

Strengths and Weaknesses of Universal Response Function Approaches for Support of Deployment Decisions

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The Universal Response Function (URF) approach to supporting seedling deployment decisions relies on historical results from common garden seed source or provenance tests to construct deployment guidelines. If these progeny tests are widely scattered across a range of climatic conditions, the weather at the test sites combined with the climate at the seed source can be used as dependent variables to predict future performance of seed sources under similar conditions, current or future. There are three components to this modeling approach and underlying assumptions inherent in each component that limit the scope of the possible conclusions.

The first component is the choice of response variables. This includes both the trait and the measurement age. Some variables, such as height at early ages, may be predictive of future production. Other traits, such as older volume per planted tree or basal area, which incorporate survival, may be more informative about adaptive resiliency. The second component is the assumption that seed sources from a provenance have genetic components that reflect their evolutionary response to common selection pressures. Many factors including mutation, migration, and heterogeneous environments effect selection. In wind-pollinated out-crossed species like loblolly pine, these factors result in tremendous amounts of tree-to-tree genetic variation that are at least as important as the provenance variation. Finally, the weather variables at the test site represent only a small portion of the site-specific variables that determine productivity. Much information on site quality such as the impact of soil fertility, drainage, and management history are completely ignored. Furthermore, the decision space is limited to the conditions tested and to the measurement ages evaluated. Progeny tests are rarely established on land deemed marginal for commercial forestry.



Josh Sherrill and Steve McKeand measuring a genetic test on Rayonier property in Atkinson County, GA. Photo courtesy of Steve McKeand.

Nevertheless, there are useful insights that have been obtained from this approach:

1. Local seed is seldom optimal and gain in production can be made from transferring seed from warmer to slightly cooler climates.
2. The further a seed source is moved to cooler or drier climates, the more important tradeoffs between production and adaptation become.
3. Tree-to-tree variation is large and should be captured through continued progeny testing and family deployment.
4. Productivity and resiliency can both be improved to the degree that aridity can be ameliorated by proper silvicultural practices.

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