



Windy and Divide Fires

Rangeland Best Management Practices and Guidance to Landowners Affected by Fire, Drought, and Erosion

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**SOUTH DAKOTA STATE
UNIVERSITY EXTENSION**

Department of **Natural Resource Management**
College of **Agriculture, Food and Environmental Sciences**



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The intent of this publication is to serve as a general guide to all South Dakota landowners who may be affected by unplanned fire events. Specifically, this report focuses on events and impacts of the January 2021 Windy Fire and the March 2021 Divide Fire that affected portions of central and northeastern Perkins County in the northwest region of South Dakota. However, the guidance provided here is applicable to similar events in surrounding areas of the northern Great Plains where rangeland conditions and climate can be highly variable. It is important to note that SDSU Extension recognizes and promotes the ecological benefits of well-planned and executed prescribed fire with clear goals and objectives. However, unplanned fire events such as the Windy and Divide fires of 2021 can have tremendous negative impacts that include but are not limited to: loss of life; loss or damage to property, equipment, and supplies; financial loss; social strife; and potentially lasting negative ecological impacts (depending on cover and soil types). These impacts can be mitigated or exacerbated by climatic conditions that either preclude or follow the unplanned fire event. Precipitation, drought, and wind erosion are ongoing concerns for both the Windy and Divide fires, and can be a concern of any unplanned fire event.*

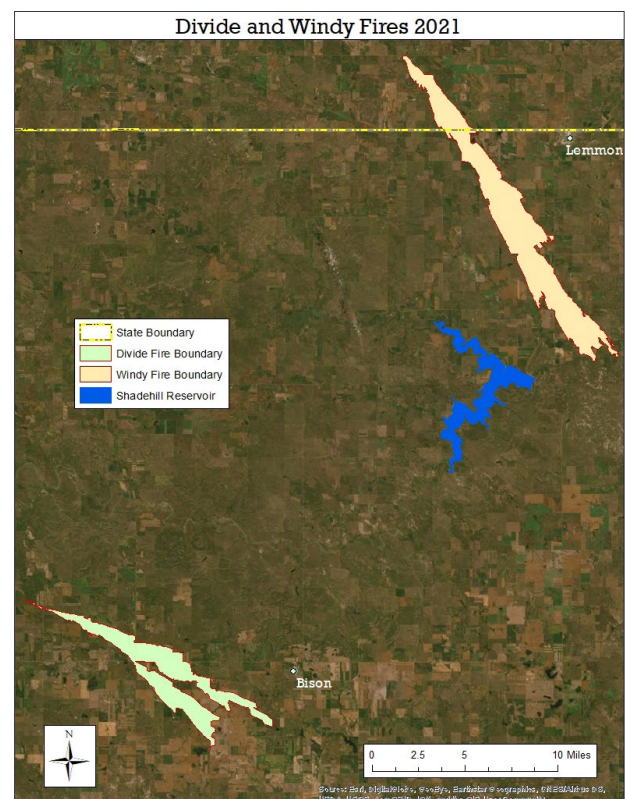


Figure 1: Windy and Divide fires Perkins County, SD. (photo date April 8, 2021).

Both the Windy and Divide fires occurred during the dormant season (i.e. plants are not actively growing). Typically, dormant season burns (while sometimes dangerous and destructive) are not often too concerning in relation to the ecology or health of the grassland, meaning that grasslands vegetation often recovers adequately with appropriate post-burn management. Here we caution that the extreme climatic conditions associated with the Windy and Divide fires may result in the need for longer-term planning and adjustments related to delaying a return to normal grazing and other land use practices. We also acknowledge that conditions may change, and the cautions we provide here may not play out over time if adequate precipitation returns to the areas impacted by these fire events.

***Landowners impacted by the Windy and Divide fires who need more information should seek out a rangeland management professional. In addition, SD NRCS and FSA have identified certain funding that may assist landowners affected by these two fire events. Individuals should visit their local USDA service center for more information. Landowners are reminded that pre-approval of practices is required if reimbursement or cost share is desired.**

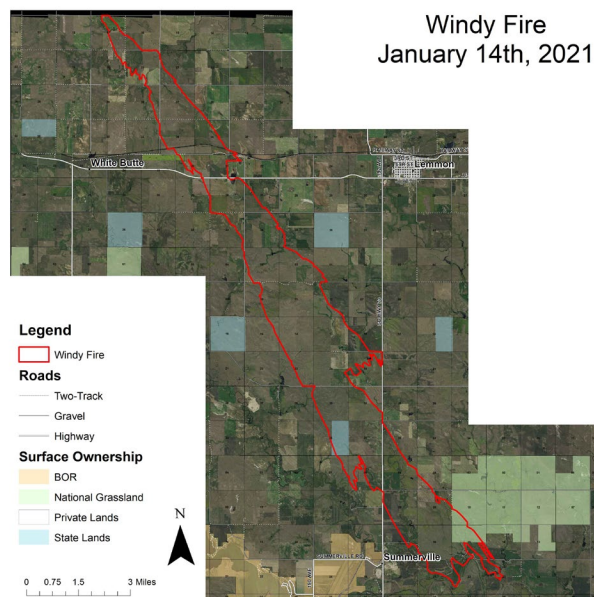


Figure 2: Windy Fire (US Forest Service Map)

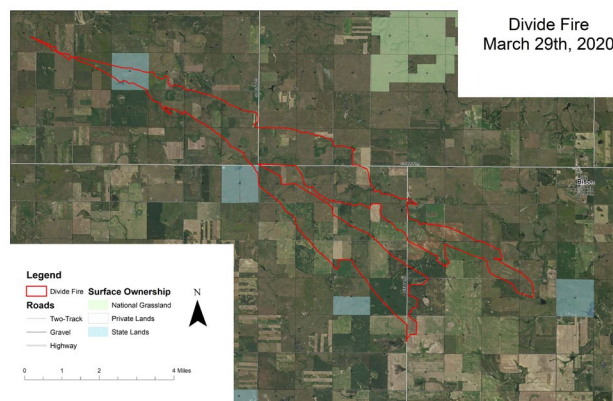


Figure 3: Divide Fire (US Forest Service Map)

Background Information

On January 14-17, 2021, the Windy Fire burned an estimated 16,262 acres in Adams County, ND (2,735 acres) and Perkins County, SD (13,572 acres) near the town of Lemmon, SD. The fire was driven by northwest winds in the approximate range of 30-40 miles per hour, with some gusts peaking at 56 miles per hour, and burned from a northwest to southeast direction over a period of approximately 73 hours, leaving a fire scar roughly 21 miles long and varying from ½ to over 4 miles wide. SDSU land use history analysis is provided here. Land categorized as native rangeland is that which shows no proof of previous tillage history or disturbance and is referred to as Potentially Undisturbed Land (PUDL) in the maps provided. We estimates that in Perkins County approximately 7,144 acres (53%) of native rangeland (PUDL), 1,345 acres (10%) of go-back rangeland (previously broken rangeland), and 5,038 acres (37%) of USDA recorded cropland and other land (including small grains, row crops, hay, farmsteads, and other land) were involved in this fire event.

On March 29-30, 2021, the Divide Fire burned an estimated 9,428 acres in Perkins County, SD near the town of Bison, SD. The fire was driven by northwest winds in the approximate range of 40-50 miles per hour, with some gusts peaking at 60 miles per hour, and burned from a northwest to southeast direction over a period of approximately 12 hours, leaving a fire scar roughly 14 miles long and up to 2 miles wide in two separate burns over the two-day period. SDSU land use history analysis estimates that approximately 3,298 acres (35%) of native rangeland (PUDL), 455 acres (5%) of go-back rangeland (previously broken rangeland), and 5,675 acres (60%) of USDA recorded cropland and other land (including small grains, row crops, hay,

farmsteads, and other land) were involved in this fire event.

As of the writing of this publication, Perkins County is in an extreme drought with most areas of the county receiving less than 0.2 inches of precipitation since the beginning of the year. The drought has been exasperated by reoccurrences of severely high winds in the northwest region of South Dakota. Due to these exceptionally dry conditions, the Windy and Divide fires burned all types of fuels including heavy to lightly grazed native rangelands; non-native grasslands and pastures; alfalfa and tame grass hayfields; cropland including various states of tillage and no-till small grain and row crop stubble; shelterbelts; farmsteads; wetlands and riparian areas; road rights-of-ways; and other fuels.

Basic information: natural ignition, prescribed/planned, and wildfire

It is not the intent of this fact sheet to document all of the aspects of grassland fire ecology. However, in general terms, Great Plains grasslands were shaped by the primary factors of grazing, climate, and fire (both human and natural ignition). Historically, fire events would have had certain ecological impacts based on climatic conditions, timing, and fuel types. These fires would have varied in scale, intensity, duration, and severity, but they would not have resulted in environmental degradation per se, as the impacts would have been deemed 'natural', regardless of the actual change in vegetation, erosion, or other shifts in the landscape ecology.

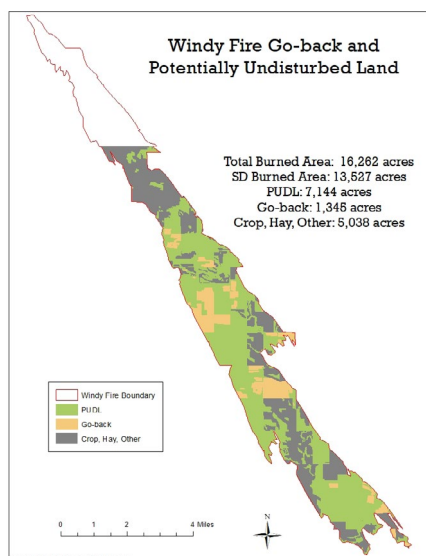


Figure 4: Windy Fire: affected land-use types (SDSU derived data, not yet publicly available).

Today's grassland landscape is much more ecologically, socially, and economically complex. Planned fires primarily focus on changing the structure, composition, or function of the existing plant community and often specifically target improving desirable native plant communities while suppressing undesirable or non-native species by controlling the timing and intensity of the fire event. The timing of such planned fires can be variable, depending on the target. For example, if the goal is to diminish the invasion of cool season exotic or tame grasses such as Kentucky bluegrass, cheatgrasses and other bromes; or various exotic wheatgrasses, a planned fire would be timed when such species are green and actively growing and susceptible to damage by fire. Generally, a fire would be timed in the early to mid-spring for the objective of controlling cool season exotic grasses. Conversely, if wanting to reduce cedar tree infestation, a fire might be better timed in the fall or very early spring when conditions are more volatile and the tree is more susceptible to damage.

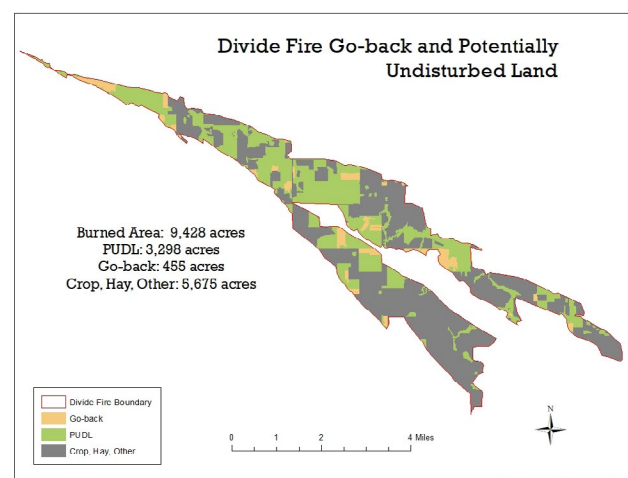


Figure 5: Divide Fire: affected land-use types (SDSU derived data, not yet publicly available).

Conversely, unplanned fires (wildfires) are not subject to objectives and simply burn when an ignition source combines with conditions that are volatile enough to support rapid fire spread (dry and available fuels, high winds, low relative humidity, etc.). Wildfires are not planned fires and the impacts and effects should not be compared in most cases. In some instances, wildfires may result in positive ecological effects. But, even if ecological impacts are positive, the unfortunate reality is that the long-term social and economic impacts of wildfires can be detrimental and often outweigh any short-term positive ecological benefits.

Fire timing: ecological effects of fire events by land use type

How the land or the landscape responds to fire is dependent on several factors, some of which have already been addressed (timing, fuel load, climatic conditions, etc.). Land use history is also very important. Below are some very general guidelines to consider when planning for short and long-term use of property affected by the Windy and Divide fires. This information will also be applicable to similar conditions on the landscapes in the future.

1) Healthy native rangeland/pasture dominated by native species

Grassland that is native sod (never previously tilled or disturbed) with a diverse and healthy native plant community will generally respond favorably to fire, regardless of timing, intensity, or climatic conditions. This is basically the historic function of fire on these individual native plants and the native plant community as a whole. Generally, healthy native sod is bound by the roots of healthy native plants that are not only resilient to fire, but often are dependent on fire to encourage reproduction, stimulate growth, seed production and tillering, and improve overall plant vigor. Also, a healthy native plant community with little or no invasion from exotic plants will generally recover from a fire event without problem, especially if grazing is delayed until late into the growing season. Even an unplanned fire can create some benefit in this situation as it may provide opportunity for the native plant community to respond positively.

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recommendations. While the healthy native rangelands affected by these fires will likely respond favorably over time, the climatic conditions of drought and high wind since the fires are a real concern. With current drought conditions in Perkins County, it is recommended that producers should plan for non-use during the 2021 grazing season, as the native plant community will likely not express itself until precipitation is adequate. The recommendation for non-use will allow the plant community to fully recover and strengthen the root system. Turning livestock onto these acres too early while the land is dry and brittle could loosen the topsoil and remove any remaining residual ground cover, further exposing the soil to wind erosion. Further, consumption of the native plants by grazing

too early will diminish their competitive advantage and may inadvertently encourage undesirable competitor species such as Kentucky bluegrass, cheatgrasses, bromes, and weedy species to establish. Do not plan to use chemical treatments on these sites, allow time to heal the area. Do not interseed native or non-native species as these native rangelands are resilient and should recover on their own. If adequate precipitation is received in the upcoming months, there may be a possibility for late fall grazing if rangeland has been given a sufficient recovery period. Producers will need to evaluate forage production and the response of the plant community throughout the growing season to determine grazing readiness. Range condition prior to the fire will also largely dictate plant recovery and grazing timing. Consultation with a trained range professional is encouraged.



Figure 6: This well managed native rangeland will likely fully recover if managed appropriately during the 2021 growing season (Windy Fire scar, April 8, 2021 photo).

2) Poor quality native rangeland/pasture dominated by invasive or exotic species

Grassland that is native sod (never previously tilled or disturbed) but that has heavy historical use, such as annual, season long, non-rotational grazing often shows a shift away from healthy native plants toward invasive or non-native species including Kentucky bluegrass, cheatgrasses, smooth brome, crested wheatgrass, and occasionally sweetclover. A fire on these types of rangelands can often be beneficial in that it can potentially stimulate expression of any native grasses and forbs still present in the system. Timing of the fire event is very important in these systems. Fires that occur in the early or later cool seasons (spring and fall) can have great impact on controlling some of these species as the fire impacts the active growth of the

plant. Dormant season fires, however, run the risk of stimulating these undesirable species through removal of thatch/litter, encouraging new growth that is often associated with precipitation and warming weather. So while the native plants may respond favorably to the fire, a poorly timed fire might result in extensive competition from the non-native plants. Conversely, a well-timed fire (when exotic plants are actively growing), can stimulate native plants while suppressing the exotic species.

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recommendations. Since this land use type is still native sod without a tillage history, it will resist wind and water erosion to a degree. But, since it is heavily dominated by shallower-rooted exotic sod-forming grasses, it may be subject to more erosion than native sod with a healthier native plant community. It is recommended that producers should plan for non-use during the 2021 grazing season and evaluate the response of the plant community. This recommendation allows the plant community to fully recover and strengthen the root system. Turning livestock onto these acres too early, while the land is dry and brittle could loosen the topsoil any remaining residual ground cover, further exposing the soil to wind erosion. Further, consumption of the native plants by grazing too early will diminish their competitive advantage and may inadvertently encourage undesirable competitor species such as Kentucky bluegrass, cheatgrasses, bromes, and weedy species.

Some producers may discover that a fairly robust native plant community is present. If native plants do not express themselves after adequate precipitation and rest during the 2021 growing season, one can likely assume that the native plant community is fairly weak or relatively non-existent. Fall grazing cool season tame grasses may be an option if plant recovery and forage production is sufficient. Timing of grazing is critical to ensure no harm of any native plants that may be present. If native plant species establishment is weak, this may also be a time to consider active improvement of the stand, and consultation with a trained range professional is encouraged. Since these areas are unbroken native sod, it is recommended that producers only plant native species adapted to the region. Weedy infestations may arise in some areas related to either drought or precipitation events. Use chemical control sparingly on these sites, as often these early invaders will diminish over time with appropriate management.



Figure 7: Native rangeland that is heavily invaded by exotic species (Kentucky bluegrass shown here) may result in a re-expression of the native plant community. Conversely, if native plants are no longer present, active improvement through re-establishment of native plants may be warranted (Divide Fire scar, April 8, 2021 photo).

3) Previously broken/go-back rangeland/pasture with a mix of native and exotic vegetation

Overall, this land use type will respond to fire based on the degree of native plants that remain. Overall, as was described in Section 2 above, vegetation present will respond in a similar fashion. These lands however, appeared to be more susceptible to wind erosion.

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recommendations. Again, it is recommended to plan for non-use during the 2021 season unless or until adequate precipitation occurs. If dominated by exotic species, these acres should be considered for grazing ahead of the native rangelands allowing those high-quality rangelands to recover fully. On these acres, if soil stability becomes more adequate and if the plant community proves to be severely degraded over time, active range improvement through seeding could be a viable option. Using native species is recommended if possible, but a mix of native and non-invasive tame species may be allowable in this instance since the land has a tillage history. It is also recommended to use no-till drills or broadcast seeding depending on current soil and climate conditions. Producers considering active replanting of these areas should consult with a trained rangeland professional experienced in land restoration.



Figure 8: Previously broken/go back rangeland or pasture that is heavily invaded by exotic species (crested wheatgrass/Kentucky bluegrass shown here) may result in a re-expression of the native plant community, but more likely will continue to be dominated by the exotic plants. These areas appear to be very impacted by wind erosion, and active restoration of a plant community may be warranted if drought and wind persist. (Windy Fire scar, April 8, 2021 photo).



Figure 9: Fire impacts to root crowns coupled with wind erosion has left little armor on the soil surface and a great deal of open space on previously broken/go back rangeland or pasture that is heavily invaded by exotic species. (Windy Fire scar, April 8, 2021 photo).

4) Previously broken hay/alfalfa/mixed tame vegetation

Overall, this land use type will not benefit from fire, regardless of timing, duration, or intensity as these plant communities are not fire dependent. Alfalfas, clovers, and tame grasses comprise the majority of vegetation on these sites.

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This land type is of concern following the Windy and Divide fires. Removal of the duff layer and burning of the organic layer appear to have occurred on these land use types. Compromised plant crowns either due to direct fire impact, wind

erosion, or both, appear to be fairly present. Again, it is recommended to plan for non-use during the 2021 season unless or until adequate precipitation occurs. On these acres, if soil stability becomes more adequate and if the plant community proves to be severely degraded over time, active re-seeding may be necessary. It is strongly recommended that landowners consider returning these fields to native species if possible, but a mix of native tame species may be desirable for forage or hay. The use of no-till drills or broadcasting depending on current soil and climate conditions is recommended. Producers considering active replanting of these areas should consult with area resource personnel to determine the most beneficial mix, and may want to consider enrollment of these acres into some type of long-term conservation program if erosion is pervasive.



Figure 10: Fire impacts to an alfalfa/brome hayfield. Wind scouring on this field did not appear to be as prominent as more open areas and it is likely the vegetation may recover with adequate precipitation. (Windy Fire scar, April 8, 2021 photo).



Figure 11: Fire impacts to a brome hayfield. Wind scouring on this field did not appear to be as prominent and it is likely the vegetation may recover with adequate precipitation. (Windy Fire scar, April 8, 2021 photo).



Figure 12: Fire impacts on a CRP native mix. Burned root crowns of native bunchgrasses are evident in the drill rows. It is likely that this stand of planted native species will recover with appropriate rest/recovery time once precipitation returns. Wind scouring on this field did not appear to be as prominent as others and the fire moved fast enough that not all litter was consumed in the January fire event (Windy Fire scar, April 8, 2021 photo).

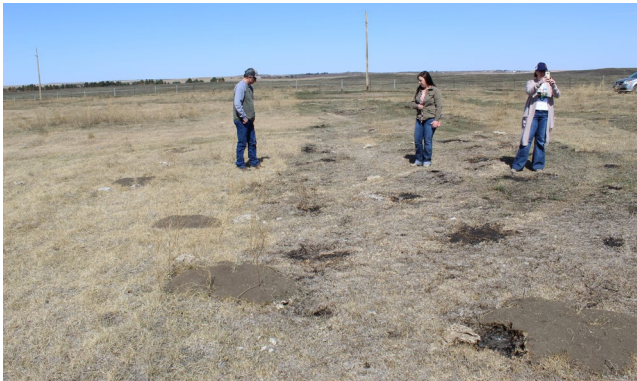


Figure 13: Fire impacts to the same CRP field shown in Figure 12 above. Native grasses did not establish well in this portion of the field that is now dominated by Kentucky bluegrass. The fire, while likely not severely directly hurting the Kentucky bluegrass, may have created secondary impact through exposure of the soil, exposing the shallow roots to drought and severe cold in February, followed by very dry spring conditions. These circumstances may delay or prevent growth of Kentucky bluegrass, and may offer a limited opportunity to establish more desirable grasses through no-till drilling (Windy Fire scar, April 8, 2021 photo).



Figure 14: A combination of removal of litter due to the January fire along with high wind erosion and drought have resulted in. Native grasses did not establish well in this portion of the field that is now dominated by Kentucky bluegrass. The fire, while likely not severely directly hurting the Kentucky bluegrass, may have created secondary impact through exposure of the soil, exposing the shallow roots to drought and severe cold in February, followed by very dry spring conditions. These circumstances may delay or prevent growth of Kentucky bluegrass, and may offer a limited opportunity to establish more desirable grasses through no-till drilling or possibly broadcasting if conditions are (Windy Fire scar, April 8, 2021 photo).

5) Wind Erosion and movement of litter, organic matter, and soils.

While some types of land use mitigated wind erosion due to healthier plant communities, overall wind erosion is a factor for all land affected by the fires. The Windy Fire area has been subject to wind events since the burn that have had enough velocity to move significant amounts of litter, organic matter, and soil (hereafter referred to simply as 'soil'). During these wind events, overall visibility has been very low due to the movement of blown soil that is essentially a powder which formed drifts, dunes, and filled in low areas.

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recommendations. Land eroded by wind is a concern and landowners should refer to guidance provided above in Sections 1-4. The basic prescription for all lands suffering from moderate to severe wind erosion is to avoid further disturbance of the soil from livestock or machinery unless or until adequate precipitation occurs to stabilize the topsoil. Wind-blown soils are a much different matter and may be difficult or impossible to contend with. Wind-blown soils are prevalent in shelterbelts, creeks and riparian areas, other low areas, road ditches, and in other areas where wind was slowed and the powdered soil was dropped. Further, the soil deposits continue to shift as wind events occur. Landowners will have to determine if dunes or drifts of soil and other material warrant active removal and re-

depositing in another area to allow for forage regrowth.



Figure 15: Reduced visibility due to movement of soil during a wind event following the Windy Fire (Windy Fire scar, April 2021 photo).



Figure 16: Wind-blown soils, silt, litter, and organic matter are mixed and deposited in catch areas, such as road ditches and shelter belts. Here a 'dune' of windblown material from a crop field that burned is several feet deep (Divide Fire scar, April 17, 2021 photo).



Figure 17: Plant regrowth through wind-blown soils. (Windy Fire scar, April 2021 photo).



Figure 18: In shelterbelts and other areas, wind-blown material accumulated to depths of several inches to several feet. Here a dune that was about 3-4 ft. high the previous week had been reduced to about 12 inches within a shelterbelt that had been burned (Windy Fire scar, April 8, 2021 photo).

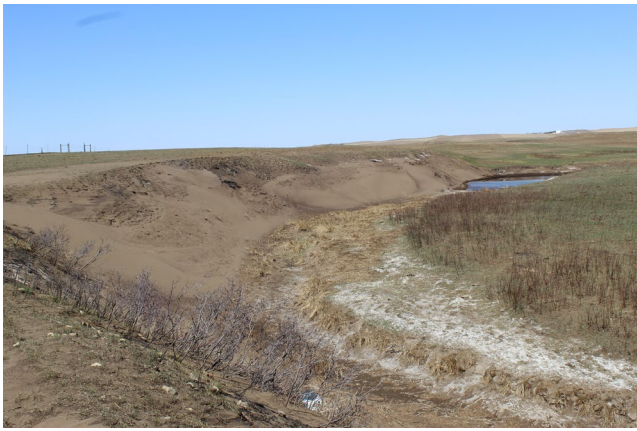


Figure 19: Wind-blown material accumulated to depths of over 12 inches along this creek bank as the wind slowed and the material fell out. (Windy Fire scar, April 8, 2021 photo).



Figure 20: Wind-blown material accumulated to depths of over 12 inches along the creek shown in Figure 19 above. This material is high in organic matter, and continues to burn nearly three months after the fire event (Windy Fire scar, April 8, 2021 photo).

6) Water sources and riparian zones impacted by erosion.

The movement of wind-blown materials has compromised many riparian zones and small open-water areas within the drainages in the region. Soils, litter, and soot appear to have drastically reduced water quality, and much of the material is floating on the surface of water bodies. It is unclear what the short or long-term impacts of this material will be related to water quality. But, with drought conditions shrinking natural water sources coupled with fire debris and naturally high salinity in the region, it seems to be logical that these sources might not be conducive to livestock health. Further, these water sources are often located in areas denuded by the fire and wind, and thus loss of use may be irrelevant in the short term as grazing is not recommended in these areas unless or

until adequate precipitation and plant growth occur. Long-term impacts will have to be evaluated once forage production is sufficient for grazing due to the riparian zone buffer being removed and replaced with eroded sediment.



Figure 21: Wind-blown material accumulated to depths of over 12 inches along the creek shown in Figures 19-20 above. This material can be seen floating on the water surface and with saline areas surrounding the small pond. (Windy Fire scar, April 8, 2021 photo).



Figure 22: Wind-blown material accumulated to depths of over 12 inches along the creek shown in Figures 17-19 above. Water quality issues, such as visible algae growth due to increased nutrient loading from wind-blown material are already present (Windy Fire scar, April 8, 2021 photo).

7) Trees and shelterbelts

The timing of the fire coupled with adequate fuels and high winds negatively impacted mature trees throughout the burn area. Many trees were killed, and many more injured. Injury to most tree species might likely prove fatal over time if drought persists. Landowners should monitor progress of tree death or recovery during the 2021 growing season. Disease and climate might further impact trees compromised by the fire, and these trees might recover or succumb to ultimate death in the future.



Figure 23: A conifer shelterbelt impacted by the January fire event. Trees that retain some greenery may recover but likely will continue to degrade or potentially die if drought persists (Windy Fire scar, April 8, 2021 photo).



Figure 24: A conifer shelterbelt killed by the January Windy fire (Windy Fire scar, April 8, 2021 photo).



Figure 25: A ponderosa pine tree with severely burned trunk and lower branches that will likely die during the 2021 growing season if drought persists (Windy Fire scar, April 8, 2021 photo).



Figure 26: A ponderosa pine tree with burned trunk and lower branches. Note the headfire (right) side is relatively unburned while the downwind (backside) of the trunk burned as the heat and flame of the fire 'wrapped' around the trunk. This tree may survive (Windy Fire scar, April 8, 2021 photo).

8) Reclamation of disked or plowed firebreaks

Throughout the burn areas, landowners attempted to reduce fire impacts via plowed or disked firebreaks in all types of grassland areas. In all cases, such firebreaks will initially persist as rough areas depending on how aggressive the tillage. Landowners may be tempted to smooth these firebreaks with a drag harrow or other implement, but we recommend avoiding any further disruption at this time, allowing the land to naturally soften and mellow, especially if drought conditions persist. If tillage was deep or the firebreak is excessively rough, we recommend waiting until conditions improve before further disturbing these areas with additional tillage.

Going forward when conditions improve, landowners can expect that native vegetation will recover to some degree if the firebreak was not dug too deep. Reseeding may not be necessary and landowners should monitor the firebreaks for weed issues. If re-seeding is planned for healthy native rangeland, only native species adapted to the area are recommended and landowners should consult with a range professional for timing and technique questions. Harrowing/leveling of these areas may not be necessary if using a heavy no-till drill. For firebreak reclamation in non-native areas (tame pastures, hayland, etc.), the same basic options apply and landowners should again consult with a range or restoration specialist for site-specific guidance.



Figure 27: A disked firebreak installed on native rangeland. This is a fairly light tillage example, and this firebreak may recover native species without any active management. However, it may remain rough well into the future. (Windy Fire scar, April 8, 2021 photo).



Figure 28: The firebreak above was installed with a much more aggressive tillage tool than that shown in Figure 27 above. This firebreak will remain very rough and possibly weedy without active smoothing and reclamation (Divide Fire scar, April 8, 2021 photo).



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