Designing wind farms in complex terrain is becoming more and more important, especially for countries like China, where a large portion of the territory is featured as complex terrain. Although potential richer wind resources could be expected at complex terrain sites (thanks to the terrain effects), they also expose many challenges for wind farm designers/developers. In this study, we present the FarmOpt methodology for designing wind farms in complex terrain, which combines the state-of-the-art wind resource assessment methods with engineering wake models adapted for complex terrain and advanced layout optimization algorithms. Various constraints are also modelled and considered in the design optimization problem for maximizing the annual energy production (AEP). A case study is presented to illustrate the effectiveness of the methodology. Further developments of the FarmOpt tool are also briefly introduced.