

ANNEX 2: Summary of current knowledge and understanding of nitrogen air pollution related effects in Europe (excluding agricultural systems)

Effects	Evidence for effect	Level of processes understanding	Modelling	Do we have an indicator	Critical value / indicator	Spatial / temporal scale	Gaps	Comments
	--,-,+,++	--,-,+,++		MapMan = Mapping Manual				
Terrestrial ecosystems, species diversity								
Semi-natural vegetation (semi-temporal vegetation, natural forest non-productive)	++	+	Steady state CL empirical +, Dynamic +/-	CL empirical and steady state mass balance approaches in MapMan, -; directives, red lists etc qualitative available	For CL empirical and steady state mass balance models; No quantitative level for habitat protection, -	Mostly NW-Europe and N-America; Temporal effect depends on whether inputs are acute or chronic	Regional, EECCA missing	Dynamic modelling in progress, applications pending, validation needed
Soil microbes	+	-	--	--	--	--	Effects of changes in diversity on ecosystem functioning and resilience	
Faunal (macro &	+	+/- (- For	-	Quantification	--	--	Need to	

micro)		processes)		missing			identify indirect effects (e.g. food chain) as well as direct	
Soils quality								
Nutritional balance	++	+	+	+ CLs MapMan for forests	+ MapMan	Depends on load		Only known for forests, perhaps crops; need to expand for other species
Acidification of soils	++	++	++	+ Bc/Al, pH, [Al]	Abundant	Slow, decades-century; large spatial impact		
Production of forests	+ for growth	+	+	+ yield,	Effect is positive	Spatially complex, temporal quick		Interaction with other drivers
Production of semi-natural vegetation	+/-	+/-	+/-	Yes, qualitatively	-	Temporal quick		Many systems used for low intensity production. Also relevant to quantify carbon sequestration
Sensitivity to events (frost, drought, diseases, management?)	+	+	+/-	Case studies	-	Years to build up susceptibility		Trees and vegetation; case studies on harmful effects on trees (risk)
Waters								
Surface waters	++	++	Many for acidification, links exist to biology	For acidity: pH, ANC; also for eutrophication	Acidification: yes; for N varies between countries linked to WFD	Timing slow. More data available for NW Europe	Regional gaps in knowledge, data mainly NW-Europe	Also biological

Marine	++	+						Insufficient expertise in the group to discuss fully
Climate								
Nitrous oxide	++	+	++	CO2-equivalents	Does not exist			
Methane	+/-	+/-	+/-	CO2- equivalents	Does not exist		Data from more regions, soils and habitats	
Carbon dioxide flux from soil organic matter	+/-	+/-	-	CO2	-	Direct effects are quick. Indirect effects through change in litter quality are slow	Reported effects on decomposition need to be fully tested	
Fine particles	+	+	+	-	-			Linked to other secondary aerosols

Note: Human health issues including nitrate in drinking water, air pollution, ozone and NOx, fine particles and pollen production were all issues beyond the expertise of the group and were not discussed.