SUSTAINABLE PHOSPHORUS MANAGEMENT IN FLORIDA

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AGRICULTURE
LANDSCAPING
CURRENT P SUPPLY CHAIN

- Mining and Weathering
- Erosion and Runoff
- Agriculture and Horticulture
- Animal and Food Waste
- People
- Human Waste
- Environment
“IMPROVED” P SUPPLY CHAIN

Mining and Weathering → Agriculture and Horticulture → People

Erosion and Runoff → Animal and Food Waste → Human Waste

People → Environment

Environment → Human Waste

Agriculture and Horticulture → Animal and Food Waste

Mining and Weathering → Erosion and Runoff

People → Environment

Agriculture and Horticulture → Human Waste
GLOBAL P SUPPLY CHAIN

Based on illustrations by Elser and Rittmann from published work by Dana Cordell and co-workers.
A backcasting analysis of global P use to achieve a sustainable target that eliminates reliance on mined phosphate rock by the year 2050. From Cordell et al. (2009).
FLORIDA EXAMPLES: REUSE
WASTEWATER P REMOVAL

Figure 19  Percent Wastewater by State Treated with and without Phosphorus Removal

Patrick Dube, Phosphorus Forum 2019
WASTEWATER P LOAD

Patrick Dube, Phosphorus Forum 2019
SUPPLY CHAIN LEAKAGE
RECLAIMED WATER

2753 2712 2213

41 499
Agriculture Landscape

Environment

MT P, SJRWMD 2018
SUPPLY CHAIN LEAKAGE
RECLAIMED WATER ENHANCED

2753 → 1218 → 468
1535 Agriculture
750 Landscape

Environment

MT P, SJRWMD 2018
FLORIDA EXAMPLE: BIOSOLIDS
SUPPLY CHAIN LEAKAGE
BIOSOLIDS

931
111 lbs P/ac

388
Animal Export

543

109
Long-term Storage

434
Environment

MT P, SJRWMD 2018
SUPPLY CHAIN LEAKAGE BIOSOLIDS ENHANCED

466 → 388 Animal Export

78 → 16 Long-term Storage

62 → Environment

MT P, SJRWMD 2018
SHOW ME THE MONEY

Fig. 4. (a) Cost effectiveness ($/lb P removed), and (b) Total annualized cost for different treatment scenarios.

Bashar et al. 2018
PHOSPHORUS HEAT MAP

- Atmospheric Deposition
- Fertilizer
- OSDS
- Reclaimed/RIBS
- Biosolids
WATERSHED STORAGE AND LEGACY LOAD

Figure 3 | Net annual P input and accumulation curves for landscape P pools (soils plus aquatic systems) of three river basins (Maumee River, USA; Thames River, UK; Yangtze River, China). Accumulated P is the cumulative sum of net annual P input over time.