The Normalized Burn Ratio (NBR) - Brief Outline of Processing Steps

Acquire adequate Landsat TM or ETM+ scenes:

Determine timing requirements: *initial* or *extended* assessment.
Pre- and Post-fire scenes should match phenologically as much as possible.
Search for available scenes using web browsers
Landsat 7 ETM+: http://edclxs2.cr.usgs.gov/L7ImgViewer.shmtl/
Landsat 5 TM: http://earthexplorer.usgs.gov/ (follow links to Landsat TM)
Check availability of already-purchased data before ordering.
Get Terrain Corrected data.

With data in hand, explore data in false-color composite images, study burn characteristics. Transform raw data to *Radiance* (L_i) and "at-satellite" *Reflectance* (R_i) for Bands 4 and 7.

$$L_i = DN_i * G_b + B_b; \qquad R_i = (L_i * \pi * d^2) / (\mathrm{Esi}_b * \cos(z_s))$$

DN_i = per-pixel raw brightness value.
G_b *and* B_b = per-band gain and bias from scene header.
d^2 = daily earth-sun eccentricity from lookup table.
Esi_b = per-band exoatmospheric solar irradiance from published L5 and L7 tables.
z_s = per-scene solar zenith angle (90-solar elevation angle reported in scene header).

Determine if atmospheric normalization is necessary, and if so, do it if for Bands 4 and 7.

Generate an NBR image for each scene, pre- and post-fire:

$$NBR = (R_4 - R_7) / (R_4 + R_7);$$

Generate the differenced (or delta) NBR:

$$\Delta NBR = NBR_{prefire} - NBR_{postfire}$$

This isolates burned from unburned areas, provides a quantitative measure of absolute change in NBR. Practical data range ≈ –500 to + 1300 when scaled by 10^3.
Apply a linear grayscale to the data range of –800 to 1100, and study this image carefully.
Define the burn perimeter using combined automated and on-screen digitizing from the ***ΔNBR***.

Make an initial cut at severity thresholds in false color. A seven-tiered configuration may be useful. Ordinal severity levels and example range of ΔNBR (scaled by 10^3) are shown:

SEVERITY LEVEL	ΔNBR RANGE
Enhanced Regrowth, High	-500 to -251
Enhanced Regrowth, Low	-250 to -101
Unburned	**-100 to +99**
Low Severity	+100 to +269
Moderate-low Severity	+270 to +439
Moderate-high Severity	+440 to +659
High Severity	+660 to +1300

(These value ranges are flexible and scene-pair dependent. Values of ΔNBR less than about -550, or greater than about +1350 may also occur. If so, they are *not* considered burned. Rather, they likely are anomalies caused by miss-registration, clouds, or other factors not related to real land cover differences.)