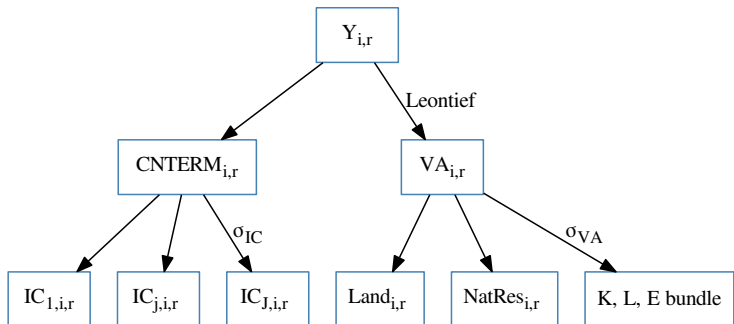# Stimul: decrease in nitrogen use
MIRAGE-e

22 March 2018
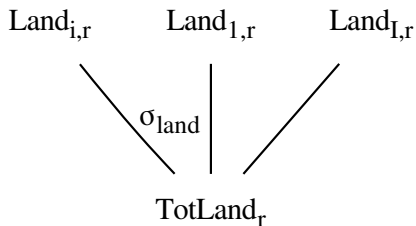
MIRAGE-e – Land and fertilizers treatment I

Production function:

- No direct substitution btw land and feritlizers $\Rightarrow$ a tax on fertilizers translates in *less* land cultivated !!
- Fertilizers: included in the *crp* sector in GTAP (Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products)

MIRAGE-e – Land and fertilizers treatment II

Land mobility (substitution across crops):

$$\text{Land}_{i,r} \qquad \text{Land}_{1,r} \qquad \text{Land}_{I,r}$$

$$\sigma_{\text{land}}$$

$$\text{TotLand}_r$$

Imperfect mobility within a given region: simple CET structure
$\Rightarrow$ same susbtitution btw wheat and maize as btw wheat and
pasture...

MIRAGE-e – Land and fertilizers treatment III

Land expansion: land supply elasticity varies across countries (2 possible values of $\sigma_{TotLand}$, 0.25 or 1)

$$TotLand_{r,t} = TotLand_{r,t0} \left(\frac{W_{r,t}^{TotLand}}{P_{r,t0}} \right)^{\sigma_{TotLand}}$$

$\Rightarrow$ 3 possibles improvements:

- substitution with intermediary consumptions,
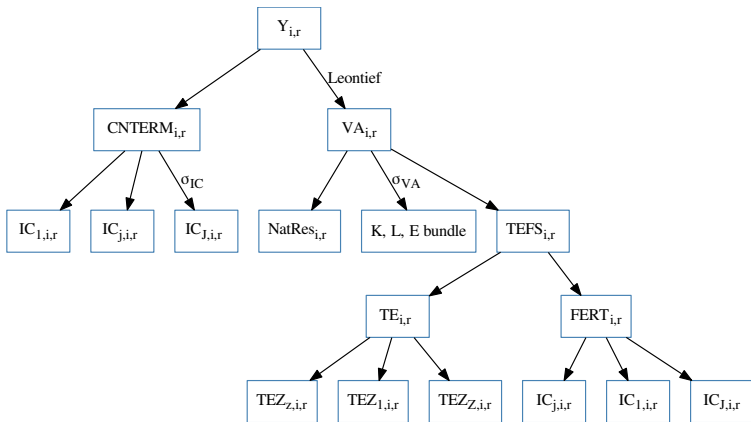- substitution across land uses,
- land expansion

Tax on fertilizers

- Assumption: nitrogen represents 25% of the use of *crp* by crop sectors
- Aim: decrease by around 12% of $IC_{crp,j,EU28}$, with j in {Cereals, Fibercrops, Oilseeds, OthCrops, Sugar, VegFruits, Wheat}
- Implementation: trial and error... $\Rightarrow$ increase by 20 pp of the tax on IC prices produces a decrease by 11% of $IC_{crp,j,EU28}$.
- GTAP 9.2, base year=2011, one shot tax increase in 2019.

Mapping table

Code	Label	Aggregation Code
pdr	Paddy rice	Cereals
wht	Wheat	Wheat
gro	Cereal grains nec	Cereals
v_f	Vegetables. fruit. nuts	VegFruits
osd	Oil seeds	Oilseeds
c_b	Sugar cane. sugar beet	Sugar
pfb	Plant-based fibers	Fibercrops
ocr	Crops nec	OthCrops
ctl	Cattle.sheep.goats.horses	Cattle
oap	Animal products nec	Animprod
rmk	Raw milk	Dairy
wol	Wool. silk-worm cocoons	Wool
frs	Forestry	Forestry
fsh	Fishing	Fishing
coa	Coal	Energy
oil	Oil	Energy
gas	Gas	Energy
omn	Minerals nec	Minerals
cmt	Meat: cattle sheep.goats.horse	Meat
omt	Meat products nec	Meat
vol	Vegetable oils and fats	Vegoils
mil	Dairy products	Dairy
pcr	Processed rice	Cereals
sgr	Sugar	Sugar
ofd	Food products nec	Othfood
b_t	Beverages and tobacco products	BevTob
tex	Textiles	Textile
wap	Wearing apparel	Textile
lea	Leather products	Textile
lum	Wood products	OthManuf
ppp	Paper products . publishing	OthManuf
p_c	Petroleum. coal products	Energy
crp	Chemical.rubber.plastic prods	Chemistry
nmm	Mineral products nec	Minerals
i_s	Ferrous metals	Metals
nfm	Metals nec	Metals
fmp	Metal products	Metals
mvh	Motor vehicles and parts	Vehicles
otn	Transport equipment nec	Vehicles
ele	Electronic equipment	Electronic
ome	Machinery and equipment nec	Machinery
omf	Manufactures nec	OthManuf
ely	Electricity	Energy
gdt	Gas manufacture. distribution	Energy
wtr	Water	OthServ
cns	Construction	OthServ
trd	Trade	Serv
otp	Transport nec	Transport
wtp	Sea transport	Transport
atp	Air transport	Transport
cmn	Communication	Serv
ofi	Financial services nec	Serv
isr	Insurance	Serv
obs	Business services nec	Serv
ros	Recreation and other services	Serv
osg	PubAdmin/Defence/Health/Educat	PubServ
dwe	Dwellings	OthServ

Sectors Nb: 3?

| Aggregation Code |
|------------------|
| Cereals |
| Wheat |
| VegFruits |
| Oilseeds |
| Sugar |
| Fibercrops |
| OthCrops |
| Cattle |
| Animprod |
| Dairy |
| Wool |
| Forestry |
| Fishing |
| Energy |
| Minerals |
| Meat |
| Vegoils |
| Othfood |
| BevTob |
| Textile |
| OthManuf |
| Chemistry |
| Metals |
| Vehicles |
| Electronic |
| Machinery |
| OthServ |
| Serv |
| Transport |
| PubServ |

MIRAGE-BioF – Land treatment I

- Land demand (production function):

$\rightarrow$ possible substitution btw land and fertilisers + imperfect
mobility across AEZ, within a given region.

MIRAGE-BioF – Land treatment II

- Land mobility (substitution across crops): complex imperfect mobility within a given AEZ, of a given region (Values of sigmas?)
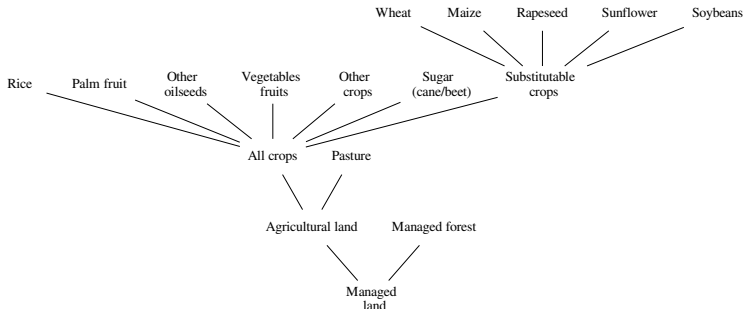
$\rightarrow$ identification of different types of LUC (pastures, deforestation of managed or natural forests...)

MIRAGE-BioF – Land treatment III

- Land expansion (land supply):

$$LANDEXT_{z,r,t} + MANAGED\_LAND_{z,r,t=0} =$$

$$MANAGED\_LAND_{z,r,t}^{Exo} \left[\left(\frac{P_{z,r,t}^{\text{Managed land}}}{P_{r,t}} \right)^{\sigma} \right]$$

with $\sigma = \sigma_{z,r}^{L} \left(\dfrac{Land\_avail_{z,r} - LANDEXT_{z,r,t}}{Land\_avail_{z,r}} \right)$

$\Rightarrow$ supply elasticity decreases when less land is available