

The Potential Impact of CO₂ Fertilization on Stand Productivity

During the development of FORECAST Climate we considered the merit of adding several different factors and/or mechanisms to represent effectively the potential influence of climate change on forest growth and development. One of the key tenants of model development is to keep the model as simple as possible to capture the essence of the target system. The addition of additional complexity must be warranted by its potential for influencing system behavior. We evaluated the merit of adding the effects of CO₂ fertilization into the model in this context.

A review of recent literature on the subject showed that there is little consensus with respect to the long-term impact of CO₂ fertilization on forest growth and development or its influence on water stress development (it has been suggested that higher CO₂ concentrations may reduce the development of water stress). Highlights from the literature review are presented in the following section:

Girardin et al. (2011) found that there was no detectable CO₂ fertilization effect in boreal jack pine forests. In addition they observed the following:

- CO₂ not limiting growth
- Temperature regulated N availability was more important with respect to tree growth
- Cautioned against incorporating CO₂ fertilization effect in models based upon short-term lab and field experiments with abrupt changes in CO₂ concentration

Gedalof and Berg (2010)

- found limited evidence of a CO₂ fertilization effect in greater than 80% of sights examined based upon an extensive analysis of tree ring data
- found no evidence of enhanced water use efficiency

Brienen et al. (2012)

- suggest that positive effects on tree ring growth attributed to CO₂ fertilization may be caused by sampling bias due to sampling only or primarily 'big' trees.

Given these findings we determined that there was not sufficient evidence nor sufficient knowledge to warrant the inclusion of a CO₂ fertilization effect in FORECAST Climate.

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<http://www.greenfacts.org/en/arctic-climate-change/toolboxes/spruce-budworm.htm>

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