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NIRAP and the CARD/RCA Model: Linkages and Assumptions

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NIRAP and the CARD/RCA Model: Linkages and Assumptions

Abstract

In response to the Project Advisory Committee's inquiries, this note examines the consistency of using outputs from the National Inter-regional Agricultural Projection model (NIRAP) as inputs to the CARD/RCA linear programming model. To examine this, the paper first addresses the output that the CARD/RCA model is scheduled to use from NIRAP and then examines the consistency of assumptions between these two models. Finally, the consistency between NIRAP's projected values and the LP's projected values will be examined.

Disciplines

Agricultural and Resource Economics | Agricultural Economics | Econometrics

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PRELIMINARY DRAFT

NIRAP AND THE CARD/RCA MODEL:

LINKAGES AND ASSUMPTIONS

by

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Working Paper

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In response to the Project Advisory Committee's inquiries, this note examines the consistency of using outputs from the National Inter-regional Agricultural Projection model (NIRAP) as inputs to the CARD/RCA linear programming model. To examine this, the paper first addresses the output that the CARD/RCA model is scheduled to use from NIRAP and then examines the consistency of assumptions between these two models. Finally, the consistency between NIRAP's projected values and the LP's projected values will be examined.

Demand for Exogenous and Endogenous Commodities

The demand for exogenous and endogenous commodities are the driving force in the CARD/RCA programming models. For exogenous commodities, the resources used must be subtracted from the resources available for agricultural production, while for the endogenous commodities, the model's solution determines the required resources.

Exogenous commodities¹

The exogenous commodities can be grouped into four types -- row, close grown, vineyards and orchards, and livestock. The commodities within each of these categories are shown in Table 1. Land and water requirements must be determined for the first three categories as well as location of production. Location of the exogenous livestock and their water and feed requirements are also needed.

¹Taken from English, Burton C. Assumptions on the 1985 RCA: A Review, background paper for PAC, CARD Series Paper 83-7.

Table 1. Land and water requirements

Crop type	Exogenous commodity
Row	Sugarcane, sugar beets, tobacco, vegetables and melons, Irish potatoes, sweet potatoes, dry beans, flaxseed
Close grown	Rice, rye
Vineyard and orchards	Citrus fruits, noncitrus fruits, and nuts
Livestock	Lambs and mutton, chicken, turkeys, and eggs

Table 2. Exogenous crops and their corresponding NRI codes

Exogenous crop	NRI code	Crop type
Tobacco	016	Row
Sugar beets	017	Row
Potatoes	018	Row
Other vegetables	019	Row
All other row crops	020	Row
Flax	115	Row
Rice	115	Close grown
All other close grown	116	Close grown
Fruit	001	V and 0 ^a
Nut	002	V and 0
Vineyard	003	V and 0
Bush fruit	009	V and 0
Berries	005	V and 0
Other horticulture	006	V and 0

^aVineyards and orchards.

For the exogenous crops, the location and land use will be determined by NIRAP at a state level and distributed to the PA. The quantity of land taken out of production will be disaggregated to land group and subtracted from land availability. This will be achieved by using the proportion of land in production on a given land group as identified by the NRI. It is assumed that the land cover/use numbers as reflected in Table 2 will be used to identify the proportions required.

Water requirements will be done in a similar manner to that in the 1980 RCA. The projected irrigated acres producing exogenous crops will be used in conjunction with consumptive water use coefficient developed by the Special Projects Division of SCS and summed to find a total exogenous crop water requirement.

Livestock can be either exogenous or endogenous. When all livestock is exogenous, more information is required of NIRAP than when it is endogenous. Livestock types that are always exogenous include lamb and mutton, chickens, turkeys, eggs, and fish. Beef, pork, and dairy can be treated as endogenous or as exogenous.

Information required from NIRAP of these livestock types includes state production levels and national projections, of imports, exports, other use, and per capita consumption.

Endogenous commodities

Endogenous crop commodities include barley, corn, corn silage, cotton, legume hay, nonlegume hay, oats, peanuts, sorghum, sorghum silage, soybeans, sunflowers, and wheat. National levels of exports, per capita consumption, imports, other use, and total production are needed for each of these commodities.

Feed use for exogenous crops will be derived using CARD's methodology and NIRAP state production estimates. Feed use will be determined by state and then weighted to market region (Figure 1) using one of two methods. If over time (1949-1978) the livestock within a state has not noticeably shifted from one state portion of a market region to another, then the 1978 Census information will be used to create weights. If shifting has occurred, then a trend over time will be used.

Exports and imports

Finally, it is required that location of exports/imports be provided. It is assumed that export/import will occur at three locations -- Atlantic Ocean, Gulf Coast, and Pacific Ocean. Table 3 indicates the ports for each of three areas.

Table 3. Ports by geographic area

Ports	Designation Assumption		
	Atlantic Ocean	Gulf Coast	Pacific Ocean
Boston	X		
Charleston	X		
Houston		X	
Los Angeles			X
Miami	X		
New Orleans		X	
New York	X		
Norfolk	X		
Portland			X
San Francisco			X

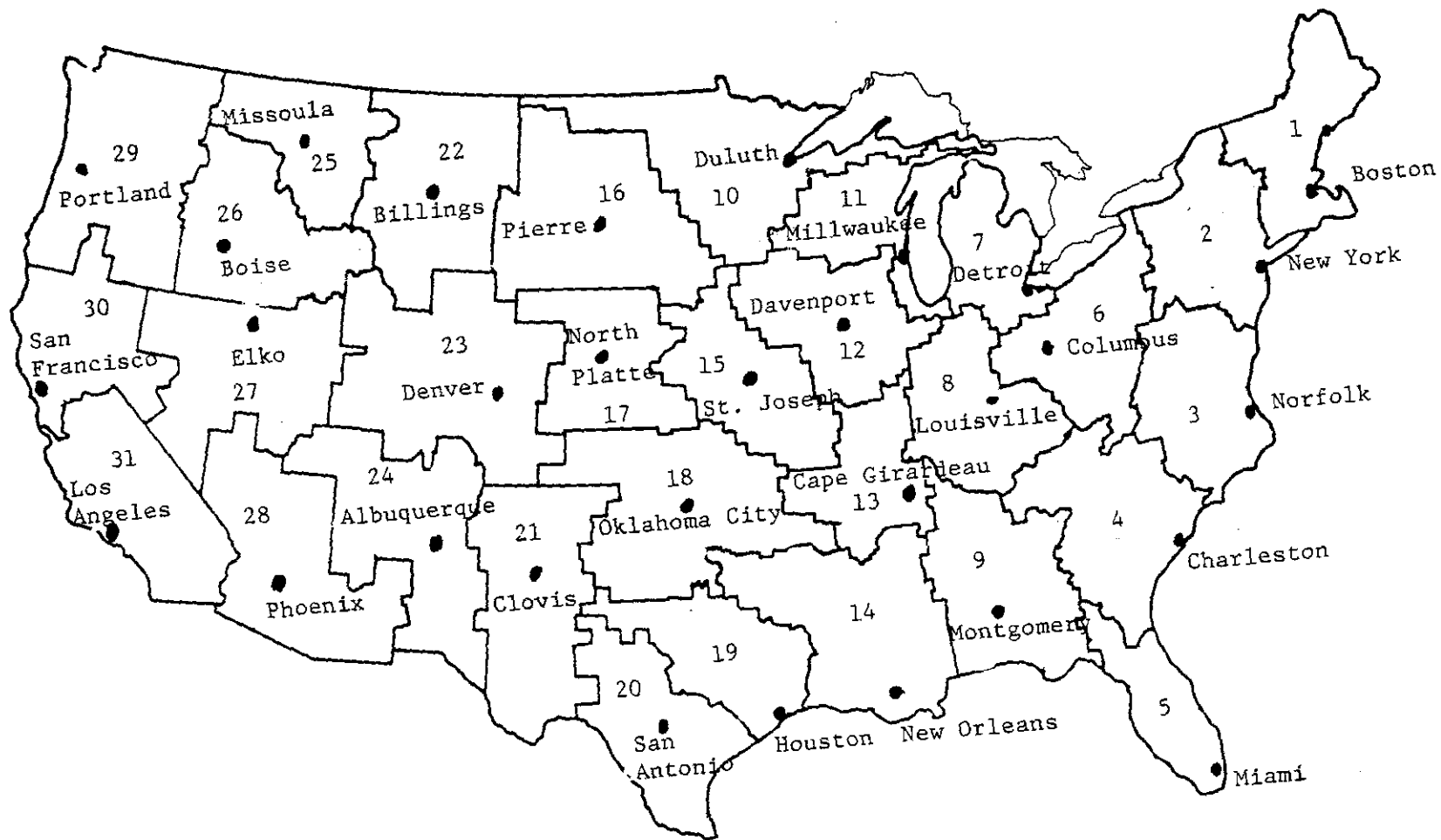


Figure 1. 31 Market regions

Consistant Assumptions

To examine the consistant assumption issue, it is necessary to identify similar assumptions made in both of the models. A sketch of important components used by NIRAP is shown in Figure 2. The model can be divided into three parts. The first part shows the scenario or input component. The second part shows these components required for solution equilibrium. Finally, the third part includes land use components. The major assumptions are made in the first part.

Also included is a sketch of the important components of the CARD/RCA model (Figure 3). The model includes crop, livestock and range production sectors along with input purchase, transportation, and water sectors. Various assumptions are made in each of these sectors with some of the important assumptions being made as to yield productivity, land use, and the environment.

Table 4 lists the assumptions used by both models and the place where these assumptions are made. These assumptions are used by both models. It is needed to insure that similar values be used.

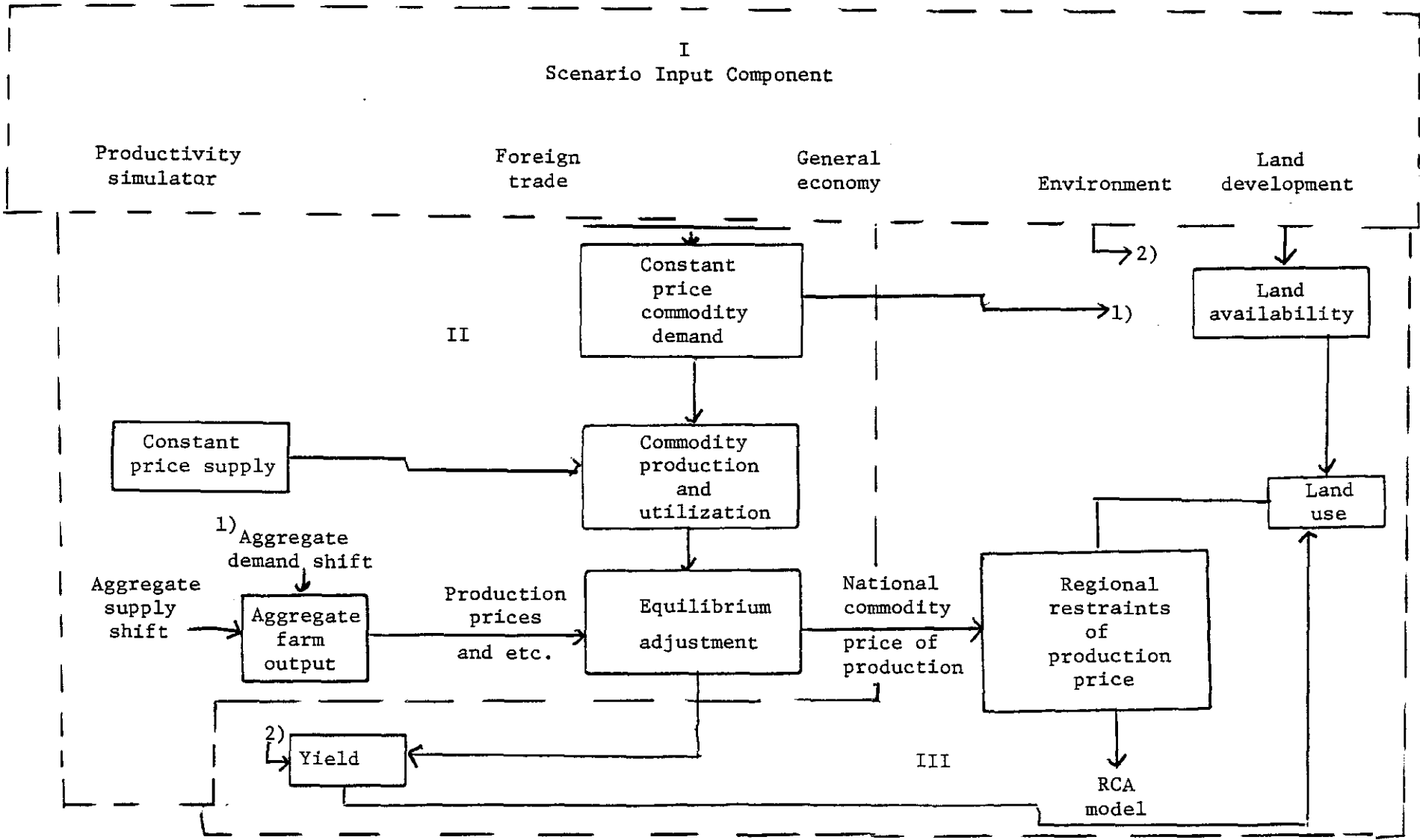


Figure 2. Overview of NIRAP model

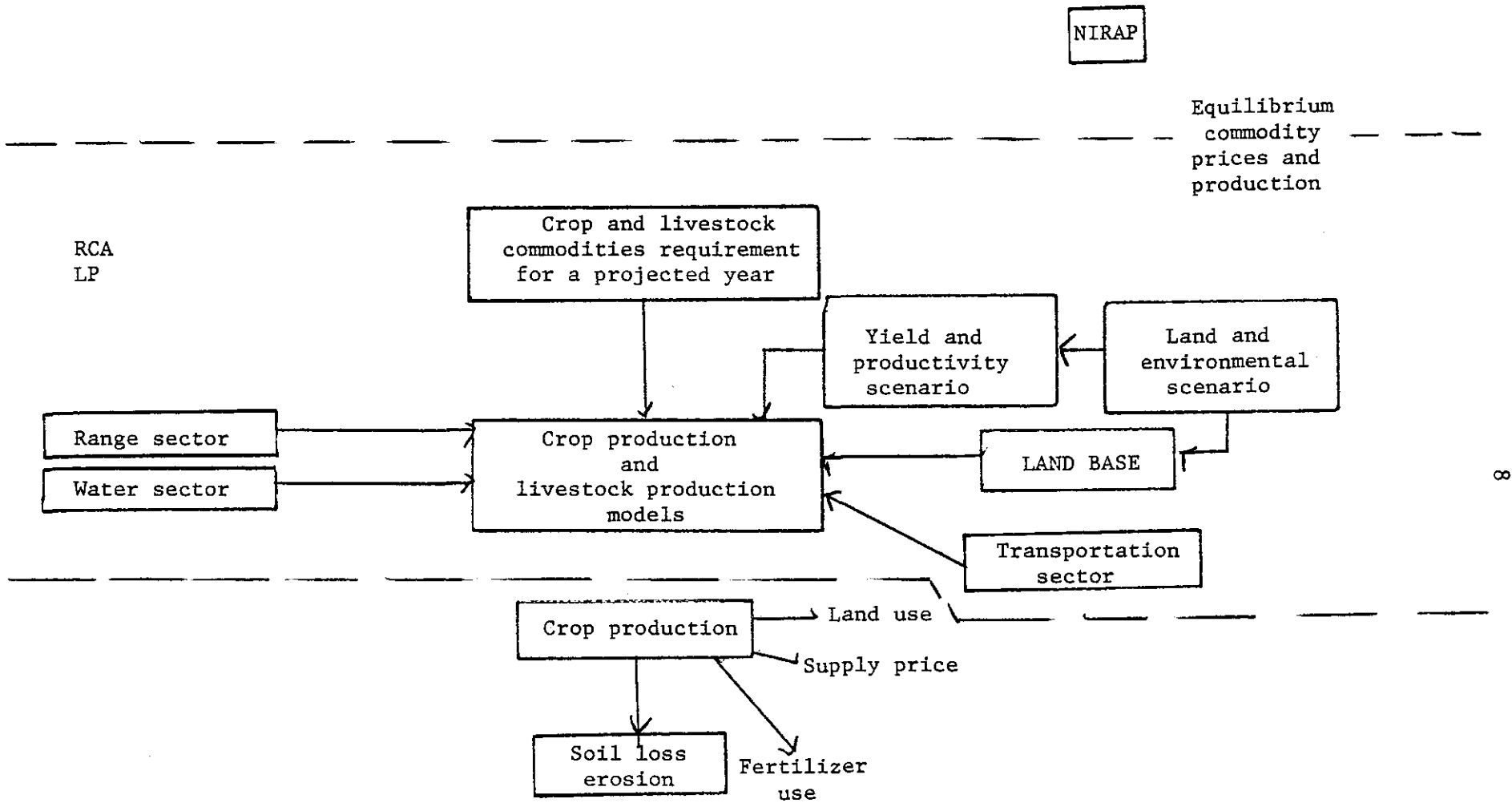


Figure 3. Overviews of RCA LP model

Table 4. List of assumptions used in the NIRAP and CARD/RCA model

Assumption	NIRAP Model	CARD/RCA Model
1. U.S. population	General economy component	1. Land base 2. Distribution of demands 3. Allocation of some exogenous water use
2. U.S. GNP growth rate	General economy component	
3. Inflation rate	General economy component	
4. Interest rate		Cost calculations
5. Input prices	Productivity scenario	1. Water sector 2. Transportation 3. Yield and productivity
6. Other agricultural land	Land use	Land use
7. Irrigation development	Land use	Land base and water sector
8. Technological change	Productivity	Yield and livestock
9. Double cropping	Land use	Internal

Results Consistency

In providing the aggregate commodity production for the CARD/RCA model, the NIRAP model also produces information on:

1. Equilibrium commodity market price, and
2. Regional land use patterns

To meet the NIRAP's aggregate production estimates, the CARD/RCA model solves for a least-cost land use pattern in each producing area and on each land quality group. It also produces the supply (shadow) price. Therefore, questions concerning the consistency of the estimated land use pattern and the commodity prices becomes apparent. For instance, are these two land use patterns consistent? Are NIRAP market prices consistent with the CARD/RCA supply prices? The first question can be resolved if it is assumed that the state production shares used in NIRAP will shift toward the land use pattern which exhibits least-cost efficiency characteristics. The second question can also be resolved if the CARD/RCA supply prices are less than the NIRAP market prices and the difference in prices is within a reasonable range. If this is not the case, a different analytical method should be used to eliminate the inconsistency.