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VALUING CATASTROPHIC CITRUS LOSSES

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- Serve as a nation-wide resource for research on public policy issues concerning specialty crops.
- Disseminate research results to, and interact with, policymakers; research, business, industry, and resource groups; and state, federal, and international agencies to facilitate the policy debate on specialty crop issues.

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Abstract. Courts are often required to estimate changes in welfare to agricultural operations from catastrophic events. For example, courts must assign damages in lawsuits, such as with pesticide drift cases, or determine "just compensation" when the government takes private land for public use, as with the removal of dairy farms from environmentally sensitive land or destruction of canker-contaminated citrus trees. In economics, the traditional method of quantifying producer losses is estimating changes in producer welfare, but courts rarely use this method. Instead, they turn to substitute valuation methods that may not fully capture welfare changes, such as changes in land value, tree replacement value, and total revenue. This study examines various measures for valuing the back-to-back catastrophic freezes that occurred in the Florida citrus industry in the 1980s. We first use the traditional method to determine the welfare change due to a freeze (1) for a citrus grove that loses one crop and is able to return to full production the next year, and (2) the lower measure of welfare loss due to a citrus grove that loses all of its trees and is abandoned or is replanted. The lower measure is used to simulate the legal doctrine of avoidable consequences. These measures are then compared to substitute valuation measures that have been used by courts to determine welfare changes. For case 1, total revenue overestimates losses by 35.6%. For case 2, total revenue overestimates losses by 55.3%, tree replacement value underestimates losses by 93.6%, and changes in land value underestimates losses by 13.2%.

VALUING CATASTROPHIC CITRUS LOSSES

One cornerstone of applied economic analysis is the valuation of dramatic events for policy analysis. For example, economists may estimate the effect of a disease outbreak on the beef industry as in the case of "Mad Cow Disease" or E. coli contamination of packing facilities, or estimate the effect of changes in agricultural or trade policy as in the case of Federal Agriculture Improvement and Reform Act or North American Free Trade Act. Courts, too, are often required to estimate changes in welfare to agricultural operations from catastrophic events. For example, courts must assign damages in lawsuits, such as with pesticide drift cases, or determine "just compensation" when government takes private land for public use, as with the removal of dairy farms from environmentally sensitive land or destruction of healthy citrus trees within range of canker-contaminated trees.

In economics, the traditional method of estimating the effects of a catastrophic event is the computation of the change in producer welfare, but courts rarely use this method because sufficient data may be lacking and because the method may seem complicated. Instead, they turn to substitute valuation methods that may not fully capture producer losses, such as changes in land value, replacement value, and total revenue.

This study examines various approaches for valuing losses to producers of perennial agricultural crops following a catastrophic event. One such catastrophic event was the back-to-back freezes that occurred in the Florida citrus industry in the 1980s. Following this event, citrus in Florida retreated further to the south. Using this catastrophic event as an example, we first compute producer losses using the traditional economic approach to valuing catastrophic losses—change in producer welfare. We then

compare these measures to other valuation approaches often used by courts and by the marketplace to estimate producer losses, including tree replacement value, the change in land values, and total revenue value. Although "Acts of God" are not a basis for compensation by a court, this catastrophic freeze example nonetheless provides a means for comparing the various valuation approaches. A summary of the alternative measures of economic loss due to the freezes of the 1980s for the typical 100-acre orange producer in Lake County, Florida using the estimated Lake County tree replacement distribution are presented in Table 1.

Catastrophic events that permanently damage perennial crops pose a more difficult valuation problem than annual crops. Much more data is needed to calculate changes in welfare (ΔW) using traditional economic measures, and courts must also consider contingencies. In the case of the freezes of the early 1980's, ΔW should be calculated with and without tree replacement (Adams et al). It is the lower of the two loss calculations that should be used to simulate courts' use of the doctrine of avoidable consequences, which provides that a damaged party must try to limit losses as much as possible. In our case, ΔW with tree replacement is the lower measure by $188,085 (Table 1).

If a court needs to use alternative measures, it is important to know which method performs best. For the typical 100-acre orange grove in Lake County, the ΔW is most closely approximated by the change in land values, with total revenue and cost of tree replacement providing much worse estimations.

The total revenue measure overestimates economic loss as compared to the ΔW measures both with and without tree replacement. This is expected because the total

revenue concept pays the grove owner for variable costs that the grove owner did not experience (e.g., pick and haul costs). Total revenue is an imprecise measure of economic loss. For the typical 100-acre grove in Lake County, the total revenue measure with tree replacement overestimates economic losses by $428,082 in year 2002 dollars, or 55.3% when compared to ΔW with tree replacement (computed from Table 1).

Table 1. Alternative measures of freeze loss for a
100-acre citrus grove in Lake County, Florida.

Method	Loss[a]
ΔW [b] without tree replacement	$-961,608
ΔW with tree replacement	-773,522
Tree replacement cost only	-49,900
Lost land value	-671,100
Total revenue w/out tree replacement	-3,823,062
Total revenue with tree replacement	-1,201,604

[a] Loss over life of grove (30 Years), in year 2002 dollars

[b] ΔW is defined as the dollar amount that will make the complaining party "whole" or as well off with the court-awarded compensation as they were before the catastrophic event.

The cost of tree replacement measure also does not perform well. It does not consider the lost revenue from current or future income that will result from the increasing yield, as the tree gets older, so it severely understates the economic loss experienced by the grove owner. Cost of tree replacement is a very imprecise measure of economic loss. In this case, when compared to ΔW with tree replacement, it

underestimates producer losses by almost $723,647, or over 93.6% (computed from Table 1).

Finally, change in land value performs the best when compared with ΔW with tree replacement, but it underestimates producer loss. Here, the change in land value when compared to ΔW with tree replacement, underestimates producer loss by $102,420 or 13.2% (computed from Table 1). Although this method performs best among the alternative methods, change in land values may not be a good estimate of producer losses, especially when urban development pressures are strong. Figure 1 shows the changes in average per acre land values for Lake County between 1981 and 1986.

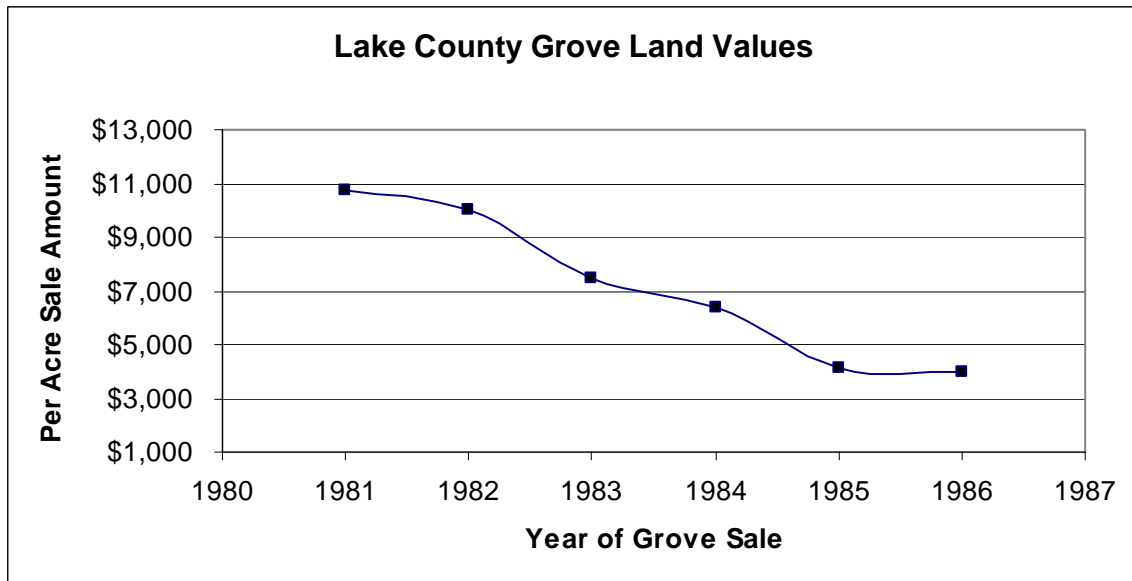**Lake County Grove Land Values**

Figure 1. Average per acre land values for Lake County orange groves before and after the 1983 freeze event.

In theory, successful lawsuits are meant to make the complaining party "whole" or as well off with the court-awarded compensation as they were before the catastrophic

event. This is equally true for personal injury awards as it is for government takings awards. In economics, the traditional method for determining the amount needed to make the party "whole" is a ΔW estimation. While the most accurate, this method requires complicated calculations and an understanding of economics and statistics to make appropriate estimations. As such, courts often turn to alternative measures, like change in total revenue, change in land value, or cost of tree replacement. These measures may not accurately capture producer losses due to a catastrophic event. Our estimates suggest that this is the case for the back-to-back freezes of the early 1980's (1) for a citrus grove that loses one crop and is able to return to full production the next year and (2) for a citrus grove that loses all of its trees and is abandoned or is replanted. For case 1, total revenue overestimates losses by 35.6%. For case 2, total revenue overestimates losses by 55.3%, tree replacement value underestimates losses by 93.6%, and changes in land value underestimates losses by 13.2%.

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