A two-dimensional array of planar Langmuir probes manufactured on a 200 mm diameter silicon wafer was used to measure the spatial distribution of ion flux impinging on the wafer surface in various discharges of electropositive (Ar) and electronegative gases (SF$_6$ and Cl$_2$) maintained in an inductively coupled plasma etching reactor with a planar spiral coil. In conjunction with the experiments, a two-dimensional fluid model of the plasma was developed to capture the dependence of the ion flux uniformity on plasma operating parameters and reactor geometry through a set of dimensionless numbers which are the ratios of various time and length scales intrinsic to the discharge. These dimensionless ratios include reactor dimensions, the skin depth, the electron energy relaxation length, ion diffusion length, and ionization and attachment rates. The model provides a simple framework within which the spatial variation of ion flux in inductively coupled plasmas can be understood. The approach captures the dependence of ion flux uniformity on plasma operating variables such as pressure and feed gas composition.