We studied the relationship between fuel variables, weather conditions, and fire behavior for 25 prescribed fires in North Dakota, USA. Temperatures 15 cm above the soil surface averaged 225C during spring burns in and 250C during fall burns. Surface temperatures averaged about 100C, but half were below 60C. Fires spread at an average of 2.5 m min. Wind speed drove faster rates of spread while higher fuel loads and lower fuel moisture produced higher canopy temperatures, but none of our measurements explained variability in soil surface temperature because ground-level heating remained low.