in southern Idaho generally provides better meteorological conditions with regard to smoke dispersion than the fall season does. Spring also provides a more opportune timeframe for conducting large-scale burning because there is usually not as much competition for airshed space. Another advantage of burning in the spring versus the fall is smoke density. Due to decomposition of the fuels that takes place over the winter, spring burning produces less smoke as less fuel is being consumed.

March

March 2009 was cooler than normal for the southern Idaho forecast area. Precipitation for the month was evenly spaced with no prolonged wet or dry spells. The western portion of the forecast area received a total of 1.26 inches; the eastern portion received 1.27 inches. Snowfall totaled 3 inches and 8.2 inches for the western and eastern portions of the forecast area, respectively. This was well above normal but similar to last year's totals (National Weather Service 2009).

April

April was characterized by wide swings in temperature with pronounced cool temperatures the first and last week, between which were two weeks of warm temperatures reaching into the 80s. April was a fairly dry month, with rain totaling three-quarters of an inch in the southwestern regions of Idaho and three-hundredths of an inch in the eastern portions of the state. April is typically the windiest month in the region but this year the gusty winds were not as prevalent as usual. This year on twelve days wind speeds over twelve miles per hour were recorded. During the period of warm temperatures in the later part of the month, areas surrounding Boise experienced isolated strong to severe thunderstorms as a cold front moved into the region breaking the warmth (National Weather Service 2009).

May

May began wet as a cold front came in from the northwest. The majority of the rain came in the early days of May, bringing nearly an inch of rain to the southwestern portion of the state, but overall May was a fairly dry month for the Boise region. On the eastern side of the state, May brought nearly an inch and a half of precipitation for the month.

It was cool during the rainy first week of May. On May 13, temperatures in the southwestern portion plummeted to 31 degrees, recording the only freezing temperature for the month, which resulted in some damaged crops. May then warmed steadily, setting a record temperature in the southwestern portion of the state at 95 degrees on May 18. May did not bring any high-impact storms, but south-central and eastern Idaho counties experienced a number of hazardous weather watches for severe thunderstorms during the early portion of the month (National Weather Service 2009).

4.6.1.2 Fall Burn Season

Gary Bennett of Bennett Fire Weather Services provided the following discussion regarding the meteorology for the fall burn season, July through October. Mr. Bennett is the Meteorological Contractor for DEQ and for other smoke management agencies throughout Idaho.

Many of the graphic images used to illustrate meteorological conditions during the fall burn season represent conditions either near the surface (ground level) or some distance above the surface. Distances above the surface are expressed in millibars, which are units of atmospheric pressure, not of linear distance. The images were produced using the computer-based modeling system known as MM5 (the full name of MM5 is Fifth-Generation NCAR / Penn State Mesoscale Model).

July

The CRB fall burn season began in July 2009; with practice burn decision processes occurring on the July 16 and 17. Operational weather forecasts began the third week of July, starting on Monday, July 20. The weather pattern over southern Idaho on July 20 had high pressure rebuilding over the airsheds. This upper-level high pressure stayed over southern Idaho for the entire first week of the burning season. Figure 16 depicts the weather pattern over southern Idaho that was typical for the first week of July. Temperatures were warm and relative humidity (RH) was dropping into the teens each day. Surface winds were generally light during this time period.

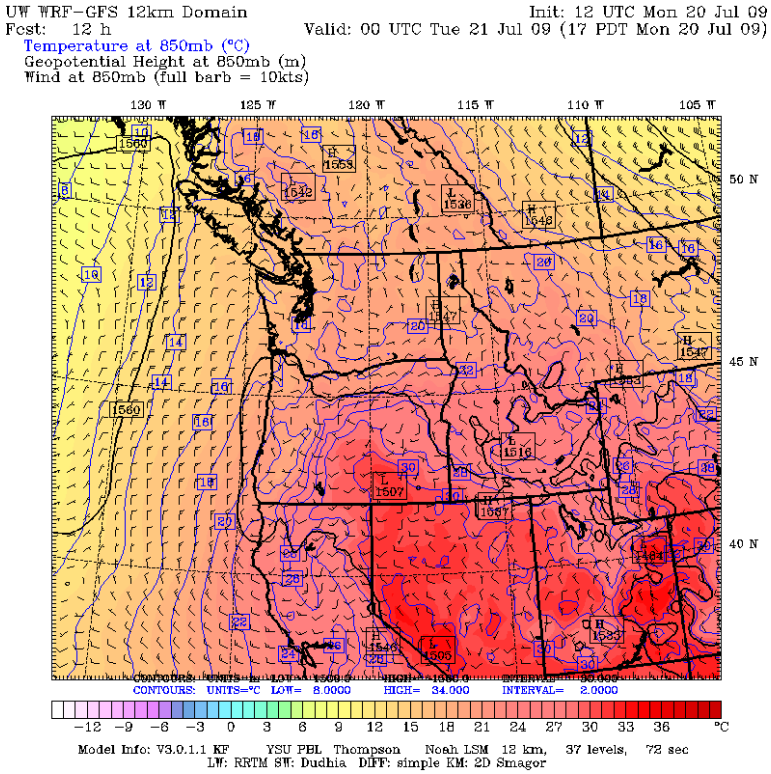

Figure 16. 850 millibar MM5 graphic for July 20, 2009.

The final week of July brought an upper-level low over the Central Idaho Mountains and a threat of thunderstorms and rain showers to the higher elevations. This type of transitory weather pattern remained for much of the 2009 summer burning season. As the upper low moved slowly into the Dakotas by July 28, another high pressure ridge was developing off the west coast that dominated the weather through the last week of July. The positioning of the offshore high-pressure and the formidable upper low over the Dakotas was nearly blocked into position, therefore yielding a very slow eastward progression to the high pressure. This is how July ended.

August

The first week of August still showed a big and strong high-pressure ridge well off the west coast. There was also an upper-level low that had developed over northern California. This weather pattern is seen in Figure 17. The air mass over southern Idaho was very warm and dry during the first week of August.

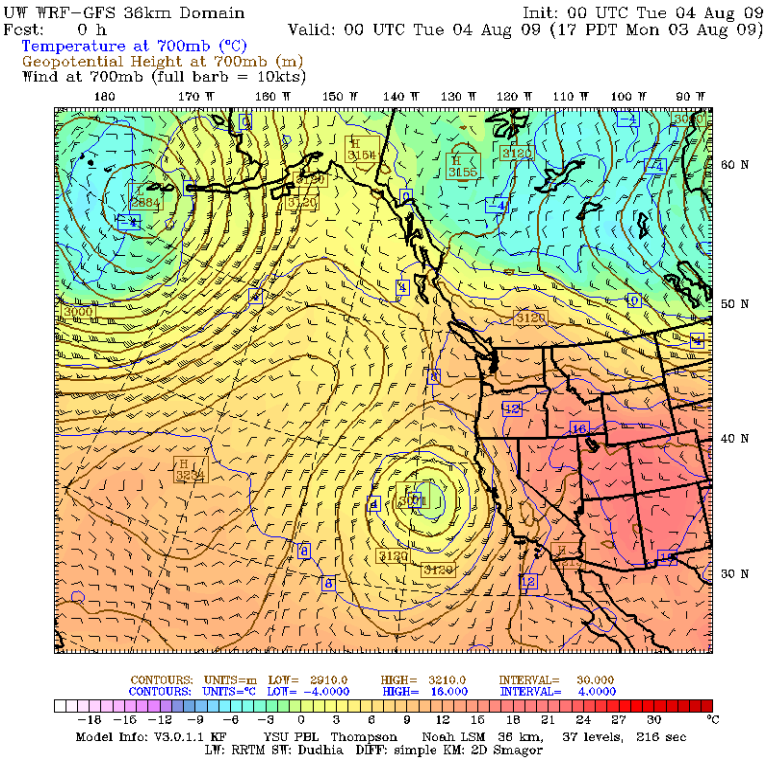

Figure 17. 700 millibar MM5 graphic for August 3, 2009.

During the rest of the first week of August the California low eventually weakened as it kicked northeast into southern Idaho. Ejecting lows like this one are a great generator for showers and thunderstorms over much of southern Idaho, and this was the case as showers and thunderstorms dropped considerable moisture over many of the airsheds. Due to the nature of showers, areal precipitation coverage was spotty, although amounts between one-tenth and four-tenths were common in the central Idaho Mountains. Boise had a thunderstorm parked over the area and recorded nearly an inch of rain on August 6 and over a half-inch on August 7. Residual showers continued on August 8 with Boise recording another quarter-inch of rain. All three days of rain

established new record daily rainfall amounts for the Boise area. This much rain slowed crop residue burning for a few days until soil moisture dried out a little. The upper-level low moved slowly east across southern Idaho.

By the second week of August, warm and dry high pressure was again rebuilding into southern Idaho. What would become a persistent weather pattern for the summer burn season was already setting up as another upper-level low pressure area was moving south in the northeast Pacific. The low "pumped up" high pressure over southern Idaho as it moved southeast. This pattern also brought the jet stream aloft further south. Figure 18 shows this pattern setting up again. The lower-latitude jet stream effectively kept the ridge over southern Idaho from gaining amplitude and strengthening it. By the end of the second week of August, this low moved across southern British Columbia, leaving a weak surface cold front to move across southern Idaho airsheds by late in the week. This had a twofold effect on field burning: 1): winds at the surface and in the mixed layer increased; and 2) mixing heights increased due to the mechanical effects of the front.

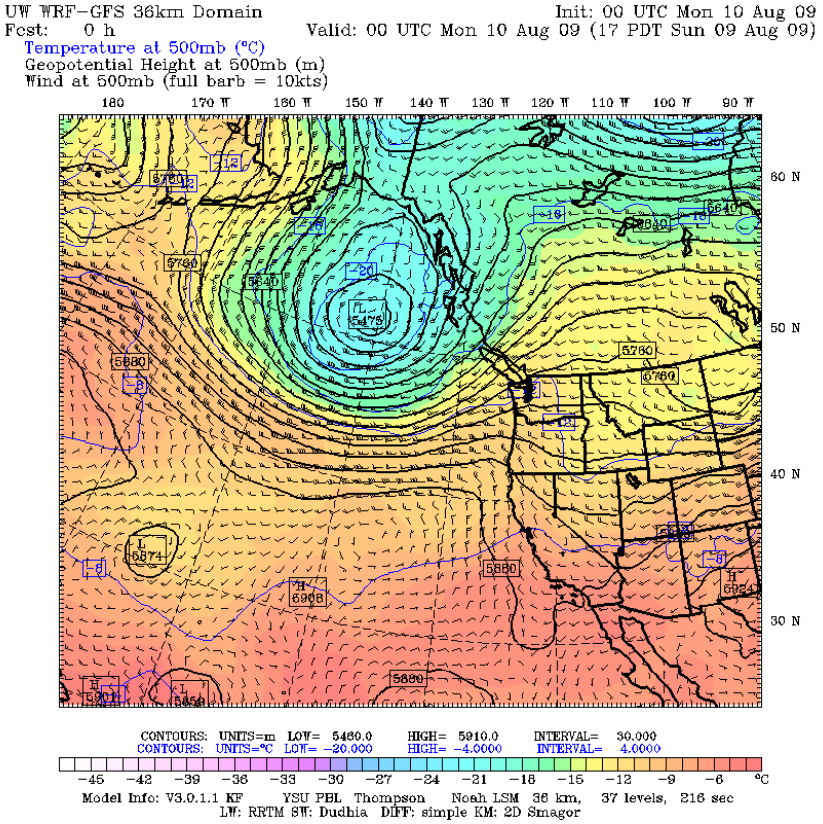

Figure 18. 500 millibar MM5 graphic for August 9, 2009.

This summer once again showed a lack of monsoonal moisture moving up from the desert southwest. This annual thunderstorm producer for southern Idaho was held in check by the positioning of the intermountain west high-pressure cell and the constant transitory state of weather systems moving in off the Pacific Ocean. With this lack of monsoonal moisture, lightning storms were held at a minimum, which translates to a lack of lightning-caused forest fires in northern Utah/Nevada and southern Idaho.

Southern Idaho was again only slightly hampered by high level smoke intrusions from wild fires in California. By mid- to late–August, a series of pacific storms moved into northern Idaho with cold fronts aiding low level mixing and keeping the California wildfire smoke well mixed. The height contours became more compact, yielding stronger westerly winds aloft that sheared monsoonal storms farther east. This pattern remained throughout the height of the summer lightning season.

Through the third and fourth weeks of August, an off shore high pressure ridge developed as the upper low in the graphic above opened up (weakened) and moved east across southern British Columbia.

The weather pattern stayed rather benign for the third week in August as winds aloft was generally light and these winds reflected the wind pattern at the surface.

Figure 19 for August 13 shows a weak frontal boundary bisecting the northern and southern districts. The air mass south of the front is very warm and dry while to the north there are cooler temperatures and a surface low over eastern Washington. This type of surface pattern dominated southern Idaho for the third week in August. By the last couple of days of the third week, the weather pattern changed or shifted from the warm and dry pattern to a cool and showery pattern again.

Figure 20 from August 22 shows the colder and more unstable air mass diving into the northeast Pacific Ocean again. Very cold air is depicted out near the Aleutian Chain. This cold air in the northern branch of the jet stream was a decent weather pattern for southern Idaho, thereby keeping a westerly component to the winds aloft for the rest of August. As Pacific storms eventually became stronger and deeper into September and October, the groundwork for the progressive weather pattern was observed in August. Precipitation during August over southwest Idaho was well above average while the rest of the state was at or a little below average. This is due to the nature of showers. The rest of the southern Idaho airsheds recorded precipitation that was near average to a little below average.

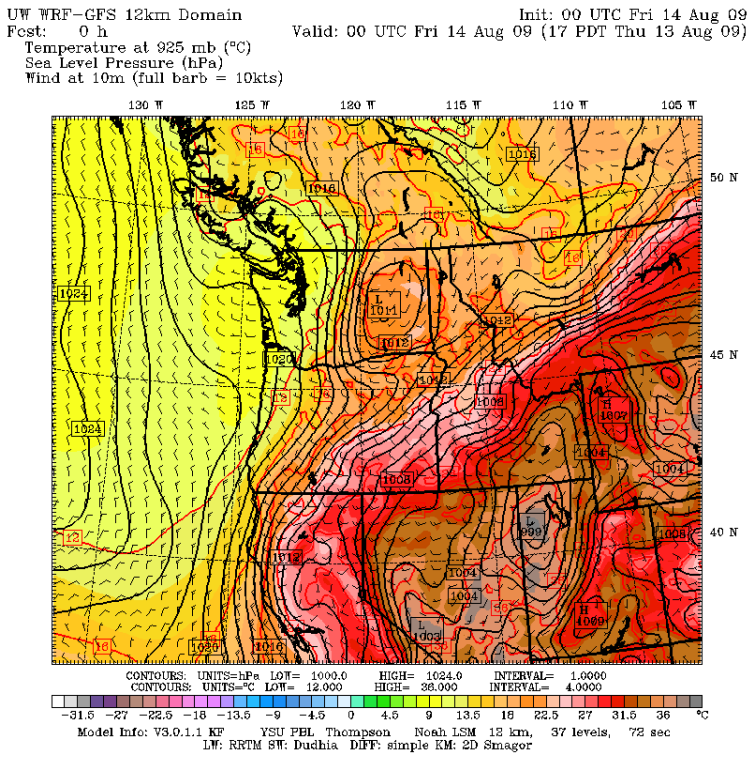

Figure 19. Surface level MM5 graphic for August 13, 2009.

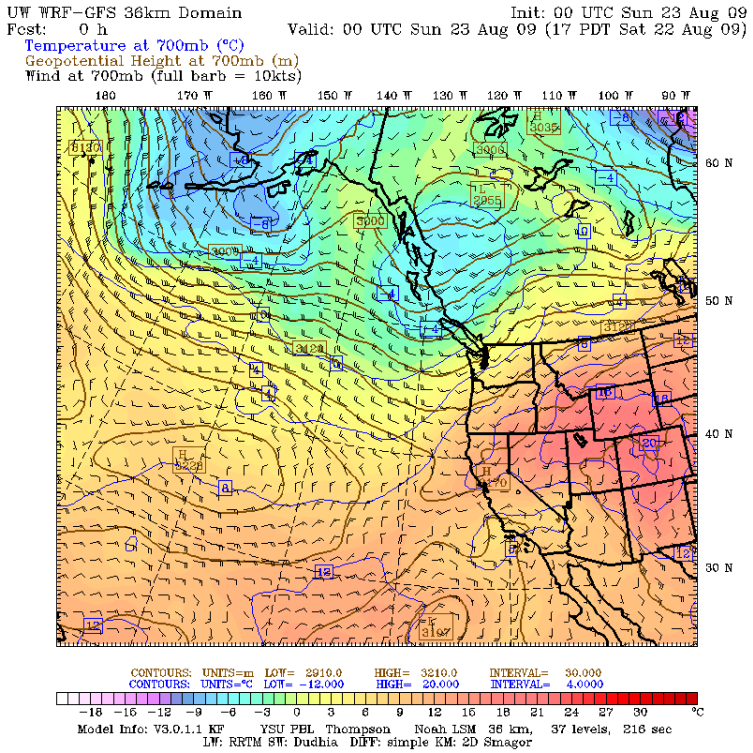

Figure 20. 700 millibar MM5 graphic for August 22, 2009.

Late in the month of August, in keeping with the progressive weather pattern, another upper-level low moved into Idaho from off the west coast. This low did produce a little rain over the mountains and moved north of the Snake River Valley.

Figure 21 shows the weak trough aloft as it ejected north and east from off the California coast. A high pressure is also slipping a little east at the same time. This pattern remained over southern Idaho through the rest of August.

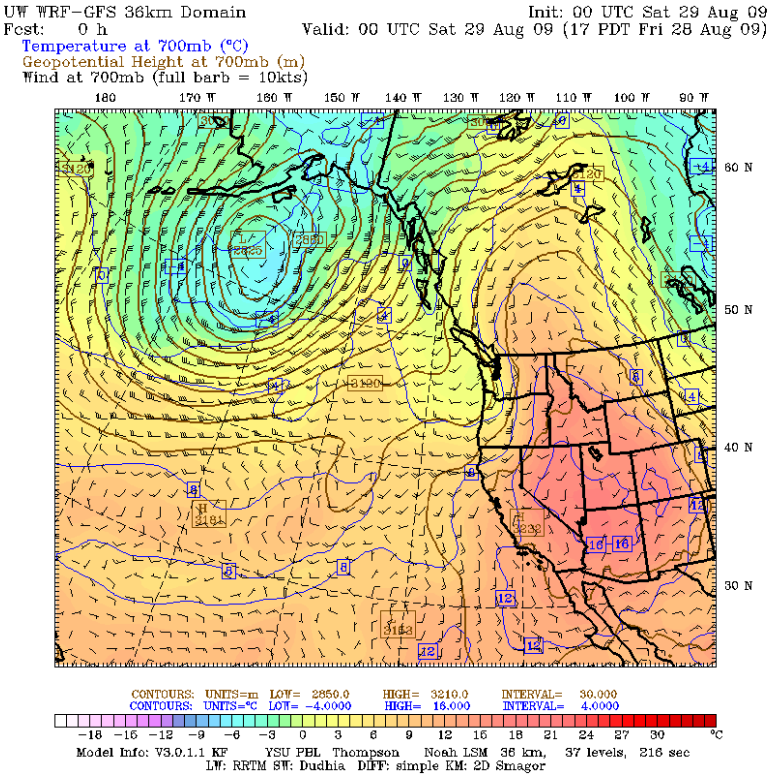

Figure 21. 700 millibar MM5 graphic for August 28, 2009.

September

September started out where August left off with a warm and stable high-pressure ridge sitting over the airsheds. Another cold low was digging south down the coast. Figure 22 shows the high pressure over southern Idaho and the deepening low off the west coast. Weather changed quickly, especially over southwest Idaho, as wet weather was on the way.

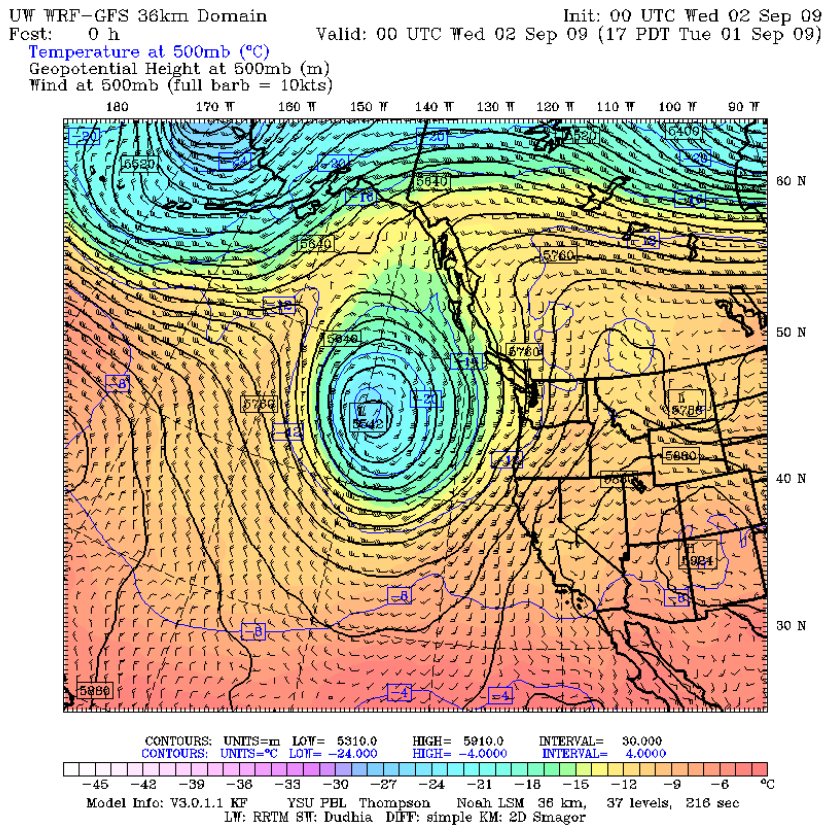

Figure 22. 500 millibar MM5 graphic for September 1, 2009.

The low, seen in Figure 23, continued to dig south and the high-pressure ridge remained over eastern Idaho, leaving the southwestern airsheds open to a more moist southwest flow aloft and rain during the first week of September. During the long Labor Day weekend, the upper-level low moved inland over Washington State. The low filled into an open upper trough and pushed and flattened the high-pressure ridge into Wyoming and Montana. This trough provided southwestern Idaho with more rainfall. The second week of September saw another blast of wet weather as another wave of Pacific storms moved onto the west coast. This appeared to be an event that might end the burn as nearly 2 inches of rain fell in the Boise area during the first 15 days of September. September would end up having precipitation that was more than an inch and a quarter above averages for precipitation at Boise. Much less rain fell during September over eastern Idaho airsheds. During September, two days of rain were reported at Idaho Falls and none at Pocatello.

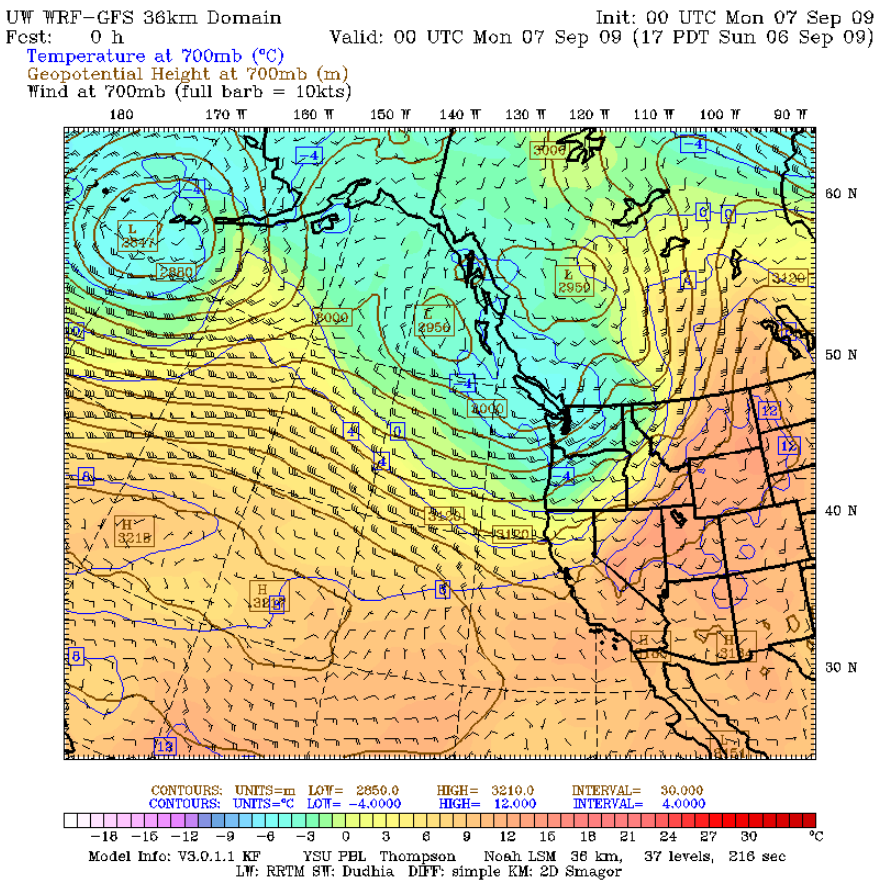

Figure 23. 700 millibar MM5 graphic for September 6, 2009.

In the third week of September, rain was again reported in Boise, from the 19th through the 22nd at Boise while eastern Idaho remained dry. These progressive Pacific weather patterns really slowed field burning across southwest Idaho in September, but in other airsheds across eastern Idaho to the Magic Valley, growers were able to complete some burning.

By the last week of September, there was a lull in the Pacific storms. A large high-pressure ridge that was off the west coast moved closer to the coast and shunted Pacific storms well to the north across central British Columbia. The jet stream had finally moved far enough north to keep the storm track in Canada. Figure 24 shows the offshore high-pressure ridging into southern Idaho. Also the temperatures warmed and the fuels and soil began to dry out again. Once again, we could see very cold air punching into the Gulf of Alaska from very cold air in the Bering Sea. As noted, earlier in August this same weather pattern eventually brought the jet stream south and with it came the cold air mass and, due to the over-water trajectory, a more moist air mass. We were now getting into the transitional part of the crop residue burning fall season when days are getting shorter and it takes less energy to develop a Pacific storm.

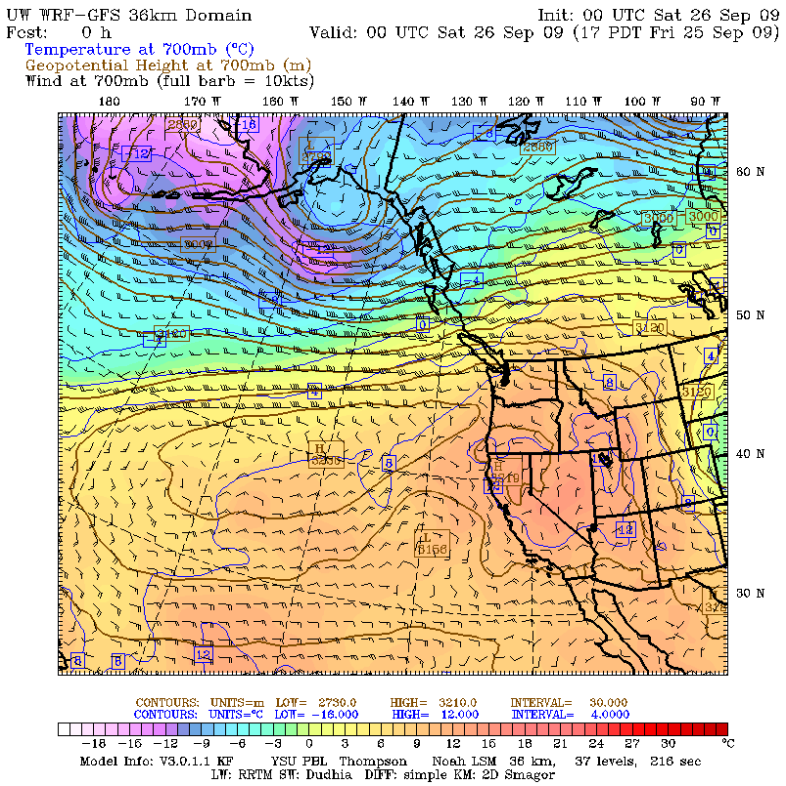

Figure 24. 700 millibar MM5 graphic for September 25, 2009.

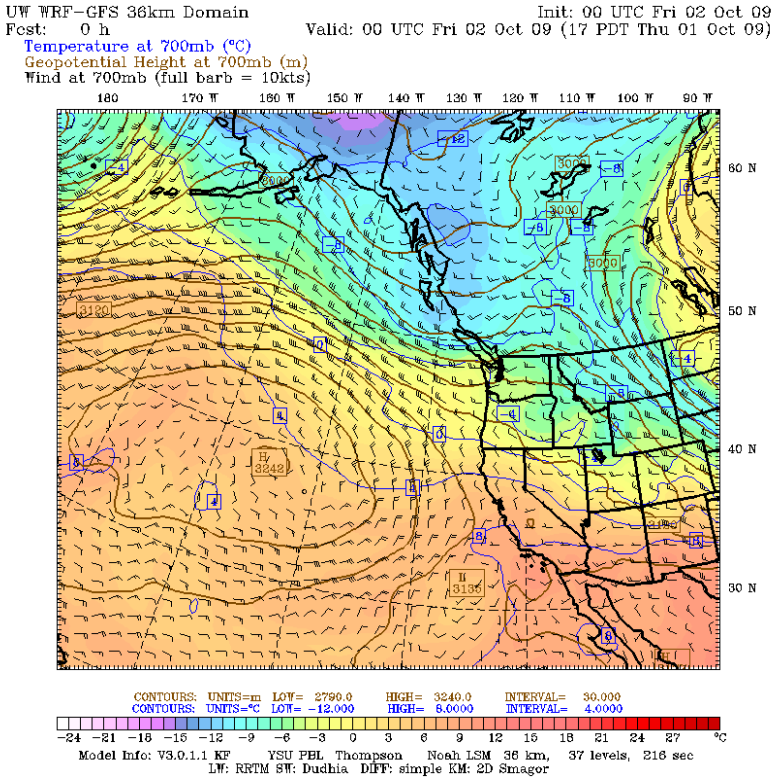

Figure 25. 700 millibar graphic for October 1, 2009.

October

The strong upper level ridge off the west coast had moved west by the first week in October. Figure 25 shows the high cell well off the west coast by October 1. Also, by that time the cold air was sagging quickly into southern British Columbia and northern Idaho.

The cold trough dug south down the west coast and over southern Idaho during the first week of October. Rain fell in Boise October 3 through 5, with four-tenths of an inch on October 4. At Twin Falls, seven-tenths of an inch was recorded on October 4. Pocatello received 0.37-inch and Idaho Falls picked up 0.23-inch. So this was a wet day across all of southern Idaho that further slowed crop residue burning.

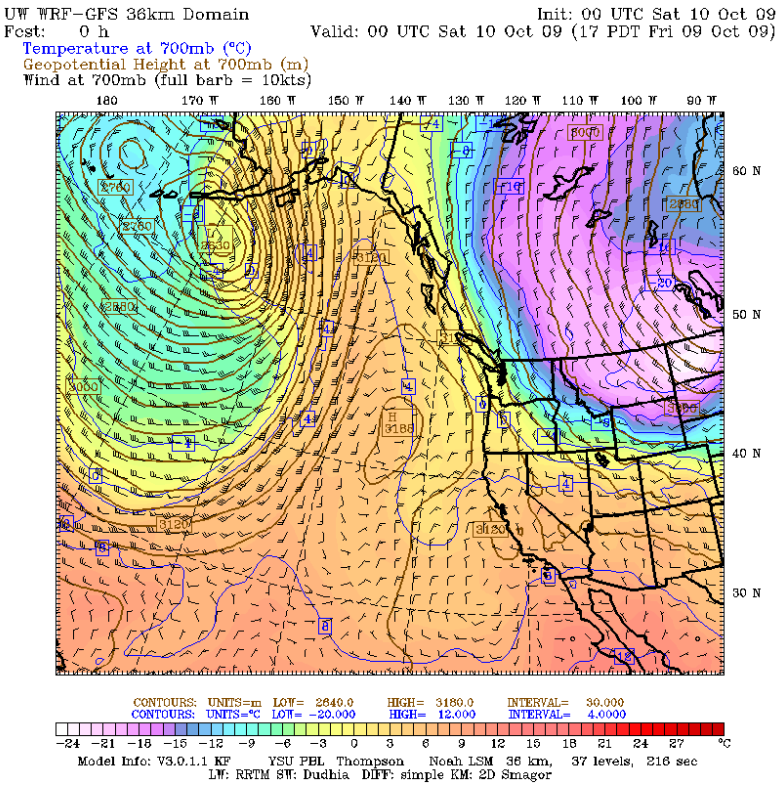

Figure 26. 700 millibar graphic for October 9, 2009.

The next major storm came into southern Idaho in the form of a modified arctic front from the north. Figure 26, for October 9, shows the very cold air mass over the Dakotas and eastern Montana. There was a cold front sliding across southwest Montana and northern Idaho. High pressure off the west coast was very strong and was ridging into Alaska. The strength of this high kept the polar storm from being the end of the season.

Figure 27, a satellite image for October 20, shows the final upper-level storm that would impact southern Idaho during the tail end of the third week of October. Generally light amounts of rain were reported after this big rain event that covered the first week of October 2009. There was a string of 5-7 days during the second and third weeks when high pressure remained strong over southern Idaho, providing opportunity for a little late-season burning.

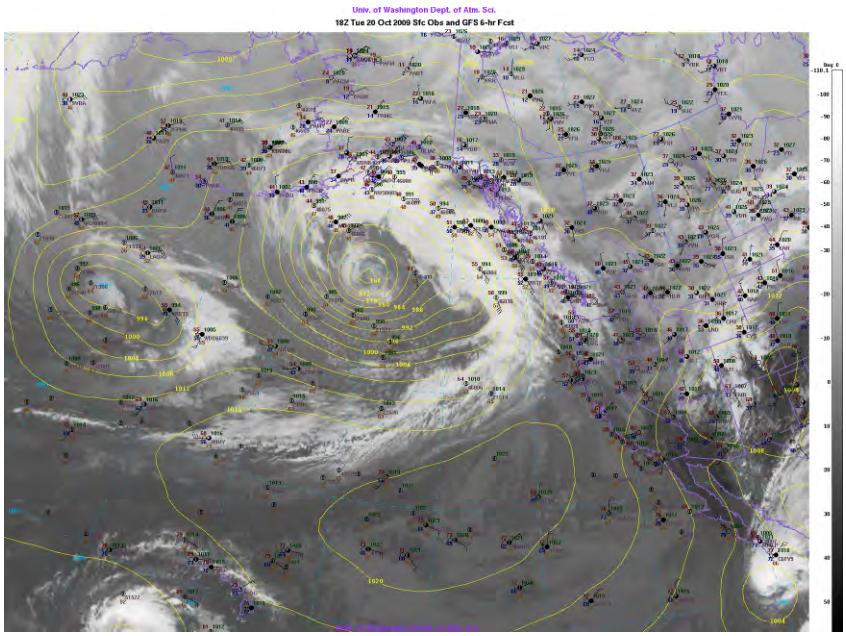

Figure 27. Satellite image for October 20, 2009.

4.6.2 Southwest Idaho Burn Management Area

The Southwest Idaho BMA includes Canyon, Ada, Elmore, and Owyhee counties. This BMA is bordered by the state of Oregon to the west and bisected by the Snake and the Boise rivers. Burning in this BMA primarily occurred in the vicinity of Homedale in northwest Owyhee County, throughout Canyon County, and in western Ada County. The crops burned were primarily cereal grain stubble and alfalfa seed residue.

4.6.2.1 Area Geography

The Southwest Idaho BMA covers a total of 12,462 square miles and includes complex terrain in the northern foothills of Ada County and the Owyhee uplands in the south. This area is part of both the Snake River Plain and Northern Basin and Range ecoregions. This area is well known for seed production and contains Idaho's largest population centers, in Ada and eastern Canyon counties. Residue burning was conducted primarily where irrigation for row crop agriculture is available. In addition to smoke produced in this area, smoke produced from wildfires and agricultural burns to the west is funneled through this area. This impacts the air quality of the Treasure Valley.

Within the Southwest Idaho BMA, there are seven reservoirs. Arrowrock and Lucky Peak reservoirs are located in the foothills northeast of Boise. These reservoirs may influence smoke produced from wildfires to the north or planetary boundary layer smoke coming from the south and west. Lake Lowell is located in south central Canyon County; this reservoir does play a part in influencing smoke dispersion in the area. Anderson Ranch, Long Tom, and Little Camas reservoirs are located northeast of Mountain Home; their effect on agricultural smoke dispersion is unknown. C.J. Strike Reservoir is located south of Mountain Home; its effect on agricultural smoke dispersion is also unknown.

4.6.2.2 Acres Burned

In the Southwest Idaho BMA, 41 acres were burned during the spring (March 1 through May 31), 2009. A total of 1260 acres were burned during the fall burn season (July 1 through October 31). For 2009, a total of 1,377 acres were registered and paid for. A total of 1,351 acres were burned, resulting in a 98% completion rate. The number of registered and paid acres was up 208% from 2008.

The summary of acres registered and burned during 2009, is presented in Table 18. The summary of acres burned by crop type and burn season is presented in Table 19.

Table 18. 2009 CRB Summary for the Southwest Idaho BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	1,764
Paid Acres	1,377
Burned Acres	1,351

Table 19. Summary of acres burned by crop type and burn season

Crop Type	Burned Acres	
	Spring	Fall
Cereal Grain	41	567
Legumes	0	10
Other	0	733

4.6.2.3 Daily Burn Decisions and Air Quality

Three air quality monitors for measuring fine particulate matter ($PM_{2.5}$) are located in the Southwest Idaho BMA. The Nampa $PM_{2.5}$ monitor is located nearly 30 miles east of where most burning occurred, but is the closest monitor in the area. The other two monitors are located further east, in Boise. There was one ozone monitor operating throughout the spring and fall burn season in the Treasure Valley; two others came online in May and went offline in October. Ozone concentrations were monitored and were considered when making daily burn decisions. The Treasure Valley experiences many inversions and air stagnation periods that affect pollutant concentrations and, ultimately, burn decisions. The presence of high-pressure systems has proven to be the meteorological feature that most influences decisions about burn/no-burn days. When high pressure is overhead, air stagnation in the valley drives up ozone and $PM_{2.5}$ concentrations, thus degrading the air quality. During spring 2009, however, burning was rarely limited due to these events.

For most days in 2009, the burn decisions were generally straightforward. During the spring burn season, growers used 2 burn days from March 1 through May 31, 2009. Two no-burn days were declared due to high fuel moisture.

For the fall 2009 burn season, Table 20 summarizes the reasons for a no-burn decision for each county in this BMA. On August 6, 10, 11, and 12, ozone monitoring values were above the program concentration limits. On those days, burns were approved that were located 65 miles southeast of Boise and outside of the Treasure Valley Airshed boundary. Winds on these days were generally from the west carrying smoke away from the Treasure Valley Airshed causing smoke not to contribute to further ozone increases in the Treasure Valley.

Table 20. Reasons for No-Burn Decisions by County in the Southwest Idaho BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
ADA	4	67	7	6	0	2	2	"Other Reasons" include holidays and red-flag warnings.
CANYON	17	47	12	4	2	4	2	
ELMORE	3	80	0	2	0	0	3	
OWYHEE	16	43	15	5	3	3	3	

Appendix D contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Southwest Idaho BMA.

4.6.3 Weiser and Lower Payette Valleys Burn Management Area

The Weiser and Lower Payette BMA includes Adams, Washington, Payette and Gem counties. This BMA is bordered by the state of Oregon to the west and is bisected by the Snake and Payette rivers. Burning was primarily conducted in the vicinities of the cities of Weiser, New Plymouth, and Emmett, on the leeward side of complex terrain. The primary crops burned were native grass seed, cereal grain stubble, and some vegetable seed commodities. Burning may occur year-round, but the typical burning season is projected to be March through April and mid-July through mid-October. Growers may spot-burn throughout the calendar year, depending on crop types and noxious weed infestations.

4.6.3.1 Area Geography

The Weiser and Lower Payette Valleys BMA totals 3,820 square miles. This BMA is comprised of the Blue Mountains, portions of Northern Rockies, and Snake River Plain ecoregions. This area is very similar to the Southwest Idaho BMA; sharing Semiarid Foothill, Unwooded Alkaline Foothill, and Treasure Valley sub-regions of the Snake River Plain ecoregions. Agricultural burning occurred in areas with similar characteristics to those of the Treasure Valley sub-region. This BMA is actually part of the Treasure Valley airshed.

4.6.3.2 Acres Burned

DEQ issued 12 burn days in this BMA during the 2009 spring season (March 1 through May 31), 2009 and 10 burn days for the fall burn season (July 1 – October 31).

For the spring and fall burn seasons, a total of 1610 acres were registered and paid for. A total of 1,353 acres were burned resulting in an 84% completion rate. Registered acres were up 1,101% from 2008 in this burn management area.

Table 21 shows the total acres that were registered, paid for, and burned in this BMA in 2009. The summary of acres burned, by crop type, is presented in Table 22.

Table 21. 2009 CRB Summary for the Weiser and Lower Payette Valleys BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	2,594
Paid Acres	1,610
Burned Acres	1,354

Table 22. Summary of burned acres by crop type and season

Crop Type	Burned Acres	
	Spring	Fall
Cereal Grain	383	718
Other	209	44

4.6.3.3 Daily Burn Decisions and Air Quality

Data from the $PM_{2.5}$ air quality monitor located in Weiser was considered in making burn decisions for this BMA. The ozone monitor located at St. Luke's Hospital in Boise was also used for burn decisions in this BMA. Prevailing winds can carry smoke from burns conducted in this BMA toward population centers of Caldwell, Nampa, and Boise. In addition, Burns conducted in Oregon, on the west bank of the Snake River, can affect the air quality in this BMA and the Treasure Valley airshed. When making burn decisions for this BMA, the diurnal effects were analyzed so that burn decisions could mitigate impacts from Oregon agricultural smoke and vehicle transportation.

On most days in 2009, the burn decisions for this BMA were generally straightforward. During the spring burn season, growers used 14 burn days (March 1 through May 31) and burned a total of 50 acres. Six no-burn days were declared in the spring due to meteorological conditions and one no-burn day was declared due to air quality.

For the fall 2009 burn season, Table 23 shows the number of burn and no-burn days along with the reasons for days with no burning.

Table 23. Reasons for no-burn decisions by county, Weiser and Lower Payette Valleys BMA -- fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning For Other Reasons	Notes
				Fuel moisture	Wind	Venti-lation		
ADAMS	0	86	0	0	0	0	2	"Other Reasons" include holidays and days when growers were not ready.
GEM	10	49	17	5	1	3	3	
PAYETTE	5	72	6	1	0	2	2	
WASHINGTON	7	61	15	0	1	2	2	

Appendix E contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Weiser and Lower Payette Valleys BMA.

4.6.4 Blaine and Camas Counties Burn Management Area

The Blaine and Camas Counties BMA includes Blaine and Camas counties. Burning was primarily conducted in the vicinities of the cities of Corral and Cary on the Camas Prairie. The primary crops burned were cereal grain stubble. Burning may occur year-round, but the typical burning season is projected to be March through April and mid-July through October. Growers may spot-burn throughout the calendar year, depending on crop types and noxious weed infestations.

4.6.4.1 Area Geography

The Blaine and Camas Counties BMA totals approximately 3,740 square miles. This BMA is comprised of the Camas Prairie and Semiarid Foothills sub-ecoregions of the Snake River Plain. This BMA ranges from higher shrub and grass covered foot hills to the Camas Prairie that traps mountain runoff resulting in a cooler climate and wetter soils than surrounding areas. Agriculture in this BMA is primarily livestock grazing but there are areas of irrigated agriculture land. Burning primarily occurred in the prairie portions of this BMA.

There are five reservoirs and lakes in this BMA. None had an influence on smoke dispersion, but the potential exists. The Mormon, Magic, Little Wood River, and Fish Creek Reservoirs and Lava Lake are located in areas where burning may occur.

4.6.4.2 Acres Burned

No burning occurred during the spring of 2009 in this burn management area. 235 acres were burned during the fall burn season. No registrations were received in 2008 for this burn management area, so no comparisons can be made between acres burned in 2009 versus 2008. Table 24summarizes the acres registered and burned, and Table 25 shows the crop type.

Table 24. 2009 CRB Summary, Blaine and Camas Counties BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	305
Paid Acres	305
Burned Acres	235

Table 25. Summary of burned acres by crop type and season

Crop Type	Burned Acres	
	Spring	Fall
Cereal Grain	0	235

4.6.4.3 Daily Burn Decisions and Air Quality

Data from the $PM_{2.5}$ air quality monitor located in Ketchum were used in making burn decisions for this BMA. This BMA is much less populated than surrounding areas where crop residue burning occurs. Air quality impacts may occur in the more densely populated Hailey to Ketchum area when south winds funnel smoke up the highway 75 corridor.

Fall 2009 is the first time DEQ has had requests to burn in this BMA. Table 26 shows the burn decisions by county. Burn decision in this burn management area seemed to be generally straight forward.

Table 26. Reasons for no-burn decisions by county for the Blaine and Camas Counties BMA -- fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
BLAINE	4	79	0	1	0	2	2	"Other Reasons" include holidays.
CAMAS	1	85	0	0	0	0	2	

Appendix F contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Blaine and Camas Counties BMA.

4.6.5 Southern Magic Valley Burn Management Area

The Southern Magic Valley BMA includes Twin Falls and Cassia counties. Burning occurred throughout the BMA, but was in large part conducted in the vicinity of Twin Falls. The primary crop burned was cereal grain stubble.

4.6.5.1 Area Geography

The Southern Magic Valley BMA covers 4,508 square miles and includes portions of the Snake River Plain and aspects of the Northern Basin and Range. Southern Magic Valley is home to the largest population in the Magic Valley subregion. The Magic Valley subregion of the Snake River Plain ecoregion is named for the irrigation canals that transformed the region into a productive agricultural valley. Elevation varies from 3,200 to 4,500 feet. The arid soils require irrigation to grow commercial crops. Many canals, reservoirs, and diversions supply water to the region's pastureland and cropland. Small grains, alfalfa, sugar beets, potatoes, and beans are grown. This area is becoming known for its growing dairy industry.

There are three reservoirs in this BMA. None had an influence on smoke dispersion, but the potential exists. The Cedar Creek, Salmon Falls, and Lower Goose Creek reservoirs are all located in the southern portions of Twin Falls and Cassia counties, well south of where burning occurred.

4.6.5.2 Acres Burned

For both the spring and fall burn seasons in 2009, 3035 acres were registered and paid for. A total of 2586 acres were burned in the during 2009, resulting in a 85% completion rate.

The summary of acres registered and burned, is presented in Table 27, and Table 28 shows acres burned by crop type and season.

Table 27. 2009 CRB Summary, Southern Magic Valley BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	3,968
Paid Acres	3,035
Burned Acres	2,586

Table 28. Summary of burned acres by crop type and season

Crop Type	Burned Acres	
	Spring	Fall
Cereal Grain	365	2,047
Legumes	0	135
Other	23	16

4.6.5.3 Daily Burn Decisions and Air Quality

Due to the homogeneous topography of the area, Magic Valley does not experience inversion effects of the same magnitude as those in the Treasure Valley, nor do they have concerns with ozone formation and ozone attainment status. Air quality trends in this area are diurnally influenced. Higher concentrations of particulates are seen during night-time hours when a nocturnal inversion is present. Southern Magic Valley has one $PM_{2.5}$ air quality monitor located in Twin Falls. The Twin Falls monitor location is subject to brief periods of localized impact throughout the year.

For most days in 2009, the burn decisions were pretty straightforward for this BMA. During the spring burn season, growers used 10 burn days from March 1 through May 31, 2009.

Table 29 below illustrates the 2009 fall burn decisions for each county.

Table 29. Reasons for no-burn decisions by county in the Southern Magic Valley BMA – fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days with No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
CASSIA	20	61	0	0	1	3	3	"Other Reasons" include holidays and red flag warnings.
TWIN FALLS	41	29	0	5	5	5	3	

Appendix G contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Southern Magic Valley BMA.

4.6.6 Northern Magic Valley Burn Management Area

The Northern Magic Valley BMA includes southeast Elmore County, the entire counties of Gooding, Lincoln, Jerome, and Minidoka, and the Blaine County panhandle. Burning was dispersed throughout the BMA. The primary crop burned was cereal grain stubble.

4.6.6.1 Area Geography

The Northern Magic Valley BMA accounts for 2,542 square miles. The lava beds in the northeast portion divide the area, restricting agriculture to the remainder of the BMA. This area is entirely in the Snake River ecoregion and is considered the heart of the Magic Valley subregion that shares agricultural similarities with the Southern Magic Valley BMA. Mountain Home Uplands, Semiarid Foothills, Eastern Snake River Basalt Plains, and Lava Field sub-regions of the Snake River Plain ecoregion make up the Northern Magic Valley BMA.

There are three reservoirs located in this BMA. Bray Lake Reservoir is located northwest of Gooding. Its effects on smoke dispersion are unknown. Wilson Lake Reservoir, located west of Paul, and Lake Walcott Reservoir, located east of Rupert, do influence smoke dispersion. These reservoirs are in dense agricultural areas.

4.6.6.2 Acres Burned

A total of 6266 acres were registered and paid for, of which 4511 acres were burned. This results in a 72% completion rate.

The summary of acres registered and burned is presented in Table 30. Table 31 shows the number of acres burned by crop type and season.

Table 30. 2009 CRB Summary, Northern Magic Valley BMA – number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	13,214
Paid Acres	6,266
Burned Acres	4,511

Table 31. Summary of acres burned by crop type and burn season

Crop Type	Burned Acres	
	Spring	Fall
CRP	0	23
Cereal Grain	30	4,268
Legumes	0	181
Other	0	9

4.6.6.3 Daily Burn Decisions and Air Quality

The Northern Magic Valley BMA and Southern Magic Valley BMA are characteristically similar as far as air quality trends. However, the Northern Magic Valley BMA is much less populated. Air quality impacts can occur from agriculture practices like particulates produced from tilling practices and burning; there are also a few industrial sources, plus transportation. Air quality trends in this area are diurnally influenced. Higher concentrations of particulates are seen during night-time hours when a nocturnal inversion is present. Northern Magic Valley has one $PM_{2.5}$ air quality monitor located in Paul.

For most days in 2009, the burn decisions were pretty straightforward for this burn management area. During the spring burn season, growers used 2 burn days from March 1 through May 31, 2009. Fifteen "no burn" days were declared due to meteorological conditions.

For the fall 2009 season, Table 32 summarizes the burn decision for each county.

Table 32. Reasons for no-burn decisions by county for the Northern Magic Valley BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days with No Burning for Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
GOODING	3	81	0	0	0	2	2	"Other Reasons" includes holidays.
JEROME	23	58	0	1	2	2	2	
LINCOLN	11	74	0	0	0	1	2	
MINIDOKA	15	67	0	0	1	3	2	

Appendix H contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Northern Magic Valley BMA.

4.6.7 Southeast Idaho Burn Management Area

The Southeast Idaho BMA includes Bingham, Power, Bannock, Caribou, Oneida, Franklin, and Bear Lake counties. Burning was dispersed throughout the BMA. The primary crops burned were cereal grain stubble. Burning may occur year-round, but the typical burning season is projected to be March through April and mid July through mid-October.

4.6.7.1 Area Geography

The Southeast Idaho BMA covers a total of 9,428 square miles; the topography in the area is considered complex with the exception of the Snake River Plain. This BMA includes the Snake River Plain and the Caribou Highlands. This portion of the state is known for phosphate mining and production as well as agricultural production of wheat, potatoes, and sugar beets.

There are several mountain ranges within southeastern Idaho, and these north/south-running ridges, with their valleys, dominate the landscape. Also within southeastern Idaho, there are two large water supply reservoirs, one in the Snake River Plain and the other located in the Caribou Highlands: the American Falls reservoir and the Blackfoot reservoir. Both of these reservoirs play a part in influencing smoke dispersion in the area. A majority of the farming occurs along

the Snake River Plain and in the Caribou Highland valleys. This BMA is bordered to the south by the State of Utah and to the east by the State of Wyoming.

Burning in the Southeast Idaho BMA occurred primarily in the vicinity of Rockland and in the vicinity of Soda Springs. This BMA's agricultural practices are fairly diverse, ranging from dry-land crop cultivation in the mountain valleys to irrigated farming along the Snake River plain.

Burning occurred most frequently in the higher elevations of the Caribou Highlands valleys and the Rockland highway corridor where the terrain is more complex and dry-land farming occurs at 5,500 to 5,800 feet. In these areas, there are typically cooler air temperatures, higher relative humidity, and stronger nocturnal inversions than in the Snake River Plain. There was also greater potential for morning dew on the fuels that needed to be considered for ignition times. Synoptic-scale winds aloft that parallel the valley, synonymous with unstable atmospheric conditions in these regions, often resulted in higher surface winds that consistently yielded better ventilation values for smoke management but risky conditions for fire behavior. The winds in these areas tended to be an obstacle to on-site ignition approval. During the day, ventilation attributed to radiation heating of the slopes contributed to better ventilation of the smoke.

4.6.7.2 Acres Burned

A total of 10,347 acres were registered and paid, of which 8,616 acres were burned. This results in a 83% completion rate. Registered paid acres were up 62% from 2008 in this BMA. 84 acres were burned during the spring while 8,532 acres were burned during the fall.

The summary of acres registered and burned is presented in Table 33. Table 34 shows the number of acres burned by crop type and season,

Table 33. 2009 CRB Summary for the Southest Idaho BMA -- number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	10,584
Paid Acres	10,347
Burned Acres	8,616

Table 34. Summary of acres burned by crop type and burn season

Crop Type	Burned Acres	
	Spring	Fall
CRP	0	1,711
Cereal Grain	62	6,771
Other	18	50
Turf Grass	4	0

4.6.7.3 Daily Burn Decisions and Air Quality

Real-time air quality monitors that measure $PM_{2.5}$ are located in Pocatello and Soda Springs. During the spring season, only the Pocatello monitor was used for the CRB program due to the monitor's location in proximity to the burns.

For most days in 2009, the burn decisions were generally straightforward. During the spring burn season, growers used 7 burn days from March 1 through May 31, 2009. Eleven no-burn days were declared due to meteorological conditions unsuitable for burning.

Table 35 shows the 2009 fall burn decisions for each county.

Table 35. Reasons for no-burn decision by county for the Southeast Idaho BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning Due to Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
BANNOCK	3	81	0	1	0	1	2	"Other Reasons" include holidays and days when growers were not ready.
BEAR LAKE	3	83	0	0	0	0	2	
BINGHAM	18	56	0	7	1	2	4	
CARIBOU	13	71	0	2	0	0	2	
FRANKLIN	6	66	0	7	3	4	2	
ONEIDA	13	59	0	7	3	4	2	
POWER	0	86	0	0	0	0	2	

Appendix I contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Southeast Idaho BMA.

4.6.8 Eastern Idaho Burn Management Area

The Eastern Idaho BMA includes Clark, Fremont, Butte, Jefferson, Madison, Teton, and Bonneville counties. Burning was primarily conducted in Jefferson and Bonneville counties. The primary crops that were burned were cereal grain stubble. Burning may occur year-round, but the typical burning season is projected to be March through April and mid-July through mid-October.

4.6.8.1 Area Geography

This BMA is very similar in nature to the Southeastern Idaho BMA, simply because it also encompasses the Snake River Plain. This area is better known as the Yellowstone-Teton region and serves as a gateway to several popular recreation areas. Eastern Idaho is intersected by several rivers and the Palisades Reservoir, which can influence smoke dispersion. This BMA is well known for Upper Snake River Plain farming of sugar beets, wheat, and potato crops. The topography is complex on the eastern edge along the Wyoming border; otherwise, the area is relatively flat in the plain with rolling hills.

Burning was conducted primarily along the Snake River plain, where irrigation for row crop agriculture is available. The most prominent factor considered in this area was the effects of building surface winds.

4.6.8.2 Acres Burned

A total of 11,640 acres were burned during 2009; 1,364 during spring and 10,311 during the fall. 15,148 acres were registered and paid, resulting in a 77% completion rate. Registered paid acres were up 487% from 2008 in this BMA.

The summary of acres registered and burned is presented in Table 36. Table 37 shows the number of acres burned by crop type and season.

Table 36. 2009 CRB Summary for the Eastern Idaho BMA -- number of acres registered, paid for, and burned

Category	Number of Acres
Registered Acres	21,323
Paid Acres	15,148
Burned Acres	11,640

Table 37. Summary of acres burned by crop type and burn season

Crop Type	Burned Acres	
	Spring	Fall
CRP	0	39
Cereal Grain	1,364	10,196
Other	0	41

4.6.8.3 Daily Burn Decisions and Air Quality

Two real time air quality monitors for measuring fine particulate matter ($PM_{2.5}$) are located in the Eastern Idaho BMA. The seasonal Rexburg monitor is located approximately 12.5 miles northeast of where most burning occurred and the Idaho Falls monitor is located approximately 16 miles southeast of where most burning occurred. The Rexburg monitor is operational only during the periods when CRB is being approved.

For most days in 2009, the burn decisions were generally straightforward. During the spring burn season, growers used six burn days. Twelve no-burn days were declared due to meteorological conditions.

Table 38 shows the 2009 fall burn decisions for each county.

Table 38. Reasons for no-burn decisions by county for the Eastern Idaho BMA – Fall 2009

County	# of Burn Days	# of No-Request Days	# of No-Burn Days Due to Air Quality	# of No-Burn Days Due to Meteorological Conditions			# of Days With No Burning Due to Other Reasons	Notes
				Fuel Moisture	Wind	Venti-lation		
BUTTE	0	86	0	0	0	0	2	"Other Reasons" includes holidays and test burn in priority areas.
CLARK	7	78	0	0	0	1	2	
FREMONT	14	65	0	4	0	3	2	
JEFFERSON	30	41	0	7	2	6	2	
MADISON	2	84	0	0	0	0	2	
BONNEVILLE	19	52	0	7	2	5	3	
TETON	10	63	0	8	1	4	2	

Appendix J contains a comparison of the acres burned versus the 1-hour, 4-hour, and 24-hour average $PM_{2.5}$ concentrations recorded and collected by DEQ monitors for the Eastern Idaho BMA.

5. Recommended Improvements

This section provides recommendations for improvements, which are divided into two general categories: program implementation and DEQ procedures. Those recommendations for program implementation would directly impact both the growers and public, while the recommendations for DEQ procedures would impact only DEQ staff and would improve the existing implementation design.

Delineate Treasure Valley CRB management area for ozone

DEQ conducted a preliminary modeling study to better define the Treasure Valley Airshed with respect to crop residue burning and effects on ozone. This study shows that under the most frequently occurring meteorological conditions, crop residue burning of relatively small acreages (less than 240 acres) in Washington County would have little effect on ozone levels at the monitors in Ada County. In the upcoming burn seasons, if the appropriate conditions are present, DEQ will be able to authorize burns on days that previously would have been declared no-burn days due to elevated ozone concentration based on sensitivity studies such as the Washington County study.

DEQ intends to conduct additional modeling for other counties in the Southwest Idaho and Weiser and Lower Payette burn management areas to determine the impacts of CRB in those areas on Treasure Valley air quality.

Develop guidelines for roadway safety for growers

To provide growers with the information needed to ensure they maintain adequate visibility on roadways during crop residue burning so as not to create a hazard, DEQ will coordinate with state and local traffic and transportation authorities to develop guidance that may include recommended best practices.

Development of best management practices for burning

DEQ continues to develop best management practices for burning under the CRB program. These best management practices focus on residue load, stubble height, and ignition techniques (method and number of people). DEQ is working towards requesting the following information on the registration form completed by growers, which would then be used in the burn approval process:

- Residue load and stubble height
- Ignition method and number of people to be used for performing ignition

Require growers to pass (80%) a test to received credit for the grower training

DEQ updated the grower training and developed a test. At this point, the growers take the test during the live training. The test is self-graded by the grower and a group discussion is used to review the test questions and answers. DEQ decided that a pass/fail test should be implemented in stages.

Consolidation of CRB Permit with burn permits from Idaho Department of Lands

DEQ was not able to accomplish this recommendation. This change turned out to be much more complicated than first anticipated. More research and coordination with IDL and rural fire districts is needed. DEQ is currently gathering information on all local ordinances pertaining to open burning. DEQ is also contacting all the fire districts to gather information on open burning permit requirements.

Appendix K of this report summarizes the CRB Advisory Committee annual meeting. The following are the final recommendations submitted to DEQ from the Advisory Committee:

- Develop a protocol for allowing institutions to request "institutions with sensitive populations" status.
- Develop a streamlined process for addressing harrow piles and spot burns, possibly by implementing a separate permit by rule (will require rulemaking and SIP revision).
- Include a better summary of outreach results from contacts with institutions with sensitive populations in the annual report.
- Move an air quality monitor to Garwood School on the Rathdrum Prairie. This is a relocation of the Rathdrum monitor not a new monitor.
- Develop a process for better documenting the post burn analysis (meteorological conditions).
- Develop a guideline for growers for public roadway safety.
- Consider grading system for grower training requirement instead of focusing on training and test once every five years – modify training requirement to mimic ISDA pesticide applicator training requirements.
- Staff need not be present for blanching (propane flaming) within 3 miles of an institution with sensitive population.
- Develop best management practices for burning.
- Delineate the Treasure Valley Airshed for managing CRB burning – related to ozone.

6. Conclusions

Overall, DEQ considered the second year of the CRB program a success. Even though DEQ air quality monitors recorded values above the CRB program concentration limits for 8-hour ozone

and 1-hour and 24-hour average $PM_{2.5}$, none of these occurrences were a result of crop residue burning approved by DEQ.

Of all acres burned, about 56% were in southern Idaho with the remainder in northern Idaho.

DEQ recommends several improvements in the program implementation, as identified above, to help ensure continuing compliance with the Rules for the Control of Air Pollution in Idaho and the State Implementation Plan.