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Modeling Water Flux for a Coastal British Columbia Fertilized & Unfertilized Douglas fir Mid-Chronosequence Plantation

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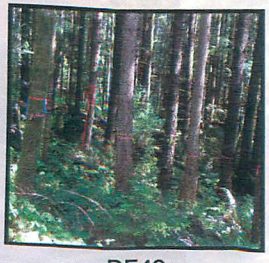
The British Columbia coastal Flux sites

- established to examine Carbon sequestration in a chronosequence of Douglas fir forest sites ranging from new forest clearcuts and young plantations to mature forest stands
- DF49, Mature stand established 1949; harvested January 2011
- HDF88, Mid-chronosequence stand established 1988
- HDF00, Youngest chronosequence stand established 2000

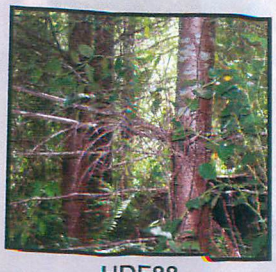
Forest Fertilization:

- All three sites fertilized January/February 2007
- Stands divided into fertilized & non-fertilized areas
- Fertilizer applied by hand around base of selected trees
- Rate of application = 200 Kg N/ha

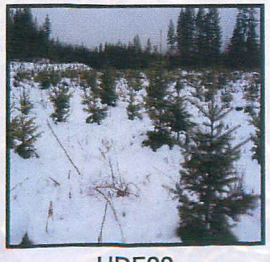


DF49

HDF88



HDF88



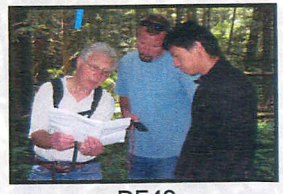
HDF00

Objectives of this study were:

- To quantify seasonal water flux (forest canopy transpiration/sapflow) for a chronsequence of coastal Douglas fir stands
- To determine if seasonal canopy water flux differences exist for fertilized (F) versus non-fertilized (NF) Douglas fir stands
- To provide data to be compared with other methods such as eddy covariance measures

Methods:

- Measurements at HDF88 intermediate chronosequence site
- TDP-30 probes installed in paired trees from both fertilized and non-fertilized stands
- 32 paired trees (16 F & 16 NF) selected ranging in diameter (dbh) from 7.0 to 24.4 cm dbh
- Measured May through September, 88 days



DF49

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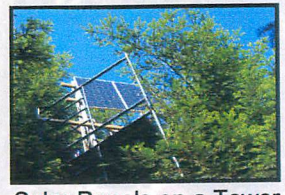


Solar Panels on a Tower

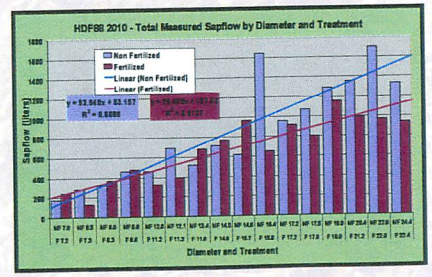
Setup in Non–Fertilized Area

Sample Trees

Sample Tree

Results & Conclusions

- Preliminary fertilization effects were examined by pairing non-fertilized (NF) and fertilized (F) trees of similar or same diameter
- Linear regression lines were fitted to both sets of data, NF & F, and slopes of lines compared for any treatment difference
- Fitted lines yielded significant r2 values of 0.810 (NF) & 0.814 (F) for total measured flow for all trees over the 88-day measurement period
- The slopes of the two lines were not parallel and crossed at around 9.9 cm dbh
- Below 9.9 cm, the F line was higher than that for NF trees, and with higher sapflow
- Above 9.9 cm, the NF line was higher than that for F trees, and with higher sapflow
- Using a paired tree approach, the results were variable, some pairs showing a positive fertilizer response, others negative, and some flipping during the growing season
- Most pairs responded positively to the 1-time fertilization up through 14 cm dbh
- Larger trees responded negatively to F, F trees having lower sapflow than their NF counterparts
- Results suggest that trees are most responsive to being fertilized when they are small in diameter prior to crown closure & the onset of intense intraspecific competition
- Smaller trees can profit from being fertilized, resulting in higher sapflow, and likely higher rates of Carbon assimilation
- Once crowns close, F profitability may diminish



Further Work

- Data will be combined with daily diurnal meteorological data in order to estimate water and Carbon flux on a per hectare basis for differing age chronosequences
- Similar measurements for HDF00 in 2011

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