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**IDENTIFYING LONG RUN AGRICULTURAL RISKS AND EVALUATING
FARMER RESPONSES TO RISK**

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Comments on "Western Water Policy from an Agricultural Risk Perspective"
by Delworth Gardner

Discussion by Bruce A. McCarl

Del Gardner's paper on western water policy provides an interesting historical review of water policy with some material relating to a risk perspective. However, to a large extent the manuscript does not probe deeply into many risk issues. Thus, I am accepting Dr. Gardner's invitation to probe more deeply into the risk issues regarding western water policy. However, I am not in a position to write an entire paper on this topic as discussions are ordinarily limited to only two or three pages. Thus, I will provide a broad overview of the topic.

First, let me say, that when viewing western water policy from an agricultural risk prospective one can probably should use a fairly broad definition of risk. The definition of risk used here will involve income fluctuation, resource availability fluctuation, fluctuation in producers ability to pay fixed commitments and fluctuation in societies exposure to poor investments.

I will structure this discussion around four propositions: 1) western water supply and agricultural water use are risky propositions; 2) western water policy has responded to risk; 3) western water has become even more risky in recent years; and 4) western water policy is under stress and needs to respond yet further.

Water Supply and Agricultural Water Use is Risky

Water is a critical resource in many areas of the country. In regions, agricultural

production is impossible without water. Water also is an essential input to human life and many human activities. However, while water is such an essential input it is also a highly variable input in terms of supply from surface water dependent systems. For example, the coefficient of variation in recharge to the Edwards Aquifer in Texas is roughly two-thirds. Similarly, in the Columbia River the coefficient of variation is almost as large. Groundwater is also risky.

Furthermore, water demand is inversely related to supply with increased water conceivably needed under drought conditions to supplement lost natural rainfall. Thus, not only does supply fluctuate substantially but demand inversely fluctuates.

Reliance on groundwater can insure one of the declining water availability scheme and makes long term investments in high priced irrigation equipment difficult pay back. A number of other risk factors are also relevant. Low priced water has led many to capitalize the excess value of water into the federal and this is put individuals in risky positions as increases in water prices to recover "full" cost are considered. Finally, the increased reliance on irrigation has tended to make larger areas of the country more highly correlated and this in itself leads to an increase in the variance as compared to times when more independent production decisions were made (as argued in Hazell).

Water Policy has Adjusted to Take Care of Some of the Risk

Water policy is one of the first institution structures which explicitly recognized fluctuations in input availabilities. Obviously, the first in time first in right, prior appropriation doctrine is designed to accommodate uncertainty. Nowadays this doctrine is

overland with water marketing policies which permit individuals to purchase senior rights of others thereby gaining some insurance against water fluctuations. Water policy has also fostered large water developments providing more secure irrigation water supplies which again has aided in mitigating water availability risk.

Water is becoming yet more risky

Today water is riskier than it was yesterday. There is also declining availability of water development opportunities. Increases in population have lead and will lead to increased dependence on water for municipal and agricultural uses. This ever increasing demand means that the relatively constant supply has lead to the price being driven higher and higher. In many areas water rights exceed the dependable flow and rivers are known as fully appropriated. Increasingly junior users have higher use values with people used to paying four to five hundred dollars per acre foot for tap water being junior to 30-50 dollars per acre foot agricultural usages. In such cases, the junior users could buy out the agricultural user without a great percentage increase in their water bills. Increasingly there is intersectorial and interstate conflict with one area championing its right to water over another. There is increasing discussion of changes in water pricing with farmers having to pay the "real" cost of water. Groundwater policy is in a state of flux everywhere. Increasingly there are calls for conjunctivally managing ground and surface waters to help alleviate drought situations. Water developments has become increasing politicized. Increasingly laws are being placed on the books to provide certain essential but junior users priority rights over senior water users.