Deployment and Support to Models Used for Natural Resource Conservation Programs in the United States

J. Carlson, O. David

Department of Civil and Environmental Engineering
Colorado State University, Fort Collins CO, 80526, USA
{jack.carlson, odavid}@colostate.edu

Abstract: Colorado State University (CSU) develops, validates, and stages natural resource models and computational tools deployed as web services to the data center hosting the information systems of the USDA Natural Resources Conservation Service (NRCS). The effort also includes the staging and deployment of national soil, climate, land management, and model specific data marts and services to supply input for model simulations. NRCS business applications call the model services to generate output for resource assessments and conservation plans, supporting a field workforce of approximately 10,000 agency and partner employees working in 2,800 county-level offices.

Until recently, use of natural resource models supporting technical assistance has involved distribution of several stand-alone tools, each with their own datasets, to agency offices. With contemporary scalable architectures and a common platform, these tools now deploy as web services integrated into business applications, reducing time for science product delivery, improving operational efficiency, and reducing burden on field users to carry out their daily work. In addition, the services and data stores can be re-purposed to support other initiatives, for example, the Field to Market initiative of a consortium of agricultural, food industry, and environmental organizations engaged with the Fieldprint Calculator, a tool for assessing farm production sustainability throughout the country.

Deployed services include models for cropland water and wind erosion prediction, soil erodibility potentials, soil organic matter degradation, soil tillage intensity, air soil particulate matter, nutrient leaching and runoff potential, and farm energy consumption. Completed services pending deployment include soil-pesticide interaction ratings, pesticide hazard ratings, forage-animal balance, rangeland hydrology and erosion, and farm carbon emissions. Deployed national-scale data marts and associated data services include soil, land management (crops and farming operations), climate (including climate and wind generators), pesticides, as well as model specific parameter data. Model service translators convert data from these common data marts to formats suitable to the respective model engines.

CSU, NRCS, and the USDA Agricultural Research Service (ARS) have developed a Cloud Services Integration Platform (CSIP)[1] providing a common service development, staging, and deployment architecture crucial to integrating the chosen models developed at different times in different languages across several organizations. National, regional, and state NRCS technical specialists provide training and support to field users of the applications running the model services, backed up by the scientists in ARS and universities responsible for the models. NRCS also assigns region and state data stewards to keep the common national data marts current, usually on an annual refresh schedule.

All services have time-to-live settings for their request/response data payloads on the hosting platform, and do not consume or process personally identifiable information (PII). Applications using these services persists model service output within an organization's security and privacy policy constraints. Model service response payloads usually contain sufficient data to reconstruct the model simulation. NRCS achieves long-term stability and support of the models it uses for program delivery through a capital planning and investment control process, including support service contract management.

Resources
[1]CSIP project website: https://alm.engr.colostate.edu/cb/project/csip