THE POWER AND PROBLEMS OF PHOSPHORUS

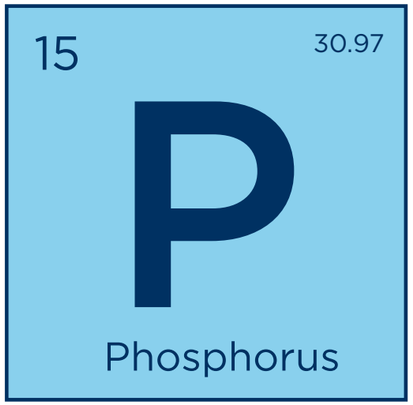
Most people probably don't think about phosphorus very much during their day. Or at all. But in the next few decades, phosphorus will be on everyone's mind. This chemical element (with the symbol P) is essential for all life as it is part of many biological molecules. P thus plays a vital role in agriculture, supporting the growth of healthy, productive crops. Unfortunately, the world is running out of P resources.

FACTS:

PHOSPHORUS OFTEN IS A **LIMITING ELEMENT** FOR PLANT GROWTH.

EROSION, ELUVIATION AND CROP REMOVAL ARE MAJOR WAYS SOIL LOSES PHOSPHORUS.

UNABSORBED
PHOSPHORUS REMAINS IN THE SOIL WHERE IT **BECOMES** EITHER **TIGHTLY BOUND** OR USED BY MICROBES, OR THROUGH ELUVIATION AND EROSION ENTERS AND **POLLUTES** RIVERS, LAKES AND SEAS.



PHOSPHORUS IS **ESSENTIAL** FOR PLANTS AND ANIMALS AS IT IS PART OF NUCLEIC ACIDS, BIO-MEMBRANES AND CENTRAL METABOLITES OF PROCESSES SUCH AS PHOTOSYNTHESIS, SYNTHESIS AND BREAK-DOWN OF CARBOHYDRATES, AND ENERGY TRANSFER REACTIONS.

PHOSPHORUS IS NOT AVAILABLE IN NATURE ON ITS OWN, BUT IS FOUND IN SEDIMENTARY AND MAGMATIC DEPOSITS, MOSTLY AS MINERAL ROCK PHOSPHATE.

PLANTS **BUILD LARGER** AND MORE **BRANCHED ROOT SYSTEMS** AND STRUCTURES IN LOCATIONS **WHERE** SOIL NUTRIENTS, SUCH AS **PHOSPHORUS, ARE LOW**.

PHOSPHORUS IS THE **SIXTH** MOST ABUNDANT ELEMENT IN THE HUMAN BODY.

CROPS ARE NOT ALWAYS EFFICIENT IN UPTAKE; SOMETIMES ONLY **15-20%** OF PHOSPHORUS IS USED BY CROPS.

GUANO AND MANURE ARE ADDITIONAL, BUT LESS IMPORTANT, SOURCES OF PHOSPHORUS.

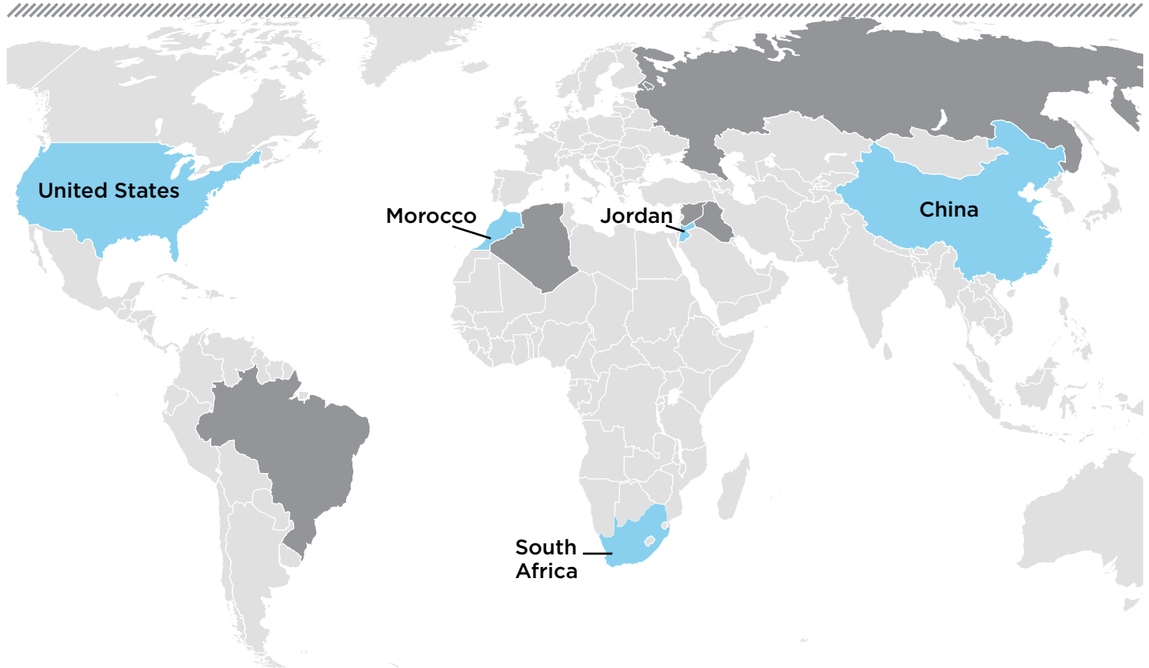
There is only enough minable phosphorus to last the next

30-40 years.

PHOSPHORUS MINERALS ARE PREDOMINANTLY USED FOR FERTILIZER PRODUCTION, BUT ARE ALSO NEEDED IN PRODUCTION OF STEEL, PHOSPHOR BRONZE, DETERGENTS AND PESTICIDES.

5 **countries control 90 percent of the world's known phosphorus supply.**

Also: Iraq, Algeria, Syria, Russia, Brazil



THE UPTAKE OF **PHOSPHORUS** AND **NITROGEN** BY PLANT ROOTS IS STRONGLY CONTROLLED BY THE NUTRIENT STATUS IN THE SHOOT (THE LEAVES), IMPLYING SYSTEMIC CONTROL.

NOBLE PRINCIPAL INVESTIGATOR **WOLF SCHEIBLE**, PH.D., IS **EXPLORING THE MOLECULAR BASIS** OF HOW PLANTS CAN MORE EFFECTIVELY USE PHOSPHORUS.

BY **IDENTIFYING** THE **SIGNALING COMPONENTS** INVOLVED, SCIENTISTS MIGHT BE ABLE TO **DEVELOP PLANTS** WITH **ROOT SYSTEMS** THAT ARE **MORE EFFICIENT** IN UPTAKING PHOSPHORUS AND NITROGEN.

MORE **EFFICIENT ROOT SYSTEMS** THAT UPTAKE NUTRIENTS BETTER **MIGHT LOWER FERTILIZER COSTS** AND PRESERVE CROP PRODUCTION FOR THE **FUTURE**.