IMPLICATIONS OF A DEREGULATED WHEAT MARKET FOR THE WESTERN CAPE PROVINCE: EVALUATION WITH THE AID OF A SPATIAL MODEL

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The deregulation of the single channel marketing system for wheat poses new challenges to producers and advisors in the Western Cape Province. This deregulation is simultaneous with a number of other changes in the socio-political, economic, marketing and technological environments. In facing these challenges it is necessary to incorporate such diverse trends as globalisation and individualisation within a single framework.

In the first part of this paper the development of a model, combining spatial data, resource attributes, crop characteristics and financial/economic data in an interactive model is described. This is followed in the second part by the evaluation of the impact of certain macro-economic variables on farm-level enterprises. This is done with the aid of six scenarios. It was found that, under certain specific conditions (i.e. low international wheat price, zero tariff protection and 40 percent of production being exported), wheat production in the Western Cape is unprofitable. However, if an import tariff on wheat of 30 percent (fob, ad valorem) is introduced and the marketing mix is changed to only 20 percent of local production being exported, then ceteris paribus, wheat can be profitably produced on 68 percent of the area. This allows the opportunity for structural adjustments and cost reducing practices. If the cost of production is lowered by 20 percent and the import tariff removed, then, ceteris paribus, wheat can be profitably produced on 59 percent of the area. Even more important than the results from the scenarios is the fact that a methodology was developed through which the impact of macro-economic variables on farm level profitability can be investigated. As this methodology allows for the identification of specific areas or farms that will be adversely affected, specific remedial measures can be implemented. This methodology will be an important tool in the hands of decision-makers.

1. INTRODUCTION

The Western Cape has traditionally been seen as the breadbasket of South Africa. Although the province produced only 31,6% of the wheat-crop in South Africa (average for the period 1986 – 1996), it is by far the most stable wheat producing area in the country. This is illustrated by the coefficient of variation, which was 17,2% by volume of wheat produced during 1986-96, compared to 40,5% in the rest of South Africa over the same period. In the

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previous political dispensation this stability contributed to the policy objective of food self-sufficiency. The incentives that accompanied this policy objective resulted in the production of an annual surplus of wheat in the Province. On average, for the period 1986 to 1996, 49% of the wheat produced in the Province was not consumed locally. In some years this surplus was as high as 62% of production (Wheat Board, 1997).

The political transformation in South Africa in 1994, coupled with trade liberalisation and market deregulation, has, however, led to new policy objectives. This implies *inter alia* a movement away from food self-sufficiency to food security and to a liberalised trade regime. The result is that the Western Cape, with a traditionally secure market for its surplus wheat in the rest of South Africa, needs to re-evaluate its options and strategies.

A couple of other apparently conflicting trends influencing Western Cape wheat producers are the trend to globalisation on the one hand, and the trend to individualisation on the other. By implication, local wheat producers have become part of the international playing field, but in the same instance they cannot be treated as a homogeneous group. The particular and unique circumstances of each individual producer must be evaluated and taken into consideration in any attempts to propose future strategies for the industry. In this paper the application of a geographic information system (GIS), to allow for the spatial dimension and characteristics of wheat production, will be illustrated as an aid in managing these two apparently conflicting trends.

2. DESTINATIONS FOR WESTERN CAPE WHEAT

Wheat produced in the Western Cape Province can be marketed either locally, in other metropolitan areas within South or Southern Africa, or abroad. For the purposes of this paper Cape Town was identified as the main local market, Gauteng as the main market within South(ern) Africa and the Far East (Japan) as the main export market.

2.1. Domestic market

As South Africa is a net importer of wheat in seven out of ten years (Wheat Board, 1997), the main factors influencing local prices will be the international price of wheat and the import tariff. Although the method of calculation of a tariff (a moving tariff *versus* a fixed *ad valorum* tariff) is still under contention, a fixed *ad valorum* tariff is used here for illustrative purposes. The calculation of the price that farmers can expect at the silo gate[1], given a FOB price of US$140 per ton, is illustrated in Table 1.

Table 1: Calculation of Silo-gate price of wheat, marketed locally or in Gauteng, realised by Western Cape producers (1998)

ITEM	TARIFF LEVELS							
	0%		10%		20%		30%	
	WCape	Gaut.	WCape	Gaut.	WCape	Gaut.	WCape	Gaut.
Trigo Pan (FOB) ($)	140.0	140.0	140.0	140.0	140.0	140.0	140.0	140.0
Shipping ($) (+)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Insurance ($) (+)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Tariff ($) (+)	0.0	0.0	14.0	14.0	28.0	28.0	42.0	42.0
CIF ($) (=)	160.6	160.6	174.6	174.6	188.6	188.6	202.6	202.6
Exchange rate (R/$)	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
CIF (R) (=)	786.8	786.8	855.4	855.4	924.0	924.0	992.6	992.6
Docking costs (R) (+)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Discharge cost (R) (+)	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5
Landed cost (R) (=)	835.3	835.3	903.9	903.9	972.5	972.5	1 041.1	1 041.1
Transport to mill (R) (+)	32.0	105.0	32.0	105.0	32.0	105.0	32.0	105.0
Financing (R) (+)	97.6	105.8	105.3	113.5	113.0	121.2	120.7	128.9
Price at mill (R) (=)	964.9	1 046.1	1 041.2	1 122.4	1 117.5	1 198.8	1 193.9	1 275.1
Transport mill (R) (-)	28.0	177.0	28.0	177.0	28.0	177.0	28.0	177.0
Silo price (R) (=)	936.9	869.1	1 013.2	945.4	1 089.5	1 021.8	1 165.9	1 098.1
Storage (W Cape) (R) (-)	65.0	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Storage (Gaut) (R) (-)		40.0		40.0		40.0		40.0
Silo-gate price (R) (=)	871.9	764.1	948.2	840.4	1 024.5	916.8	1 100.9	993.1
% Difference	0.0	0.0	8.8%	10.0%	17.5%	20.0%	26.3%	30.0%

Sources: Calculated from Lourens (1997), Mentz & Nqaba (1997), IWC (1994), Renfreight (1997), Snyman (1997) and Lewis (1997)

In Table 2 the effect of a range of FOB prices in US$ per ton on the silo-gate price is illustrated.

2.2. International market

In circumstances where a surplus of wheat (either produced or imported) exists in the other South African markets, new markets must be found for some of the wheat produced in the Western Cape Province. Using the Far East (Japan) as an example, a similar calculation shows the silo-gate price that producers in the Western Cape can expect under these conditions. The results of these calculations, on the basis of a parametric analysis incorporating changes in exchange rate and wheat prices, is presented in Table 3.

3. THE SPATIAL MODEL

Location has as important an effect on the profitability of a farming enterprise as other factors such as the quality of the natural resource base and the quality

Table 2: Silo-gate price of wheat, marketed locally or in Gauteng, realised by Western Cape producers: Parametric analysis of different import tariff levels vs. FOB price (Gulf of Mexico)

FOB	TARIFF LEVELS							
	0%		10%		20%		30%	
	W Cape	Gauteng	W Cape	Gauteng	W Cape	Gauteng	W Cape	Gauteng
$100	R 653	R 545	R 707	R 600	R 762	R 654	R 816	R 709
$120	R 762	R 655	R 828	R 720	R 893	R 785	R 959	R 851
$140	R 872	R 764	R 948	R 840	R 1 025	R 917	R 1 101	R 993
$160	R 981	R 874	R 1 069	R 961	R 1 156	R 1 048	R 1 243	R 1 135
$180	R 1 091	R 983	R 1 189	R 1 081	R 1 287	R 1 179	R 1 385	R 1 277
$200	R 1 200	R 1 093	R 1 309	R 1 202	R 1 418	R 1 311	R 1 527	R 1 420

Source: Troskie, 1998:13

Table 3: Parametric analysis: Silo-gate price (per ton) of wheat exported given changing international prices and exchange rates

Change in exchange rate	Price					
	$100	$120	$140	$160	$180	$200
30%	R 88.90	R 149.50	R 210.10	R 270.70	R 331.30	R 391.90
20%	R 122.38	R 191.64	R 260.90	R 330.15	R 399.41	R 468.67
10%	R 155.87	R 233.78	R 311.70	R 389.61	R 467.52	R 545.44
0%	R 189.35	R 275.92	R 362.50	R 449.07	R 535.64	R 622.21
-10%	R 222.84	R 318.07	R 413.29	R 508.52	R 603.75	R 698.98
-20%	R 256.32	R 360.21	R 464.09	R 567.98	R 671.86	R 775.75
-30%	R 289.81	R 402.35	R 514.89	R 627.44	R 739.98	R 852.52
-40%	R 323.30	R 444.49	R 565.69	R 686.89	R 808.09	R 929.29
-50%	R 356.78	R 486.64	R 616.49	R 746.35	R 876.21	R 1 006.06
-60%	R 390.27	R 528.78	R 667.29	R 805.81	R 944.32	R 1 082.83

Source: Troskie, 1998:18

Notes:
a) The base exchange rate is assumed to be R4,90 for each US$1 (as was the case when the model was developed).
b) In the Change in exchange rate column a positive sign indicates a strengthening of the exchange rate and a negative sign a weakening of the exchange rate.

of management. The usual (and often implicit) assumption in the analysis of the policy implications of scenarios such as those detailed above is that the affected area is represented by a single point on a map. The farm-gate price is influenced by the geographic location of each producer, and therefore by the distance to markets.

3.1. Transport cost

In the development of the spatial model the transport cost (a) from the farm gate to the silo, and (b) from the silo to the final destination was taken into consideration. Three distance categories were defined in the case of transport from the farm gate to the silo. These include those farms within or equal to a radius of 15 kilometres from the nearest silo; farms situated less than or equal to 30 kilometres, but more than 15 kilometres from the nearest silo; and farms situated more than 30 kilometres from the nearest silo. It was further assumed, based on Finrec (1996) results, that a truck with a capacity of eight tons was used in the transport of the wheat from the farm to the silo. Based on these assumptions the transport costs from farm-gate to silo would, according to Mentz & Nqaba (1997), amount to:

- Radius less than or equal to 15 km: R6,92 a ton
- Radius more than 15, but less or equal to 30 km: R17,31 a ton
- Radius more than 30 km: R34,62 a ton

For the purposes of the model the second part of transport costs, namely the points where the Western Cape produced wheat leaves the agricultural distribution channels are:

- The mills in Paarl for wheat consumed in the local market,
- Rustenburg via Beaufort-West for wheat consumed in Gauteng, and
- Cape Town Harbour in the case of wheat being exported.

It was assumed that transportation by rail would be the most cost-effective method of transportation. Due to the competitive nature of the transport sector, however, role-players were unwilling to make known their rates. This problem was circumvented by means of a range of assumptions. The consequent results were tested on the relevant role-players during a number of iterations until reliable transport costs were arrived at from each silo to the respective destinations. Due to the confidentiality of the results the data cannot be presented here, but were included in the model by replacing the transport costs presented in Table 1 with the relevant vector.

3.2. Agricultural potential for rainfed wheat production in the Western Cape Province

A map of the potential for wheat production in the Western Cape can be produced by combining the most important factors influencing rainfed wheat production with the crop characteristics of wheat in a GIS-model. The relevant

factors include soil characteristics, annual rainfall, the distribution of such rainfall through the year, and minimum and maximum temperatures. Wheat produced under irrigation is not included in the model due to the opportunity costs[2] involved and the limited availability of water for agricultural activities in the Western Cape.

It is important to note that this map represents an indication of the potential for wheat production and not the actual yields achieved. The reason is twofold. In the first instance the necessary data to monitor the actual yields are not available. In addition, the map will only be used to identify the actual location of four classes of land, namely high-, medium-, low potential and unsuitable areas for rainfed wheat production. Through a process of consultation with experts more realistic levels of actual yields were identified in defining the yield classes used in the spatial model (see Table 4).

Table 4: Yield-levels of wheat used in the spatial model

YIELD-CLASS	YIELD (t/ha)		
	Average	Lower limit	Upper limit
Unsuitable		0	<1
Low potential	1,5	1	<2
Medium potential	2,5	2	<3
High potential	3,5	3	No limit

3.3. Combining the different aspects of the model

The components of the model, namely the price of wheat, transport cost and potential for rainfed wheat production, were combined in a simple matrix in an Excel worksheet in such a way that the parameters could be changed with a minimum of effort. As the aim is to identify the profitability of wheat production in different localities, the costs of production (based on Combud (1997) and Finrec (1996) results) were included in the matrix for each specific locality and yield class. Although a wide variety of production systems exist, the model was initially based on a traditional wheat-wheat production system.

3.4. Development of scenarios

The development of scenarios is a useful tool for evaluating the effects of a wide variety of external and internal factors. Through the process of scenario development a progressive reflection of the impact of these factors on the

subject can be created. It must, however, be kept in mind that assumptions used in the scenarios are often as important as the results of the scenarios themselves, and that no scenario is the final answer. In most cases, therefore, scenarios can and should do no more than contribute to a better understanding of the subject. Table 5 provides an indication of the assumptions used in the development of the respective scenarios.

Table 5: Assumptions on which scenarios are based

ASSUMPTION	SCENARIO					
	I	II	III	IV	V	VI
Level of tariff protection	0%	30%	30%	0%	0%	0%
FOB price of wheat*	$100	$100	$100	$100	$140	$180
Change in cost of production	0%	0%	-20%	-20%	-20%	-20%
Change in exchange rate	0%	0%	0%	0%	-10%	-10%
Percentage consumed locally	40%	40%	40%	40%	40%	40%
Percentage consumed in Gauteng	20%	40%	40%	40%	40%	40%
Percentage consumed abroad	40%	20%	20%	20%	20%	20%

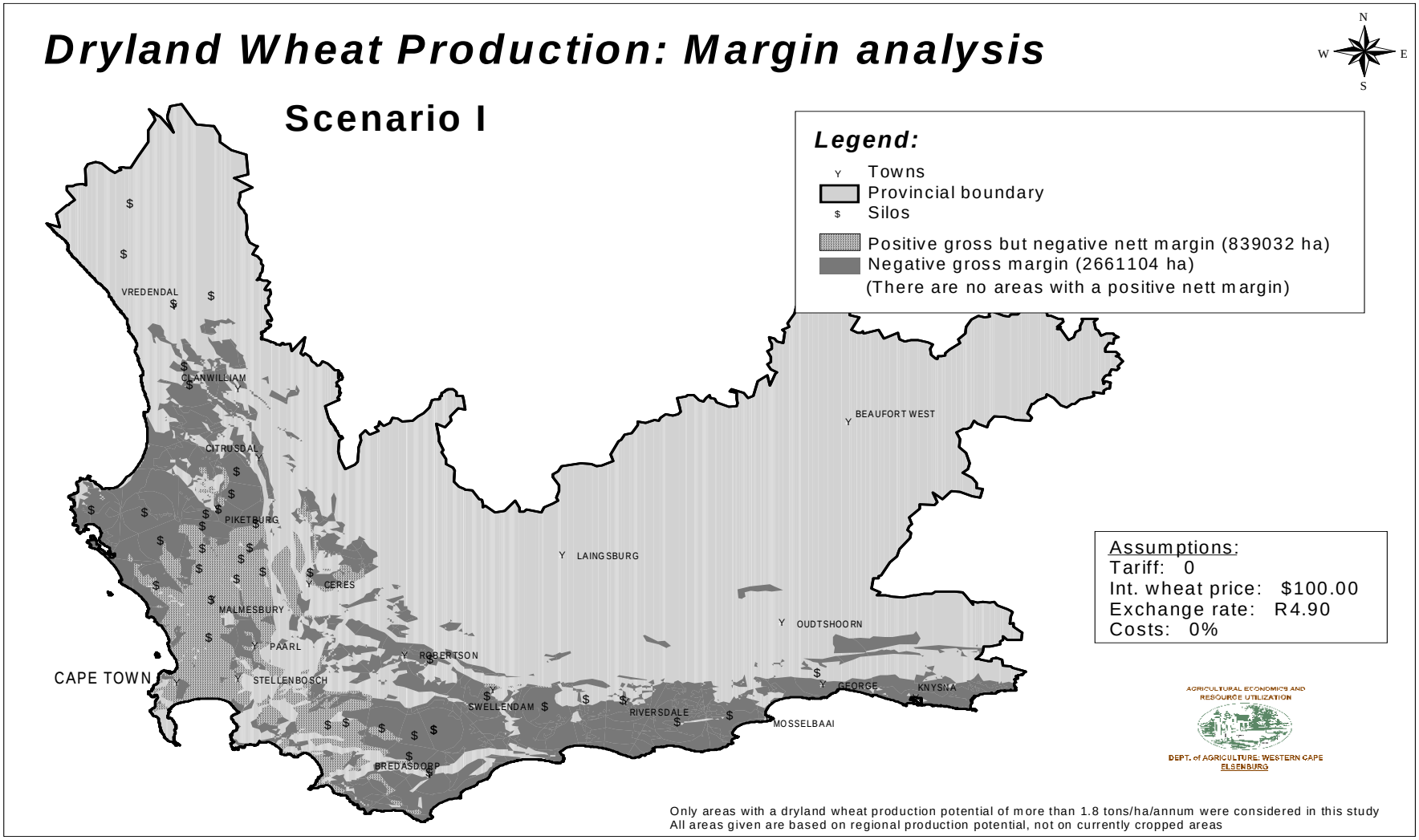
* US$/ton, Gulf of Mexico

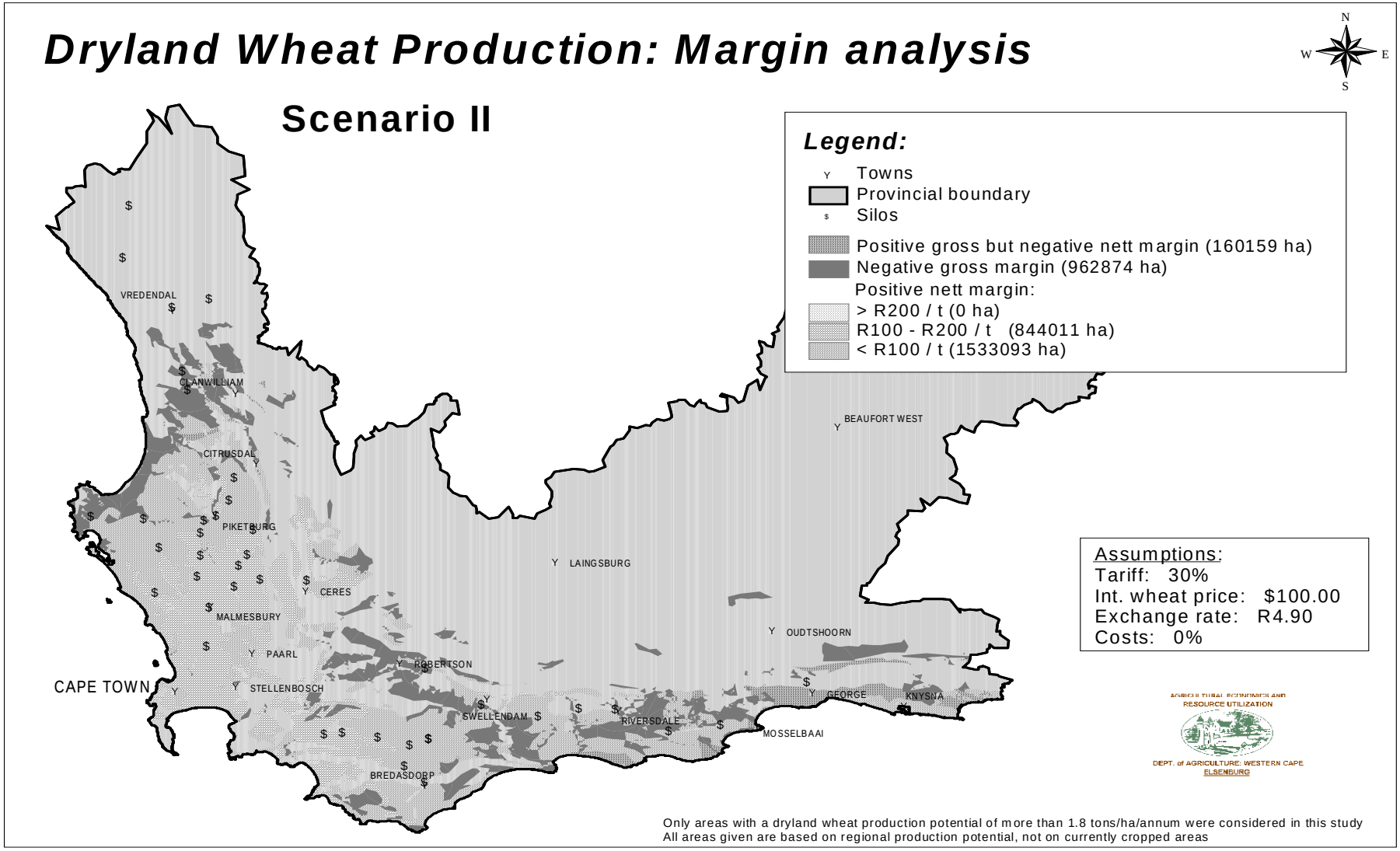
It must be noted that a weakening in the exchange rate would lead to an increase in the price, as quoted in Rand, of imported wheat. It would, however, also lead to an increase in the cost of production. Therefore, in those scenarios where a weakening of the Rand/US$ exchange rate is assumed, the local cost of wheat production was adapted by a factor based on the results of van Shalkwyk *et al* (1995). The change in the cost of production is achievable, as is indicated in Smit & Van Zyl (1998).

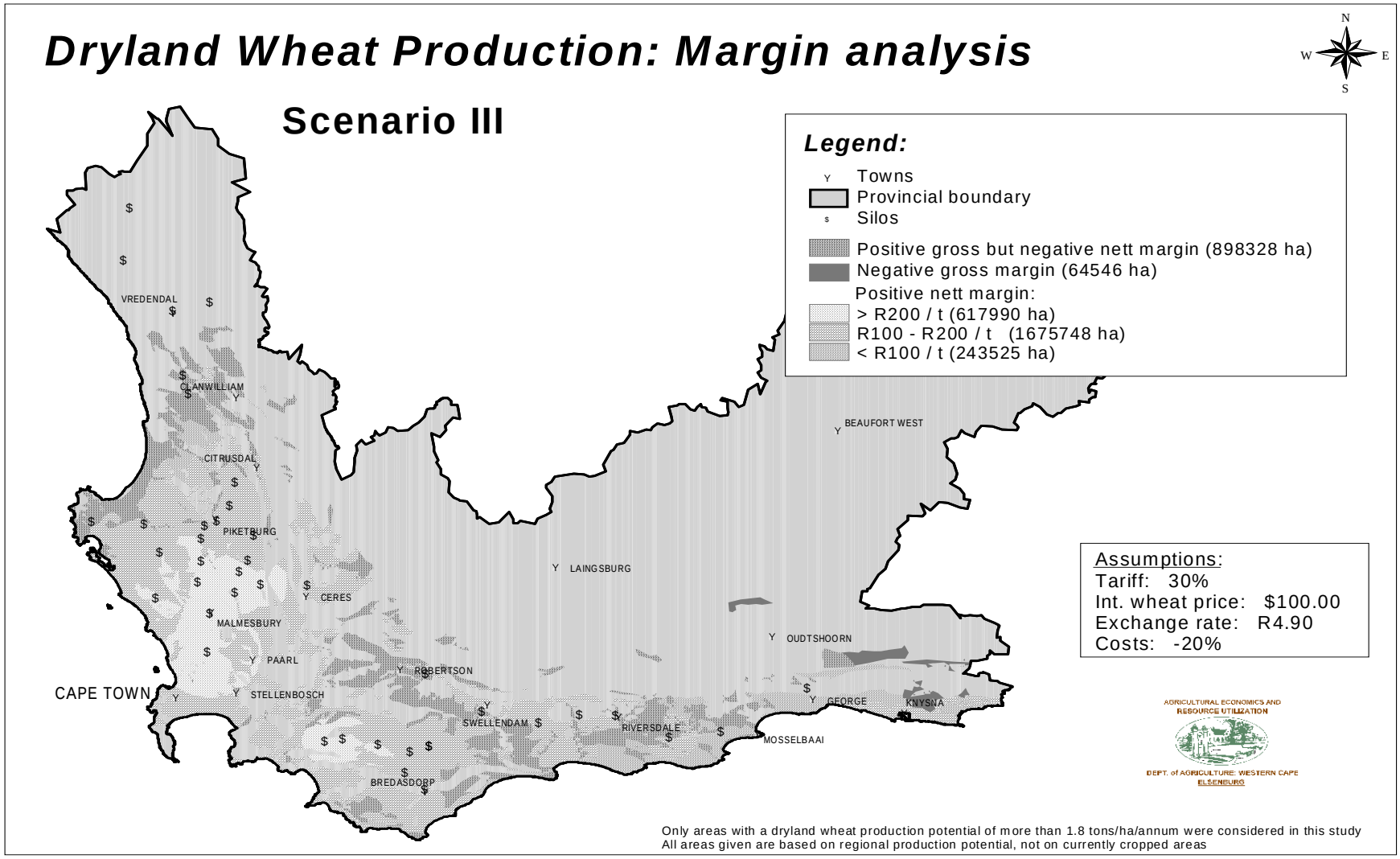
4. RESULTS

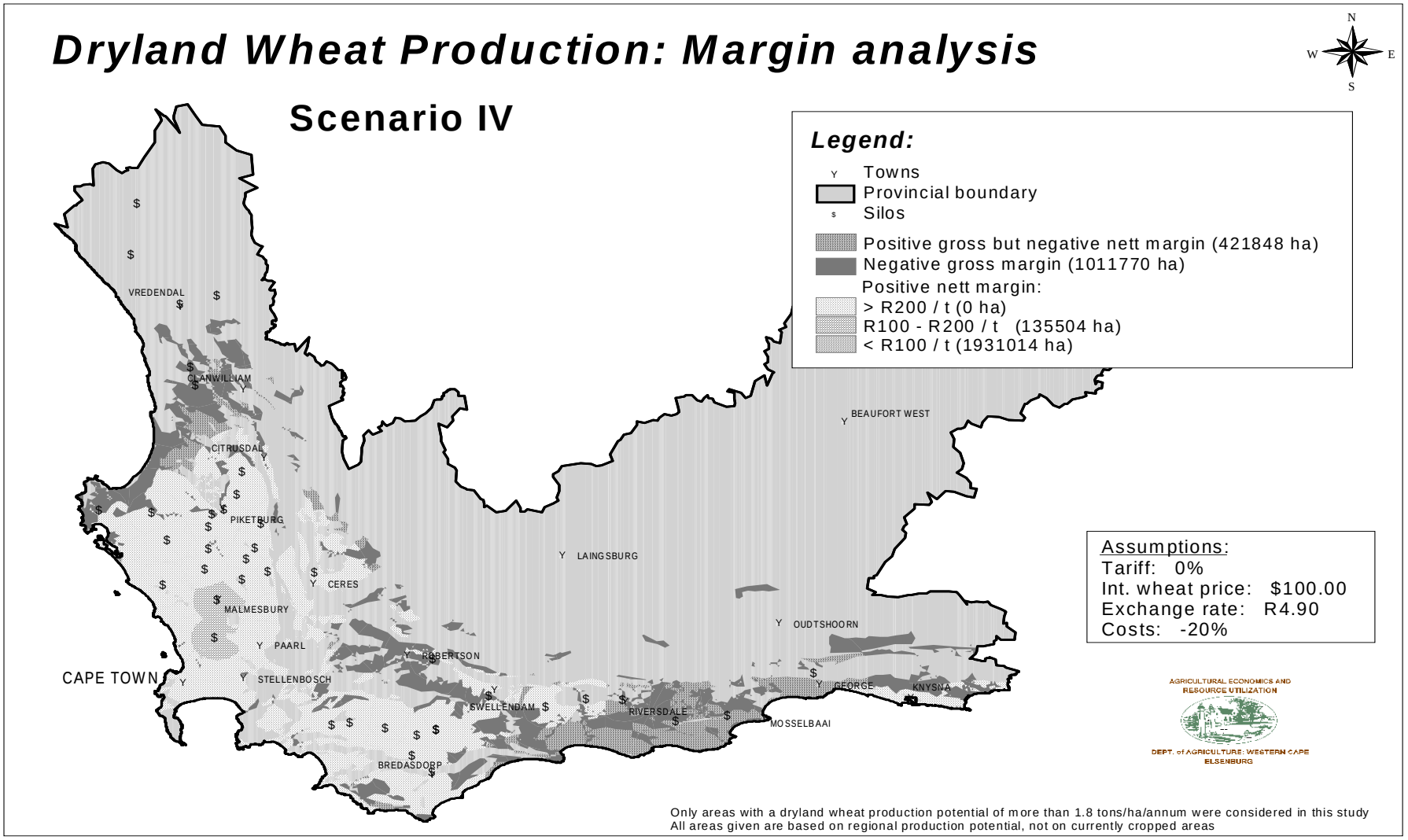
From the potential for wheat production model it can be deduced that 3,5 million hectares in the Western Cape are suitable for the production of wheat under rainfed conditions. Of this, 26,1% is of a high potential, 43,8% of a medium potential and 30,1% of a low potential. It is significant that the areas with higher potential are closer to the Cape Town metropolis. This confirms the importance of managed expansion of urban areas.

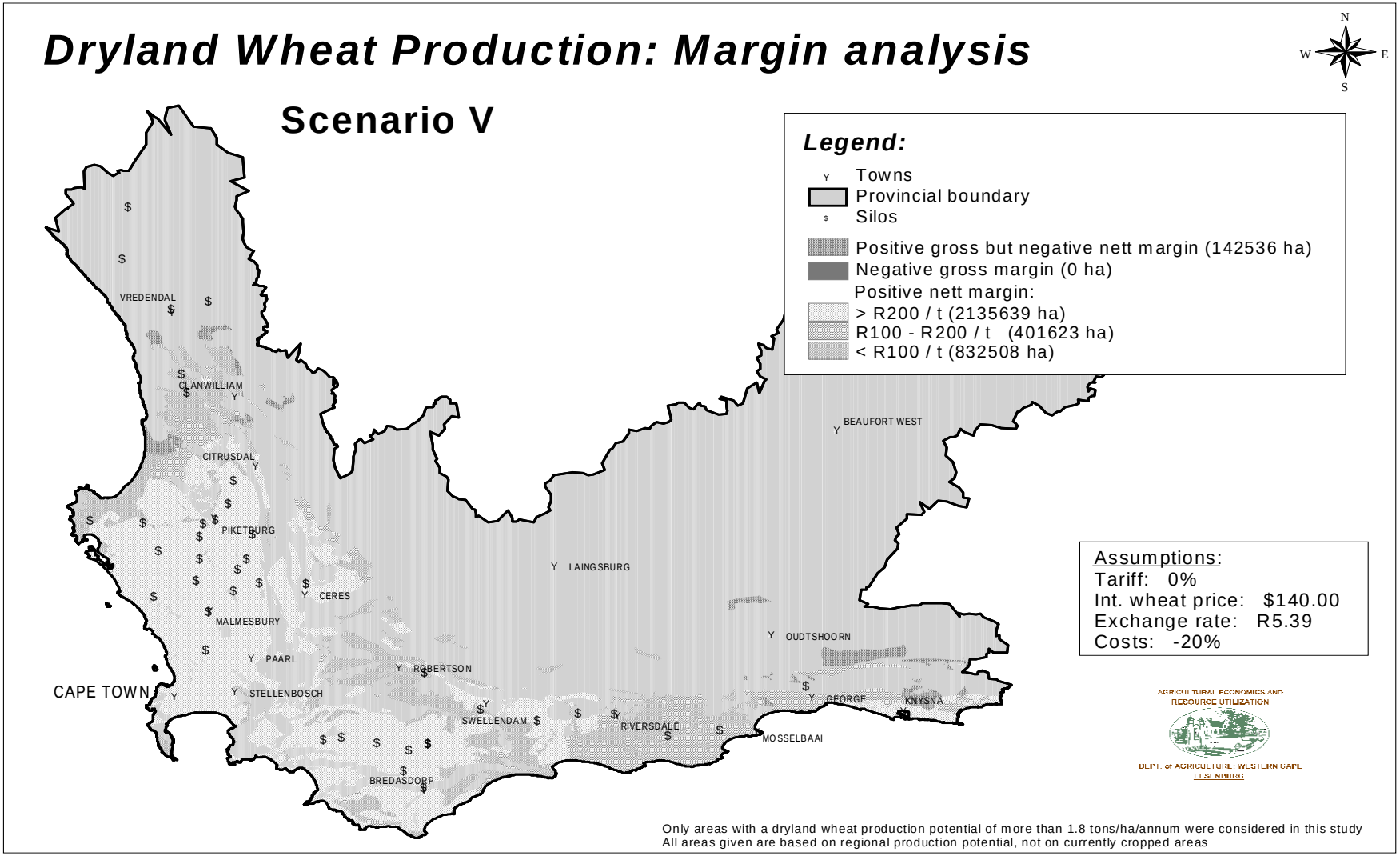
Graphic representations of the scenario results are attached to this paper.

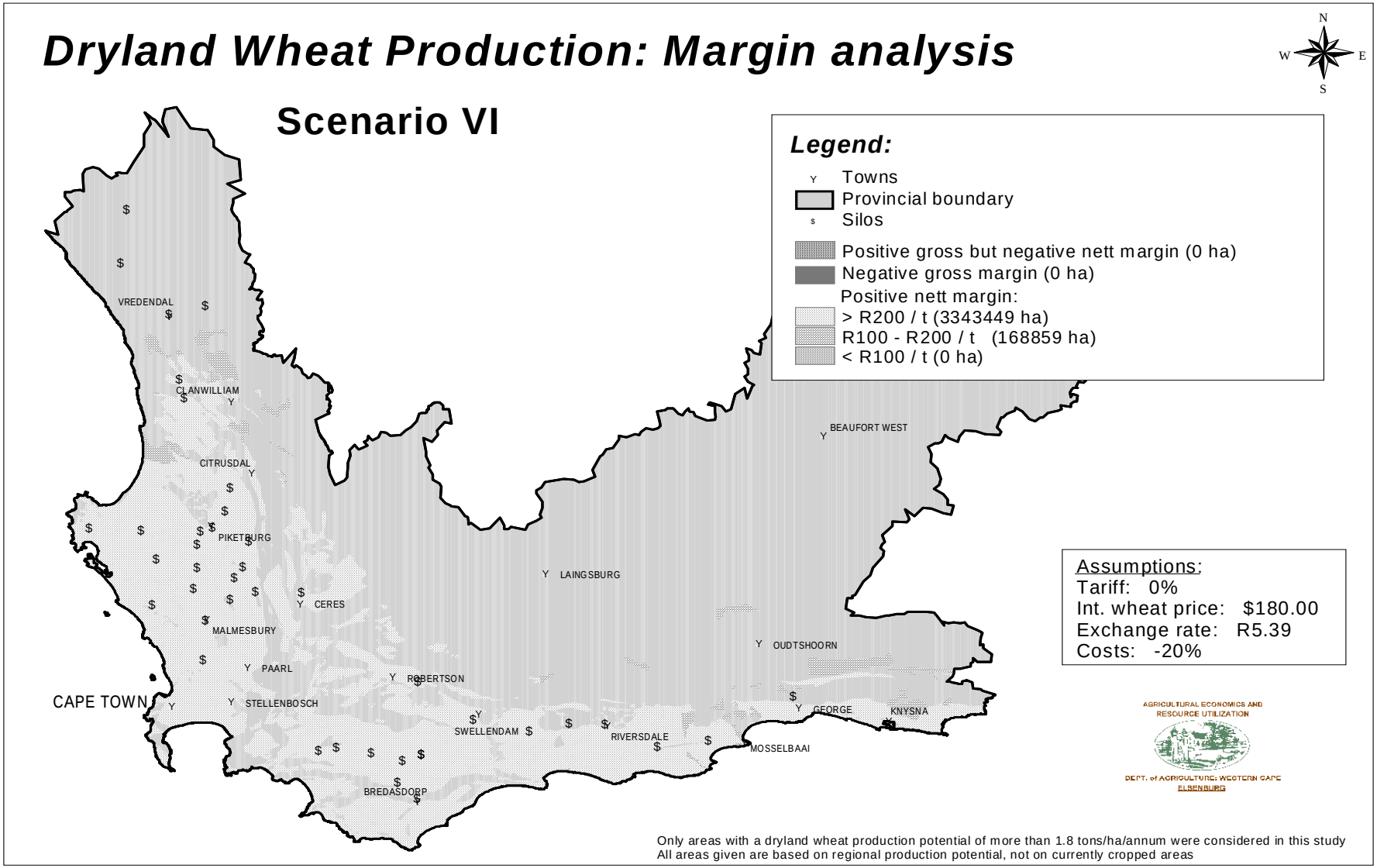

Dryland Wheat Production: Margin analysis
Scenario I
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (839032 ha)
Negative gross margin (2661104 ha)
(There are no areas with a positive nett margin)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
MALMESBURY
PAARL
CAPE TOWN
STELLENBOSCH
CERES
LAINGSBURG
BEAUFORT WEST
OUDTSHOORN
ROBERTSON
SWELLENDAM
RIVERSDALE
GEORGE
KNYSNA
MOSSELBAAI
BREDASDORP
Assumptions:
Tariff: 0
Int. wheat price: $100.00
Exchange rate: R4.90
Costs: 0%
AGRICULTURAL ECONOMICS AND RESOURCE UTILIZATION
DEPT. of AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas


Dryland Wheat Production: Margin analysis
Scenario II
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (160159 ha)
Negative gross margin (962874 ha)
Positive nett margin:
> R200 / t (0 ha)
R100 - R200 / t (844011 ha)
< R100 / t (1533093 ha)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
MALMESBURY
CERES
PAARL
STELLENBOSCH
CAPE TOWN
ROBERTSON
SWELLENDAM
BREDASDORP
LAINGSBURG
BEAUFORT WEST
OUDTSHOORN
RIVERSDALE
GEORGE
KNYSNA
MOSSELBAAI
Assumptions:
Tariff: 30%
Int. wheat price: $100.00
Exchange rate: R4.90
Costs: 0%
DEPT. of AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas


Dryland Wheat Production: Margin analysis
Scenario III
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (898328 ha)
Negative gross margin (64546 ha)
Positive nett margin:
> R200 / t (617990 ha)
R100 - R200 / t (1675748 ha)
< R100 / t (243525 ha)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
MALMESBURY
CERES
PAARL
CAPE TOWN
STELLENBOSCH
ROBERTSON
SWELLENDAM
RIVERSDALE
BREDASDORP
LAINGSBURG
BEAUFORT WEST
OUDTSHOORN
GEORGE
KNYSNA
MOSSELBAAI
Assumptions:
Tariff: 30%
Int. wheat price: $100.00
Exchange rate: R4.90
Costs: -20%
AGRICULTURAL ECONOMICS AND RESOURCE UTILIZATION
DEPT. of AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas


Dryland Wheat Production: Margin analysis
Scenario IV
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (421848 ha)
Negative gross margin (1011770 ha)
Positive nett margin:
> R200 / t (0 ha)
R100 - R200 / t (135504 ha)
< R100 / t (1931014 ha)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
MALMESBURY
CAPE TOWN
PAARL
STELLENBOSCH
CERES
LAINGSBURG
BEAUFORT WEST
ROBERTSON
SWELLENDAM
RIVERSDALE
OUDTSHOORN
GEORGE
KNYSNA
MOSSELBAAI
BREDASDORP
Assumptions:
Tariff: 0%
Int. wheat price: $100.00
Exchange rate: R4.90
Costs: -20%
AGRICULTURAL ECONOMICS AND RESOURCE UTILIZATION
DEPT. of AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas


Dryland Wheat Production: Margin analysis
Scenario V
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (142536 ha)
Negative gross margin (0 ha)
Positive nett margin:
> R200 / t (2135639 ha)
R100 - R200 / t (401623 ha)
< R100 / t (832508 ha)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
CERES
MALMESBURY
PAARL
CAPE TOWN
STELLENBOSCH
ROBERTSON
SWELLENDAM
RIVERSDALE
BREDASDORP
LAINGSBURG
BEAUFORT WEST
OUDTSHOORN
GEORGE
KNYSNA
MOSSELBAAI
Assumptions:
Tariff: 0%
Int. wheat price: $140.00
Exchange rate: R5.39
Costs: -20%
AGRICULTURAL ECONOMICS AND RESOURCE UTILIZATION
DEPT. OF AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas


Dryland Wheat Production: Margin analysis
Scenario VI
N
W
E
S
Legend:
Towns
Provincial boundary
Silos
Positive gross but negative nett margin (0 ha)
Negative gross margin (0 ha)
Positive nett margin:
> R200 / t (3343449 ha)
R100 - R200 / t (168859 ha)
< R100 / t (0 ha)
VREDENDAL
CLANWILLIAM
CITRUSDAL
PIKETBURG
MALMESBURY
CERES
PAARL
CAPE TOWN
STELLENBOSCH
ROBERTSON
SWELLENDAM
RIVERSDALE
BREDASDORP
LAINGSBURG
BEAUFORT WEST
OUDTSHOORN
GEORGE
KNYSNA
MOSSELBAAI
Assumptions:
Tariff: 0%
Int. wheat price: $180.00
Exchange rate: R5.39
Costs: -20%
AGRICULTURAL ECONOMICS AND RESOURCE UTILIZATION
DEPT. of AGRICULTURE: WESTERN CAPE
ELSENBURG
Only areas with a dryland wheat production potential of more than 1.8 tons/ha/annum were considered in this study
All areas given are based on regional production potential, not on currently cropped areas

A summary of the results is presented in Table 6.

Table 6: Scenario results: percentage of area, suitable for rainfed wheat production in the Western Cape, falling in specific profitability classes

PROFITABILITY OF WHEAT PRODUCTION	SCENARIO					
	I	II	III	IV	V	VI
Positive net margin	***0%***	***68%***	***73%***	***59%***	***95%***	***100%***
>R200/ton	-	0%	18%	0%	60%	95%
R100 – R199,99/ton	-	24%	48%	4%	11%	5%
R0 – R99,99/ton	-	44%	7%	55%	24%	0%
Negative net margin	***100%***	***32%***	***27%***	***41%***	***5%***	***0%***
Positive gross; negative net	24%	5%	25%	12%	5%	-
Negative gross	76%	27%	2%	29%	0%	-

Note: Only land that is suitable for the production of wheat under rainfed conditions included.

With the aid of the spatial analysis it is clear that the production of wheat under rainfed conditions is a viable option in certain areas of the Western Cape Province. It is, however, also clear that the opposite holds for certain other areas, especially the 27% of land identified as marginal in scenario III. Producers unfortunate enough to farm in these areas should, as a matter of urgency, investigate alternative crops, products, markets and resource use options for their natural resource.

An interesting and noteworthy aspect is the fact that six of the silos in the Western Cape Province are built in areas that are unsuitable for the production of wheat under rainfed conditions. This is a clear indication of the distortions resulting from previous incentives.

Although time is necessary to implement the necessary structural adjustments at the micro-, meso- and macro level, these adjustments are viable. The introduction of a conditional *ad valorum* tariff would assist role-players in implementing the necessary adjustments.

5. CONCLUSION

The deregulation of the marketing system for wheat has met with considerable resistance in some circles. Wheat production in the Western Cape, being a surplus producer of wheat and distanced from the main market

in South Africa, was especially perceived as under threat. With the aid of a spatial model the implications of this deregulation have been investigated. Although the relative changes in profitability are important, of more significance are a couple of general results.

Two important results, one methodological and the other contextual, flow from this paper. The methodological result can be found in the combination of spatial data, resource attributes, crop characteristics and financial/economic data in an interactive model. With the aid of this model it is possible to evaluate the effect of macro-economic variables on farm-level operations. It is therefore possible to bridge the apparent divide between globalisation and individualisation.

The contextual result is situated in the fact that regions, or even individual farms, that could (positively or adversely) be affected by policy programmes can be identified and delineated. From the perspective of the Government of the Western Cape Province, it is therefore possible to identify specific areas or farms that need specialised attention. In the case of the wheat industry case study, this specialised attention may include assistance in exiting farming, changing the structure of the farming operation or measures with the objective of helping farmers to attain different supply and demand functions. The latter is worth a research project in itself.

NOTES

1. *It is necessary to clarify the use of a silo-gate price. The farm-gate price is dependent on the transport cost between the farm and the silo. As transport cost varies according to the distance travelled, this factor will be included as part of the spatial analysis.*

2. *More profitable water-use alternatives do exist. These include deciduous fruit, wine grapes, table grapes, vegetables, citrus and, of course, industrial use and human consumption.*

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