Abstract: Coupled nonlinear inverse problems arise in numerous imaging applications, and solving them is often difficult due to ill-posedness and high computational cost. In this work, we introduce LAP, a linearize and project method for coupled nonlinear inverse problems with two (or more) sets of coupled variables. LAP is implemented within a Gauss–Newton framework. At each iteration of the Gauss–Newton optimization, LAP linearizes the residual around the current iterate, eliminates one block of variables via a projection, and solves the resulting reduced dimensional problem for the Gauss–Newton step. The method is best suited for problems where the subproblem associated with one set of variables is comparatively well-posed or easy to solve. LAP supports iterative, direct, and hybrid regularization and supports element-wise bound constraints on all the blocks of variables. This offers various options for incorporating prior knowledge of a desired solution. We demonstrate the advantages of these characteristics with several numerical experiments. We test LAP for two and three dimensional problems in super-resolution and MRI motion correction, two separable nonlinear least-squares problems that are linear in one block of variables and nonlinear in the other. We also use LAP for image registration subject to local rigidity constraints, a problem that is nonlinear in all sets of variables. These two classes of problems demonstrate the utility and flexibility of the LAP method.