Environmental Science 10   J. Bartolome
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Nitrogen cycles

1. Basic ecosystem model
2. Nitrogen flux in terrestrial systems
3. The global N cycle
4. Effects of humans on N

Figures and tables: Pickering Figure 4.11, Begon Figure 19.5, Schlesinger Table 6.4, B&K Figure 4.16

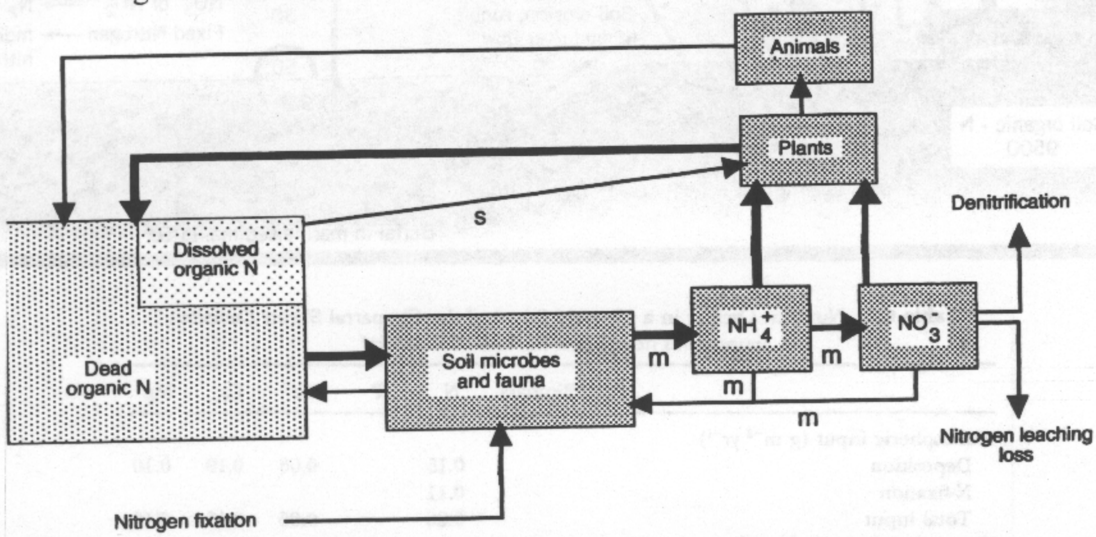

Figure 4.11 *Main fluxes (arrows) and sinks (boxes) for nitrogen in terrestrial ecosystems. Arrow thickness is approximately proportional to the magnitude of the net flux. 'm' denotes microbial controls, conventionally believed to limit the rate of nitrogen cycling. The path marked 's' short-circuits these conventional microbial controls and may be important as an alternative pathway for the transfer of nitrogen within infertile ecosystems. Redrawn after Northup* et al. *(1995).*

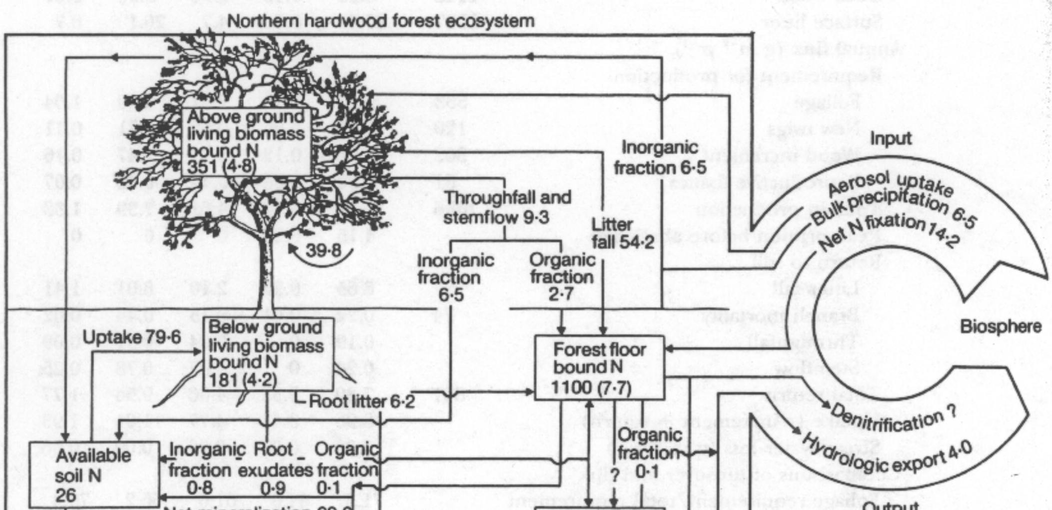

Figure 19.5. Annual nitrogen budget for the undisturbed Hubbard Brook Experimental Forest. Values in boxes are the sizes of the various nitrogen pools in kilograms of nitrogen per hectare. The rate of accretion of each pool (in parentheses) and transfer rates are expressed in kilograms of nitrogen per hectare per year. (After Bormann *et al.*, 1977.)

FIGURE 4.16 The global nitrogen cycle. Pools (❑) and annual (→) flux in 10^{12} g N_2. Note that the industrial fixation of nitrogen is nearly equal to the global biological fixation. (*Source:* Data from R. Söderlund and T. Rosswall, 1982, in O. Hutzinger (ed.), *The Handbook of Environmental Chemistry*, Vol. 1, Pt. B, Springer-Verlag New York.

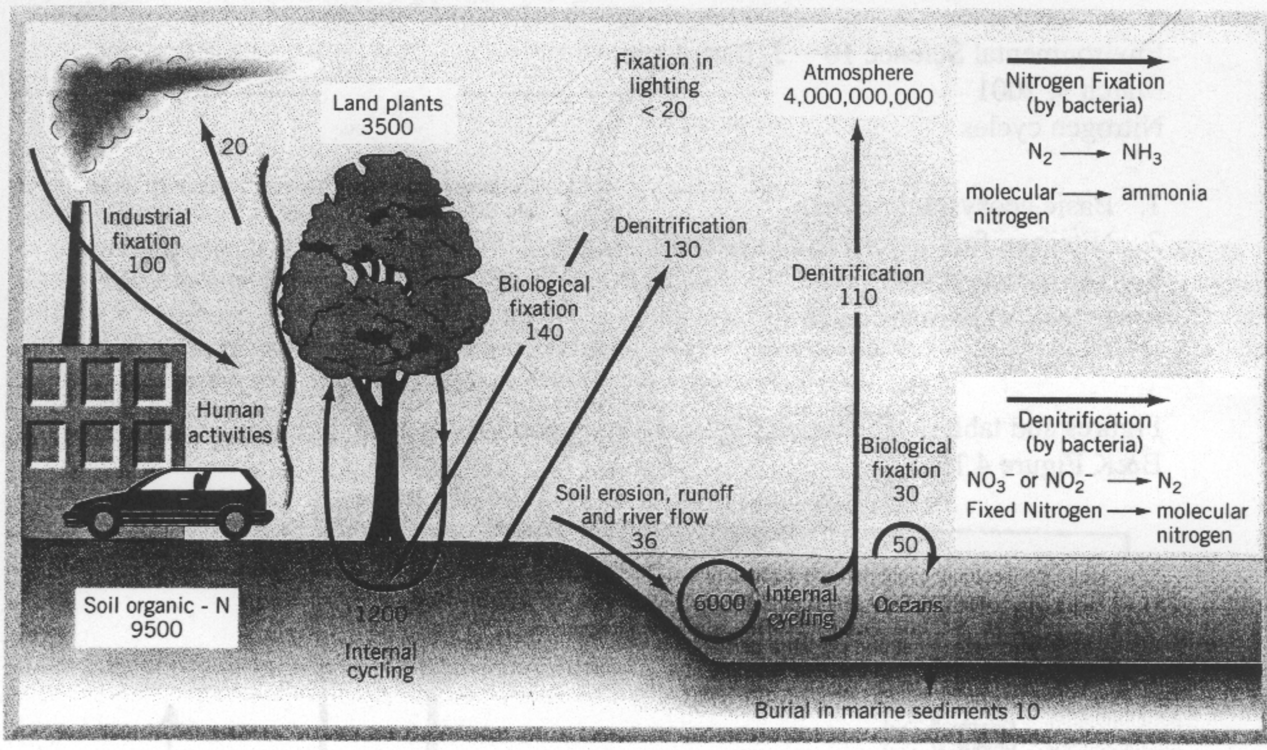

Table 6.4 Nutrient Cycling in a 22-yr-old Stand of the Chaparral Shrub *Ceanothus megacarpus* near Santa Barbara, California[a]

	Biomass	N	P	K	Ca	Mg
Atmospheric input (g m^{-2} yr^{-1})						
Deposition		0.15		0.06	0.19	0.10
N-fixation		0.11				
Total input		0.26		0.06	0.19	0.10
Compartment pools (g/m^2)						
Foliage	553	8.20	0.38	2.07	4.50	0.98
Live wood	5929	32.60	2.43	13.93	28.99	3.20
Reproductive tissues	81	0.92	0.08	0.47	0.32	0.06
Total live	6563	41.72	2.89	16.47	33.81	4.24
Dead wood	1142	6.28	0.46	2.68	5.58	0.61
Surface litter	2027	20.5	0.6	4.7	26.1	6.7
Annual flux (g m^{-2} yr^{-1})						
Requirement for production						
Foliage	553	9.35	0.48	2.81	4.89	1.04
New twigs	120	1.18	0.06	0.62	0.71	0.11
Wood increment	302	1.66	0.12	0.71	1.47	0.16
Reproductive tissues	81	0.92	0.08	0.47	0.32	0.07
Total in production	1056	13.11	0.74	4.61	7.39	1.38
Reabsorption before abscission		4.15	0.29	0	0	0
Return to soil						
Litter fall	727	6.65	0.32	2.10	8.01	1.41
Branch mortality	74	0.22	0.01	0.15	0.44	0.02
Throughfall		0.19	0	0.94	0.31	0.09
Stemflow		0.24	0	0.87	0.78	0.25
Total return	801	7.30	0.33	4.06	9.54	1.77
Uptake (=increment + return)		8.96	0.45	4.77	11.01	1.93
Streamwater loss (g m^{-2} yr^{-1})		0.03	0.01	0.06	0.09	0.06
Comparisons of turnover and flux						
Foliage requirement/total requirement (%)		71.3	64.9	61.0	66.2	75.4
Litter fall/total return (%)		91.1	97.0	51.7	84.0	79.7
Uptake/total live pool (%)		21.4	15.6	29.0	32.6	45.5
Return/uptake (%)		81.4	73.3	85.1	86.6	91.7
Reabsorption/requirement (%)		31.7	39.0	0	0	0
Surface litter/litter fall (yr)	2.8	3.1	1.9	1.2	3.3	4.8

[a] Modified from Gray (1983) and Schlesinger et al. (1982).