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Environmental Proposal: The role of phosphorus level control in the restoration efforts of the Florida Everglades, USA

In the early 19th century, extensive water drainage programs were instituted in Florida in order to convert wetlands into an agriculturally viable region, a project called ‘reclaiming the everglades’(1). Since more agricultural space was needed at the time the project was proposed, it seemed like a very logical and obvious course of action.

Several years after the reclamation project had been completed, significant problems began to arise. The project was unsuccessful in a number of ways. Constant flooding made the region less than ideal for farming. Severe limitations of the natural flow of the watershed caused extreme ecological problems in the everglades of central and southern Florida. Agricultural runoff introduced excess phosphorus into the water, which in turn also contributed to the degradation of the everglades (2).

Ongoing efforts of restoring the everglades have been instituted for several decades now, but if strict standards are not set forth to control pollution sources, many efforts become futile. It is important to take an interdisciplinary approach when addressing pollution control, an aspect that has become such a problem for this ecosystem (3). Current restoration strategies being implemented by State and Federal governments include building approximately 18,000 ha of treatment wetlands to reduce nutrient loads in runoff before this water enters the Everglades (4). The projects proposed in this paper should be implemented as part of a large scale ecosystem restoration project, since they only address one of the many problems currently disturbing the region.

The approval of potentially ecologically harmful projects before a full assessment of the potential damage is done has been a big impediment to successful restoration efforts. This tends to reduce the effectiveness of restoration efforts, and imposes even higher costs to a project that has already cost billions of dollars. When considering new developmental projects, the conservation of the Everglades should be given priority, since so much money has been invested in restoring it already. People tend to forget about that investment when they see a project that is financially profitable in the short term. There should be stricter permitting regulations to discourage projects whose impacts are unknown but are suspected to have. This would encourage thorough ecological assessment before the potential damage is made. Currently, there is a proposal to mine limestone and sand from rock material in areas of central Florida, but the ecological impacts of said project are unknown(5). Even though there is a high demand for this type of rock in the state, projects like this should not be approved without knowing if the possible ecological consequences will reverse restoration efforts implemented thus far. Once they are approved, the companies need to adhere to stringent measures to prevent future sediment and toxic chemical pollution deposition into the water.

In order for any restoration efforts to be permanent and more effective, phosphorus pollution would have to be controlled from the source. In order to achieve this, water that runs into the watershed from northern municipalities would also have to be controlled. This would require for the regulation of many agricultural sites in the central and northern regions of the state. A bill was recently passed that imposed higher water quality restrictions on storm water and sewage run off that is deposited into the Okechobee watershed, which in turn deposits into the Everglades(6). More bills like this one need to be drafted and passed by congress because it is much easier to control contamination at the source, than attempt to restore an entire ecosystem once it has been damaged. Some farmers have been able to successfully reduce fertilizer use without significantly altering crop yields (7). Since this type of reduction has been proven to be an effective method of controlling the quantity of phosphorus that is introduced into the watershed, stricter standards should be implemented to limit the use of excessively phosphorus- rich fertilizers by farmers. Possible government subsidizing of more ecologically friendly fertilizers might encourage farmers to follow these practices, which have a lower impact on the environment.

Some studies show that there is a dramatic diversity difference between wet and dry seasons. This indicates there is a dramatic difference in resource consumption rates and process efficiencies that may affect the rates of phosphorus absorption (8). Restoration efforts would probably be more efficient throughout the year if during the dry season stricter water restrictions were imposed upon residents and cities that drain water from the everglades to supply their demands. Efforts of water restriction programs are already being instituted in Southern Florida, such as a regulation that only allows lawn watering twice a week(9). This way, a rather constant flow of water might prevent elevated levels of phosphorus from depositing in the water column. Maintaining the water flow at a certain level throughout the year might be difficult since the natural flow of water is being controlled by 1,000 miles of manmade canals and other structures that divert 6.4 million meters cubed of water daily from the Everglades to the surrounding seas (10). An effort to divert less of the water is necessary in order for the benefits of restoration efforts to accumulate through the seasons.

Education could play a key role in encouraging water conservation by residents. Pamphlets suggesting simple water conservation techniques should be sent to residents. A program could be incorporated into the school system to educate future generations on the importance of water conservation, since it will be an issue they will have to address more seriously if water levels keep falling and water quality continues to deteriorate. Residents should also be taught which type and how much fertilizer to use when tending their lawns or gardens. A reduction of phosphorus in the waste water and storm water runoff would make treatment of this water less expensive and more effective.

Since extensive hydrology restoration programs are being implemented to restore the original biotic composition of the everglades (11) (12), a water conservation program will make this restoration effort a bit less strenuous. A study should also be conducted to determine how phosphorus levels in the water affect the biota, in order to determine whether a program that integrates hydrological restoration and phosphorus level control would be more effective in restoring the native vegetation of the ecosystem, as opposed to implementing these two types of projects separately.

There have been several efforts to directly remove phosphorus from the water column. Two different water treatment systems that have demonstrated an enhanced phosphorus removal ability utilizing aquatic plants and biomass are Wetland Stormwater Treatment Areas (STA) and Managed Aquatic Plant Systems (MAPS). STAs are more effective at removing phosphorus at levels higher that 500 parts per billion (ppb), whereas MAPS were more effective at removing phosphorus at lower concentration (13). Since the concentration of this element varies along the watershed, it should be quantified in order to determine which system would be most effective to implement in each area.

A study showed that wetlands dominated by submerged aquatic vegetations (SAVs) may take up nutrients, particularly phosphorus, from surface flow with high efficiency (14). An assessment of what type of submerged vegetation exists in the Everglades and the quantity of this vegetation should be obtained. It should be determined whether introducing higher levels of submerged vegetation would be an ecological advantage, and if so, this would be another good mechanism to reduce elevated levels of phosphorus in the water.

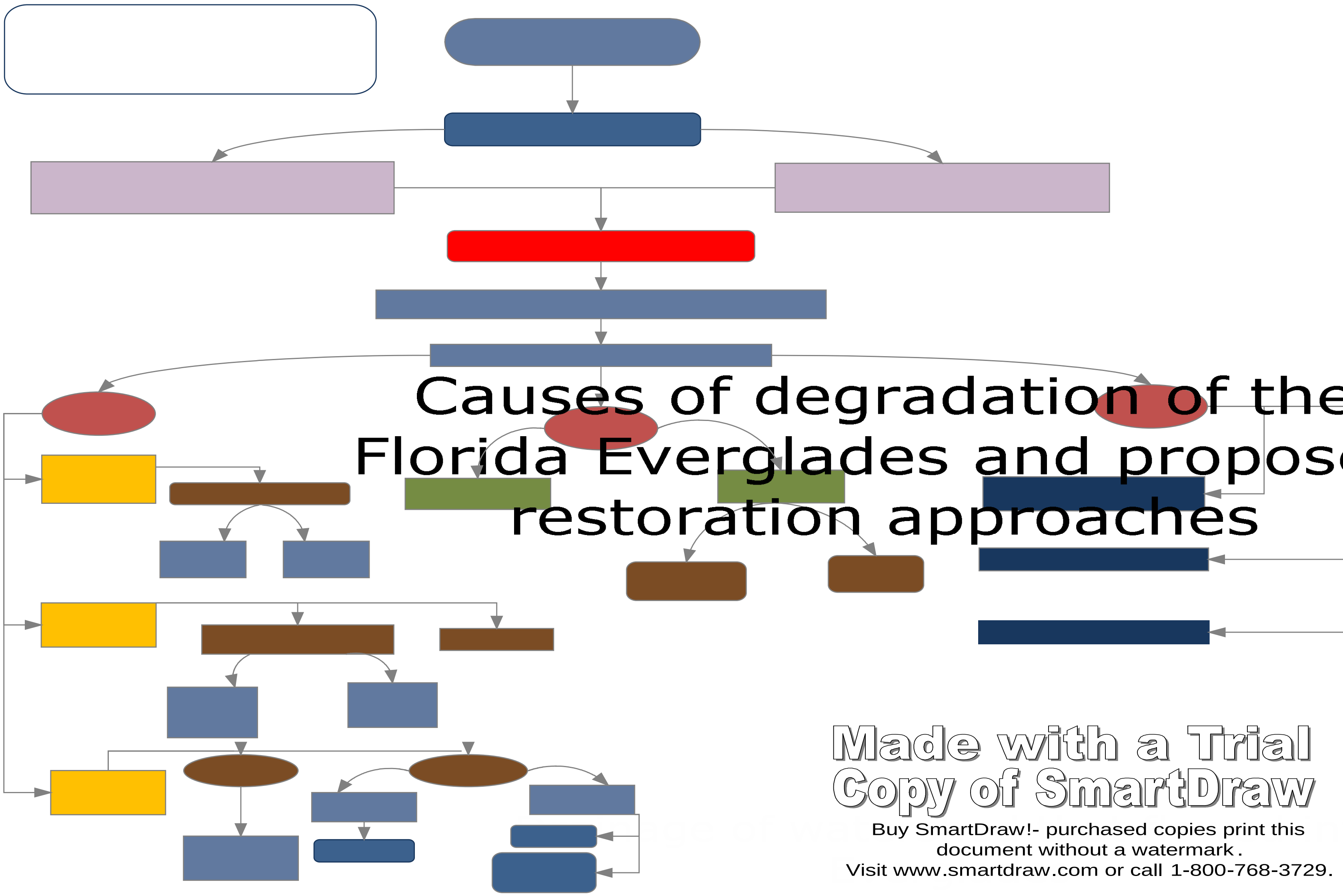
Another study to remove phosphorus from the water column was done in Ireland, where ‘ochre,’ the precipitate of iron formed in abandoned mines, was utilized to remove unwanted phosphorus introduced into rivers from agricultural runoff (15). A project in the Everglades could be implemented that monitors whether ochre would in deed filter effectively phosphorus from agricultural runoff from farms in the northern region of the Everglades. Once the ochre is saturated with phosphorus and is filtered out of the water, this byproduct could be used as a slow release fertilizer. The first experiments would have to be very controlled to ensure that if ochre is not captured by a filtering mechanism and is accidentally deposited into the Everglades, it does not have worse adverse effects than the phosphorus does in the first place. The problem with utilizing ochre is that its transportation can be very expensive, but if it is determined that it is available in near by abandoned mines, it is an alternative that should be considered.

In order to quantify the efficacy of ongoing restoration projects, and to determine whether the cost and effort necessary to realize these projects is worth it, it is suggested that phosphorus levels be tracked. It has been suggested that finding a suitable battery of ecological indicators would be a great aid in quantifying the process (16) (17). An experiment should study how the levels of phosphorus-absorbing vegetation correlate to the phosphorus concentration of the water they inhabit. If a reliable pattern can be established, quantifying levels of this type of vegetation would be a good field indicator of whether levels of phosphorus in the water are indeed being reduced.

Since most of the proposed projects mentioned above are rather expensive to implement, it is important for a serious economic commitment from the government and other organizations interested in the restoration process. Recently, budget cuts for the restoration projects have been proposed by President Bush, since he does not believe the restoration of this ecosystem is a priority (18). Since there obviously is a limit as to how much funding can be allotted to the restoration efforts, a thorough cost-benefit analysis of each project is necessary in order to determine which projects would be most beneficial. These projects should be given funding priority. It is better to implement fewer projects that are able to run for a long time, than implementing many projects that need to be cut short because of budgeting limitations.

There are many efforts to restore many aspects of the Florida everglades that have been degraded as a result of human interference. It is clear that in order for any plan to be successful in the long term, it is necessary to implement a plant that integrates the different aspects of a society that affect the ecosystem. It is wrong to only focus on the scientific aspect of the restoration efforts because there are many other factors that affect the science. The incorporation of complex environmental, engineering, management, policy, and technical issues by many federal, Native American, state, and local organizations is essential to the success of any restoration efforts (19) (20). Even though the above suggestions only address the issue of elevated phosphorus levels in the everglades, its efficacy can only be calculated if the restoration of the everglades is quantified from an ecosystem perspective, and not simply by one specific factor of that ecosystem. Ongoing efforts must integrate the findings of different projects that restore certain ecological traits of the system. Political, economic, and ecological aspects need to be integrated. It must be determine how the projects interact in order to decide which avenue will be most efficient in recovering the ecosystem and preventing any further degradation.

Causes of degradation of the Florida Everglades and proposed restoration approaches



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