VEGETATIVE MINING OF SOIL PHOSPHORUS

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Description
The removal of phosphorus from the soil by the removal of crop biomass from a site [1], with the aim of reducing the risk of P losses. The option is also known as phytoremediation [2], or soil depletion.

Rationale, mechanism of action
When the P status of a soil is high this can lead to large losses of P to surface or ground water. Lowering the P status by removal of biomass will lead to a decrease of the P pools in soil that are most vulnerable to leaching, and decreases the risk of losses [3,4]. The measure will be most effective when biomass production is high, so other nutrients like e.g. N and K should be ample available. In case of grassland, no grazing should take place, since via cow droppings P will be transported to the soil surface, decreasing the effectiveness of the measure.

Applicability
The measure will be most effective when applied under climatic conditions that favor a high biomass production, so it will be less effective in a cold or dry climate. Harvesting of biomass must not be problematic, so slope must not be too steep. Soils that tend to fix P may give lower P contents in biomass, so removal will be slower. If possible, a crop should be chosen that has both a high biomass production, like e.g. grass or maize, and a high P content [1]. No specific skills or technical equipment is needed, other than for harvesting biomass.

Effectiveness, including certainty
When transport of dissolved P via runoff or via preferential flow is important on a site, the effectiveness will be high within a few years. Incidental losses after application of P fertilizers or manure will no longer occur. When transport of particulate P is important erosion control [see link] must also be applied. Mining will be most effective when P status is high or very high; when the status is extremely high the time needed before an effect is found can become (very) long [1,5,6]. Desorption of P from stronger bound P pools leads to uncertainty.

Time frame
Effect of disappearing incidental losses [7], or of cow droppings when grazing stops can be expected on short term. Other effects will take longer, and are strongly dependent of the amount of P removed via biomass and the initial P content of the soil.

Environmental side-effects / pollution swapping
Risk of loss of fecal organisms and the emission of greenhouse gasses will be reduced when manure is no longer applied and when grazing stops. No effects on loss of pesticides or sediments is expected. The biodiversity due to presence of manure (e.g. insects, birds, badgers) will decrease.

Relevance, potential for targeting, administrative handling, control
The option can be relevant for all fields where P status is above optimal for crop growth. Control on grazing will be easy, regular testing of soil P-status must show a decrease in values (on the longer term).

Costs: investment, labor
No additional labor costs or investments are known. When a farmer keeps livestock producing manure that cannot be applied on a field that is mined it is possible that the manure has to be transported from the farm, which can be costly. It may be necessary to give subsidies for covering costs of manure transport. Also, extra mineral fertilizers (N, K etc.) have to be bought.

References

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