Rainfall Events and Their Effect on Severly Burned Areas of Western Montana Following the Forest Fires of 2000

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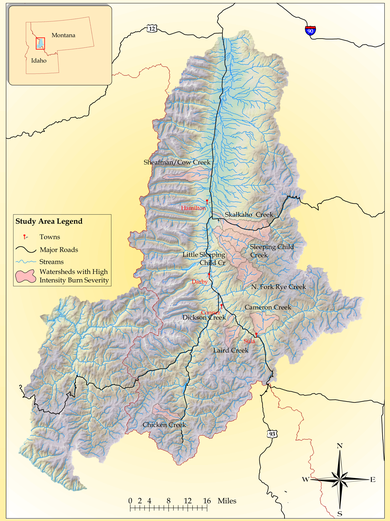
Study Area



Forest fires that occurred in the summer of 2000 burned large tracts of land in western Montana. Approximately 356,000 acres of forested land were burned in the mountains surrounding the southern end of the Bitterroot Valley, with many rural residents losing homes to the flames. Once the fires had dissipated the first week of September, the focus turned to possible flood threats in the rural residential interface. Many homes that survived the fires and new homes being built next to the burned areas were at risk of being flooded. Small watersheds in the Bitterroot National Forest had soils that were altered by high intensity forest fire and this left the landscape susceptible to increased runoff. Laird Creek and North Fork Rye Creek were two watersheds where the residential interface was at a high risk of flooding. Laird Creek is a small tributary of the East Fork of the Bitterroot River near the town of Sula, Montana, and North Fork Rye Creek feeds Rye Creek which enters the Bitterroot River between the towns of Conner and Darby, Montana. United States Forest Service (USFS) mapping of the watersheds indicated high intensity burn severity across some portion of these drainages. This type of burn left the hillsides void of vegetation and duff layers which intercept and absorb precipitation. A series of precipitation events occurred across the watersheds over the next water year (October 2000 - September 2001). Long duration rainfall events caused little runoff from the watersheds while high intensity, short duration storms caused flash flooding.

Missoula, Montana
National Weather Service
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Point Created November 2001 by John Lintak
Elevation Data, and Herman Layer from Forest Service
Road Layer and City Layer from ST-TIGER
Inundation Photos, and Cameron Creek Photo from US Forest Service

Legend For Precipitation Events

Towns

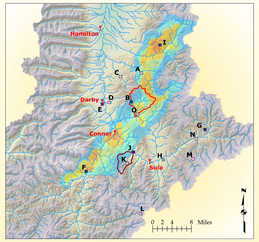
Rain Fall Total (inches)
- 0.10
- 0.11 - 0.20
- 0.21 - 0.30
- 0.31 - 0.40
- 0.41 - 0.50
- 0.51 - 0.60
- 0.61 - 0.80
- 0.81 - 1.00
- 1.01 - 1.25

Rain Gage Type
- data collection
- real time

Rain Gage Owner
- NWS
- USFS
- USGS
- USGS / NWS

Watershed
- Laird Cr
- North Fork Rye Cr

Precipitation Events



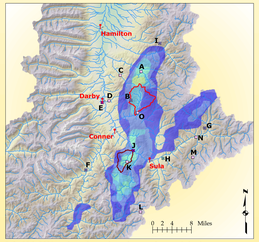
July 15th 2001 storm total radar precipitation compared to storm total raingage data in the southern Bitterroot mountains.

ID	Gage	time	inches
A	Sleeping Child	15:10	0.01
		15:20	0.01
		15:25	0.01
		15:30	0.03
		15:35	0.21
		15:40	0.17
		15:45	0.15
		15:50	0.08
		15:55	0.02
		16:00	0.02
		16:05	0.02
		16:10	0.01
		16:15	0.02
		16:20	0.01
		16:25	0.02
		16:30	0.02
		16:35	0.01
		16:40	0.01
		16:45	0.01
		total	0.83
B	Deer Mountain (Ehr data)	16:05	0.01
		16:10	0.01
		16:15	0.01
		total	0.21
E	Darby R.S.	no precipitation recorded	
F	West Fork (Ehr data)	15:00	0.52
		16:05	0.32
		17:05	0.07
		total	0.91

ID	Gage	time	inches
C	Little Sleeping	15:40	0.01
		15:50	0.01
		16:00	0.01
		16:05	0.01
		16:10	0.01
		16:15	0.01
		16:20	0.02
		16:25	0.02
		16:30	0.02
		16:35	0.02
		16:40	0.02
		total	0.12
D	Burke Gulch		
		time	inches
		15:20	0.01
		15:25	0.03
		15:30	0.06
		15:35	0.02
		15:40	0.02
		15:50	0.01
		16:00	0.02
		16:05	0.01
		16:10	0.01
		16:15	0.02
		total	0.21
E	Darby R.S.	no precipitation recorded	
F	West Fork (Ehr data)		
		time	inches
		16:00	0.19
		total	0.19

ID	Gage	time	inches
G	Tepee Pt	no precipitation recorded	
H	Sula 3 ENE	no precipitation recorded	
I	Gird Point (Ehr data)		
		time	inches
		16:09	0.57
		17:04	0.41
		18:09	0.11
		total	1.09
J	Laird Ck/Hwy 93		
		time	inches
		15:15	0.01
		15:20	0.14
		15:25	0.07
		15:30	0.03
		15:35	0.03
		15:40	0.03
		16:15	0.01
		total	0.32
K	Upper Laird Ck		
		time	inches
		15:15	0.08
		15:20	0.09
		15:25	0.08
		15:30	0.05
		15:35	0.01
		15:40	0.02
		15:50	0.01
		16:30	0.01
		total	0.35

ID	Gage
L	Little Blue Joint
M	Meadow Ck
N	Lower Meadow Ck
O	North Fork Rye Ck



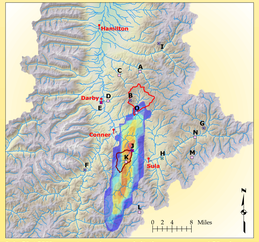
July 20th 2001 underestimated one hour radar precipitation amounts compared to 30-minute storm total raingage data in the southern Bitterroot mountains.

ID	Gage	time	inches
A	Sleeping Child	15:25	0.01
		15:30	0.08
		15:35	0.05
		15:40	0.01
		15:45	0.01
		total	0.16
B	Deer Mountain (Ehr data)		
		time	inches
		16:04	0.13
		total	0.13
C	Little Sleeping		
		time	inches
		18:15	0.01
		total	0.01
D	Burke Gulch	no precipitation recorded	

ID	Gage	time	inches
H	Sula 3 ENE (Ehr data)		
		time	inches
		21:00	0.21
		total	0.21
I	Gird Point (Ehr data)		
		time	inches
		16:04	0.19
		total	0.19
E	Darby R.S.	no precipitation recorded	
F	West Fork (Ehr data)		
		time	inches
		16:03	0.02
		total	0.02
G	Tepee Pt	no precipitation recorded	

ID	Gage	time	inches
J	Laird Ck/Hwy 93		
		time	inches
		14:50	0.03
		15:00	0.06
		15:05	0.12
		15:10	0.12
		15:15	0.07
		15:20	0.03
		15:25	0.02
		16:10	0.01
		total	0.44
K	Upper Laird Ck		
		time	inches
		14:55	0.03
		15:00	0.21
		15:05	0.14
		15:10	0.03
		15:15	0.01
		15:30	0.01
		total	0.43

ID	Gage
L	Little Blue Joint
M	Meadow Ck
N	Lower Meadow Ck
O	North Fork Rye Ck



July 21st 2001 accurate one hour precipitation amounts and 30-minute storm total raingage data in the southern Bitterroot mountains.

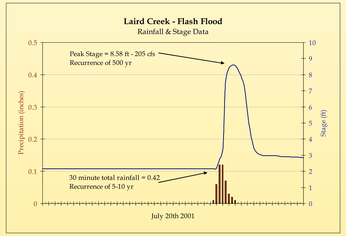
ID	Gage	MDT	inches
A	Sleeping Child	19:25	0.04
		19:30	0.07
		19:35	0.16
		19:40	0.19
		19:45	0.05
		19:50	0.01
		20:00	0.01
		20:10	0.01
		20:20	0.01
		20:35	0.01
		20:50	0.01
		21:05	0.01
		21:25	0.01
		21:45	0.01
		22:05	0.01
		22:25	0.01
		22:50	0.01
		23:15	0.01
		23:40	0.01
		total	0.65
B	Deer Mountain	no precipitation recorded	
C	Little Sleeping	no precipitation recorded	
D	Burke Gulch	no precipitation recorded	
E	Darby R.S.	no precipitation recorded	

ID	Gage	MDT	inches
F	West Fork	no precipitation recorded	
G	Tepee Pt (Ehr data)		
		MDT	inches
		17:00	0.06
		18:00	0.02
		19:00	0.06
		22:00	0.07
		23:00	0.05
		total	0.26
H	Sula 3 ENE (Ehr data)		
		MDT	inches
		10:00	0.27
		7/22-18:00	0.22
		total	0.49
I	Gird Point (Ehr data)		
		MDT	inches
		20:06	0.22
		21:06	0.04
		total	0.26
J	Laird Ck/Hwy 93		
		MDT	inches
		18:50	0.04
		18:55	0.16
		19:00	0.15
		19:05	0.16
		19:10	0.02
		19:15	0.01
		19:25	0.01
		19:35	0.01
		19:40	0.01
		19:45	0.01
		total	0.58

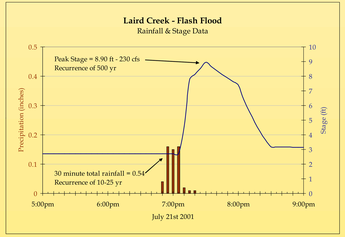
ID	Gage	MDT	inches
K	Upper Laird Ck		
		MDT	inches
		18:45	0.08
		18:50	0.07
		18:55	0.15
		19:00	0.03
		19:05	0.02
		19:15	0.02
		19:20	0.01
		19:25	0.04
		19:30	0.02
		19:35	0.02
		19:40	0.01
		19:45	0.01
		19:55	0.01
		20:05	0.01
		20:15	0.01
		20:30	0.01
		20:45	0.01
		20:55	0.01
		21:10	0.01
		21:30	0.01
		21:45	0.01
		22:05	0.01
		22:25	0.01
		22:55	0.01
		23:20	0.01
		total	0.61
L	Little Blue Joint	no precipitation recorded	

ID	Gage	MDT	inches
M	Meadow Ck		
		MDT	inches
		16:10	0.01
		16:45	0.01
		16:55	0.01
		17:20	0.01
		17:25	0.01
		17:30	0.01
		17:35	0.03
		17:40	0.02
		17:50	0.01
		18:40	0.01
		18:45	0.01
		18:50	0.02
		21:40	0.11
		21:45	0.02
		21:55	0.01
		22:00	0.02
		22:05	0.01
		22:10	0.02
		22:35	0.01
		total	0.36
N	Lower Meadow Ck		
		MDT	inches
		17:05	0.01
		17:40	0.01
		17:45	0.01
		17:50	0.02
		19:15	0.01
		19:20	0.20
		19:25	0.02
		21:50	0.04
		22:15	0.01
		22:20	0.01
		22:50	0.01
		23:35	0.01
		total	0.36
O	North Fork Rye Ck		
		MDT	inches
		19:15	0.01
		19:20	0.03
		total	0.04

Flash Floods & Recurrence Intervels



Rainfall, stage and discharge data from the July 20th 2001 storm at Laird Creek near Sula, Montana.

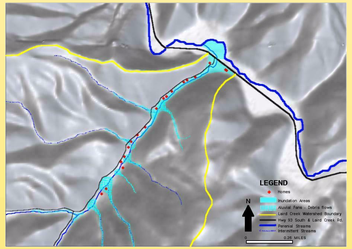


Rainfall, stage and discharge data from the July 21st 2001 storm at Laird Creek near Sula, Montana.

Inundation of Homes

Homes along Laird Creek flooded with ash, mud and debris from July 20th and 21st 2001 convective rains.

Homes along Laird Creek flooded with ash, mud and debris from July 20th and 21st 2001 convective rains.



Innundation area of flood waters and debris flows that occurred on July 20th and 21st of 2001.

Geomorphic Processes

Trees and granitic boulders transported by debris flows in high severity burn area.

Gully formed by hyperconcentrated flow and debris flow in a high severity burn area.

Debris fan deposited at the base of a gullied draw in the Cameron Creek watershed.