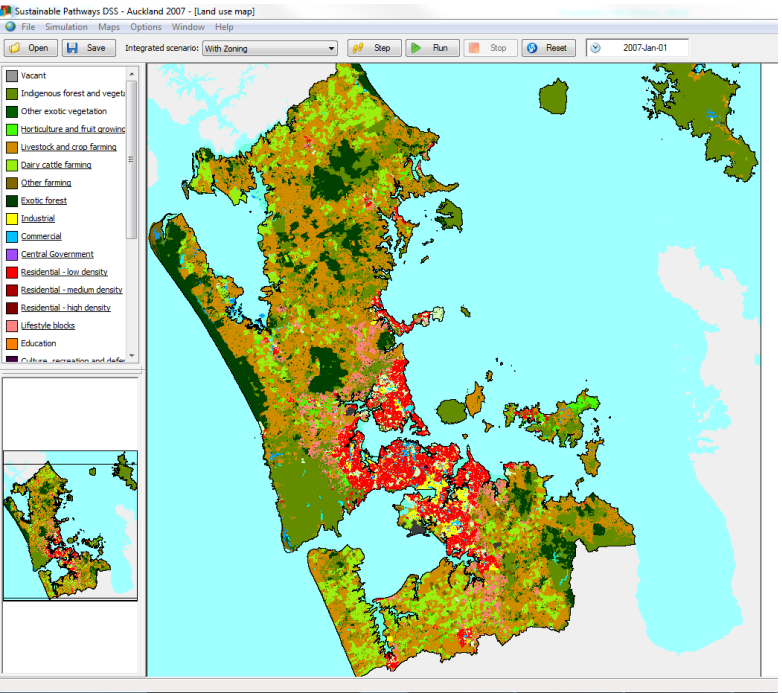
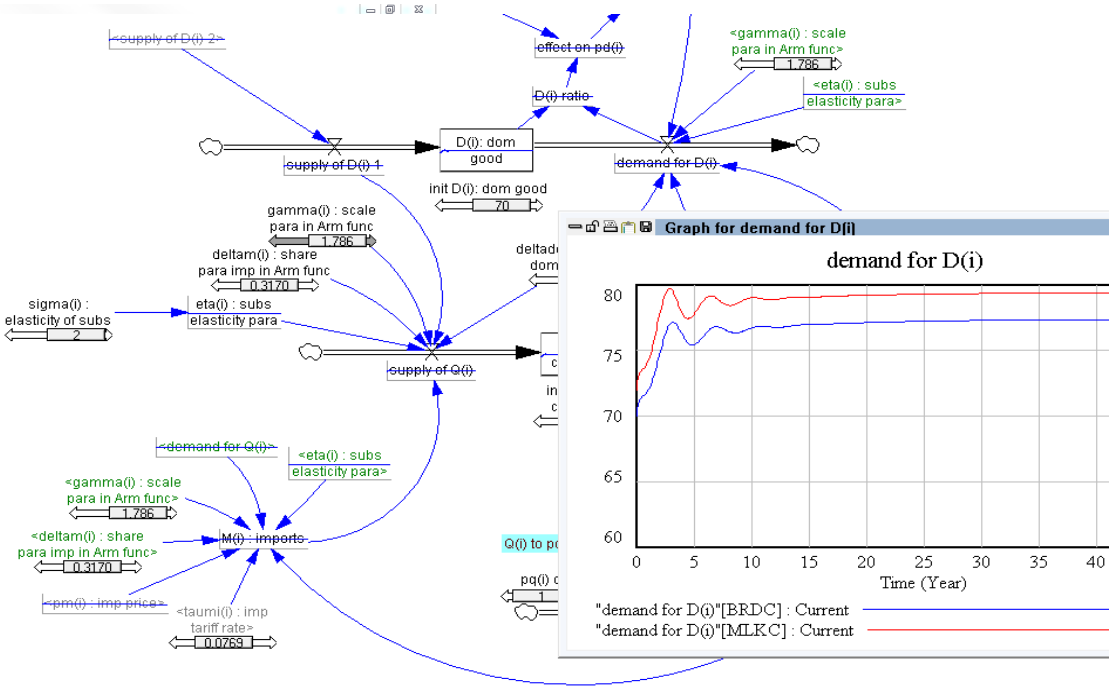
Assessing the long-term impacts of natural hazard events using integrated land use - economic - transport models





Sustainable Pathways II

2009 to 2015 MBIE funded research programme focused on achieving sustainable urban futures ($3.8 million over 6 years)

Led by Garry McDonald (Market Economics), Hedwig van Delden (RIKS), Regan Solomon (Auckland Council), Melanie Thornton (Greater Wellington), Beat Huser (Waikato), Marjan van den Belt (Massey University)

Key Output: Integrated Scenarios Explorer

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Waikato Regional Council
Te Kaunihera ā Rohe o Waikato

greater Wellington Regional Council
Te Pane Matua Taiao

me market economics environment • spatial

Massey University
Te Kunenga ki Pūrehuroa
University of New Zealand

Ministry of Business, Innovation & Employment

Science + Innovation

RIKS
research institute for knowledge systems

Economics of Resilient Infrastructure

Economics of Resilient Infrastructure, $2.8m MBIE programme, 2012-16

Led by Garry McDonald, Hedwig van Delden, Michele Daly (GNS) and Erica Seville (ResOrgs)

Key Outputs: MERIT and Spatial MERIT

GNS SCIENCE TE PŪ AO

Resilient ORGANISATIONS

m.e environment

Auckland Council
Te Kaunihera o Tāmaki Makaurau

RIKS
research institute for knowledge systems

Resilience to Nature's Challenges Urban Workstream

Led by Garry McDonald and Suzanne Wilkinson (UoA)

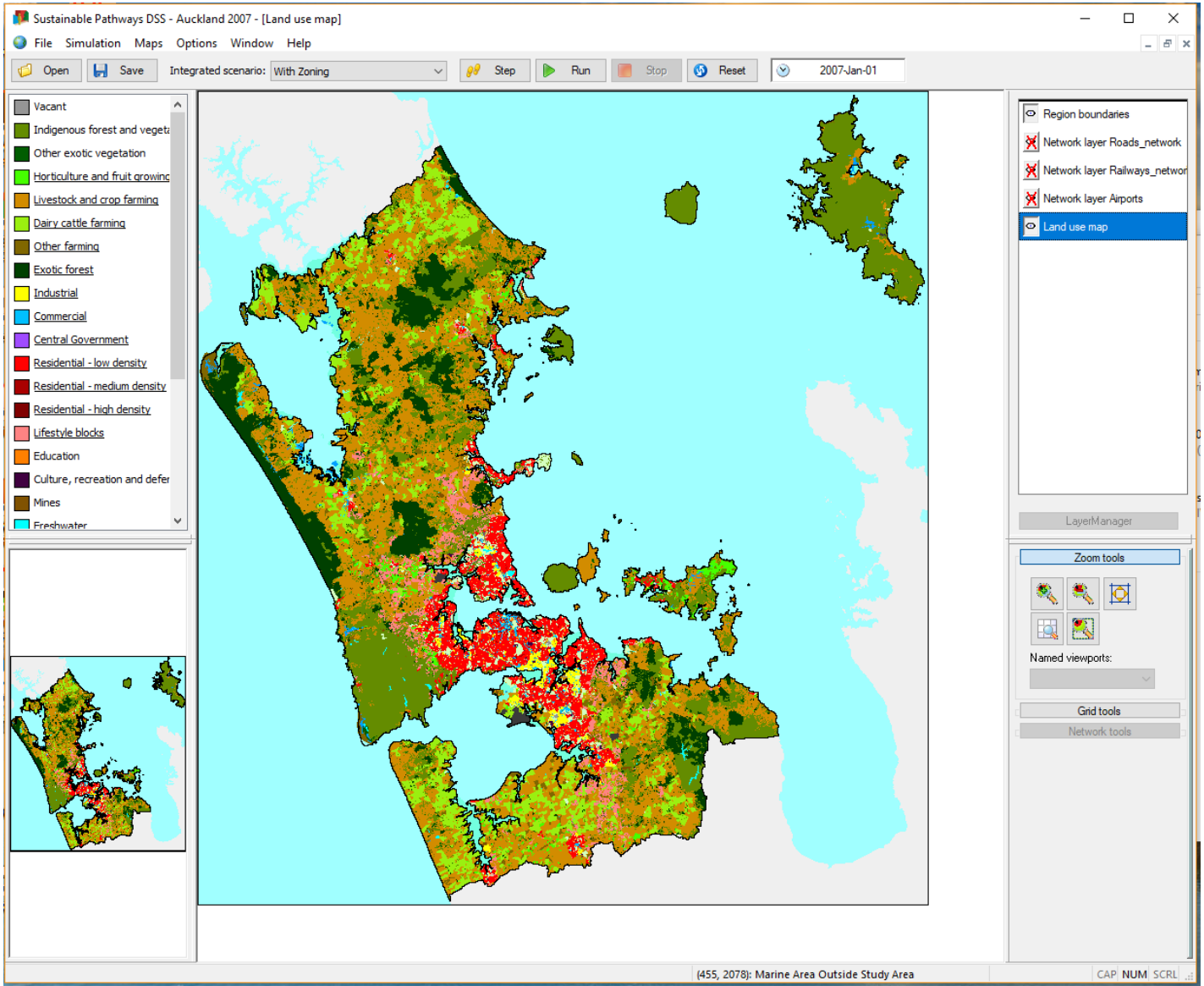
Robert Cardwell (PhD student, UoA, Market Economics)

Key Output: Application of ISE, MERIT and Spatial MERIT to hazard scenarios

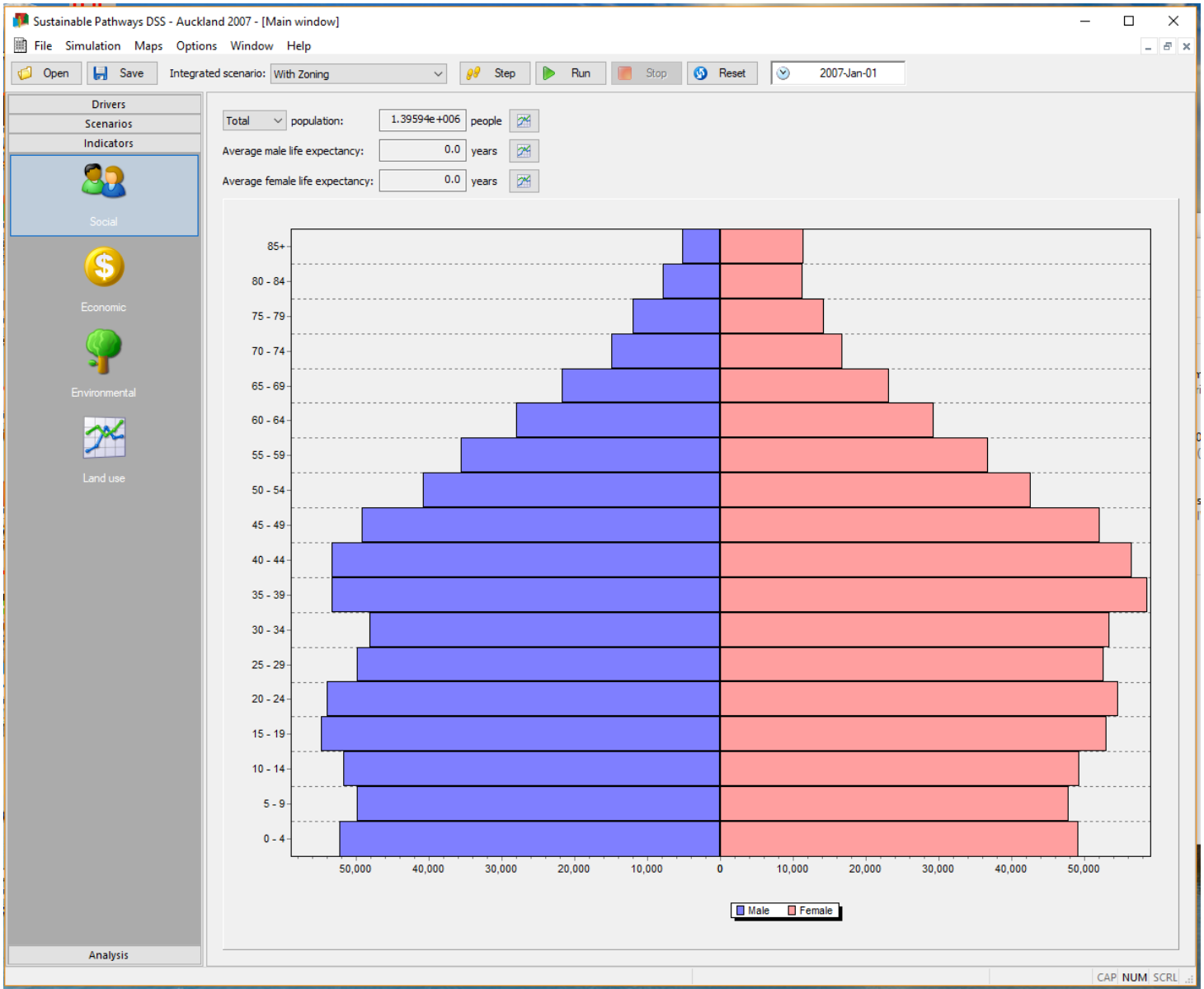
THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

m.e market economics
environment • spatial

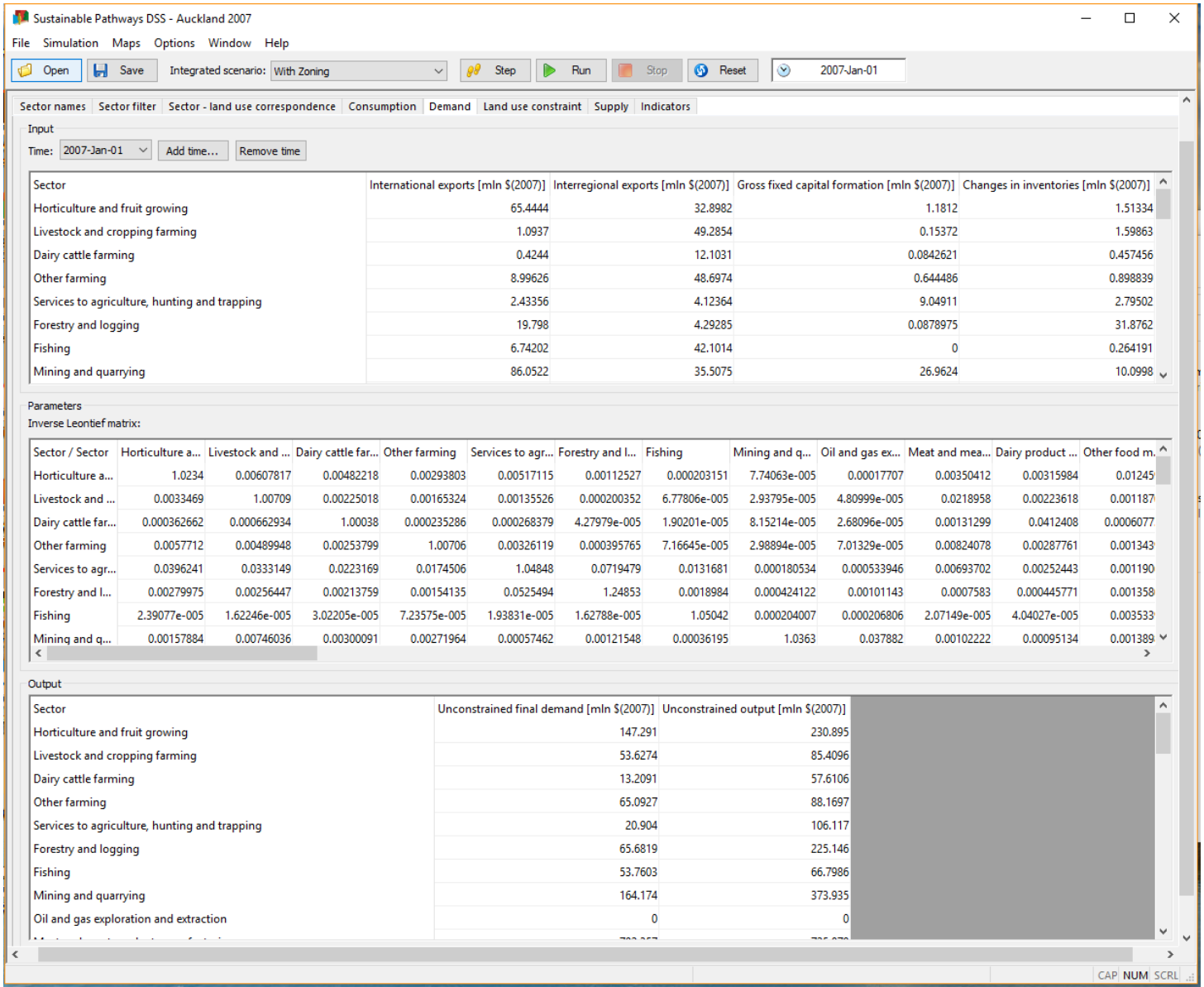
Integrated Scenarios Explorer (ISE)



Population


Sustainable Pathways DSS - Auckland 2007 - [Main window]
File Simulation Maps Options Window Help
Open Save Integrated scenario: With Zoning Step Run Stop Reset 2007-Jan-01
Drivers
Scenarios
Indicators
Social
Economic
Environmental
Land use
Analysis
Total population: 1.39594e+006 people
Average male life expectancy: 0.0 years
Average female life expectancy: 0.0 years
85+
80 - 84
75 - 79
70 - 74
65 - 69
60 - 64
55 - 59
50 - 54
45 - 49
40 - 44
35 - 39
30 - 34
25 - 29
20 - 24
15 - 19
10 - 14
5 - 9
0 - 4
50,000 40,000 30,000 20,000 10,000 0 10,000 20,000 30,000 40,000 50,000
Male Female
CAP NUM SCRL

Economic Demand

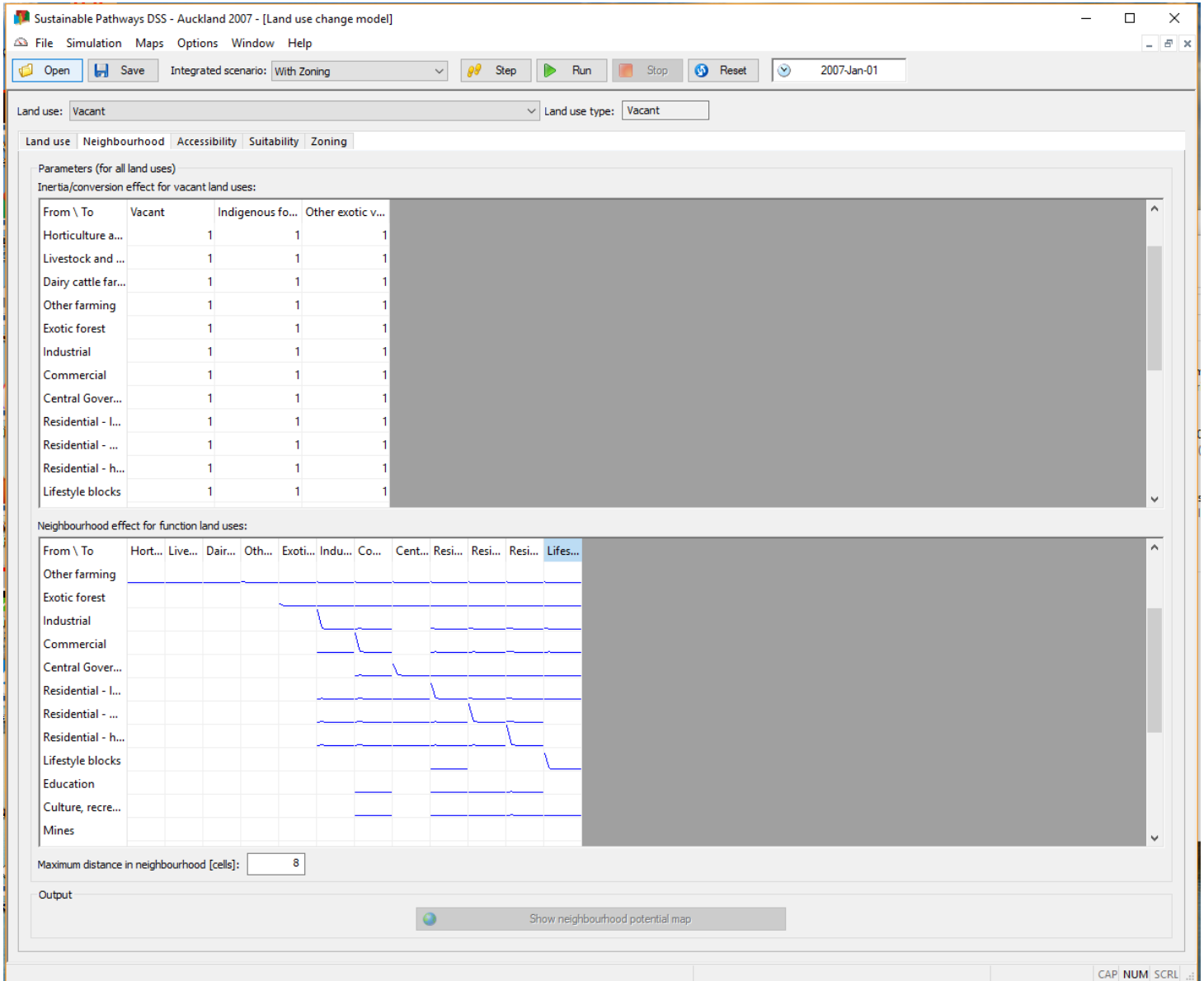


Sector	International exports [mln $(2007)]	Interregional exports [mln $(2007)]	Gross fixed capital formation [mln $(2007)]	Changes in inventories [mln $(2007)]
Horticulture and fruit growing	65.4444	32.8982	1.1812	1.51334
Livestock and cropping farming	1.0937	49.2854	0.15372	1.59863
Dairy cattle farming	0.4244	12.1031	0.0842621	0.457456
Other farming	8.99626	48.6974	0.644486	0.898839
Services to agriculture, hunting and trapping	2.43356	4.12364	9.04911	2.79502
Forestry and logging	19.798	4.29285	0.0878975	31.8762
Fishing	6.74202	42.1014	0	0.264191
Mining and quarrying	86.0522	35.5075	26.9624	10.0998

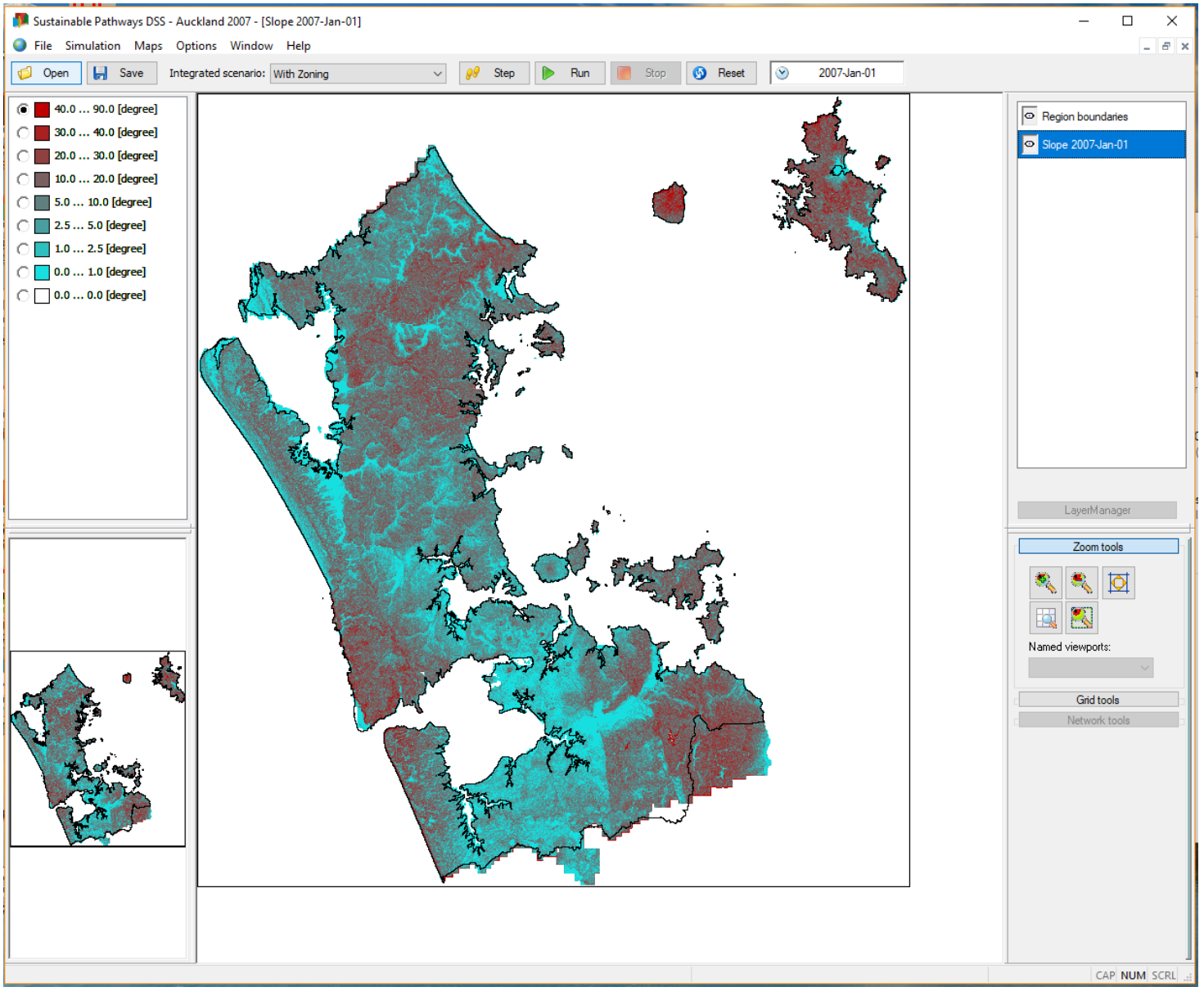
Sector / Sector	Horticulture a...	Livestock and ...	Dairy cattle far...	Other farming	Services to agr...	Forestry and l...	Fishing	Mining and q...	Oil and gas ex...	Meat and mea...	Dairy product ...	Other food m.
Horticulture a...	1.0234	0.00607817	0.00482218	0.00293803	0.00517115	0.00112527	0.000203151	7.74063e-005	0.00017707	0.00350412	0.00315984	0.01245
Livestock and ...	0.0033469	1.00709	0.00225018	0.00165324	0.00135526	0.000200352	6.77806e-005	2.93795e-005	4.80999e-005	0.0218958	0.00223618	0.001187
Dairy cattle far...	0.000362662	0.000662934	1.00038	0.000235286	0.000268379	4.27979e-005	1.90201e-005	8.15214e-005	2.68096e-005	0.00131299	0.0412408	0.0006077
Other farming	0.0057712	0.00489948	0.00253799	1.00706	0.00326119	0.000395765	7.16645e-005	2.98894e-005	7.01329e-005	0.00824078	0.00287761	0.001343
Services to agr...	0.0396241	0.0333149	0.0223169	0.0174506	1.04848	0.0719479	0.0131681	0.000180534	0.000533946	0.00693702	0.00252443	0.001190
Forestry and l...	0.00279975	0.00256447	0.00213759	0.00154135	0.0525494	1.24853	0.0018984	0.000424122	0.00101143	0.0007583	0.000445771	0.001358
Fishing	2.39077e-005	1.62246e-005	3.02205e-005	7.23575e-005	1.93831e-005	1.62788e-005	1.05042	0.000204007	0.000206806	2.07149e-005	4.04027e-005	0.003533
Mining and q...	0.00157884	0.00746036	0.00300091	0.00271964	0.00057462	0.00121548	0.00036195	1.0363	0.037882	0.00102222	0.00095134	0.001389

Sector	Unconstrained final demand [mln $(2007)]	Unconstrained output [mln $(2007)]
Horticulture and fruit growing	147.291	230.895
Livestock and cropping farming	53.6274	85.4096
Dairy cattle farming	13.2091	57.6106
Other farming	65.0927	88.1697
Services to agriculture, hunting and trapping	20.904	106.117
Forestry and logging	65.6819	225.146
Fishing	53.7603	66.7986
Mining and quarrying	164.174	373.935
Oil and gas exploration and extraction	0	0

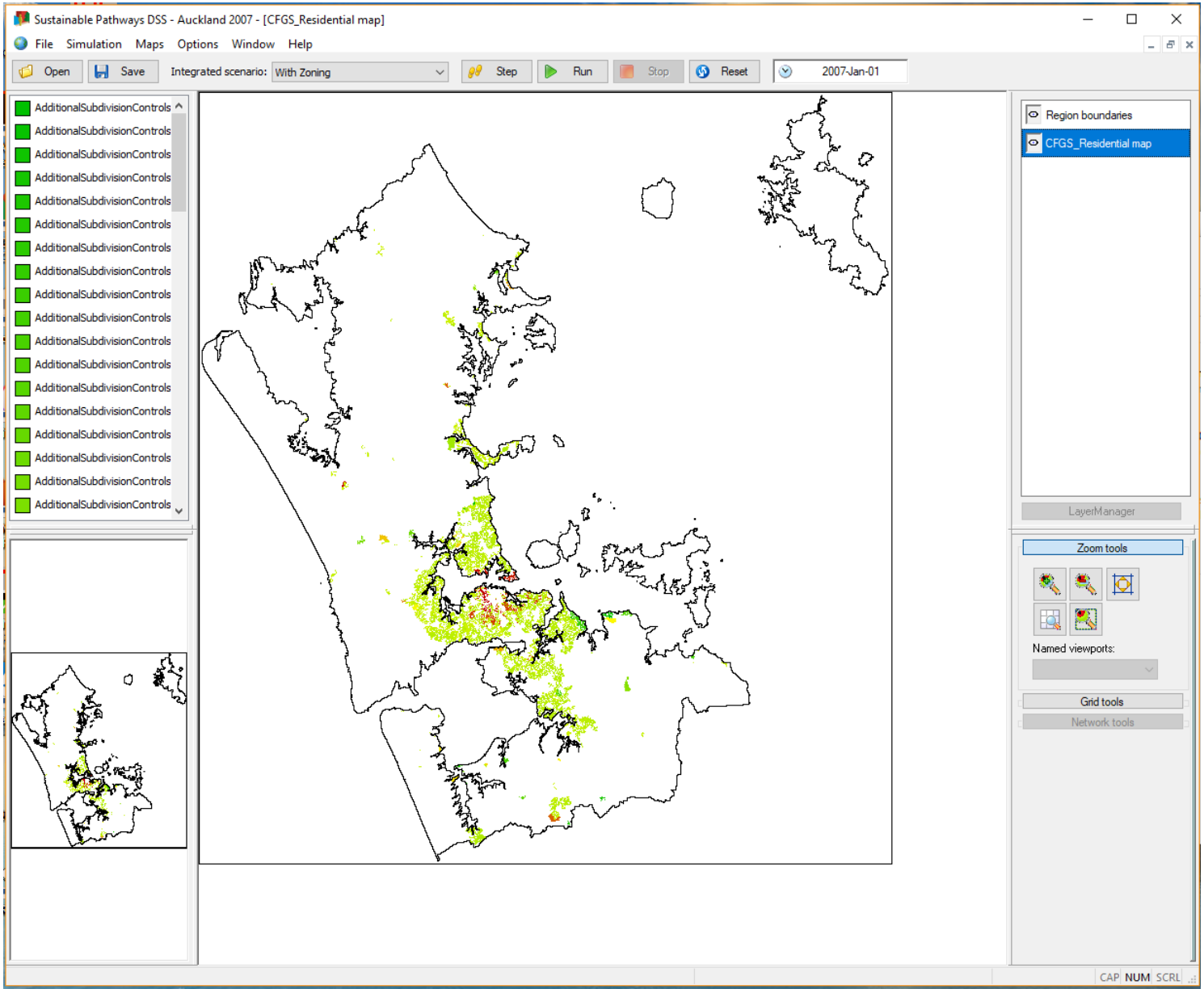
Land Use Neighbourhood Interaction



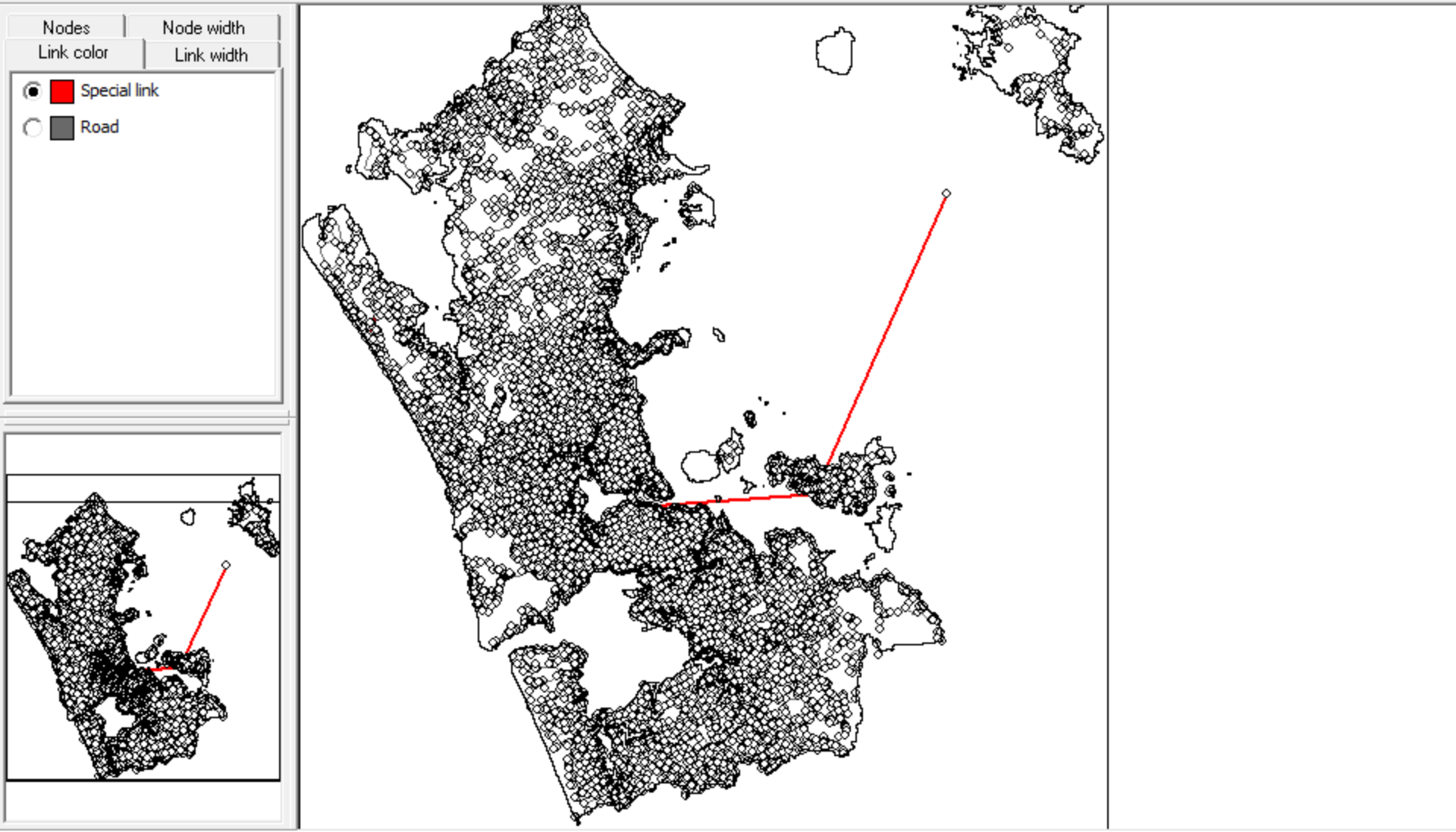
Suitability



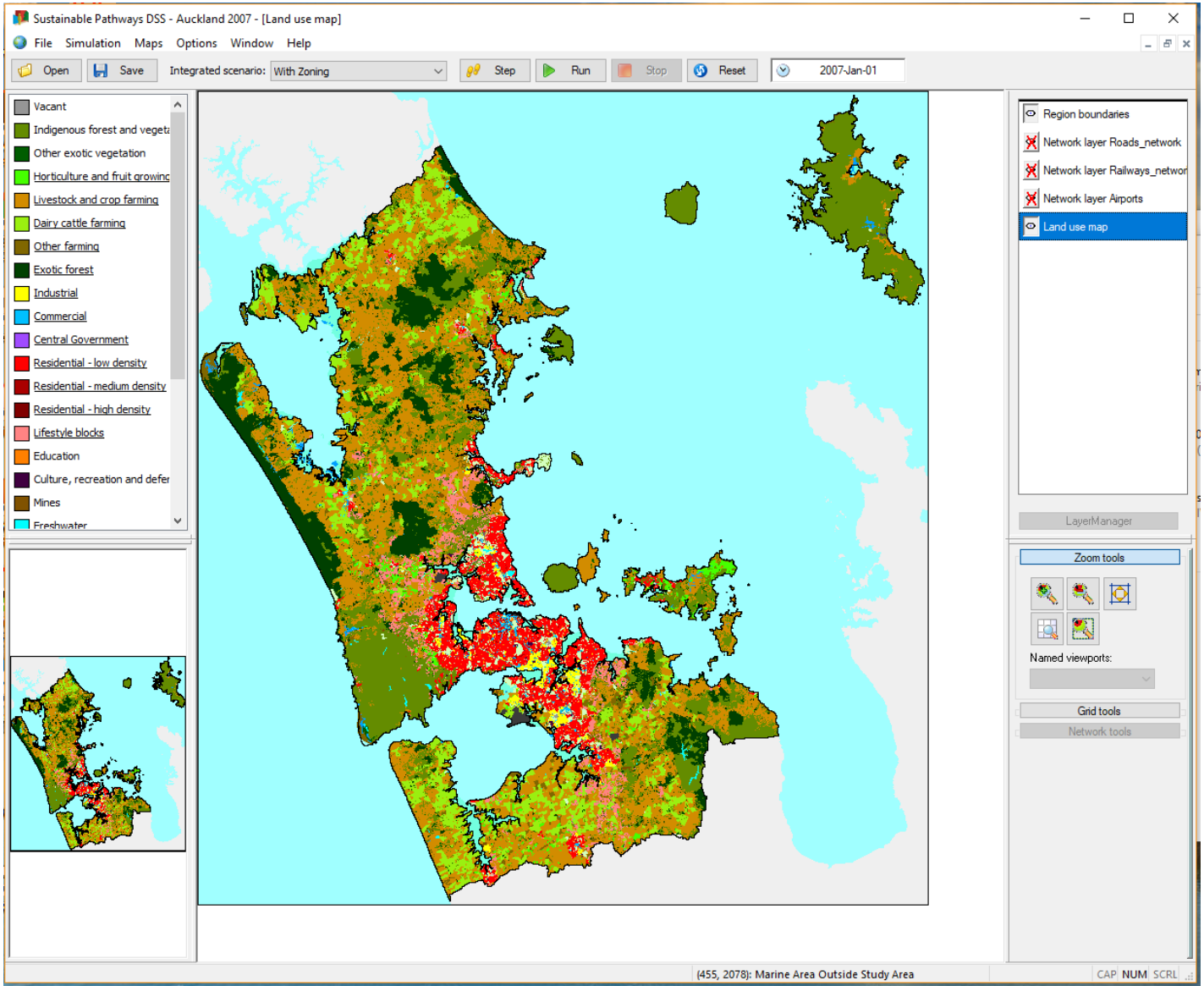
Zoning


Sustainable Pathways DSS - Auckland 2007 - [CFGS_Residential map]
File
Simulation
Maps
Options
Window
Help
Open
Save
Integrated scenario:
With Zoning
Step
Run
Stop
Reset
2007-Jan-01
AdditionalSubdivisionControls
Region boundaries
CFGS_Residential map
LayerManager
Zoom tools
Named viewports:
Grid tools
Network tools
CAP
NUM
SCRL

Transport Network

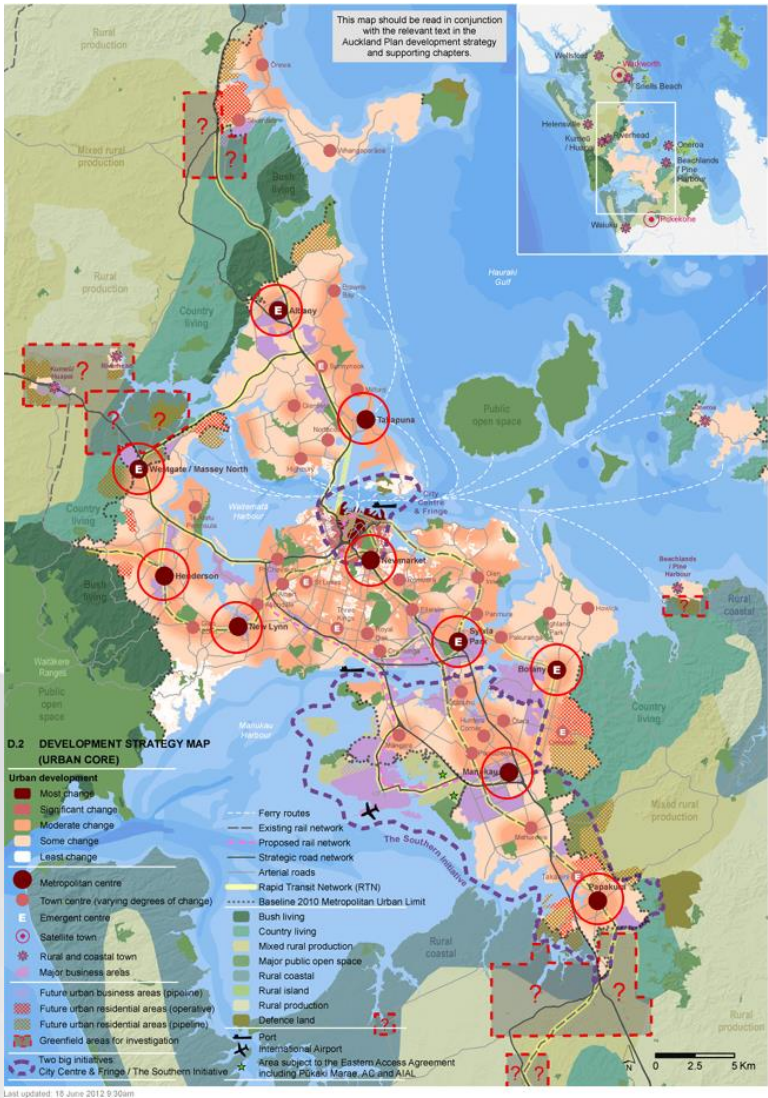


Bringing it all Together

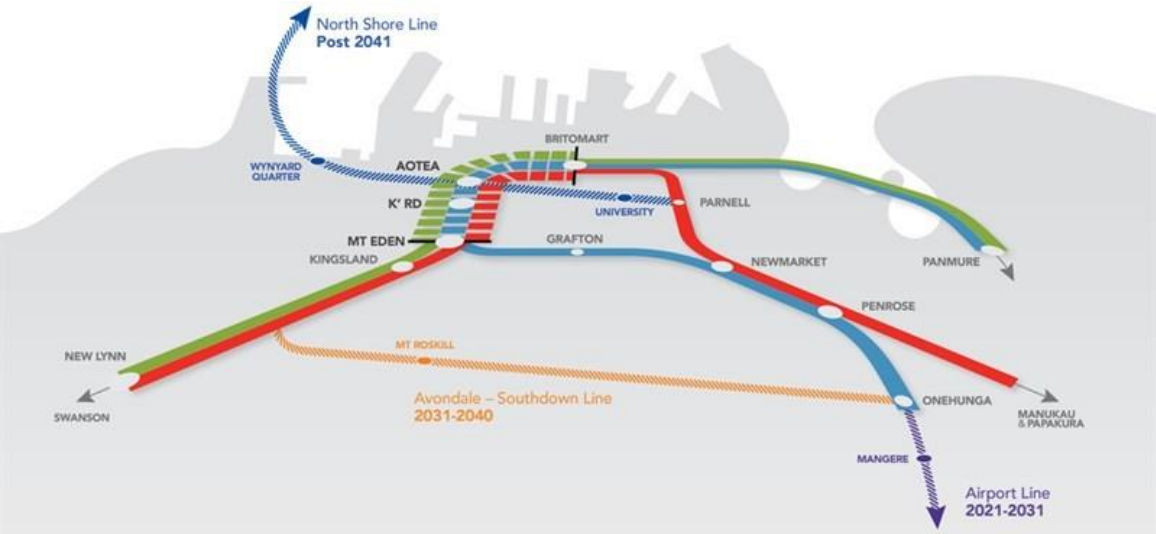


Scenarios

Auckland Plan

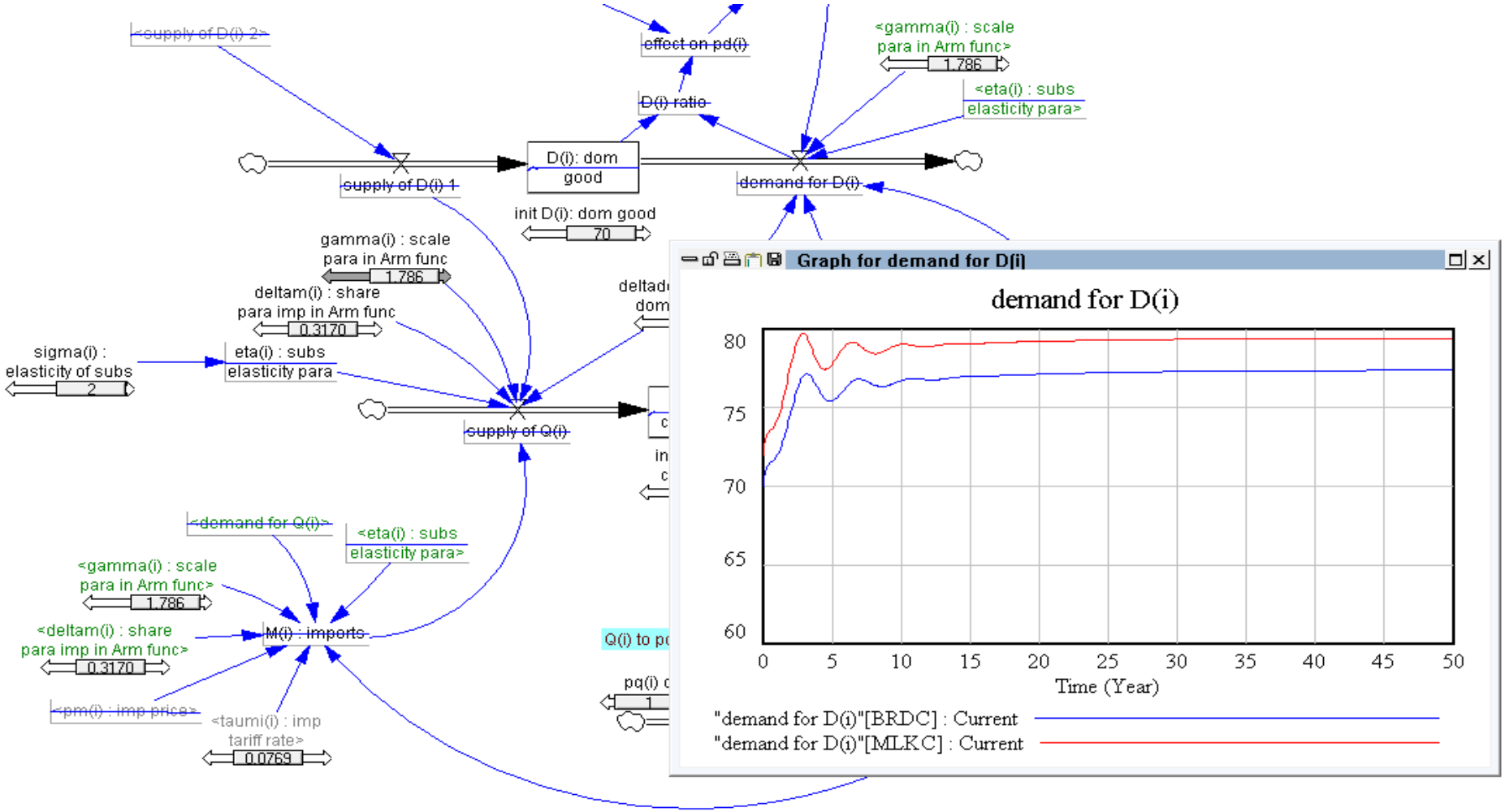


CRL

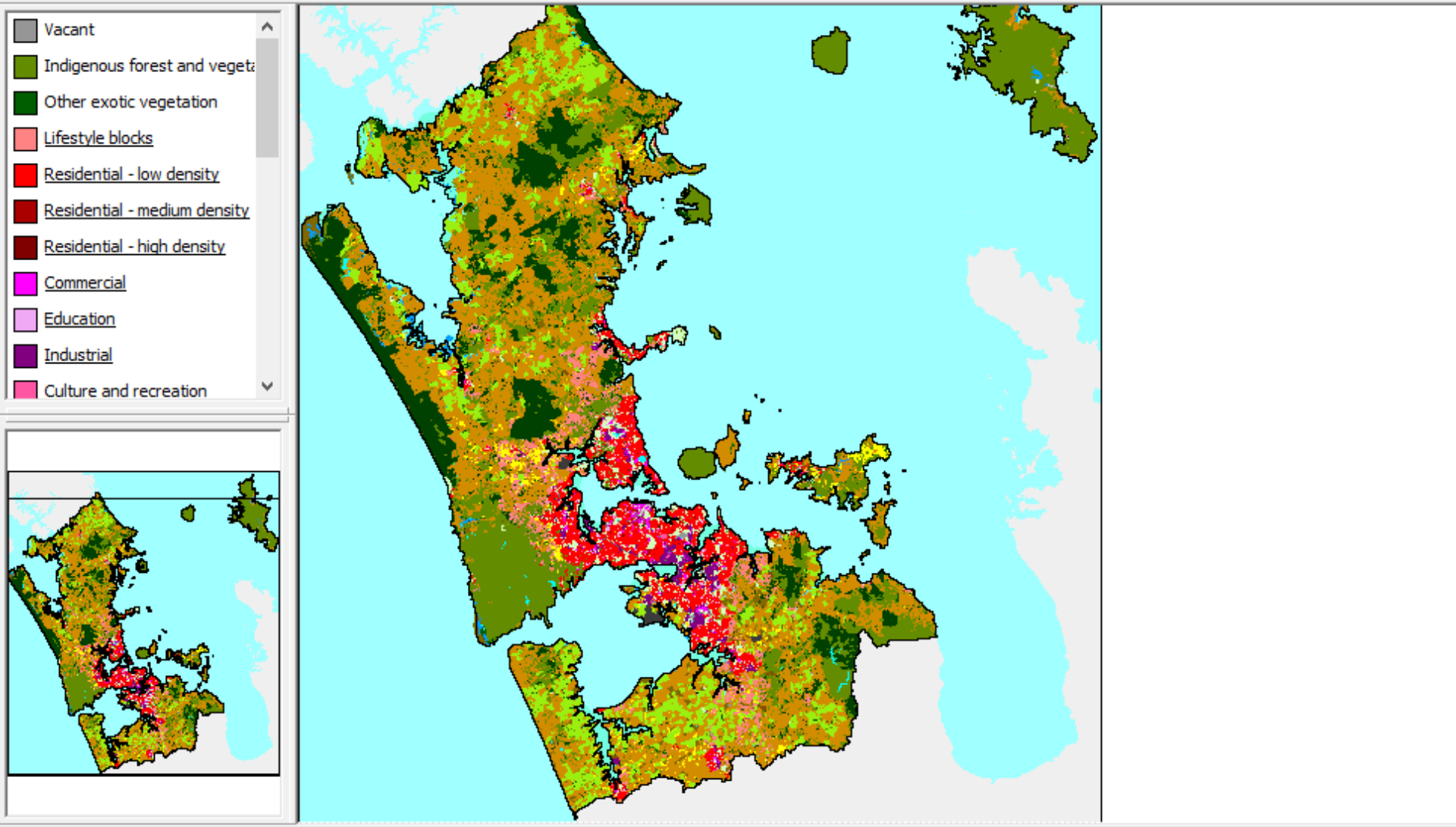


Hazard Scenarios

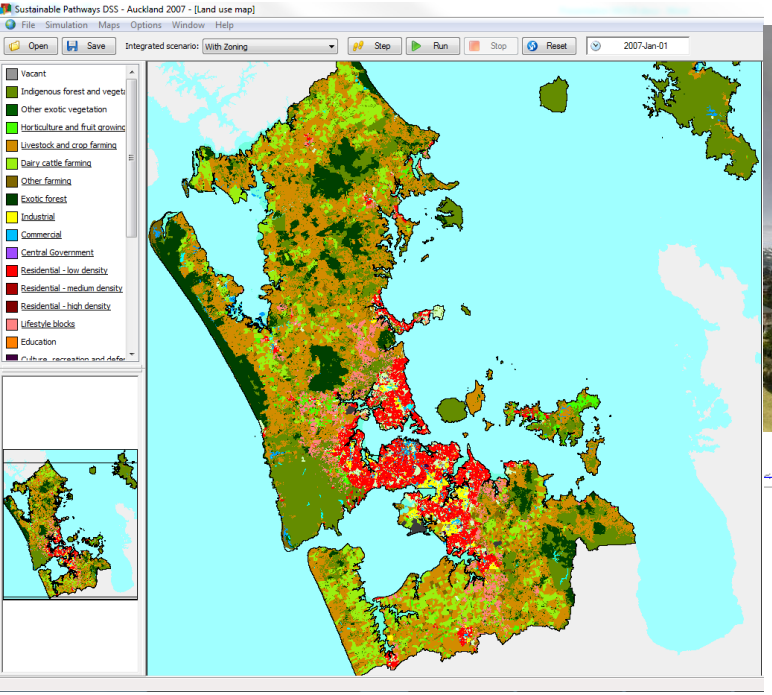
MERIT

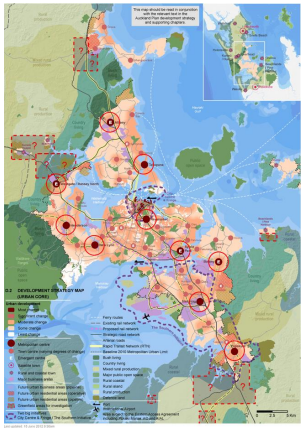

<supply of D(i) 2>
effect on pd(i)
<gamma(i) : scale para in Arm func>
1.786
D(i) ratio
<eta(i) : subs elasticity para>
D(i): dom good
supply of D(i) 1
demand for D(i)
init D(i): dom good
70
gamma(i) : scale para in Arm func
1.786
deltam(i) : share para imp in Arm func
0.3170
sigma(i) : elasticity of subs
2
eta(i) : subs elasticity para
supply of Q(i)
<demand for Q(i)>
<eta(i) : subs elasticity para>
<gamma(i) : scale para in Arm func>
1.786
<deltam(i) : share para imp in Arm func>
0.3170
M(i) : imports
<pm(i) : imp price>
<taumi(i) : imp tariff rate>
0.0769
Graph for demand for D(i)
demand for D(i)
80
75
70
65
60
0
5
10
15
20
25
30
35
40
45
50
Time (Year)
"demand for D(i)"[BRDC] : Current
"demand for D(i)"[MLKC] : Current

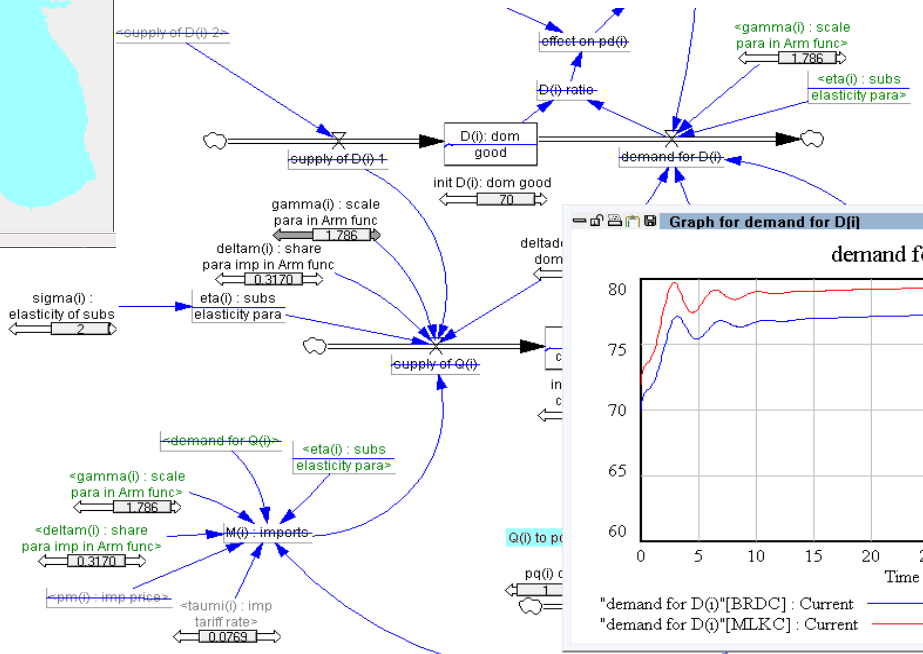
Spatial MERIT



Summary


Sustainable Pathways DSS - Auckland 2007 - [Land use map]
File Simulation Maps Options Window Help
Open Save Integrated scenario: With Zoning Step Run Stop Reset 2007-Jan-01
Vacant
Other exotic vegetation
Horticulture and fruit growing
Livestock and crop farming
Dairy cattle farming
Other farming
Exotic forest
Industrial
Commercial
Central Government
Residential - low density
Residential - medium density
Residential - high density
Lifestyle blocks
Education




<supply of D(i) 2>
effect on pd(i)
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2
eta(i) : subs elasticity para
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<demand for Q(i)>
<eta(i) : subs elasticity para>
<gamma(i) : scale para in Arm func>
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M(i) : imports
<pm(i) : imp price>
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demand for D(i)
80
75
70
65
60
0
5
10
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20
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45
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"demand for D(i)"[MLKC] : Current