基于不同立地质量评价指标的杉木大径材林分树高-胸径模型

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摘 要：【目的】基于不同立地质量评价指标，构建杉木大径材林分的树高-胸径模型，评价包含不同立地质量评价指标模 型的拟合及预测效果，为大径材林分下的杉木生长预测和经营措施制定提供参考。【方法】以福建省上杭白砂国有林场的大 径材杉木人工林为研究对象，选取 7 个具有代表性的树高-胸径模型，从中筛选出拟合效果最优的模型作为树高-胸径基础模 型，在基础模型中分别加入优势高、地位级、地位指数和立地形 4 个不同立地质量评价指标，并引入样地效应构建非线性混 合效应模型，通过交叉检验对不同模型的预测效果进行评价。【结果】在 7 个树高-胸径候选模型中，选定 Richards 模型作 为杉木大径材林分的树高-胸径基础模型，在基础模型中引入不同立地质量评价指标均可有效提高模型的拟合及检验精度， 其中加入优势高的模型表现效果最好。添加样地随机效应后，所有模型的拟合和检验精度均获得了提升，且包含不同立地质 量评价指标模型的排序没有变化。其中，以优势高为立地质量评价指标的混合效应模型预测精度最高。最优模型各径级的残 差比基础模型更小、更稳定，无偏性更好。【结论】与传统回归方法建立的基础模型相比，加入立地变量和随机效应的树高 -胸径模型能更好地描述大径材杉木树高与胸径之间的关系。优势高的表现优于其他立地质量评价指标，立地形与地位指数 的效果接近，二者均可以作为杉木大径材林分中地位指数的替代指标。

关键词：混合效应；优势高；立地形；地位指数；大径材

Height-Diameter Model of *Cunninghamia lanceolata* Large-Diameter Stands

Based on Various Site quality evaluation index

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Abstract: [**Objective**]The height-diameter model of *Cunninghamia lanceolata* large-diameter stands was developed based on different site quality evaluation index. We assessed fitting and prediction effects of the models containing different site quality evaluation index, so as to provide reference for the growth prediction and practice formulation of *Cunninghamia lanceolata* large-diameter stands. [**Method**] The *Cunninghamia lanceolata* large-diameter plantations in Shanghang Baisha State owned Forest Farm of Fujian Province were chose as the research object.

Seven representative tree height-diameter models were selected, and the model with the highest goodness-of-fit was chosen as the base model. Four different site quality evaluation indices, namely, dominant height, site class, site index and site form, were added to the base model respectively. Meanwhile, random effect was also introduced to construct non-linear mixed effect models. The prediction effects of different models were evaluated by cross validation. [**Result**] Among the seven height-diameter candidate models, the Richards model was selected as the base model for *Cunninghamia lanceolata* large-diameter stands. The fitting and validation performance were improved effectively by adding different site quality evaluation index in the base model, and the model containing dominant height received the best results. After introducing random effect, the fitting and validation statistics of all models were improved, and the ranking of models containing different site quality evaluation index did not change. Among them, the mixed effect model with dominant height obtained the best prediction accuracy. The optimal mixed effect model produced smaller residuals for each diameter class, and provided more stable and unbiased predictions than those of base model. [**Conclusion**] Compared with the base model, the height-diameter

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