12.1 AN INVESTIGATION OF CHANGES IN THE LENGTH OF THE GROWING SEASON IN OREGON

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1. INTRODUCTION

One of the expected effects of possible anthropogenic "global warming" is a lengthening of the growing season. Climate models suggest that the greatest temperature rise from an enhanced greenhouse would occur in the cold season; this might cause the dates of late spring frosts to occur earlier, and late autumn frosts to occur later, thus lengthening the "freeze free" season. According to the National Research Council (2001), "A lengthening of the growing season also has been documented in many areas, along with an earlier plant flowering season and earlier arrival and breeding of migratory birds." According to IPCC (2001), "Increases in growing-season length also have been observed in Europe—for example, in western Russia and in Fennoscandia.

2. PROCEDURE

To investigate possible growing season changes in the Pacific Northwest, the authors used data from the Historical Climatological Network for Oregon and generated time series of the last spring and first autumn occurrences of 24, 28, 32, and 36 degree F temperatures to determine trends for each station and each temperature threshold. The procedure was as follows:

1. Using daily minimum temperature data, the last occurrence in spring and the first occurrence in fall of each temperature threshold were determined. August 1 was assumed to be the beginning of "fall."
2. The difference in days between the first fall and last spring occurrence represented the "growing season."
3. Year with incomplete data were left out of the calculations.
4. Linear trends and 5-year running averages were computed.

For simplicity, only the 32 degree F results are presented here.

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3. RESULTS

Oregon encompasses very diverse geography, from mild, wet coastal areas to high mountain peaks to dry inland deserts. Precipitation, temperature and growing season vary dramatically across the state, and the temporal distributions vary as well. Nonetheless, there are some general statements about growing season that can be made:

1. Growing season length correlates closely with mean annual temperatures. Cold years tend to be cold throughout, and growing seasons correspondingly short. Figure 1 shows the growing season and mean minimum temperature at Corvallis, a high-quality rural station with more than 100 years' record.
2. The early part of the 20th century was rather cool, and growing seasons were generally short. The 1930s, on the other hand, were a warm decade, and growing season length was generally the longest on record. In addition to the Corvallis data, this is evident in North Bend (coast), Salem (Willamette Valley) and Bend (central Oregon interior) – see Figure 2.
3. Some of the sites show evidence of steady warming that appears to represent the effects of urban warming. This is especially evident in the Willamette Valley, the most heavily populated and fastest-growing part of the state.

3.1 *Discussion*

To investigate the effects of urban warming on the growing season data, we compared several sets of nearby stations located in differing physical environments. Figure 3 shows growing season length since 1949 at Hillsboro, a suburb of Portland. Hillsboro's growing season is in marked contrast to that at Clatskanie, a rural station approximately 30 miles away. Clatskanie's growing season has actually gotten shorter in the past 30 years.

Figures 4 and 5 show growing season and county population at Hillsboro and Clatskanie compared with population growth for each county. Hillsboro is in Washington County (current population 445,342) and Clatskanie is in Columbia County, which was at one time part of Washington County (county

population 43,560). We have found other examples of similar discontinuities which are probably largely due to urban/rural differences.

4. CONCLUSIONS

Growing season varies widely across Oregon. Recent decades have been warmer than those in the 1950s and 1960s, as well as those in the early part of the 20th century, but comparable to or less than the generally warmer periods in the 1930s and early 1940s. Care should be exercised in attributing growing season trends to large-scale climate change, because there is evidence that urban warming has affected temperatures (and thus, growing season) at some locations. Careful research into a measurement station's location and local geography should be undertaken before decisions are made which utilize growing season length.

5. REFERENCES

Intergovernmental Panel on Climate Change (IPCC), 2001. Climate Change 2001:Impacts, Adaptation and Vulnerability. IPCC Secretariat, Geneva Switzerland.

National Research Council, 2001. Climate Change Science: An Analysis of Some Key Questions .National Academy Press, Washington, D.C.

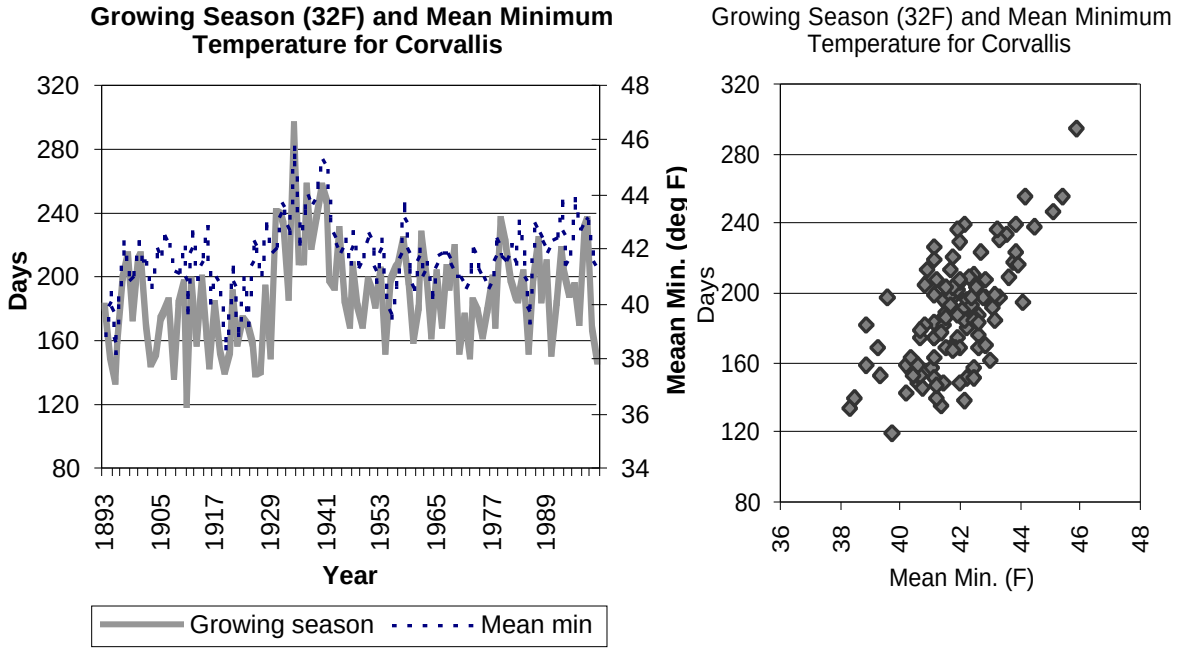

Figure 1. Corvallis growing season (32 F) and mean annual minimum temperature (left) and scatter plot of growing season vs. temperature (right).

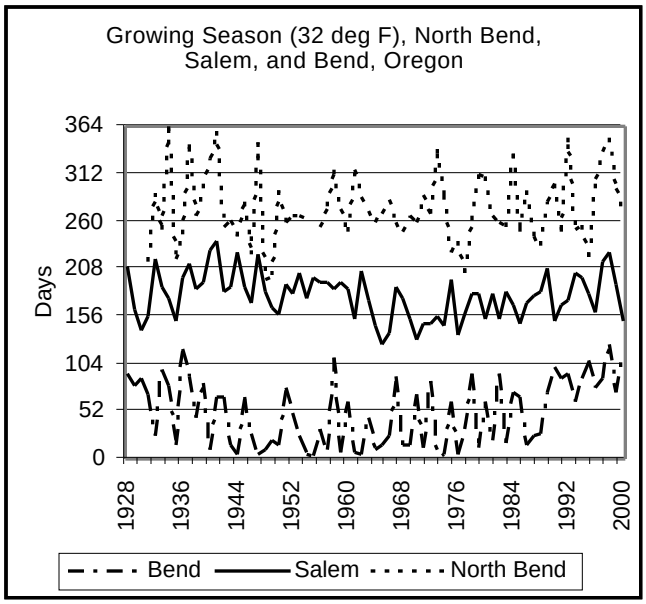

Figure 2. Growing season (32 F) for period of record at North Bend (coast), Salem (Willamette Valley and Bend (interior).

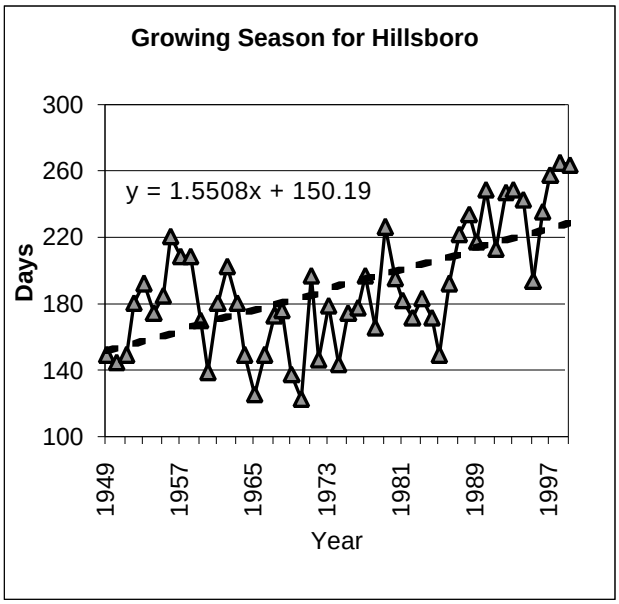

Figure 3. Growing season (32 F) since 1949 at Hillsboro. Dashed line shows best-fit linear correlation.

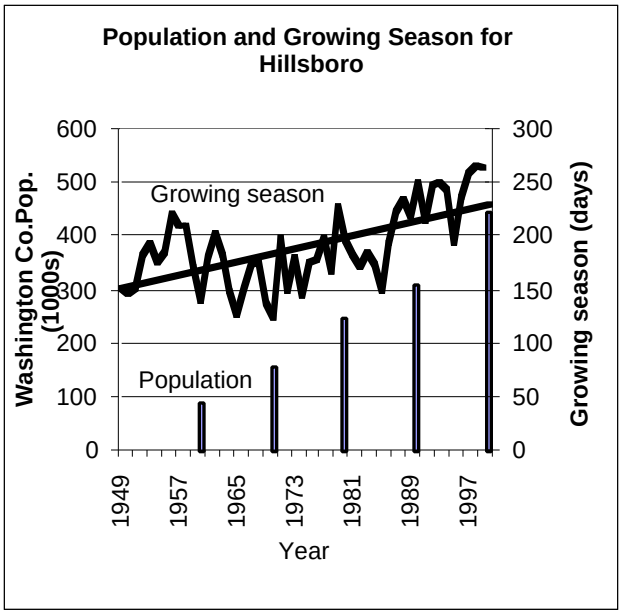

Figure 4. Growing season and population at Hillsboro, 1949-2000

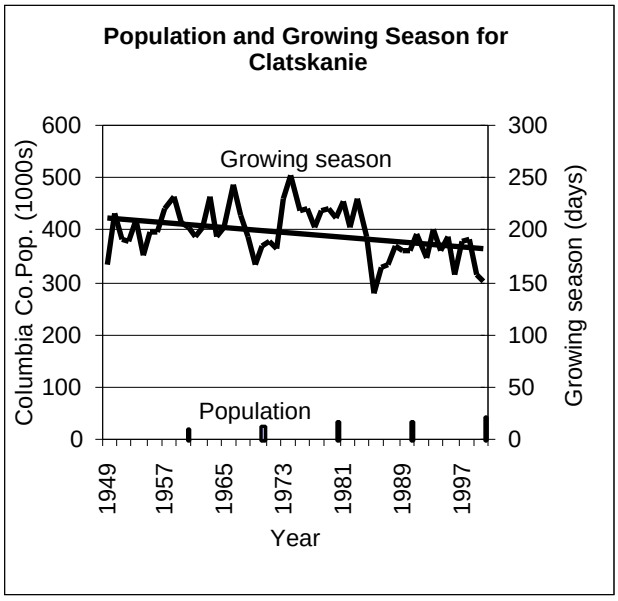

Figure 5. Growing season and population at Clatskanie, 1949-2000