CLIMATE CHANGE AND NATURE,

INTEGRATION OF SPATIAL POLICIES WITH A LAND USE MODEL

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1:

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Background

- **In a small and crowded country like the Netherlands, many claims are laid upon the use and destination of land.**

- **In the last 30 years, these claims increased for:**

  - water-management, transport by ships and water-quality

  - recreation and urbanization

  - nature development

  - agriculture and forestry

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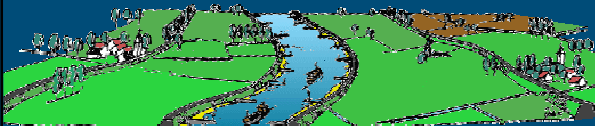**Faculty of Economics & Business Administration**

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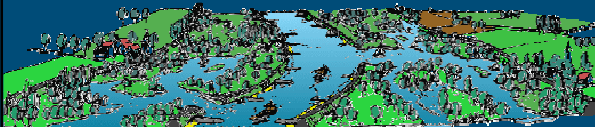## Scenarios related to Land Use Change Modelling

Current situation (2010)

Scenario 1. Agricultural development (e.g. 2040)

Scenario 2. Urbanization (e.g. 2040)

Scenario 3. Nature development (e.g. 2040)

Scenarios depending on development factors

Different land use scenarios can be made depending on the importance and the combination of all relevant development factors

-**How to design them?**

-**How to make sure they are useful for planning support**

-**Can all factors and land use classes mutually weighed**

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Nature and Climate Change in Land Use Modelling

- Research Question: Is it possible to improve the simulation of nature development in the **Land Use Scanner** model, taking into account climate change scenarios?

- For this presentation 4 sub-questions:
  1. What is the Land Use Scanner ?
  2. How was "nature" previously implemented ?
  3. Which steps have been taken to improve the simulation of nature (development) ?
  4. Examples of results from several policy options

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1. What is the Land Use Scanner?

Ruimtescanner

- The Land Use Scanner (in Dutch: Ruimtescanner) is a modelling framework for Land Use change modelling. Developed from 1995 onwards

- The LUS uses a discrete (1ha resolution) allocation method that generates an allocation with maximum total suitability within the constraints of the regional Land Use claims

  - Regional land use claims (Area). Claims at several regional levels (province, agricultural region, soil regions, …..)

  - Suitability for all Land use classes (urban, nature, agricultural and water), in total 23 classes. → CONVERED TO AN ECONOMIC VALUE (Euro / m^2)

  - Maximizes the total suitability over all land use classes in the to be allocated space: NL in100 meter grid level (approximately 3.300.000 cells)

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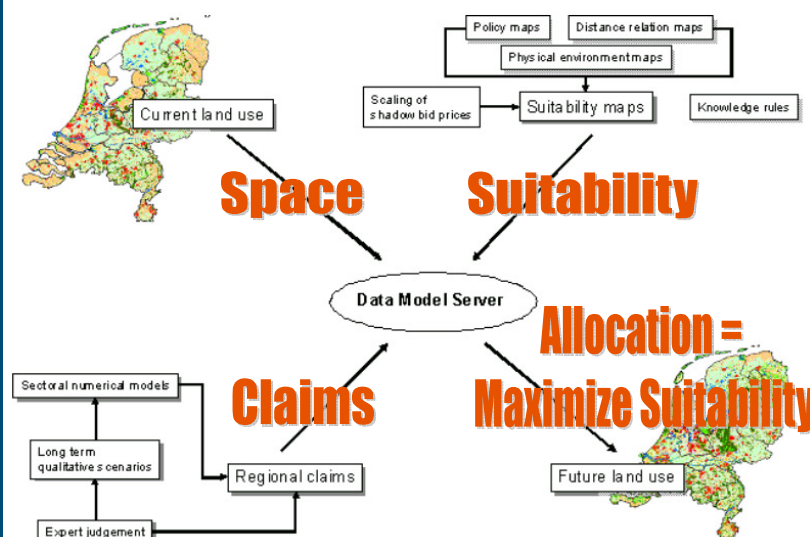
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1. What is the Land Use Scanner?

Ruimtescanner

- Model outline

Figure 1 Flow chart of the model structure

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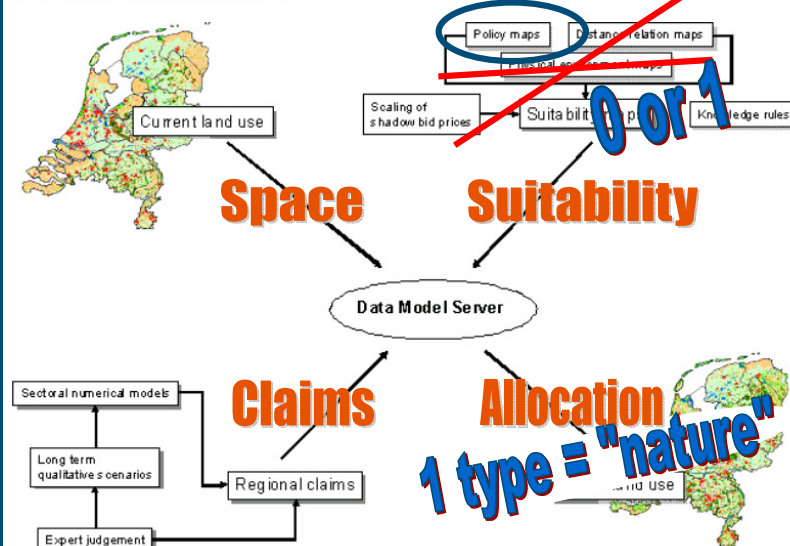**Faculty of Economics & Business Administration**

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2. How was "nature" previously implemented

- Model outline

Figure 1 Flow chart of the model structure

Space   Suitability

0 or 1

Claims   Allocation

1 type = "nature"

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3. Which steps have been taken to improve the simulation of nature (development)

A. Modelling the (change of) abiotic suitabilities for different nature types for different climate scenarios

B. Taking into account the spatial conditions (area size and configuration for Fauna) as an extra suitability parameter

C. Split the class "nature" in more relevant types.
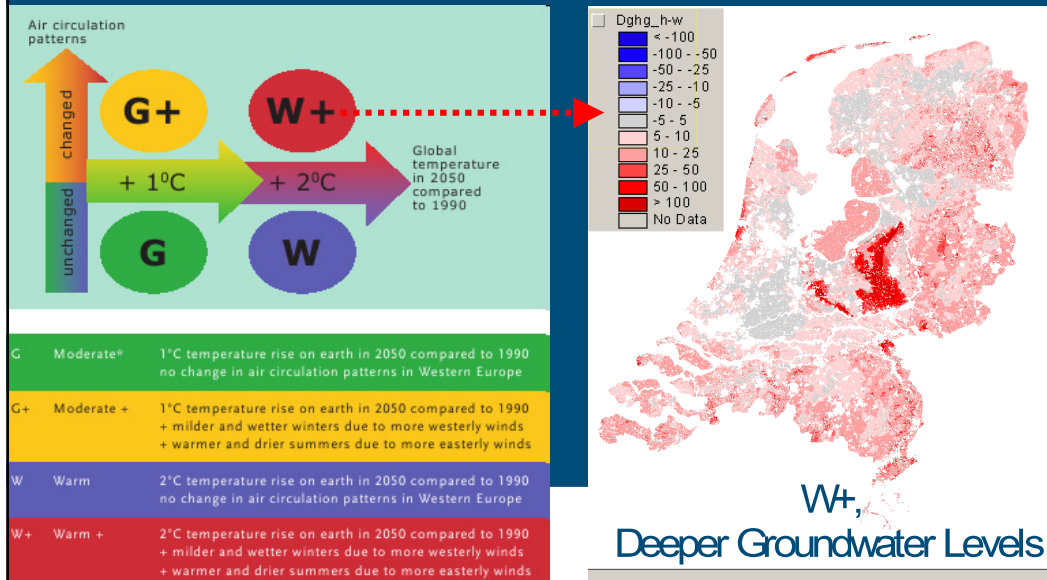
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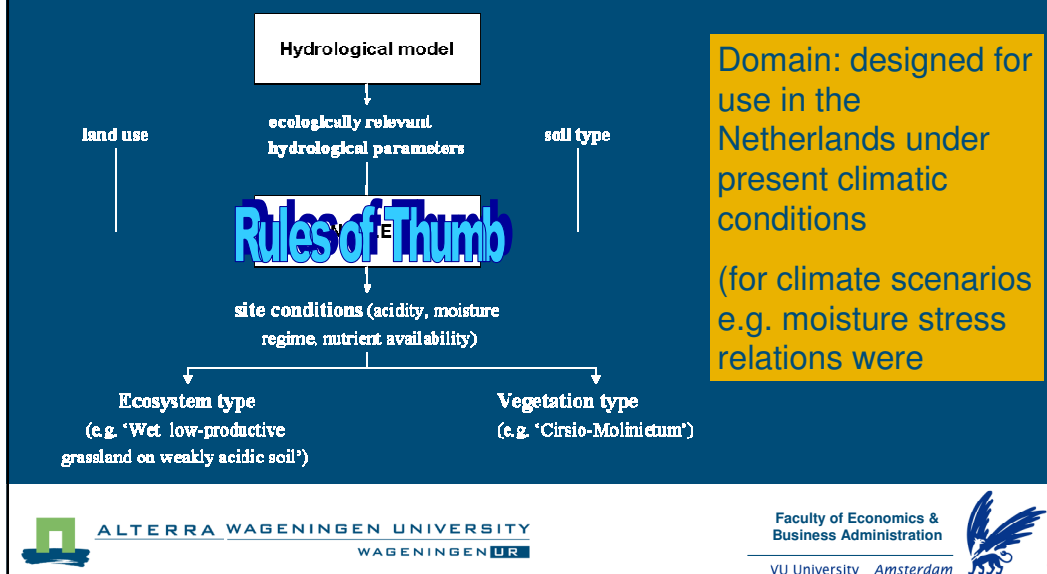
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3. Which steps have been taken to improve the simulation of nature (development)

A. Modelling the change of abiotic suitabilities under different climatologic conditions

Air circulation patterns

changed / unchanged

+ 1°C + 2°C

G+   W+

G   W

Global temperature in 2050 compared to 1990

Dghg_h-w
- < -100
- -100 - -50
- -50 - -25
- -25 - -10
- -10 - -5
- -5 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- > 100
- No Data

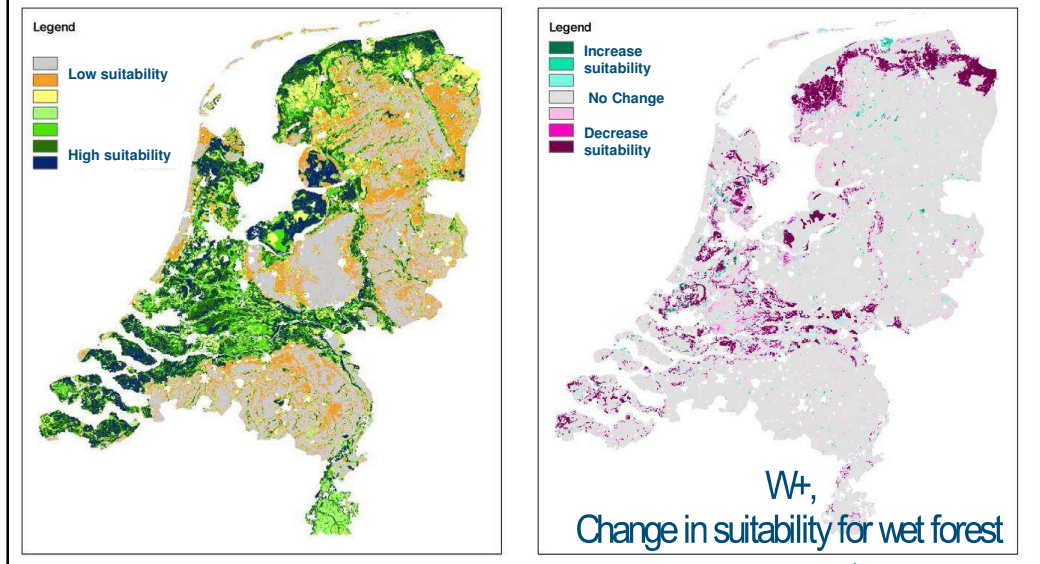| G | Moderate* | 1°C temperature rise on earth in 2050 compared to 1990 no change in air circulation patterns in Western Europe |
G+	Moderate +	1°C temperature rise on earth in 2050 compared to 1990 + milder and wetter winters due to more westerly winds + warmer and drier summers due to more easterly winds
W	Warm	2°C temperature rise on earth in 2050 compared to 1990 no change in air circulation patterns in Western Europe
W+	Warm +	2°C temperature rise on earth in 2050 compared to 1990 + milder and wetter winters due to more westerly winds + warmer and drier summers due to more easterly winds

W+,
Deeper Groundwater Levels

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3. Which steps have been taken to improve the simulation of nature (development)

A. Modelling the change of abiotic suitability under different climatological conditions

Hydrological model

land use

ecologically relevant hydrological parameters

soil type

Rules of Thumb

site conditions (acidity, moisture regime, nutrient availability)

Ecosystem type
(e.g. 'Wet low-productive grassland on weakly acidic soil')

Vegetation type
(e.g. 'Cirsio-Molinietum')

Domain: designed for use in the Netherlands under present climatic conditions

(for climate scenarios e.g. moisture stress relations were

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3. Which steps have been taken to improve the simulation of nature (development)

A. Modelling the change of abiotic suitability under different climatological conditions

Legend
- Low suitability
- High suitability

Legend
- Increase suitability
- No Change
- Decrease suitability

W+,
Change in suitability for wet forest

How many nature types in the Land Use Scanner ?

- 2 Nature types:
  - Wet
  - Dry

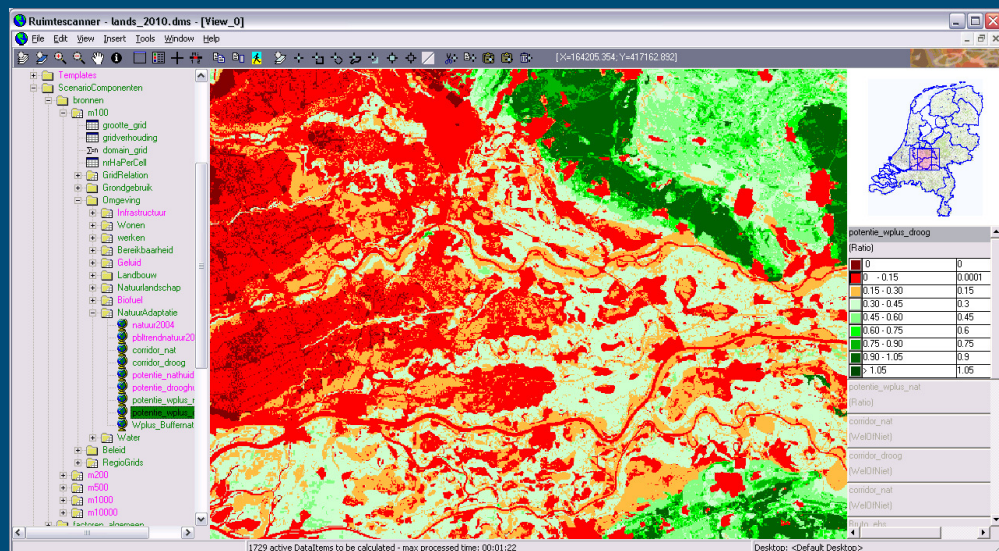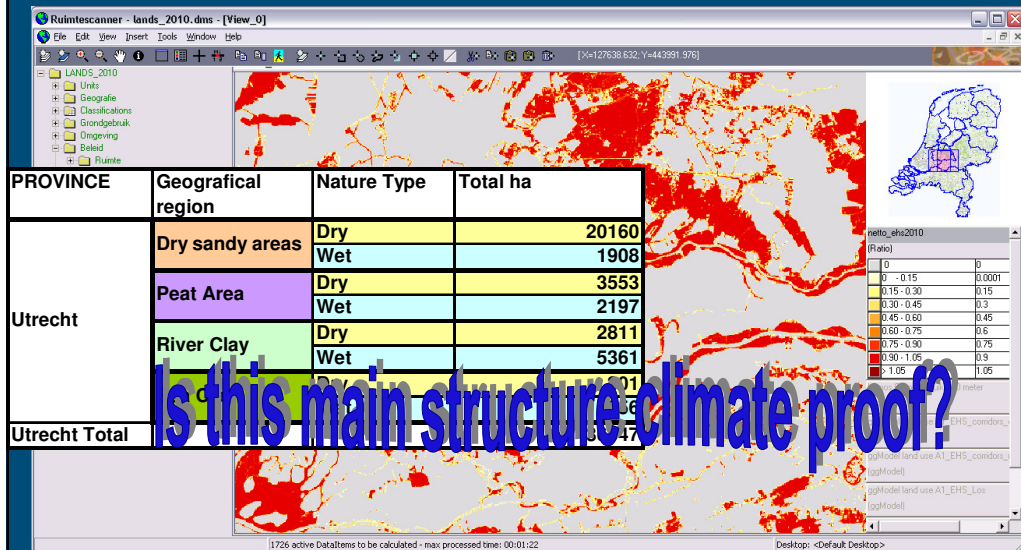 But with claims in specific regions (e.g. Dry sandy areas, Peat areas

- E.g. agriculture has 3 classes

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NATLES

Hoofdtype LANDS (identiek aan A2)	Subtype LANDS	VEG-CODE NDT	NDT te berekenen in LANDS
Bos	dBos	3.49	rivierduin en -strand
		3.52	zoom en mantel en droog struweel van de hogere gronden
		3.53	zoom en mantel en droog struweel van het rivieren- en zeekleigebied
		3.54	zoom en droog struweel van de duinen
		3.64	bos van arme zandgronden
		3.65	eiken- en beukenbos van lemige zandgronden
		3.68	eiken-haagbeukenbos van het heuvelland
		3.69	eiken-haagbeukenbos van zandgronden
	vBos	3.56	eikenhakhout en –middenbos
		3.58	eiken-haagbeukenhakhout en middenbos van het heuvelland
		3.59	eiken-haagbeukenhakhout en middenbos van zandgronden
		3.66	bos van voedselrijke en vochtige gronden
		3.67	bos van bron en beek
dHei	dGras	3.33	droog schraalgrasland van de hogere gronden
		3.34	droog kalkarm duingrasland
		3.35	droog kalkrijk duingrasland
	dHei	3.45	droge heide
		3.46	droge duinheide
	kGras	3.36	Kalkgrasland
GrasAkker	GrasAkker	3.5	akker van basenrijke gronden
		3.51	akker van basenarme gronden
Moeras	mBos	3.55	wilgenstruweel
		3.57	elzen-essenhakhout en -middenbos
		3.6	park-stinzenbos
		3.61	ooibos
		3.62	laagveenbos
		3.63	hoogveenbos
	mGras	3.29	nat schraalgrasland
		3.3	dotterbloemgrasland van beekdalen
		3.31	dotterbloemgrasland van veen en klei
		3.32	nat en matig voedselrijk grasland
		3.37	bloemrijk grasland van het heuvelland
		3.38	bloemrijk grasland van het zand- en veengebied
		3.39	bloemrijk grasland van het rivieren- en zeekleigebied
	Moeras	3.24	Moerassen
		3.25	natte strooiselruigte
		3.26	natte duinvallei
		3.27	trilveen
		3.28	veenmosrietland
nHei	nHei	3.42	natte heide
		3.43	natte duinheide
		3.44	levend hoogveen
OpenDuin	OpenDuin	3.47	zandverstuivingen
		3.48	strand en stuivend duin

Tabel 1 Gehanteerde indeling in Natuurtypen voor de Ruimtescanner

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Example final suitability "wet nature"

Example final suitability "dry nature"

4. Examples of results from several Policy options

PROVINCE	Geografical region	Nature Type	Total ha
	Dry sandy areas	Dry	20160
		Wet	1908
	Peat Area	Dry	3553
		Wet	2197
Utrecht	River Clay	Dry	2811
		Wet	5361
Utrecht Total			

EHS: Dutch Ecological Main Structure: 750.000 ha total in 2018, ca. 50% still needs to be allocated. Regional policy plans showing reserved space

Land Use Scanner Types: Land Use 2010
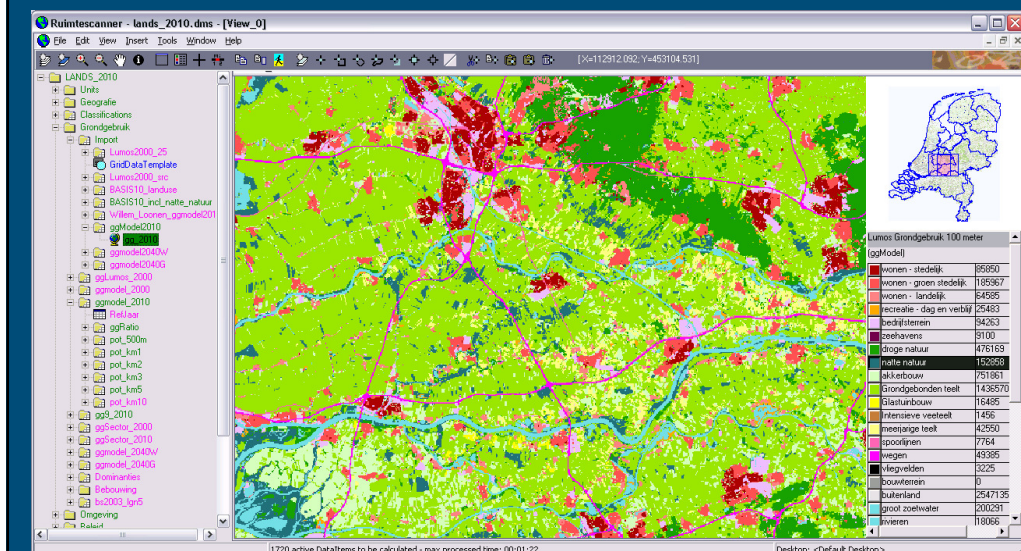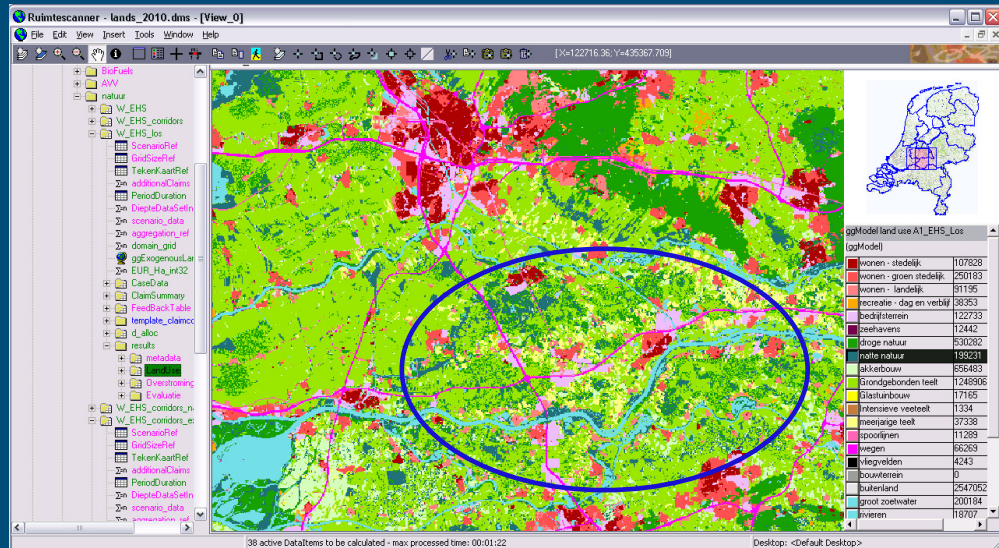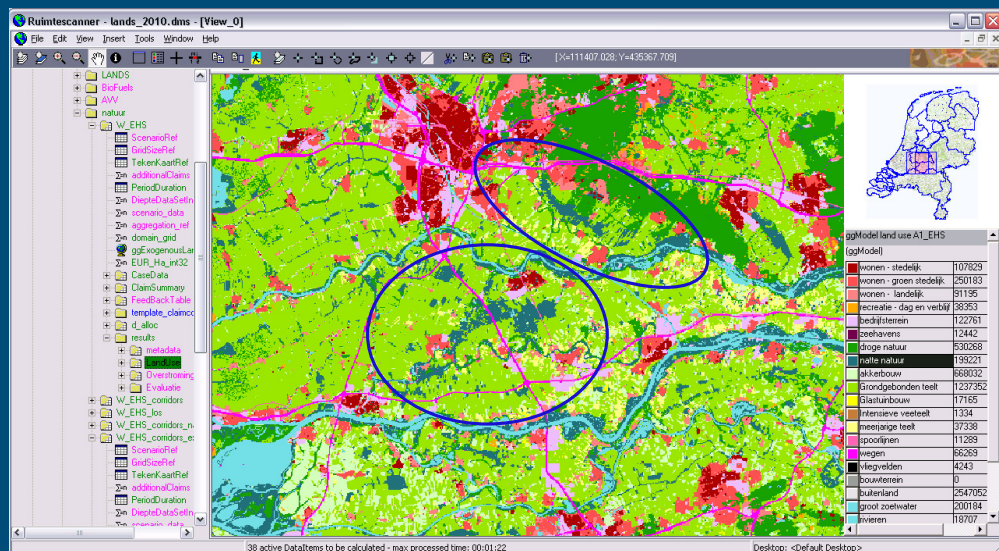
No EHS, No climate policies: Land Use 2040

In EHS, No climate policies: Land Use 2040
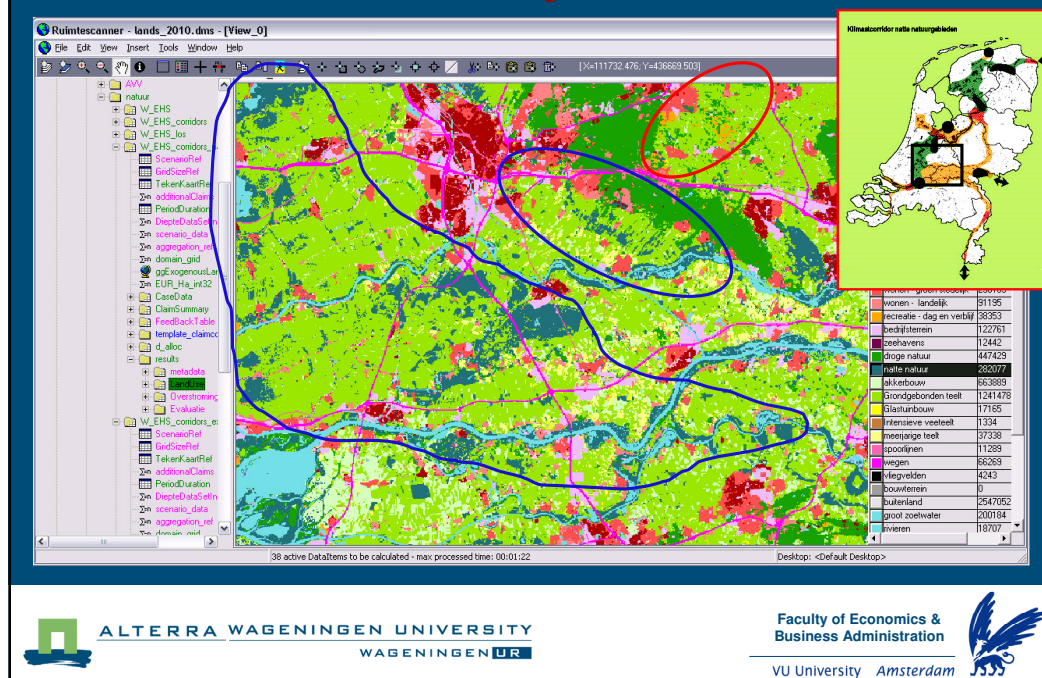
In EHS, with climate policies (corridors): Land Use 2040
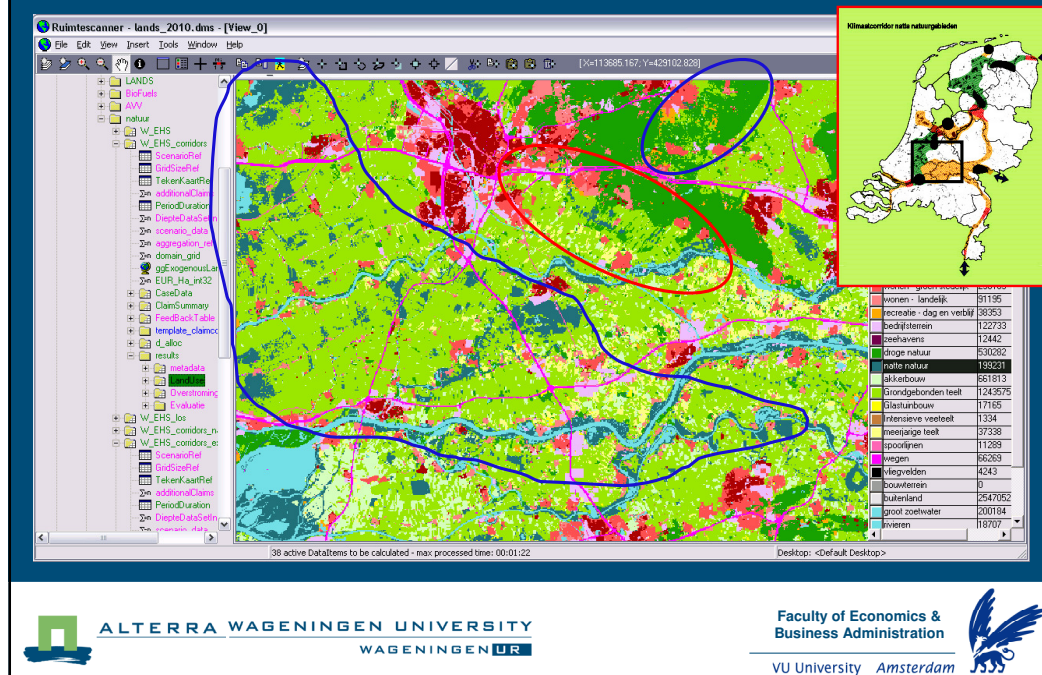
In EHS, with climate policies (corridors): Land Use 2040
+ shift claim from "dry" to "wet" nature

Conclusions

- Nature is now treated in the same way as all other land use types (specific suitability for 2 different types combined with regional demands) → future improvement of knowledge makes it easier to change sceanario settings

- The model-train (Hydrological Model → Ecological Model → Land Use Change Model) has many uncertainties. If we assume the hydrological model to be correct, still more knowledge is needed to forecast real effect of climate change on nature types. However, the level of uncertainties of all other land use types in de Land Use Scanner is comparable!

- Preliminary results show that realising climate corridors / -buffers takes more effort than simply defining regions without adjusting claims

- Heavily depending on land pricing related to agricultural value → Create Scenario with Subsidies for Climate adaptation

Thank you

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