Agronomic opportunities to reduce agricultural nitrogen pollution

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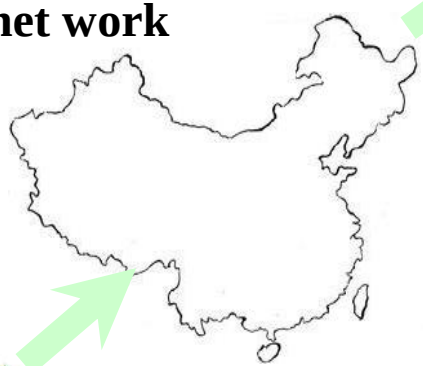
Research in different scales

- Different scientific questions
- Different approaches

Monitoring net work
GIS +Model

Global scale

Monitoring net work
GIS +Model



National or
Continent scale

Monitoring net work
GIS +Model

Regional or
Catchment's scale

Field
installations

Plot scale or
Cropping systems

Molecular or
Microcosm

Microorganisms
Process level

Up

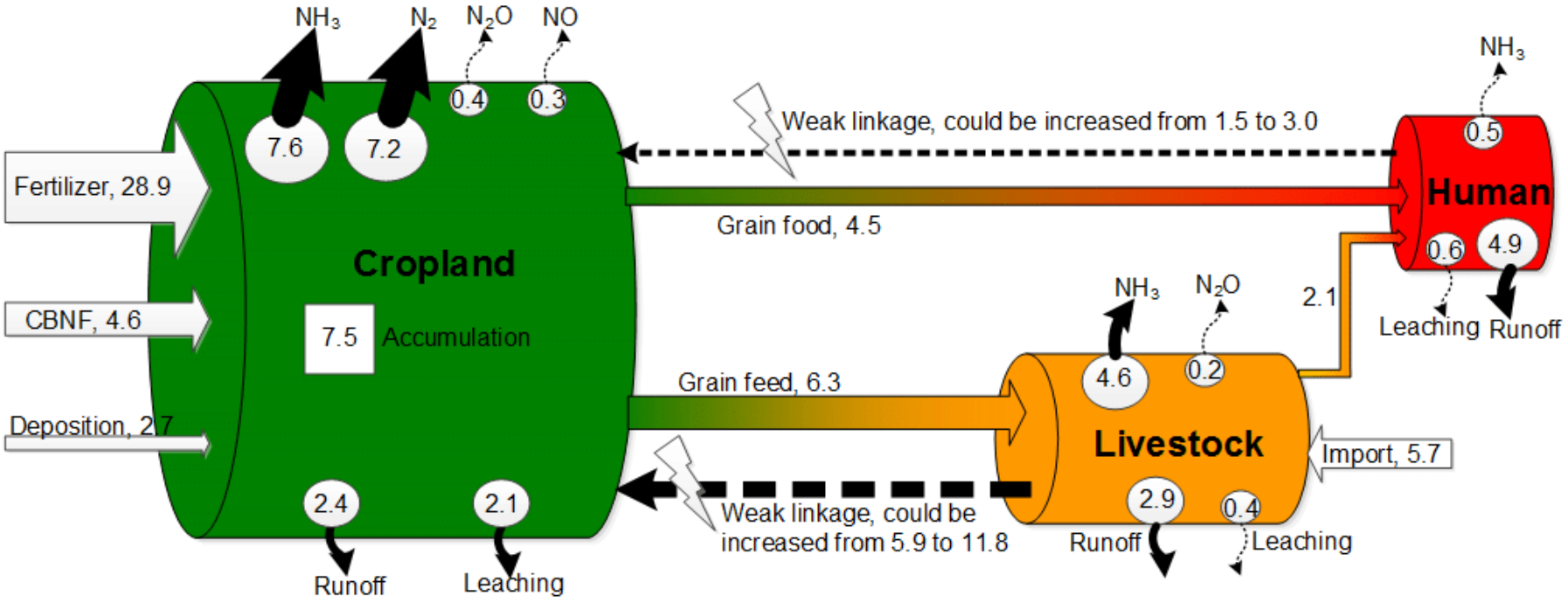
Top

Bottom

Down

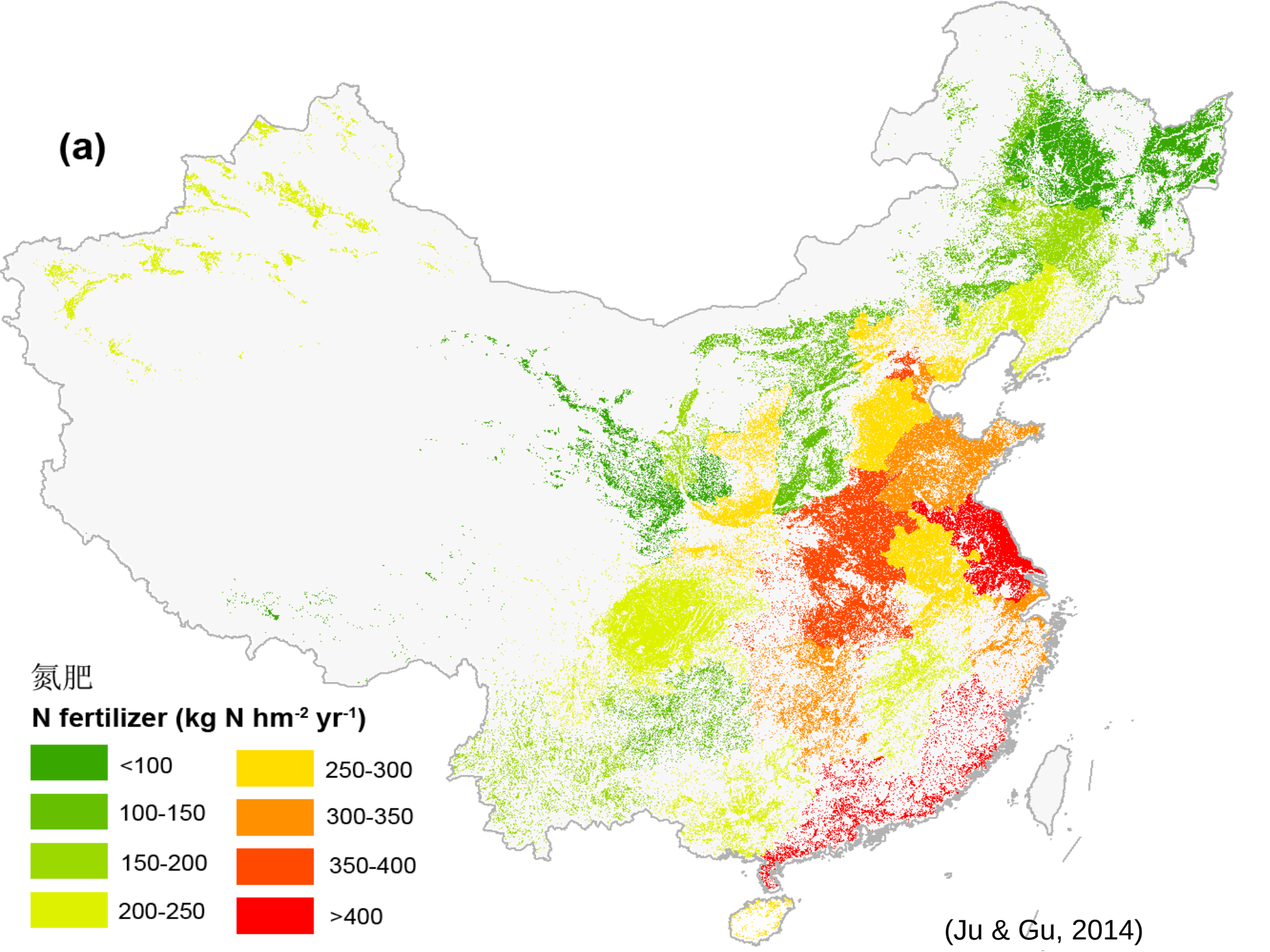
Big picture of agricultural nitrogen in China

Unit: Tg N in 2010



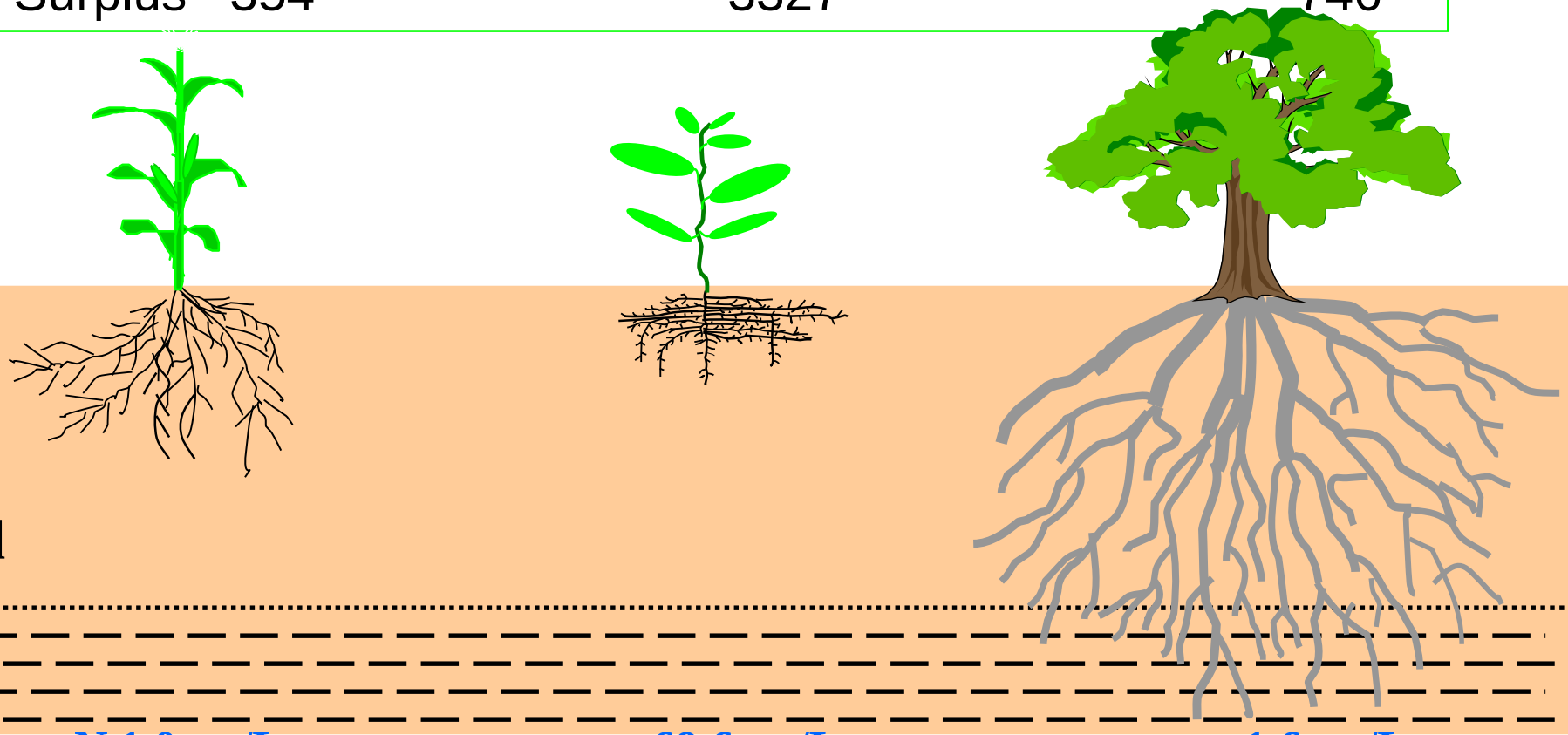
- Increase NUE in cropland and livestock
- Increase recycling rate from manure

(unpublished)


(a)
氮肥
N fertilizer (kg N hm-2 yr-1)
<100
100-150
150-200
200-250
250-300
300-350
350-400
>400
(Ju & Gu, 2014)

Effect of cropping system on nitrate-N concentration (kg N ha^{-1} y^{-1})

	wheat-maize	greenhouse vegetable	apple tree
Input	629	3656	867
Output	280	329	121
Surplus	354	3327	746

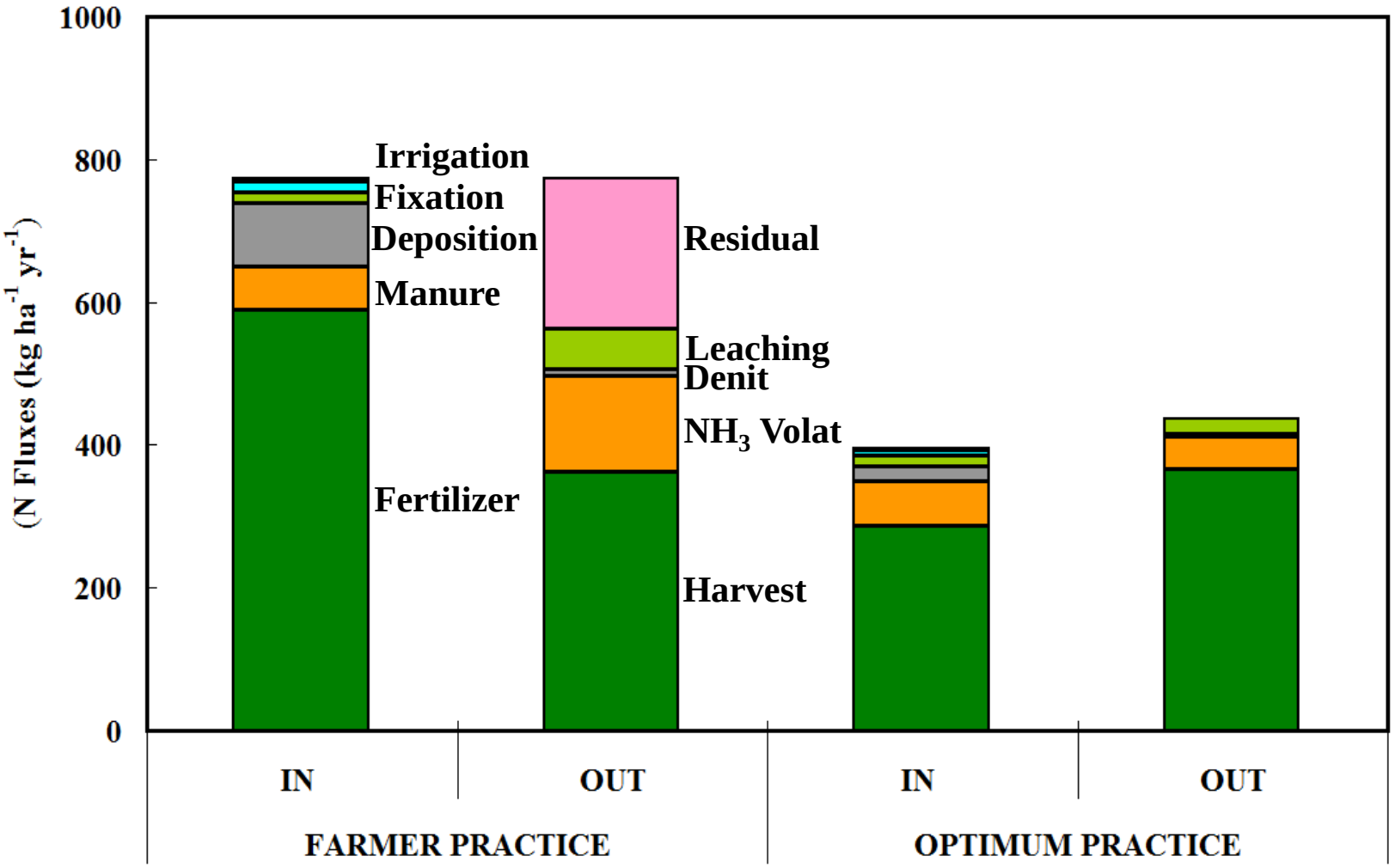


Nitrate-N	1.0mg/L	69.6mg/L	1.6mg/L
<15m	/	99	5
>15m	1	5	0

Groundwater

(Ju et al., 2006)

Wheat-Maize cropping system in NCP (Ju et al.,2009)



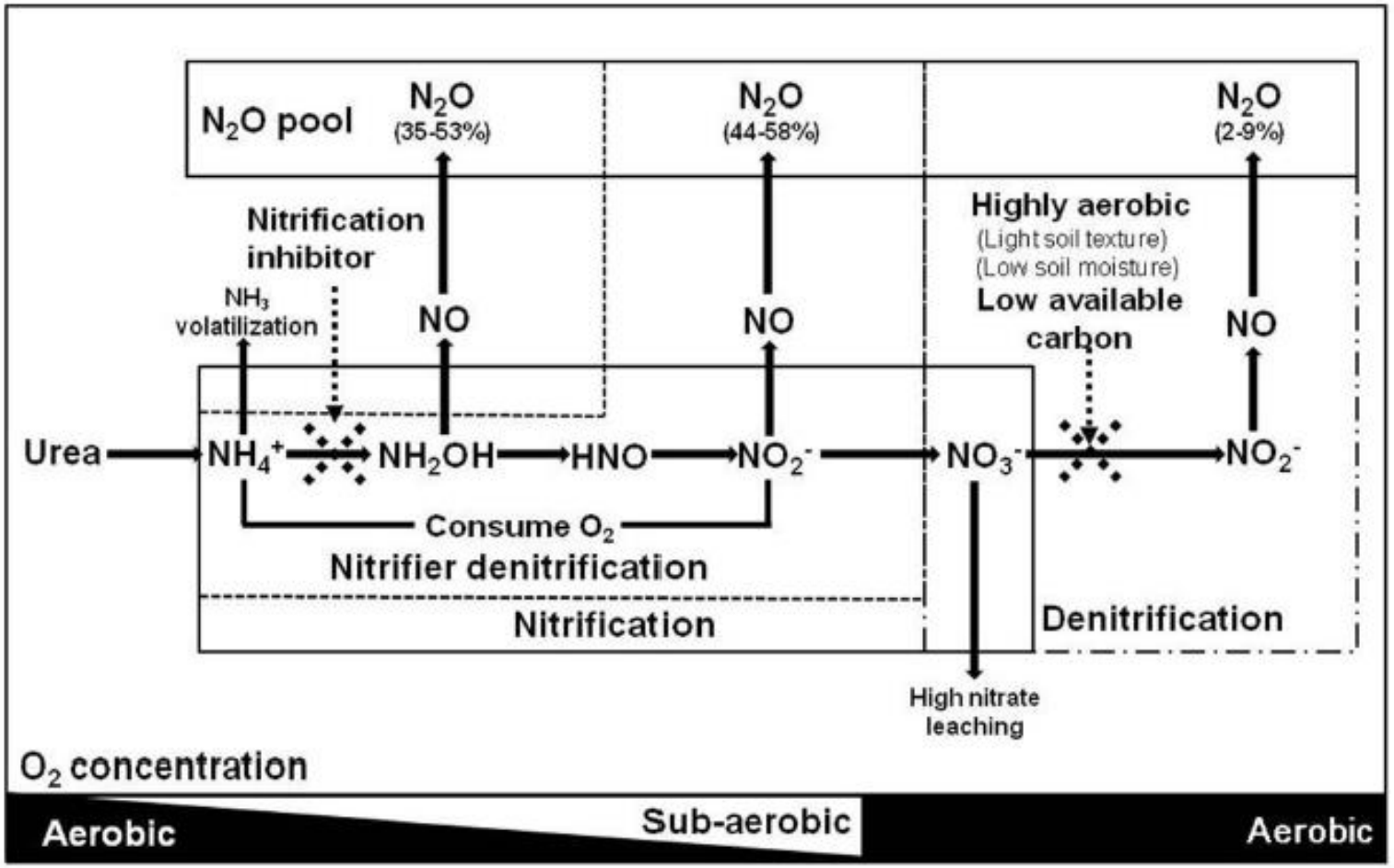
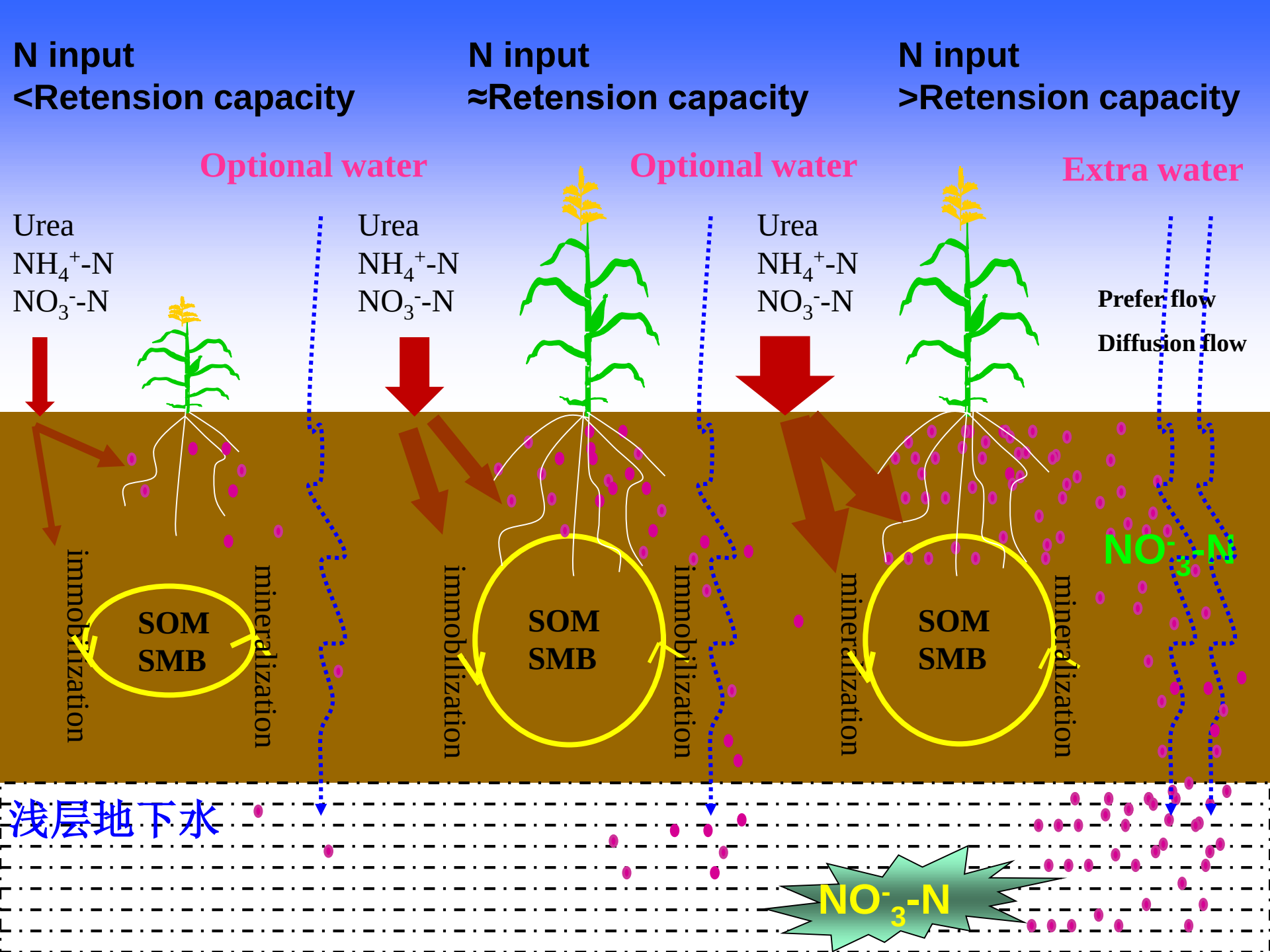


Figure 5 | Conceptual model of N_2O generation in the intensively managed calcareous Fluvo-aquic soil.

(Huang et al., 2014)

Thanks for your attention


N input
<Retension capacity
N input
≈Retension capacity
N input
>Retension capacity
Optional water
Optional water
Extra water
Urea
NH_4^+-N
NO_3^--N
Urea
NH_4^+-N
NO_3^--N
Urea
NH_4^+-N
NO_3^--N
Prefer flow
Diffusion flow
immobilization
mineralization
SOM
SMB
immobilization
mineralization
SOM
SMB
immobilization
mineralization
SOM
SMB
NO^-_3-N
浅层地下水
NO^-_3-N

The loss rate (%) of N applied as inorganicand organic N in China's croplands, divided into the south and north regions

N loss	Synthetic N input				Organic
	Upland		Paddy field		
	North	South	North	South	
NH_3 emission	21.3	11.0	16.0	16.0	23.0
Denitrification	3.2	25.3	33.0	36.4	15.0
Leaching	7.3	3.2	0.5	1.2	4.0
Runoff	3.5	11.0	5.2	5.2	5.0
N_2O emission	1.1	1.1	0.4	0.4	1.0
NO emission	0.7	0.7	0.1	0.1	0.7

(unpublished)

Outlooks

- N is main contributor to Chinese food security after 1980s
- Current N threat to environments might be more serious than European and US in 1970s
- N research in different level have been addressed, but need to deepen, widen and integrated
- Need national monitoring net work
- Need integrated N assessment
- Need integrated N management from fields to country

Fig. 1a: Definition of acceptable boundaries for N output/input ratios giving a desirable range for NUE

(all values are provisional and only serve as examples)

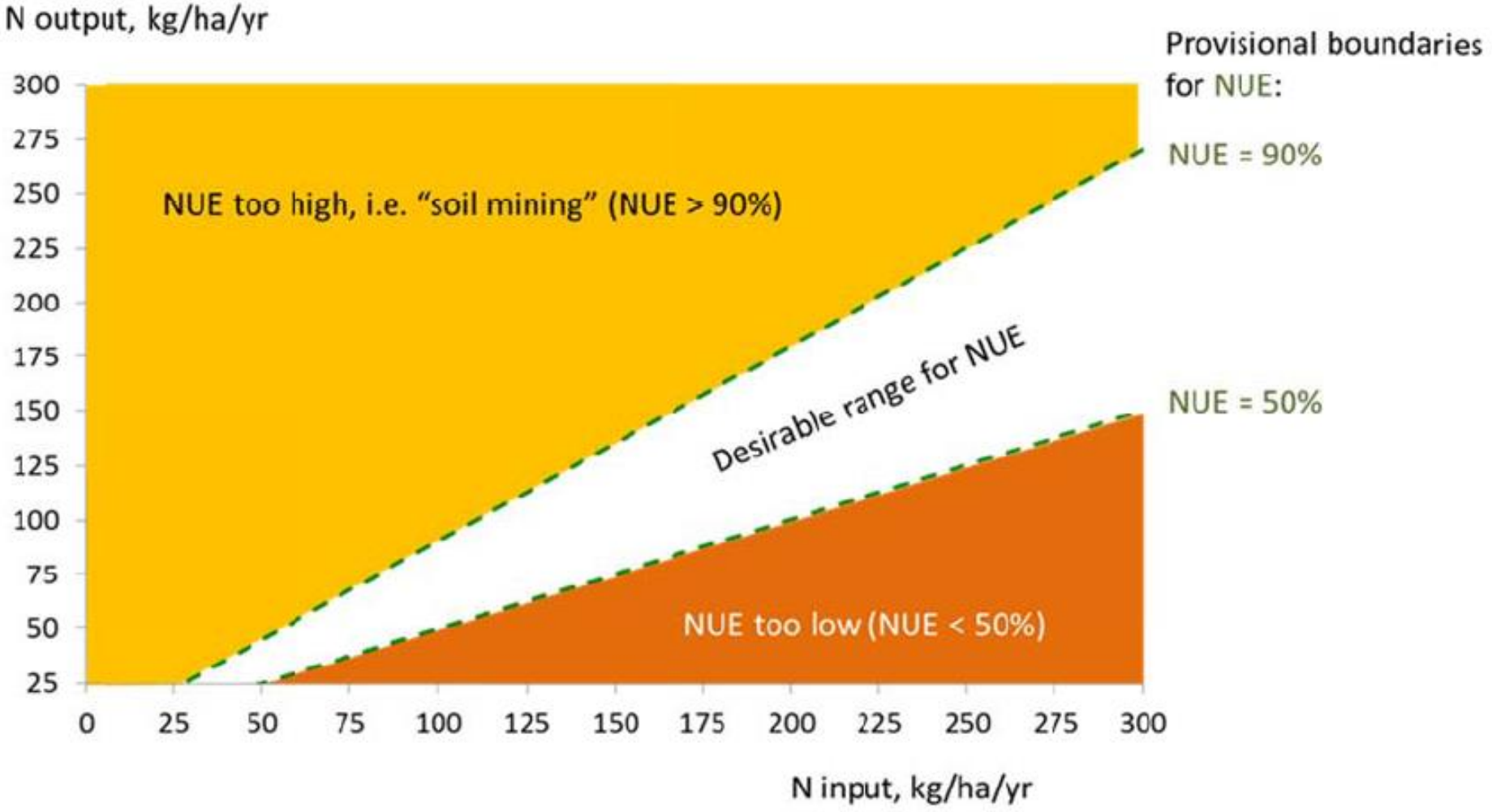


Fig. 1b: Definition of acceptable boundaries for N output/input ratios giving a desirable range for NUE – supplemented by a desired minimum productivity level
(all values are provisional and only serve as examples)

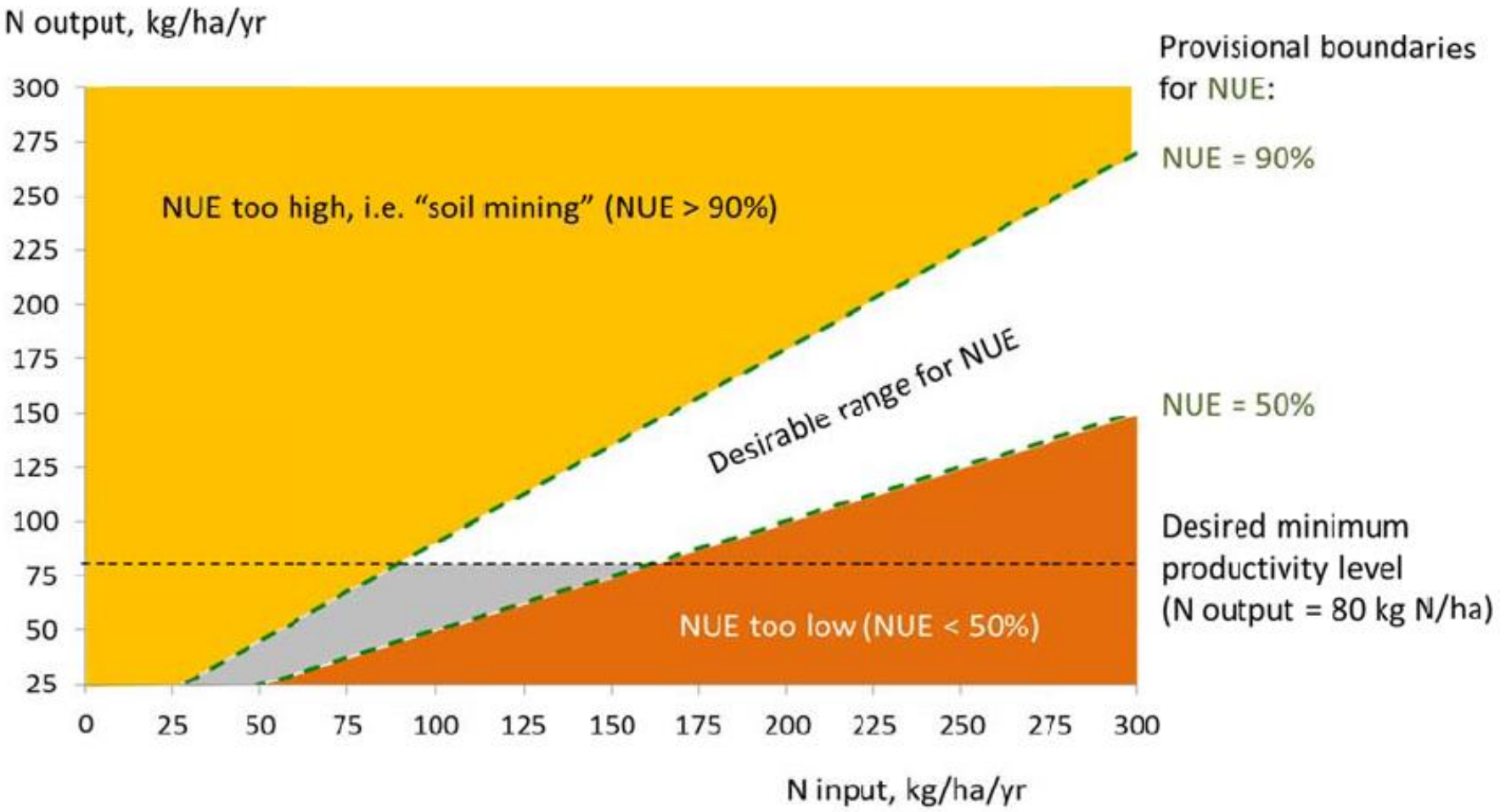


Fig. 1c: Definition of acceptable boundaries for N output/input ratios giving a desirable range for NUE – supplemented by an acceptable N balance surplus
(all values are provisional and only serve as examples)