We demonstrate magnetic-field sensing using an ensemble of nitrogen-vacancy centers by recording the variation in the pump-light absorption due to the spin-polarization dependence of the total ground-state population. Using a 532 nm pump laser, we measure the absorption of native nitrogen-vacancy centers in a chemical-vapor-deposited diamond placed in a resonant optical cavity. For a laser pump power of 0.4 W and a cavity finesse of 45, we obtain a noise floor of $\sim 100$ nT/\sqrt{Hz} spanning a bandwidth up to 125 Hz. We project a photon shot-noise-limited sensitivity of $\sim 1$ pT/\sqrt{Hz} by optimizing the nitrogen-vacancy concentration and the detection method.