A CLIMATE CHANGE RESPONSE FUNCTION FOR LOBLOLLY PINE (*PINUS TAEDA* L.) FROM THE WESTERN GULF REGION OF THE UNITED STATES

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The Western Gulf Forest Tree Improvement Program (WGFTIP) established a geographic seed source study for loblolly pine (*Pinus taeda L.)* between 1974 and 1978 to better delineate breeding and deployment zones within the Western Gulf region of the USA. A total of seventy-three plantings were established in two series with each series replicated over two years. Series I sampled 26 open-pollinated families representing a north-south transect, while Series II sampled 17 open-pollinated families in an east-west transect, that were planted at 43 and 30 test sites, respectively. The locations ranged from the maritime conditions of the Mississippi Gulf Coast to the more xeric and continental conditions encountered beyond the northern and western edges of the current natural range for the species in Arkansas and Oklahoma. The objectives of this study were to develop models that could be used to 1) guide future deployment decisions, 2) support projections of future forest productivity when combined with climate models, and 3) direct future breeding efforts by quantifying the variation among families for phenotypic plasticity exhibited in response to changing environments. Family responses to variation in climate were modeled using regression procedures in SAS. Age-fifteen height, diameter, and planted-tree volume were used as response variables. Mean minimum temperature of the coldest month (MMIN [°C]) and aridity index (AI) and its coefficient of variation, at both the provenance and the test site, were used as explanatory variables. Data show that the optimal performance is achieved when southern sources are moved to more northern locations by MMIN ≈ 2-4°C, which confirms earlier observations, and that a moderate level of AI is optimal. Both mean AI and its variance reached maxima near the western species boundary indicating their potential role as the range limiting factor. The data were insufficient, however, to delineate the adaptability-limiting factors in the east-west transect.