The European CAP and feasible eco-hydrological impacts for the Dill catchment, Germany

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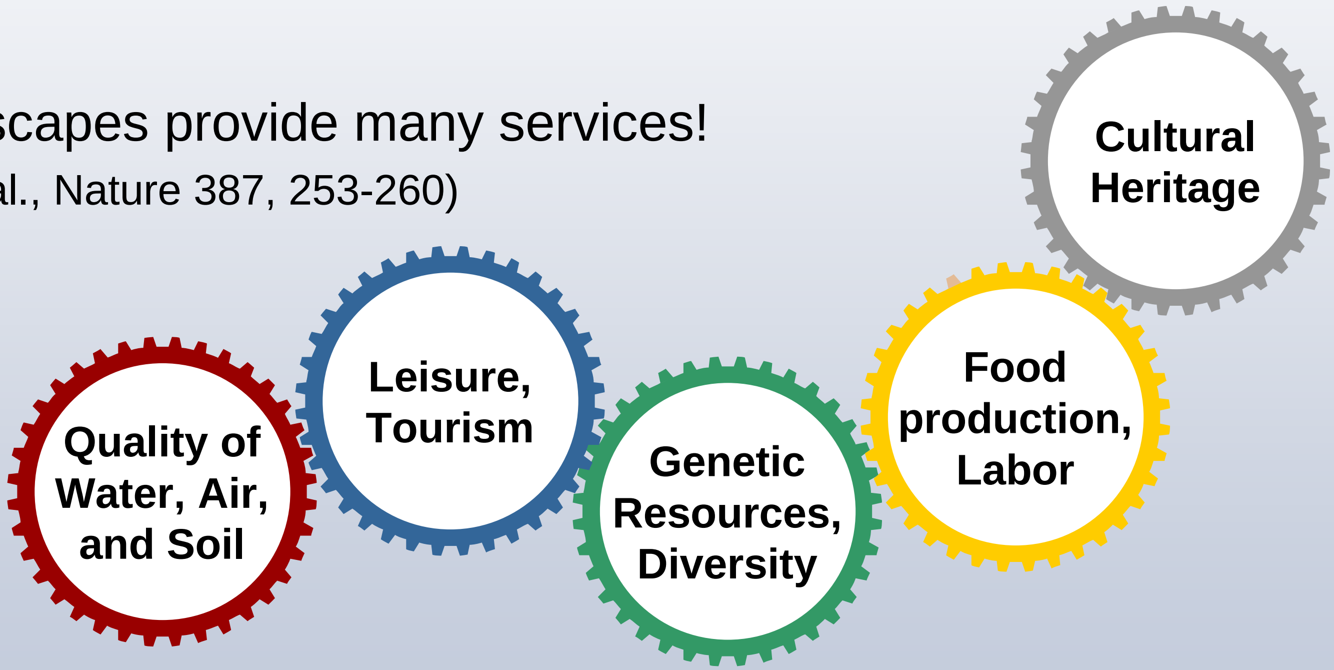
Background

Agricultural practice in marginal regions is decreasing, leading to land abandonment and changes in the economic structure.

- … but landscapes provide many services!
  (Costanza et al., Nature 387, 253-260)



- Required: An integrated assessment of land use change effects

Dill catchment

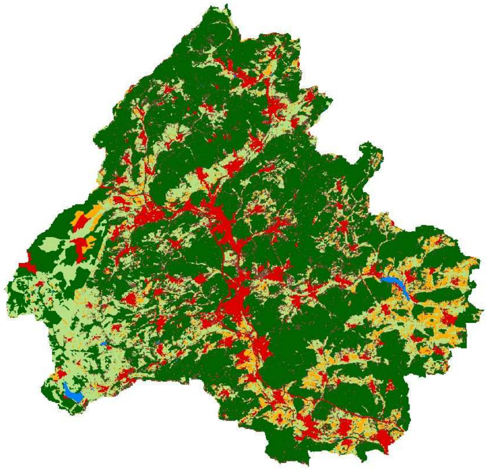
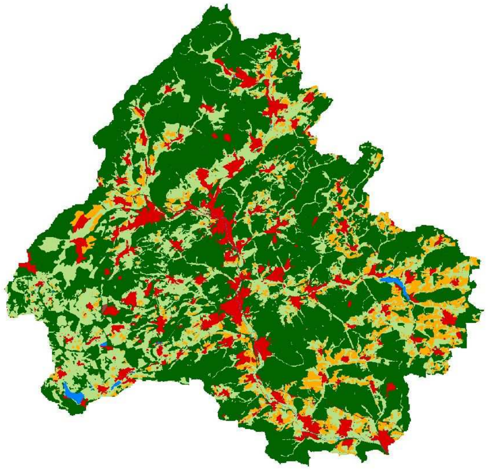
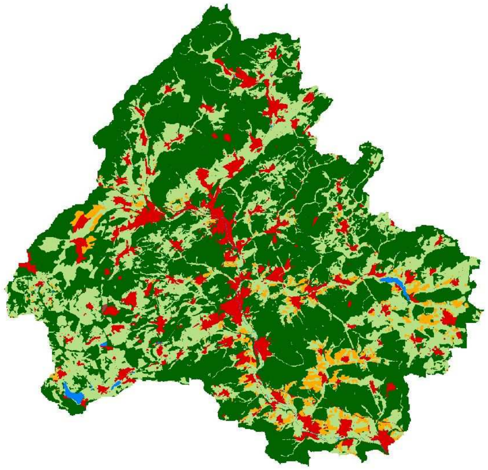
Land use scenarios

- Grassland bonus
- Field size allocation
- Outwintering suckler cows
- European Common Agricultural Policy

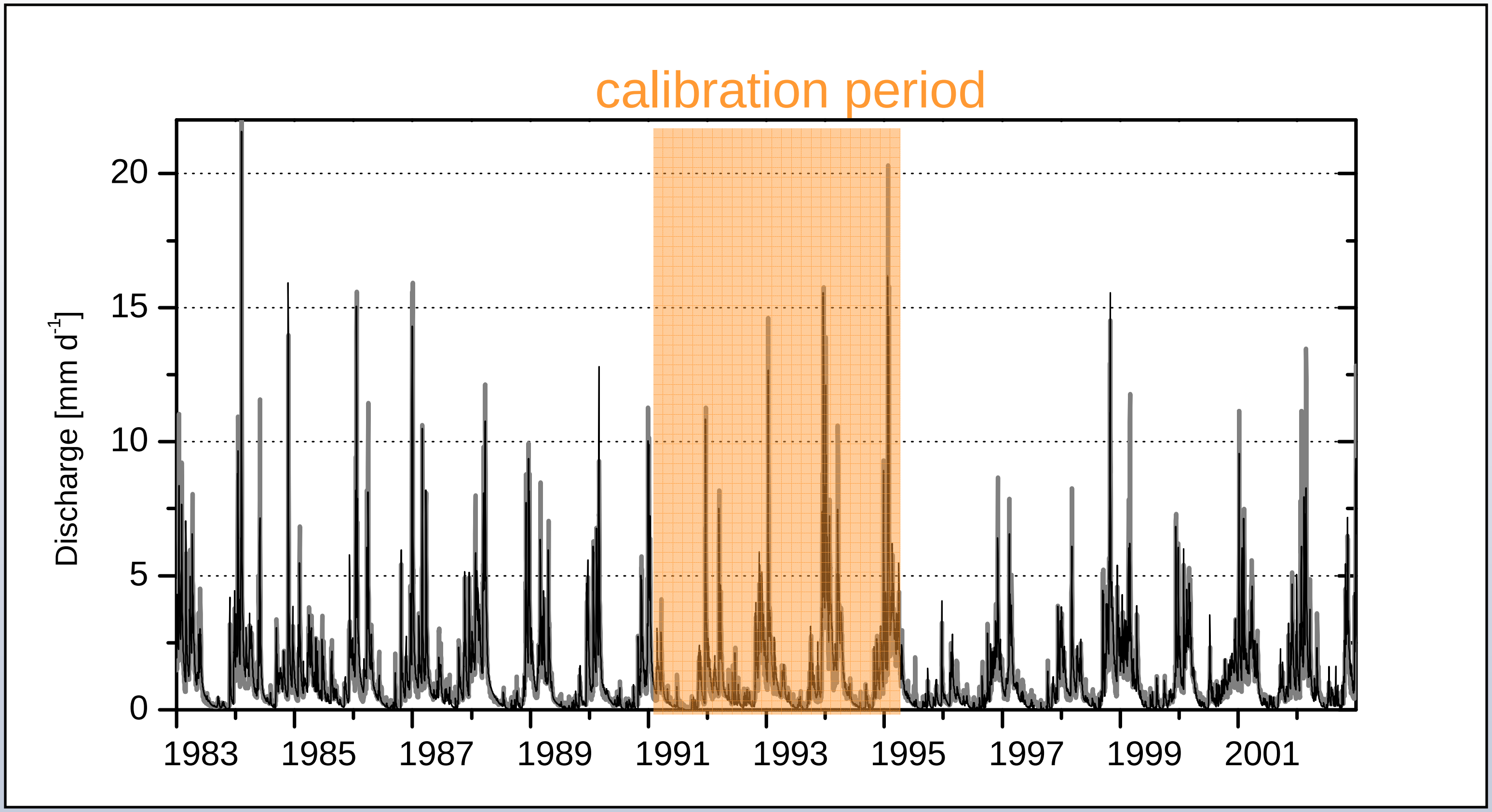
Size ~ 692 km^2

54 % forest
21 % pasture
9 % settlement
9 % fallow
7 % agriculture

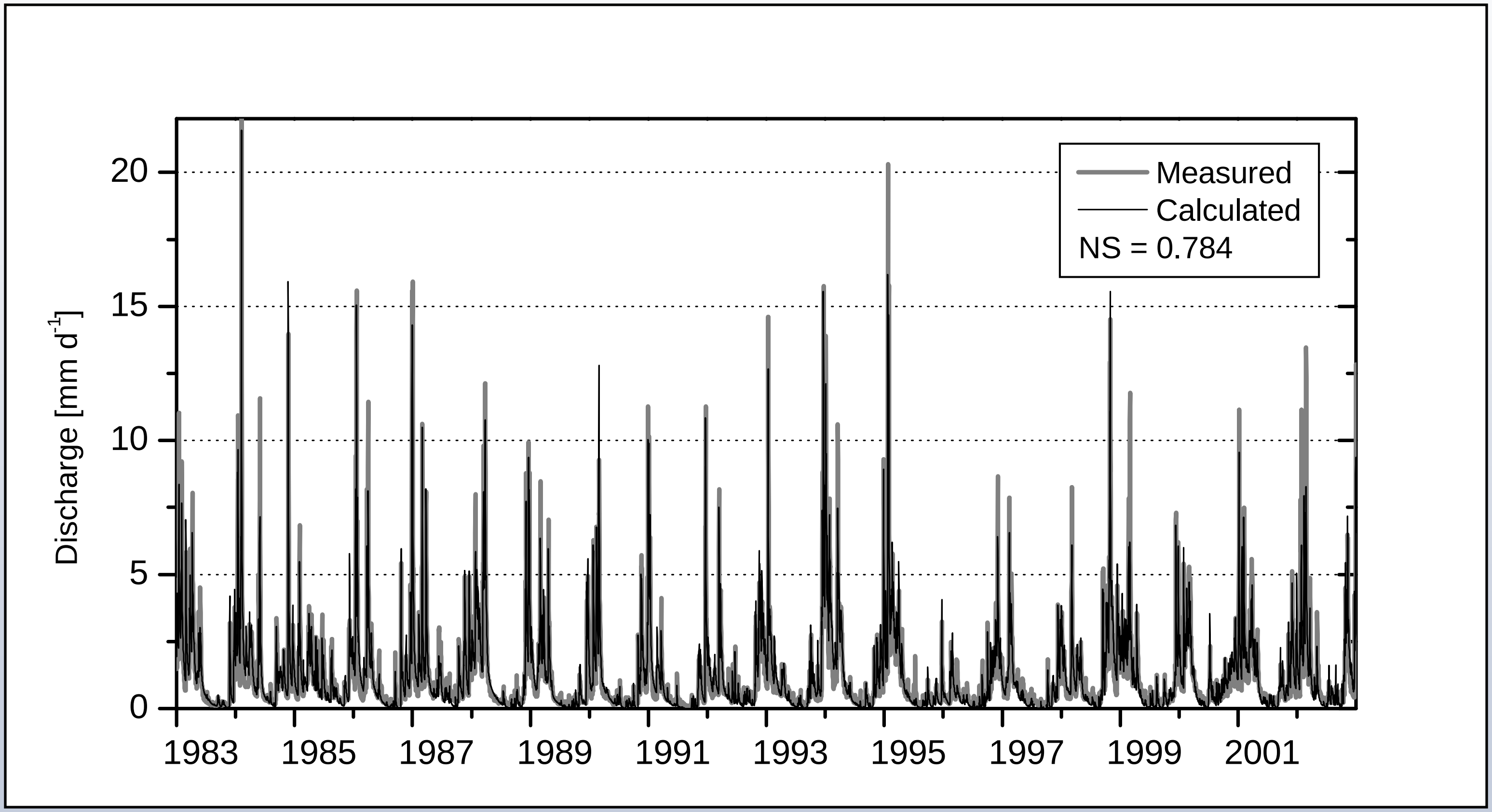
CAP Land use scenarios

Baseline	Agenda2000	CAP
		
AGRL 6.5 % PAST 20.5 %	AGRL 8.0 % PAST 25.5 %	AGRL 3.7 % PAST 30.4 %

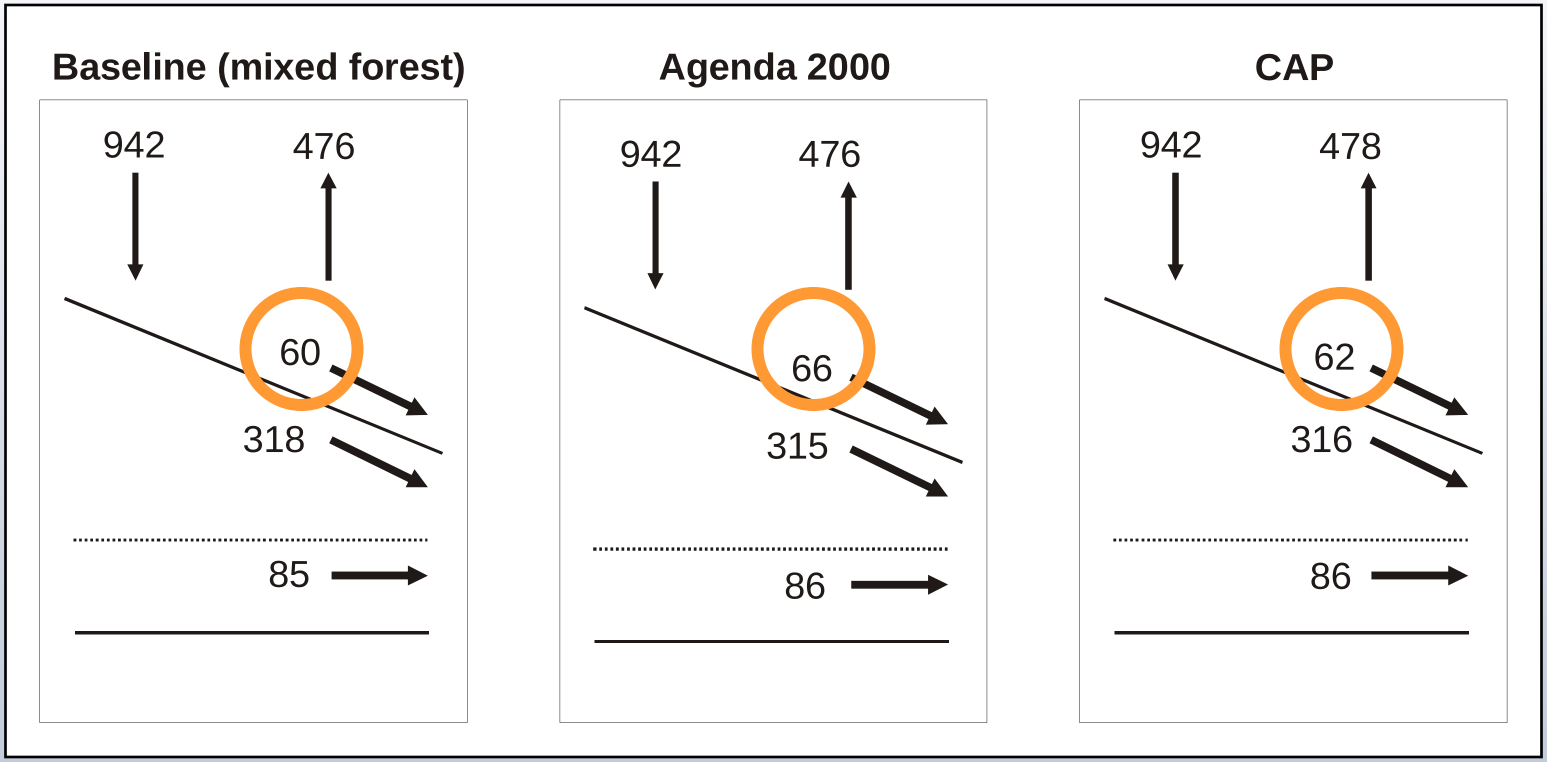
Model validation



Model validation

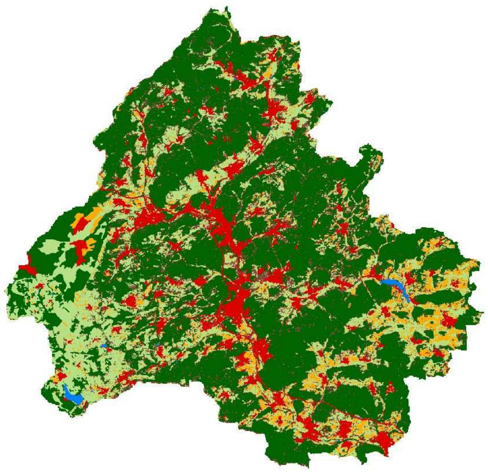
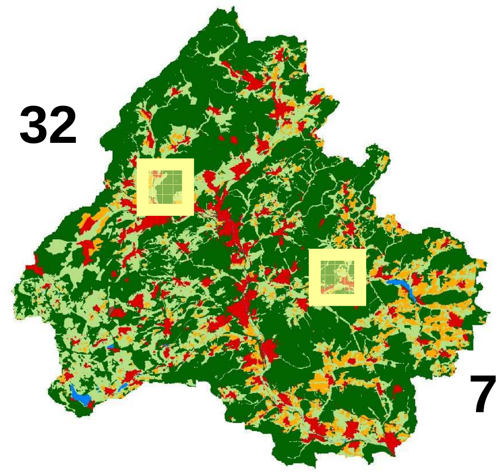
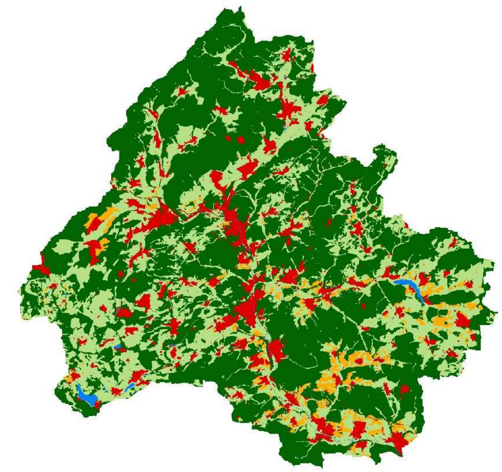


Hydrology

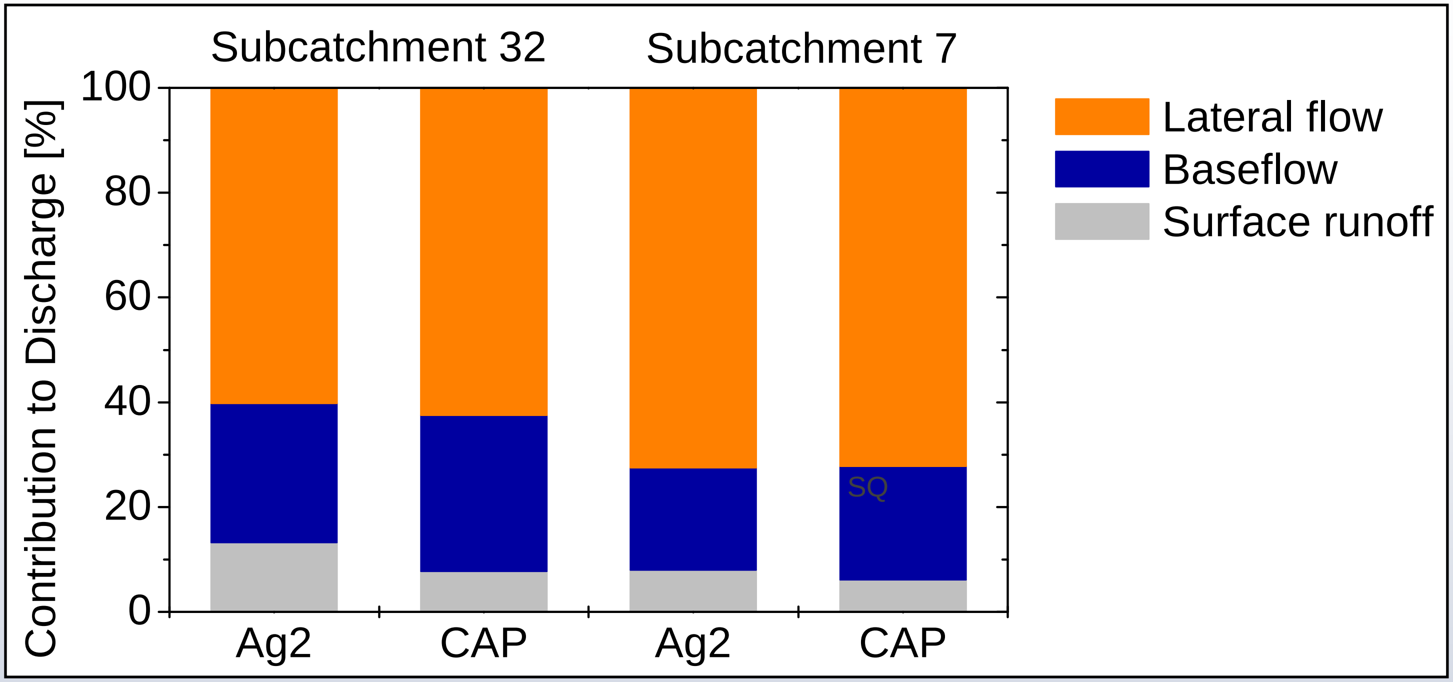


Baseline (mixed forest)
942
476
60
318
85
Agenda 2000
942
476
66
315
86
CAP
942
478
62
316
86

Subcatchments

	Baseline	Agenda2000	CAP
			
7	AGRL 7 % PAST 25 %	AGRL 12 % PAST 33 %	AGRL 0 % PAST 46 %
32	AGRL 30 % PAST 30 %	AGRL 39 % PAST 23 %	AGRL 8 % PAST 56 %

Subcatchments



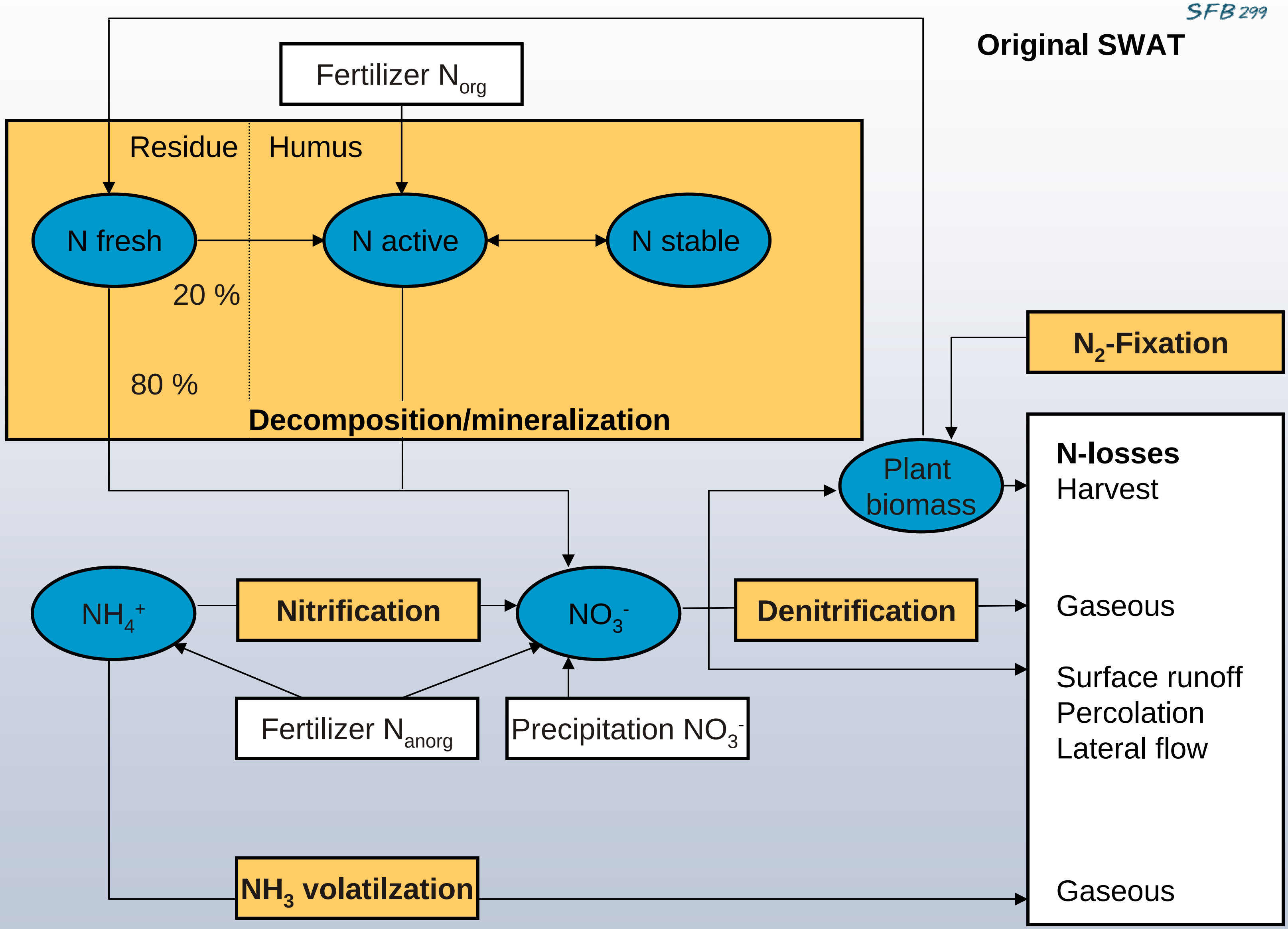
7	AGRL 7 % PAST 25 %	AGRL 12 % PAST 33 %	AGRL 0 % PAST 46 %
32	AGRL 30 % PAST 30 %	AGRL 39 % PAST 23 %	AGRL 8 % PAST 56 %

Biogeochemistry

- Apart from hydrological modelling a focus of SFB299 is on nutrient cycling
- Analysis of simulated N cycle in HRU did not perform satisfactorily

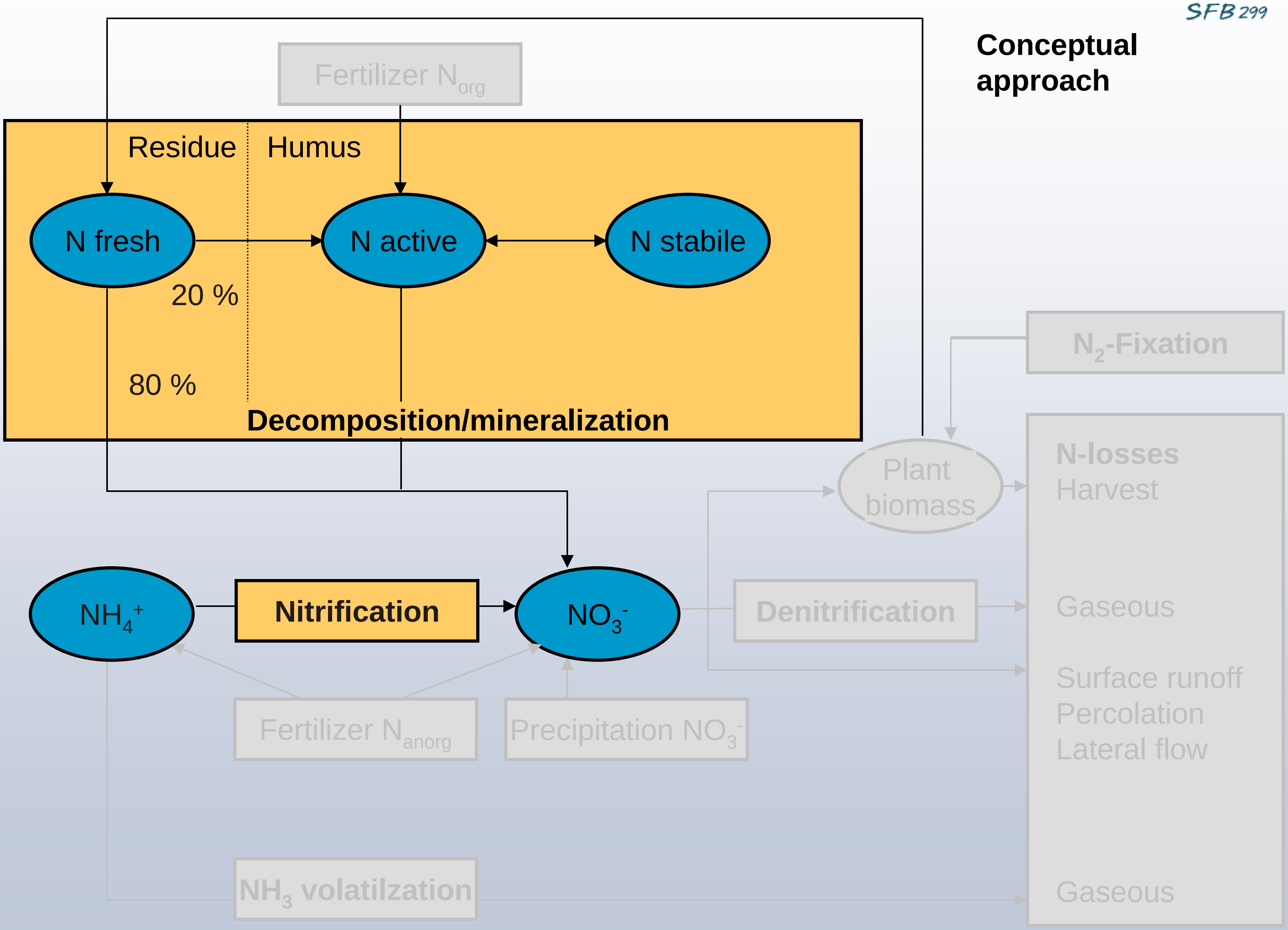
Process	Nitrate kg N ha^{-1} a^{-1}
Fertilisation	151.7
Denitrification	135.5
Plant uptake	44.3
Lateral flow	23.9
Leaching	4.4
Surface runoff	5.1

Biogeochemistry



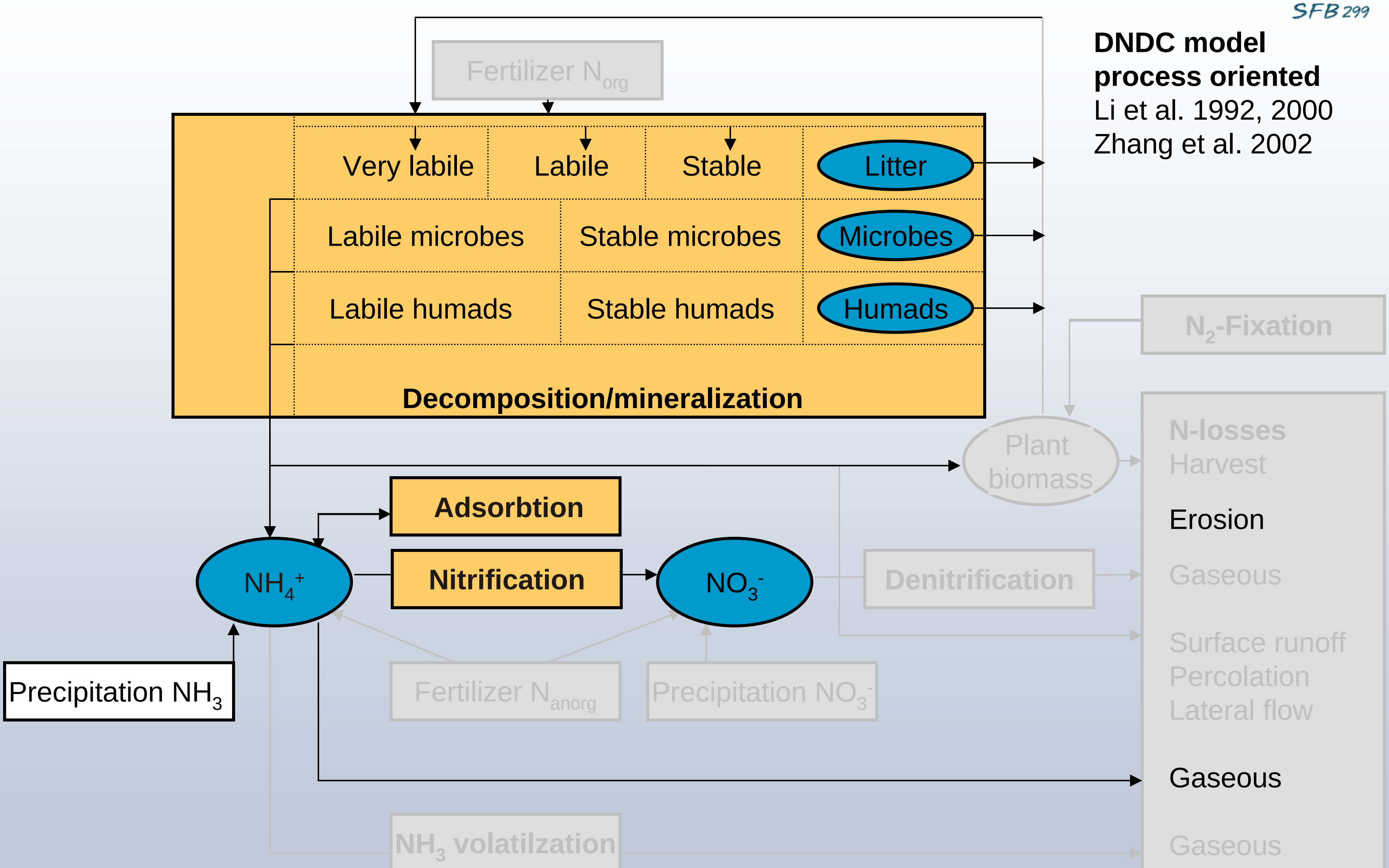
Biogeochemistry

Conceptual approach

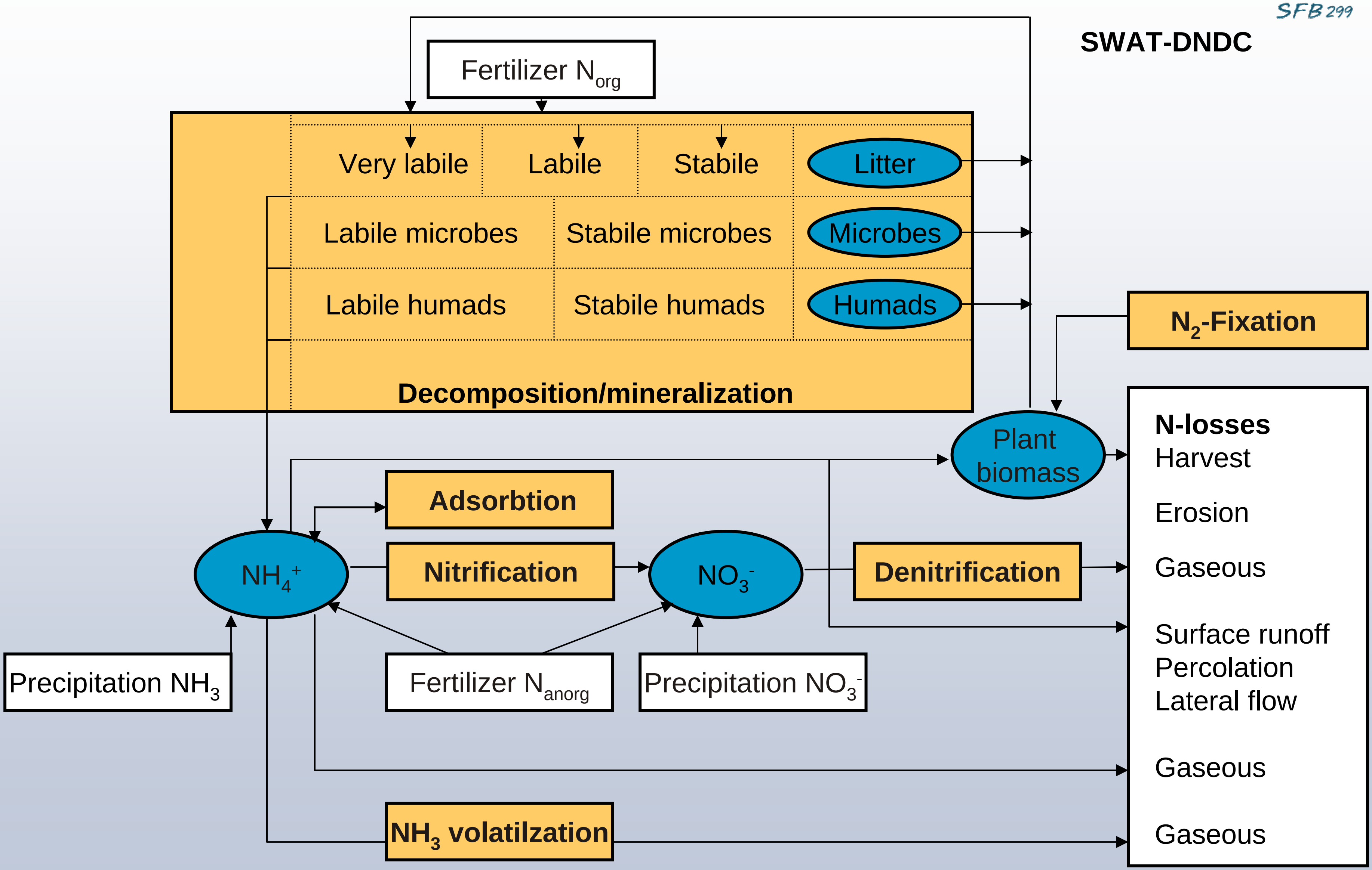


Biogeochemistry

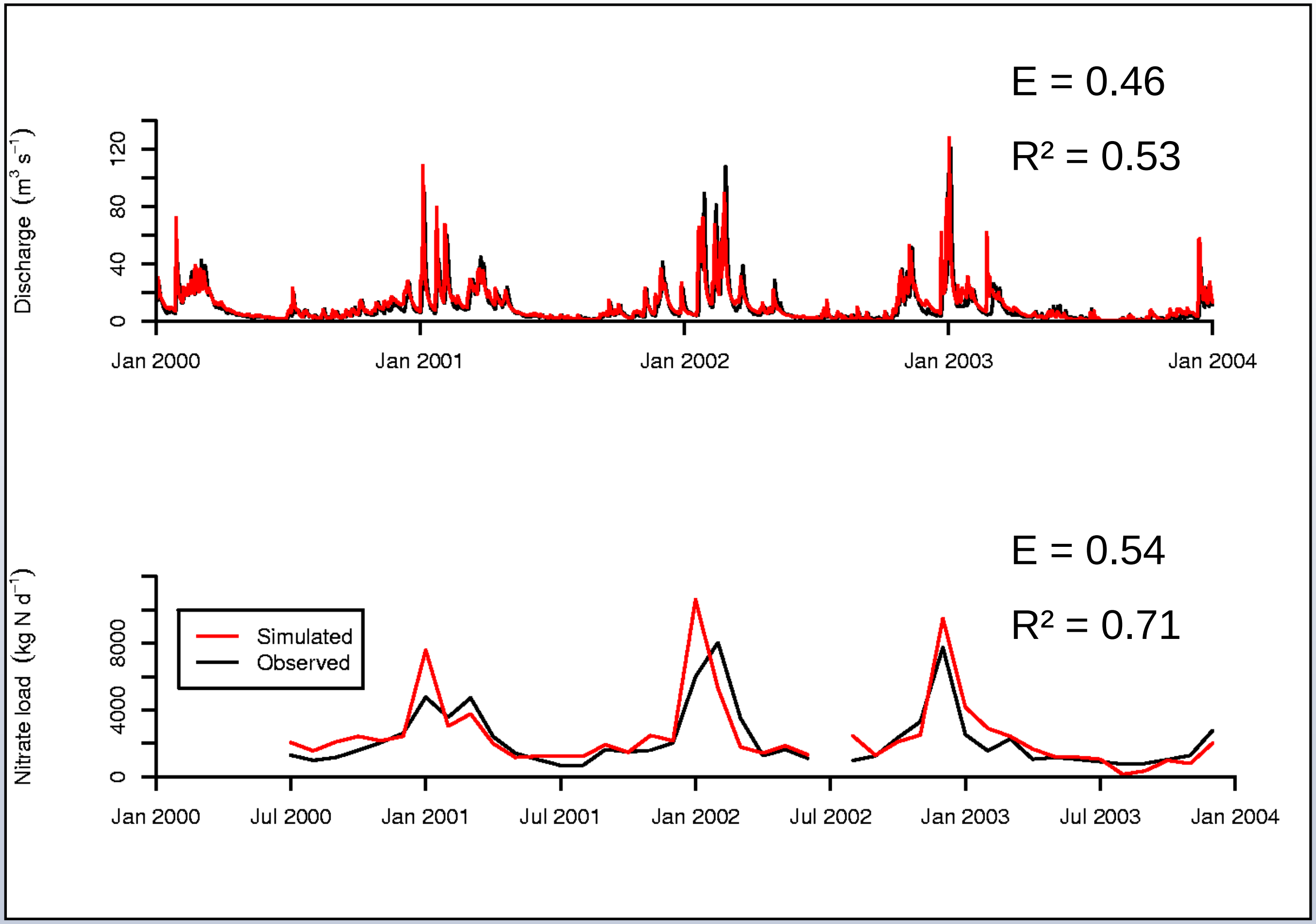
DNDC model
process oriented
Li et al. 1992, 2000
Zhang et al. 2002



Biogeochemistry



Validation of SWAT-DNDC

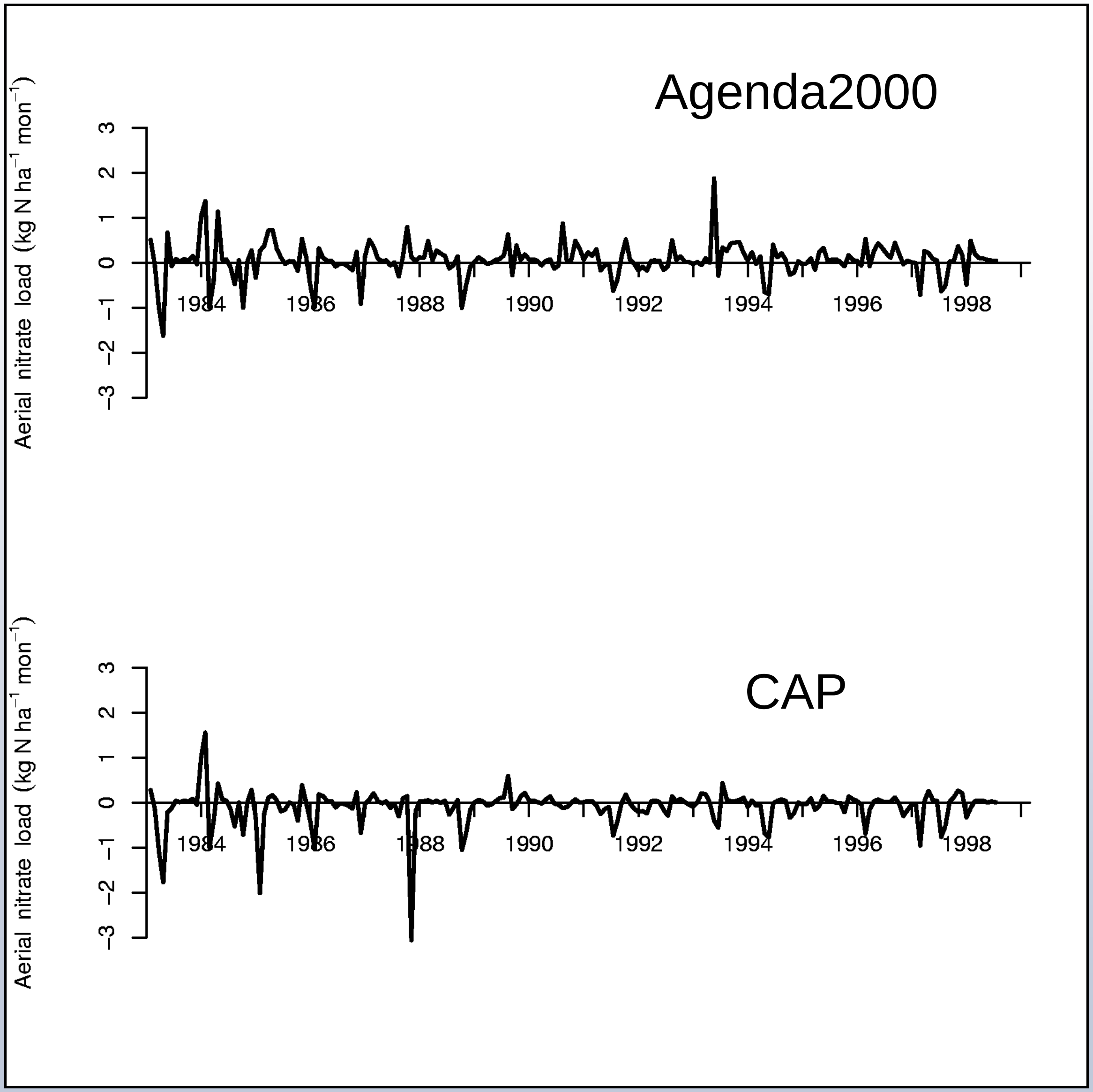


Daily discharge and monthly nitrate load

Farm management

Baseline		Agenda2000		CAP	
Arable land:	kg N ha^{-1}	Arable land:	kg N ha^{-1}	Arable land:	kg N ha^{-1}
Winter rape	145	Maize silage	22	Maize silage	17
Winter barley	50	Maize silage	22	Sugar beet	149
Oat	50	Winter wheat	132	Winter wheat	103
				Winter barley	32
Pasture:		Pasture:		Pasture:	
Extensively used	50	Extensively used	33	Extensively used	29

N export related to land use



N export:
13.4 kg N ha^{-1} a^{-1}

N export:
11.6 kg N ha^{-1} a^{-1}

Conclusion

- SWAT was already useful for hydrological assessment
- Through the coupling of SWAT and DNDC the credibilty of N simulation could be enhanced
- Minor impacts on both water quantity and quality through moderate land use changes
- SWAT provides valuable tool as part of ITE^{2}M to predict changes in water and nutrient fluxes due to land use change