TeaLeaf is a valuable research tool that has been used to successfully investigate the performance of a number of modern parallel programming models. The current RAJA implementation requires a similar development effort to OpenMP, and we have shown it exhibits competitive performance on the CPU. Its reliance on C++11 lambdas has limited its functional portability, but this will be improved upon before public release. Kokkos uses C++ templates, demanding extensive re-development of C or Fortran codes, and represents a greater up-front development effort than OpenMP or RAJA. However, Kokkos provides abstractions that reduce some of the complexities inherent with porting to CUDA and OpenCL. Importantly, we have demonstrated with TeaLeaf that codes using Kokkos can expect impressive performance portability between CPUs and NVIDIA GPUs. Collaboration with Sandia found that it is possible to attain good native performance on KNC, using hierarchical parallelism, but this solution represents a trade-off, exposing additional layers of parallelism and increasing complexity, while improving KNC performance and reducing performance of some solvers on the GPU.