

Storage Analysis

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Network Environ Analysis Overview

Systems Ecology
Network Environ Analysis

Pathway Analysis
enumerates number of pathways to travel in a network

Flow Analysis ($g_{ij}=f_{ij}/T_j$)
identifies non-dimensional flow intensities along indirect pathways

Storage Analysis ($c_{ij}=f_{ij}/X_j$)
identifies non-dimensional storage intensities along indirect pathways

Utility Analysis ($d_{ij}=(f_{ij}-f_{ji})/T_i$)
identifies non-dimensional utility intensities along indirect pathways

Fath and Patten 1999

Storage Analysis Algebra

Algebra
Dominance of Indirect Effects
Network Homogenization
Network Aggradation

Storage Analysis: Summary

Direct Storage Intensity Matrices

output $\mathbf{P} = (p_{ij}) = f_{ij}/X_j * \Delta t$
input $\mathbf{P}' = (p'_{ij}) = f_{ij}/X_j * \Delta t$

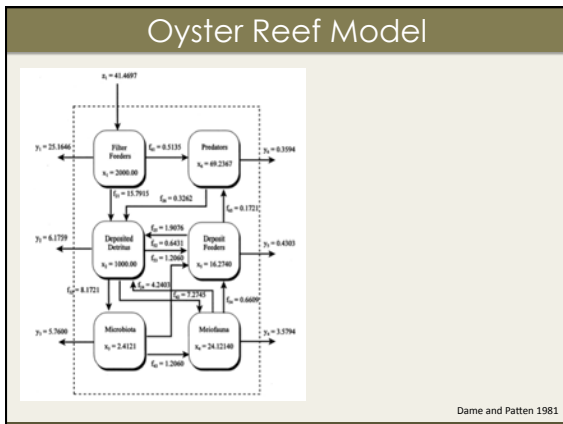
Represents the stored material that entered from direct paths.
At is selected to ensure that $p_{ij} < 0$, so the power series converges

Indirect Storage Intensity Matrices

$$\mathbf{Q} = \mathbf{I} + \mathbf{P} + \mathbf{P}^2 + \dots + \mathbf{P}^m + \dots = (\mathbf{I} - \mathbf{P})^{-1}$$

$$\mathbf{Q}' = \mathbf{I} + \mathbf{P}' + \mathbf{P}'^2 + \dots + \mathbf{P}'^m + \dots = (\mathbf{I} - \mathbf{P}')^{-1}$$

Recovering Storage

$$\vec{X} = \vec{y} \mathbf{Q}' / \Delta t \quad \vec{X} = \mathbf{Q} \vec{z} / \Delta t$$


Output Oriented Storage Analysis

Oyster Reef Model

$$\mathbf{P} = \begin{bmatrix} \text{Filter Feeders} & 0.99 & 0.00 & 0.00 & 0.00 & 0.00 & 0.00 \\ \text{Microbiota} & 0.00 & 0.15 & 0.00 & 0.00 & 0.00 & 0.00 \\ \text{Meiofauna} & 0.00 & 0.12 & 0.91 & 0.00 & 0.00 & 0.00 \\ \text{Deposit Feeders} & 0.00 & 0.12 & 0.01 & 0.96 & 0.00 & 0.00 \\ \text{Predators} & 0.00 & 0.00 & 0.00 & 0.00 & 1.00 & 0.00 \\ \text{Deposited Detritus} & 0.00 & 0.00 & 0.04 & 0.03 & 0.00 & 0.99 \end{bmatrix}$$

$$\mathbf{Q} = \begin{bmatrix} \text{Filter Feeders} & 192.91 & 0.00 & 0.00 & 0.00 & -0.00 & 0.00 \\ \text{Microbiota} & 0.23 & 1.30 & 0.34 & 0.48 & 0.29 & 0.60 \\ \text{Meiofauna} & 2.33 & 2.88 & 14.76 & 4.77 & 2.86 & 6.02 \\ \text{Deposit Feeders} & 1.57 & 4.94 & 4.30 & 29.15 & 1.93 & 4.06 \\ \text{Predators} & 6.68 & 5.27 & 4.59 & 31.13 & 406.01 & 4.34 \\ \text{Deposited Detritus} & 96.46 & 49.86 & 140.13 & 197.72 & 118.68 & 249.45 \end{bmatrix}$$

Network Statistics

> SSns

TSS	CIS	NAS	NASP	IDS.i	IDS.o	IDS.r	HMG.S.o	HMG.S.i	Lam1P
[1,] 3112.044	0.9940252	20	21	454.227	294.1527	299.1171	1.115985	1.38251	0.9975603

Network Properties of Ecosystems

