CREATION AND RESTORATION OF COASTAL PLANT COMMUNITIES pdf

1: Selected Mangrove Restoration Papers & References | Mangrove Action Project

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Each province is unique in topography, soil pH, soil depth, elevation, availability of light, and hydrology. These characteristics all combine to influence the species of plants and animals found there. Virginia is unique, encompassing parts of five of these provinces, and thus a greater variety of natural landscapes than any other eastern state. For the purposes of this list, we have grouped the physiographic provinces into three regions: Coastal Plain, Piedmont, and Mountain. This is the youngest of the physiographic provinces, formed by sediments eroded from the Appalachian Highlands and deposited along the Atlantic shoreline. The Coastal Plain varies in topography from north to south. The northern Coastal Plain consists of the three peninsulas formed between the four major tributaries of the Chesapeake Bay; the Potomac, the Rappahannock, the York, and the James Rivers. In the north, the Northern Neck is somewhat hilly and well drained. As you move southward across the Middle Peninsula and Lower Peninsula the topography flattens until south of the James River the landscape is basically level. The Eastern Shore, separated from the mainland by the Chesapeake Bay, exhibits little topographic relief. These subtle differences in topography and the variety of fresh, brackish, and saltwater systems from ocean and inland bay to rivers, ponds, and bogs, have contributed to the great variety of natural communities found on the Coastal Plain. The western boundary of the Piedmont is characterized by distinct peaks and ridges, comprising the foothills of the Blue Ridge Mountains. To the east, the Piedmont continues to slope more gently toward the Fall Line. The Fall Line marks the zone of transition from the hard, resistant bedrock underlying the Piedmont to the softer sediments underlying the Coastal Plain. Streams are able to cut more easily through the sands, gravels, and clays of the Coastal Plain, and rivers widen as the topography flattens. In the northern part of the state this boundary is sharply delineated by falls and rapids. From foothills to rapids, these varying site conditions support a mosaic of plant communities. The Blue Ridge encompasses the Blue Ridge Mountains, a wedge of ancient rock that was uplifted over younger rocks when the Appalachian Mountains were formed. A narrow system of peaks in the north, the Blue Ridge widens south of Roanoke Gap into a broad plateau topped by the highest peaks in Virginia--Mount Rogers and Whitetop. The Ridge and Valley Province is characterized by long, even-crested, parallel ridges rising above intervening valleys of various size. The ridges of the Appalachian Plateau in far southwestern Virginia were not as folded and faulted as those of the Ridge and Valley, but formed from a high, unified plateau of nearly horizontal rock layers. The modern mountainous topography was created by streams cutting deeply through the plateau, forming an intricate network of narrow, steep valleys. The diversity in topography and geologic history of the Mountain region of Virginia gives rise to a rich array of natural communities and native species. Wednesday, 19 April ,

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2: Andrew Baldwin | Environmental Science & Technology

Community College, and and is the editor of Creation and Restoration of Coastal Plant Communities,â‚¬ Mangrove Restoration - Costs and Benefits of Successful Ecological. Coastal wetland restoration bibliography / by David J.

Here are some guidelines and things to think about before you start a project. Check the history of the site and the area. A weedy cow pasture may have originally been a redwood forest, shadscale scrub community or even a salt marsh. If there are no native plants left on the site, start a botanical sweep of the area looking for remaining native plants to figure out what was originally there. Historical memories of some of the areas residents can be very useful. Whatever the site was before we showed up and screwed it up is the target of the restoration. Question the botanical survey. These lists can be a crime in themselves. Many are generated from an office in a distant city, with no botanist coming within 50 miles of the project. There should be two lists, one on the site, one from the surrounding area. The surrounding area needs only needs to include the nearest intact native plant community that mirrors the site. An old fart with no degree but tons of experience and knowledge of the local flora is sometimes better than a PhD from Nebraska, but a combination of degree and experience is preferred. Do not assume anything before the botanical survey of the AREA is complete. The plant lists for the project should be generated off of the AREA species list. Your project may be a bald field, parking lot, feed lot, etc. Rebuilding the plant community for the site should be the target for the project, not the individual rare species. The rare species are supported by the plant community. An unseeded hillside after a fire. The annual forbs and wildflowers come in first, then the perennials and shrubs. One of our fields in about Same field about 20 years later. Notice there are different trees there. Mother nature is likes to fill voids with bushes and trees, if the weeds are suppressed. Are there multiple soils and different aspects on the same site? How will the alien species be controlled? How will the weeds debris be removed? Can a roll off from the waste hauler be used? If weeds cannot be controlled and the debris removed, forget the restoration. The site will return to weeds and the money will be wasted. Leaving weeds will shift your site from a healthy ecosystem to a weedy field. Leaving the weeds is like giving your plant community HIV. For more info see simple restoration. Burning is not a solution for removing debris; remember disturbance and fertility favor weeds ruderals , not healthy ecosystems. In an already weedy area burning will just make more weeds. Planting schedules, growing schedules and weed control all need to be planned out well before the first shovel of dirt is dug. Can site specific plants be grown for the project? Are there any plants at all, anywhere grown that can be used for the project? The closer to the site the better. Plant community specific plants will have much higher success rates. In most cases they will recognize and use the plants if you are close in plant material. Do not specify weird, rare and endangered plants and expect to find 10, of them in a specific month at K mart. Weird, site specific plants do not sell well and are generally only contract grown. Some need a lead time of two or three years to even grow a few, never mind 10, After the Hwy 41 Fire the different agencies were going to seed 75,00 acres with this crud, Cucamongo Brome, Bromus carinatus. The brown areas are dead grass that was seeded. We fought them and got them to reduce the seeding to 15, acres and Senator Feinstein and Congressman Huffington a congressman in Santa Barbara, yes her former husband came to our aid and forced a detailed follow up study that showed that there was greater erosion after seeding. Does the project need irrigation? Drip is a problem for most natives. Overhead irrigation encourages weeds. Truck watering is very expensive. The more site specific the plant material, the higher the success rates, and the less water is required. If the planting can be timed for planting during the rainy season, the water needs drop dramatically. It is counter intuitive that more plants result in less water, but the weeds are the problem. The more weeds left in place and allowed to grow, the lower the yields and the higher the maintenance and water requirements. Double plant all sites. Plant a full planting of secondary pioneers along with a full planting of the climax species for the restoration site. You will have very low survival rates if you plant climax species in a weedy area. You need the pioneer species to establish the plant community and give a foot hold for the climax species. This was an area that was maybe foot wide and feet long. No irrigation, decomposed granite. Sorry about the quality. The photo was back in and we were under time constraints that were ridiculous. I had them throw rocks all over the place and we planted the rocks. Again old pre-web photos. One hundred plants per acre are a complete waste of time and money. They become a weed patch every time. As little as a plants per acre can work if there is some plant community left and there is monthly maintenance preformed on the project. The more sensitive the area, the more restrictive the herbicide use will be, and the more plants are required. This is not optional. If you do not have the budget, downsize the area! Do not blade off all of the rare and endangered plants from a site and call us a year later expecting to find of the plants! Do not amend or fertilize a restoration site. You do this for a vegetable garden not for native plants. You will have lots of dead natives and lots more happy weeds. Grasslands are for buffaloes. Most areas of California should not be planted in grasses. See Grassland plant community. Learn about herbicides, or better yet, bring in a knowledgeable PCA to be part of the team. Herbicides can be very effective in restoring a site, planting densities can be lower if the proper herbicides are use. On the other hand, the whole planting can die and the water courses can become polluted with the wrong herbicide on the wrong plant in the wrong area. Some herbicides kill only grasses, some thistles and lupines, some germinating seeds largely weeds and some everything. Once you get the easy weeds controlled, the planted plants up, then the challenge is to get rid of the problem weeds. Using herbicides also minimize soil disturbance and is highly preferable to hoeing, tilling, scraping or any of the other crazy things people try to do to get rid of weeds. They will be back next year unless you deter them with mulch or preemergents or both. More info on herbicides and weeds. Veldt grass and pampas grass have to be controlled! Sometimes, not often, but sometimes, grazing can help. If the project is hundreds of acres, and mostly grass weeds, a hard pulse of grazing can remove a great deal weeds and their litter. If there are any natives on the site try to graze around them. This can be very effective in increasing native bunch grass populations. Hydroseeding almost never works, and usually is a weedy mess with erosion problems. Wildflowers, poppies and lupines can be used to make the site pretty, but plants are usually required. They are no competition for invasive weed species. In coastal areas Pampas Grass, Veldt Grass and Pennisetum are all problems and will stop any restoration if they are present. Mycorrhizal inoculum has little science behind it. If the plant community is planted back, mycorrhiza will reestablish as the plants grow. It is still a weed. If it looks like magic, better get some more information.

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3: Native Plants for Conservation, Restoration and Landscaping - VA Physiographic Provinces

Title / Author Type Language Date / Edition Publication; 1. Creation and restoration of coastal plant communities. 1.

Possible role of Spartina alterniflora Loisel. Hillsborough Community College, Tampa, Florida. Low marshes, peninsular Florida. The ecology of the mangroves of South Florida: Tree mortality in mangrove forests. Mangrove habitat and fishery resources of Florida. Mangrove community boundary interpretation and detection of aerial changes on Marco Island, Florida: The utility of Breder traps for sampling mangrove and high marsh fish assemblages. Pages in FJ Webb Ed. The Status of the Science. Island Press, Washington, D. Creation and restoration of coastal plain wetlands in Florida. Creation and restoration of coastal wetlands in Puerto Rico and the U. Manual for investigation of hydrological processes in mangrove ecosystems. Evaluation of historical attempts to establish emergent vegetation in marine wetlands in Florida. Florida Sea Grant College, Gainesville. Coastal habitat restoration as a fishery management tool. National Coalition for Marine Conservation, Inc. Pages in GA Maul ed. Wetlands Ecology and Management 4 2: Key concepts in successful ecological restoration of mangrove forests. Disused shrimp ponds and mangrove rehabilitation. Kluwer Academic Publishers, The Netherlands. Lewis, RR and W Streever. Restoration of mangrove habitat. Planting mangroves on intertidal mudflats: Ecologically based goal setting in mangrove forest and tidal marsh restoration in Florida. Ecological Engineering 15 Restoration and management of mangrove systems â€” a lesson for and from the East African region. South African Journal of Botany Natural and mechanical alterations of mangrove forests. Published by the Consortium. Mangrove restoration â€" costs and benefits of successful ecological restoration. Effects of Hydrology on Red Mangrove Recruits. Project facilitates the natural reseeding of mangrove forests Florida. Ecological Restoration 23 4: Ecological engineering for successful management and restoration of mangrove forests. A novel approach to growing mangroves on the coastal mud flats of Eritrea with the potential for relieving regional poverty and hunger. A novel approach to growing mangroves on the coastal mud flats of Eritrea with the potential for relieving regional poverty and hunger and G. Brown, B, and RR Lewis.

4: Downloads from www.enganchecubano.com

Restoring Coastal Communities Creation and Restoration of Coastal Plant Communities, edited by. Lewis. R. R. III.

Wetland restoration Current Research: The majority of research in the Baldwin lab focuses on coastal and restored wetland ecosystems. An active collaboration with Dr. Specific questions concern effects of plant species on bacterial, archaeal, and mycorrhizal communities; effects of organic material amendments in establishment of microbial communities and their associated ecosystem functions in restored wetlands; and the role of mycorrhizae and nitrogen availability in the restoration of the native lineage of Phragmites australis, and how these factors may control growth of the invasive lineage. This projects is a collaboration with Dr. Brian Needelman, other University of Maryland faculty, and government staff. Field sampling of native and invasive Phragmites australis at the Choptank River, Maryland. In the background, the shorter stand on the left is native Phragmites, and the taller stand on the right is Invasive Phragmites. Pooled water and buttressed tree trunk in a Delmarva Bay isolated depressional wetland. Recent Projects Forecasting the response of tidal freshwater marshes to increasing salinity and higher tides due to sea level rise While it is generally accepted that coastal wetlands worldwide are threatened by increases in sea level, most research to date has focused on salt and brackish marshes. Little is known about the current status of tidal freshwater marshes or how these diverse and productive wetlands may respond to increases in water level and salinity due to rising sea level. The overall goal of this research is to understand responses of tidal freshwater marshes to sea level rise. Toward meeting this goal we have established a series of study sites in wetlands along the tidal portion of the Nanticoke River, a subestuary of Chesapeake Bay that extends from Maryland into Delaware. From these measurements we are able to determine if wetlands along the tidal fresh to brackish gradient of the Nanticoke are accreting and building elevation at a sufficient rate to keep pace with rising sea level. In a related study we simulated saltwater intrusion into tidal freshwater marshes by applying synthetic sea water solutions and measuring elevation and accretion changes using replicate SET-MH stations. This research was conducted in tidal freshwater marshes at Jug Bay on the Patuxent River in Maryland. Grazing as a means of biological control of the invasive Phragmites australis in wetlands The objective of this research was to explore the application of grazing by domestic livestock to control common reed, Phragmites australis, an invasive grass, in Maryland wetlands. The use of grazing as a management tool for promoting and maintaining plant biodiversity and rare species in wetlands has become widespread in Europe during recent decades. However, the primary means of control of Phragmites in the USA is herbicide, applied via helicopter or ground spraying, which are expensive and have negative environmental consequences including death of nontarget vegetation, toxicity to aquatic invertebrates and fish, and generation of greenhouse gases. Grazing by goats, sheep, and cattle has been used in the USA to successfully improve habitat for bog turtles, but this is the only example we have found in the scientific or gray literature of invasive plant control in US wetlands. We set up experimental plots in a Phragmites-dominated wetland at the Beltsville Agricultural Research Center in Laurel, MD where goats were used to graze the Phragmites paired with ungrazed plots. Preliminary results showed that grazing was highly effective in reducing Phragmites biomass see photo below with no observable impact on water or soil quality in the wetland. This research was supported by the Maryland Agricultural Experiment Station. Baldwin has developed and taught courses on wetland ecology, wetland creation and restoration, water quality methods, ecological risk and impact assessment, and graduate seminars on wetland plant ecology. Several of his courses incorporate rigorous field and laboratory exercises, research projects, and data analysis, interpretation, and presentation. He has received several teaching awards, and led the development of the ENST undergraduate curriculum. In addition to teaching graduate and undergraduate courses, Dr. Baldwin has supervised the research of PhD and MS students and served on numerous graduate advisory committees. Wetland Ecology students censusing plant communities of tidal freshwater marshes at Jug Bay on the Patuxent River. Warming increases plant biomass and reduces diversity across continents, latitudes, and species migration scenarios in experimental wetland communities. Nitrogen and phosphorus differentially affect annual and perennial plants in tidal freshwater and oligohaline wetlands. Estuaries and Coasts Wetland plant species richness across estuarine gradients: The role of environmental factors and the mid-domain effect. Wetland Habitats of North America: Ecology and Conservation Concerns. University of California Press, Berkeley. Seed banks of Phragmites australis-dominated brackish wetlands: Relationships to seed viability, inundation, and land cover. Rapid seed bank development in restored tidal freshwater wetlands. Backhuys Publishers, Leiden, The Netherlands. Variations in seed and spore banks across a tidal freshwater landscape. American Journal of Botany Response of two oligohaline marsh communities to lethal and nonlethal disturbance. The influence of vegetation, salinity, and inundation on seed banks of oligohaline coastal marshes. Equipment includes this ft Sea Ark research vessel, Li-COR digital canopy meters and quantum sensors, a Walz PAM chlorophyll fluorescence machine, liquid nitrogen coring system, Surface Elevation Table SET instruments, and portable meters for electrical conductivity salinity , pH, and dissolved oxygen, as well as drying ovens, muffle furnaces, balances, and other general laboratory equipment and supplies.

5: Restoration of a native plant community (Putting the ecology of your project back on track.)

Lewis () edited Creation and Restoration of Coastal Plant Communities, perhaps the first book on coastal wetland restoration. Field (b) edited Restoration of Mangrove Ecosystems that provides excellent case studies from a number of Paleotropical and Neotropical countries.

Salt marsh on Sapelo Island, Georgia, USA Salt marshes occur on low-energy shorelines in temperate and high-latitudes [3] which can be stable, emerging, or submerging depending if the sedimentation is greater, equal to, or lower than relative sea level rise subsidence rate plus sea level change , respectively. Commonly these shorelines consist of mud or sand flats known also as tidal flats or abbreviated to mudflats which are nourished with sediment from inflowing rivers and streams. In the tropics and sub-tropics they are replaced by mangroves ; an area that differs from a salt marsh in that instead of herbaceous plants , they are dominated by salt-tolerant trees. Such marsh landforms include deltaic marshes, estuarine, back-barrier, open coast, embayments and drowned-valley marshes. Deltaic marshes are associated with large rivers where many occur in Southern Europe such as the Camargue , France in the Rhone delta or the Ebro delta in Spain. They are also extensive within the rivers of the Mississippi Delta in the United States. Back-barrier marshes are sensitive to the reshaping of barriers in the landward side of which they have been formed. Large, shallow coastal embayments can hold salt marshes with examples including Morecambe Bay and Portsmouth in Britain and the Bay of Fundy in North America. They have a big impact on the biodiversity of the area. Salt marsh ecology involves complex food webs which include primary producers vascular plants, macroalgae, diatoms, epiphytes, and phytoplankton , primary consumers zooplankton, macrozoa, molluscs, insects , and secondary consumers. Many marine fish use salt marshes as nursery grounds for their young before they move to open waters. Birds may raise their young among the high grasses, because the marsh provides both sanctuary from predators and abundant food sources which include fish trapped in pools, insects, shellfish, and worms. This estimate is at the relatively low end of previous estimates 2. The most extensive saltmarsh worldwide are found outside the tropics, notably including the low-lying, ice-free coasts, bays and estuaries of the North Atlantic which are well represented in their global polygon dataset. These species retain sediment washed in from the rising tide around their stems and leaves and form low muddy mounds which eventually coalesce to form depositional terraces, whose upward growth is aided by a sub-surface root network which binds the sediment. As a result, competitive species that prefer higher elevations relative to sea level can inhabit the area and often a succession of plant communities develops. Coastal salt marshes can be distinguished from terrestrial habitats by the daily tidal flow that occurs and continuously floods the area. However, in the upper marsh, variability in salinity is shown as a result of less frequent flooding and climate variations. Rainfall can reduce salinity and evapotranspiration can increase levels during dry periods. Vegetation found at the water must be able to survive high salt concentrations, periodical submersion , and a certain amount of water movement, while plants further inland in the marsh can sometimes experience dry, low-nutrient conditions. It has been found that the upper marsh zones limit species through competition and the lack of habitat protection, while lower marsh zones are determined through the ability of plants to tolerate physiological stresses such as salinity, water submergence and low oxygen levels. Plant species diversity is relatively low, since the flora must be tolerant of salt, complete or partial submersion, and anoxic mud substrate. The most common salt marsh plants are glassworts Salicornia spp. They are often the first plants to take hold in a mudflat and begin its ecological succession into a salt marsh. Their shoots lift the main flow of the tide above the mud surface while their roots spread into the substrate and stabilize the sticky mud and carry oxygen into it so that other plants can establish themselves as well. Plants such as sea lavenders Limonium spp. Salt marshes are quite photosynthetically active and are extremely productive habitats. They serve as depositories for a large amount of organic matter and are full of decomposition, which feeds a broad food chain of organisms from bacteria to mammals. Many of the halophytic plants such as cordgrass are not grazed at all by higher animals but die off and decompose to become food for micro-organisms, which in turn become food for fish and birds. Sediment trapping, accretion, and the role of tidal creeks[edit] Bloody Marsh in Georgia, USA The factors and processes that influence the rate and spatial distribution of sediment accretion within the salt marsh are numerous. Sediment deposition can occur when marsh species provide a surface for the sediment to adhere to, followed by deposition onto the marsh surface when the sediment flakes off at low tide. Sediment size is also often correlated with particular trace metals, and can thus tidal creeks can affect metal distributions and concentrations in salt marshes, in turn affecting the biota. The elevation of marsh species is important; those species at lower elevations experience longer and more frequent tidal floods and therefore have the opportunity for more sediment deposition to occur. Native to the eastern seaboard of the United States. Considered a noxious weed in the Pacific Northwest The coast is a highly attractive natural feature to humans through its beauty, resources, and accessibility. Salt marshes can suffer from dieback in the high marsh and die-off in the low marsh. Land reclamation[edit] Reclamation of land for agriculture by converting marshland to upland was historically a common practice. In recent times intertidal flats have also been reclaimed. There have been many attempts made to eradicate these problems for example, in New Zealand, the cordgrass Spartina anglica was introduced from England into the Manawatu River mouth in to try and reclaim the estuary land for farming. Native plants and animals struggled to survive as non-natives out competed them. Efforts are now being made to remove these cordgrass species, as the damages are slowly being recognized. In the Blyth estuary in Suffolk in eastern England, the mid-estuary reclamations Angel and Bulcamp marshes that were abandoned in the s have been replaced by tidal flats with compacted soils from agricultural use overlain with a thin veneer of mud. Little vegetation colonisation has occurred in the last 60â€"75 years and has been attributed to a combination of surface elevations too low for pioneer species to develop, and poor drainage from the compacted agricultural soils acting as an aquaclude. As a result, marsh surfaces in this regime may have an extensive cliff at their seaward edge. The conversion of marshland to upland for agriculture has in the past century been overshadowed by conversion for urban development. Coastal cities worldwide have encroached onto former salt marshes and in the U. Estuarine pollution from organic, inorganic, and toxic substances from urban development or industrialisation is a worldwide problem [25] and the sediment in salt marshes may entrain this pollution with toxic effects on floral and faunal species. Nitrogen loading through human-use indirectly affects salt marshes causing shifts in vegetation structure and the invasion of non-native species. Salt marshes are nitrogen limited [15] [32] and with an increasing level of nutrients entering the system from anthropogenic effects, the plant species associated with salt marshes are being restructured through change in competition. Sea level rise[edit] Due to the melting of Arctic sea ice and thermal expansion of the oceans, as a result of global warming, sea levels have begun to rise. As with all coastlines, this rise in water levels are predicted to negatively affect salt marshes, by flooding and eroding them. These zones cause erosion along their edges, further eroding the marsh into open water until the whole marsh disintegrates. In many locations, particularly in the northeastern United States, residents and local and state agencies dug straight-lined ditches deep into the marsh flats. The end result, however, was a depletion of killifish habitat. The killifish is a mosquito predator , so the loss of habitat actually led to higher mosquito populations, and adversely affected wading birds that preyed on the killifish. These ditches can still be seen, despite some efforts to refill the ditches. Increased nitrogen uptake by marsh species into their leaves can prompt greater rates of length-specific leaf growth, and increase the herbivory rates of crabs. The burrowing crab Neohelice granulata frequents SW Atlantic salt marshes where high density populations can be found among populations of the marsh species Spartina densiflora and Sarcocornia perennis. In Mar Chiquita lagoon , north of Mar del Plata , Argentina , Neohelice granulata herbivory increased as a likely response to the increased nutrient value of the leaves of fertilised Spartina densiflora plots, compared to non-fertilised plots. Regardless of whether the plots were fertilised or not, grazing by Neohelice granulata also reduced the length specific leaf growth rates of the leaves in summer, while increasing their length-specific senescence rates. This may have been assisted by the increased fungal effectiveness on the wounds left by the crabs. A , are experiencing creek bank die-offs of Spartina spp. Populations of Sesarma reticulatum are increasing, possibly as a result of the degradation of the coastal food web in the region. Their burrows provide an avenue for the transport of dissolved oxygen in the burrow water through the oxic sediment of the burrow walls and into the surrounding anoxic sediment, which creates the perfect habitat for special nitrogen cycling bacteria. These nitrate reducing denitrifying bacteria quickly consume the dissolved oxygen entering into the burrow walls to create the oxic mud layer that is thinner than that at the mud surface. This allows a more direct diffusion path for the export of nitrogen in the form of gaseous nitrogen N2 into the flushing tidal water. Salt marshes are ecologically important providing habitats for native migratory fish and acting as sheltered feeding and nursery grounds. With the impacts of this habitat and its importance now realised, a growing interest in restoring salt marshes, through managed retreat or the reclamation of land has been established. However, many Asian countries such as China are still to recognise the value of marshlands. With their ever-growing populations and intense development along the coast, the value of salt marshes tends to be ignored and the land continues to be reclaimed. The first is to abandon all human interference and leave the salt marsh to complete its natural development. These types of restoration projects are often unsuccessful as vegetation tends to struggle to revert to its original structure and the natural tidal cycles are shifted due to land changes. The second option suggested by Bakker et al. Under natural conditions, recovery can take 2â€”10 years or even longer depending on the nature and degree of the disturbance and the relative maturity of the marsh involved. It is important to note, that restoration can often be sped up through the replanting of native vegetation. Common reed Phragmites australis an invasive species in degraded marshes in the northeastern United States. This last approach is often the most practiced and generally more successful than allowing the area to naturally recover on its own. The salt marshes in the state of Connecticut in the United States have long been an area lost to fill and dredging. As of , the Tidal Wetland Act was introduced that ceased this practice, [34] but despite the introduction of the act, the system was still degrading due to alterations in tidal flow. One area in Connecticut is the marshes on Barn Island. These marshes were diked then impounded with salt and brackish marsh during In the case of Barn Island, declines in the invasive species have initiated, re-establishing the tidal-marsh vegetation along with animal species such as fish and insects. This example highlights that considerable time and effort is needed to effectively restore salt marsh systems. Times in marsh recovery can depend on the development stage of the marsh; type and extent of the disturbance; geographical location; and the environmental and physiological stress factors to the marsh-associated flora and fauna. Although much effort has gone into restoring salt marshes worldwide, further research is needed. There are many setbacks and problems associated with marsh restoration that requires careful long-term monitoring. Information on all components of the salt marsh ecosystem should be understood and monitored from sedimentation, nutrient, and tidal influences, to behaviour patterns and tolerances of both flora and fauna species. While humans are situated along coastlines, there will always be the possibility of human-induced disturbances despite the number of restoration efforts we plan to implement. Dredging, pipelines for offshore petroleum resources, highway construction, accidental toxic spills or just plain carelessness are examples that will for some time now and into the future be the major influences of salt marsh degradation. By physically seeing the marsh, people are more likely to take notice and be more aware of the environment around them. An example of public involvement occurred at the Famosa Slough State Marine Conservation Area in San Diego , where a "friends" group worked for over a decade in trying to prevent the area from being developed. The project involved removing invasive species and replanting with natives, along with public talks to other locals, frequent bird walks and clean-up events. Sediment traps are often used to measure rates of marsh surface accretion when short term deployments e. These circular traps consist of pre-weighed filters that are anchored to the marsh surface, then dried in a laboratory and re-weighed to determine the total deposited sediment. Marker horizons consist of a mineral such as feldspar that is buried at a known depth within wetland substrates to record the increase in overlying substrate over long time periods. Hydrological dynamics include water depth, measured automatically with a pressure transducer , [19] [20] [22] or with a marked wooden stake, [18] and water velocity, often using electromagnetic current meters.

6: Salt marsh - Wikipedia

Creation and restoration of coastal wetlands in Puerto Rico and the U.S. Virgin Islands. Pp in J. A. Kusler and M. E. Kentula (eds.), Wetland Creation and Restoration: The Status of the Science.

Continue to develop and improve methods for establishing target wetland plant communities on restoration and creation sites including determining the effects of elevation, tidal amplitude, and soil properties such as, salinity, duration of saturation, and plant nutrient concentrations on success. Evaluate the effects of wetland vegetation and soils on improving water quality by removal or accumulation of nitrogen, phosphorus and other pollutants. Estimate the NO3-N retention and removal capacity of a recently restored tidal marsh in North Carolina. Utilize mesocosm-scale wetlands using soils from restoration sites to determine the nitrogen fate and assimilation potential under controlled conditions. Project Methods Field Experiments As a part of a large wetland restoration site ft. The goal of this restoration was is to restore natural habitat and associated ecosystem services that would function, and improve water quality in the estuary by routing drainage from adjacent cropland through the created through the created brackish and freshwater marshes. Soil studies will assess soil chemical and physical properties that affect plant growth and improvement of water quality in the riparian brackish marsh associated with a constructed tidal creek. Soil samples will be analyzed to determine the changes in nitrogen, phosphorus, and organic carbon. Sediment accumulation in the riparian marshes will be assessed using a combination of sediment traps, a marker layer on the original surface in selected areas, and changes in elevation. Growth of marsh vegetation in the restored riparian zones will be measured to evaluate the effects of elevation, tidal amplitude, salinity, and soil nutrients on growth and zonation of planted and volunteer vegetation, the role of the vegetation in improving water quality by accumulation of sediments, and plant uptake of nitrogen and phosphorus. Sampling at the end of each growing season in September and October will assess plant survival and growth by species in each salinity and elevation zone. In an area where nutrient availability is limiting plant growth, an experiment testing the effects of rates of N and P fertilizers on plant growth has been established. Mesocosm Studies One phase of the project will be a controlled greenhouse experiment using six wetland mesocosms 3. Three randomized replicates were loaded with two representative soil series. Scuppernong a poorly drained, organic soil typically associated with Pocosins and Deloss a poorly drained, mineral soil typically associated with marine terraces soils were excavated directly from the restoration sites. Soft-stemmed bulrush Schoenoplectus tabernaemontani was planted to allow for plant establishment prior to experimentation. Experiments will be conducted as batch studies. Mesocosms will be loaded at the same hydraulic and nutrient rates. Nitrogen loading will be based on volume to ensure equal N loads to each wetland replicate, with maximum water depth not exceeding 30 cm. Batch studies will last days, depending on season and N loading to the wetlands. Measurements during each batch study will include changes in concentrations of nitrate nitrogen, dissolved organic carbon, and total organic carbon concentrations as water is circulated by pumps through each of the six wetland mesocosms. Target audiences included scientists, graduate and undergraduate students, extension agents, and citizens who are interested in environmental restoration, wetland soils, wetland vegetation, and water quality. Scientific publications, classroom instruction, scientific meetings, and extension outreach were methods used to reach these audiences. Nothing Reported What opportunities for training and professional development has the project provided? This project provided training opportunities for graduate and undergraduate students and professional development opportunities for research faculty. How have the results been disseminated to communities of interest? Results were disseminated through publication of a journal article. What do you plan to do during the next reporting period to accomplish the goals? Continue work ona project to monitor hydrology, water quality, soils, and biota at 18 wetland sites in North Carolina. Soil characterization field work will be completed during Impacts What was accomplished under these goals? Wetlands provide important ecosystem services such as habitat for fish and wildlife, production of carbon that contributes tofood webs, capturing and storing atmospheric carbon, providing flood storage, protecting shorelines against erosion and serving as filters that improve water quality by removing sediments, excess nutrients, and other pollutants,. The loss and degradation of tidal marshes and wetlands due to development, led to an interest in restoring or creating new wetlands to replace lost ecosystem services. In some cases farmland that was wetland before being drained, cleared, and used for growing crops is being converted back to wetlands to mitigate wetland losses and improve water quality. Restored or created wetlands are often designed so that drainage water from land producing crops is routed through the new wetlands to improve water quality by removing or reducing sediments, excess nutrients, and other pollutants before the drainage reaches lakes, streams, or estuaries. Results of research published in evaluated the nitrogen removal effectiveness of two wetland restoration sites using a two-year mesocosm study. Six wetland mesocosms along with unplanted controls were used in this experiment. Three replicates of two soils that differed in organic matter and pH were planted with soft-stem bulrush Schoenoplectus tabernaemontani and allowed to develop for two growing seasons prior to the study. Simulated drainage water was loaded into the mesocosms over eighteen batch studies across seasons with target nitrate-N levels from 2. Samples were collected from the water column and analyzed for nitrate-N, dissolved organic carbon, and chloride, along with other environmental parameters such as pH, water temperature, and soil redox. Nitrogen and carbon concentrations in the wetland plants and soil were also measured. Differences in nitrate-N reductions between treatments were compared. Variables included carbon availability, temperature, moisture conditions, nitrogen loading, and water pH. Target audiences reached were scientists, graduate and undergraduate students, extension agents, and citizens who are interested in environmental restoration, wetland soils, wetland vegetation, and water quality. This project provided training opportunities for graduate students and professional development opportunities for research faculty. Results were disseminated through publication of a journal article and presentation of a paper at a scientific meeting. Nothing Reported Impacts What was accomplished under these goals? Results of a study that was designed to understand the magnitude of greenhouse gas emissions from a created brackish water marsh were published. Results showed that the major greenhouse gas emitted from the marsh was carbon dioxide, but the flux was near the lower levels of other wetlands with comparable salinities. Methane flux from the soil was likely inhibited by the high soil sulfate concentration, which poised the soil redox potential above mV. The low nitrous oxide flux from the test site was due to low soil nitrate concentration and ideal soil redox which favored complete denitrification that produced nitrogen gas. Fluxes of green house gas emmitted from this created marsh were generally lower than those recorded from marshes with lower salinities. Tidal Marsh Restoration and Creation. Target audiences reached included scientists, graduate and undergraduate students, state and federal regulators, and extension agents and citizens who are interested in environmental restoration, wetland soils, wetland vegetation, and water quality. Scientific publications, classroom instruction, workshops, and extension outreach were methods used to reach these audiences. This project provided training for graduate students and opportunities for research faculty. Results were desiminated through publication of a dissertation and a presentation of a paper at scentific meeting. Continue a greenhouse experiment to assess acceptability of irrigation of food crops using wastewatertreated by a constructed wetland. Participate in a project to monitor hydrology, water quality, soils, and biota at 18 wetland sites in North Carolina. Soil characterization field work will be done during the summer of Evaluate plant response to N and P fertilizer at theNorth River marsh restoration site. A study completed by a graduate student in was designed to understand the magnitude of greenhouse gas emissions from the created brackish water marsh. He determined that environmental factors impact greenhouse fluxes, and compared observations from this site with other systems previously studied at other locations. The major greenhouse gas emitted from the marsh was carbon dioxide, but the flux was near the lower levels of other wetlands with comparable salinities. The low nitrous oxide flux was due to low soil nitrate concentration and ideal soil redox which favored complete denitrification that produced nitrogen gas. Fluxes of green house gas emmitted from this created marsh were generally lower than those recorded from natural marshes. Conference Papers and Presentations Status: Efforts to reach these audiences utilized scientific publications, classroom instruction, workshops, and extension outreach. The project provided taining and development opportunities for several graduate students to conduct research and report results at professional conferences and in scientific journal publications. Results were disseminated through publications and presentation at professional meetings and to the public through extension activities.

Work during the next year will focus on two aspects of wetland research. One will be utilizing mesocosm-scale wetlands to determine their capacity to assimilate or remove nitrogen from water. The second will measure plant uptake of chemicals of anthropogenic origin from wastewater treated by a constructed wetland system. Tidal marshes provide important ecosystem services including habitat for fish and wildlife, supporting the estuarine food web, capture and storage of carbon, improving water quality by removing sediments, excess nutrients, and other pollutants, storage of flood water, and shoreline stabilization. Restoring or creating new marshes results in replacement of lost ecosystem services. Farmland and other areas that were wetland before being drained are being converted back to wetlands to mitigate wetland losses and reduce inputs of nutrients and other pollutants to adjacent estuaries. During a previous project, tidal brackish-water creeks designed to simulate natural tidal creeks, were constructed at North River Farms in Carteret County. The riparian areas associated with this drainage system were graded to the elevations required to support intertidal marshes. Native vegetation adapted to each elevation and salinity zone was planted to create new fish and wildlife habitat, and to filter water draining from Open Grounds Farm. Effects of elevation, hydrology, and salinity on growth of planted marsh vegetation Spartina alterniflora, Spartina patens, and Juncus roemerianus were evaluated. The effectiveness of the restored wetland in improving water quality by removing nitrogen from water draining from crop land was determined by intensively monitoring stream flow and nitrogen concentrations. Results indicate that the restored wetland reduced the total amount of nitrate nitrogen in drainage water by only nine percent. This was attributed to short retention time of water in the marsh during storm events, and methods to retain water for longer periods of time should be considered. The effects of N and P fertilizers on plant growth were measured in plots where low soil levels of these nutrients were limiting plant growth. Fertilization resulted in complete cover of marsh vegetation, while unfertilized control plots had only sparse cover after five growing seasons. A study of methane gas emissions and carbon sequestration from the restored marsh was completed. Results indicated that methane and nitrous oxide emissions from the brackish water marsh were very low and that the marsh is a net carbon sink. A greenhouse experiment was initiated to study plant uptake of chemicals of anthropogenic origin from water treated by constructed wetlands. Evaluating responses of four wetland plant species to different hydrologic regimes.

CREATION AND RESTORATION OF COASTAL PLANT COMMUNITIES pdf

7: Roy R. Lewis III

Creation and Restoration of Coastal Plant Communities FIGURE Mangrove planting area on the island Of St. Croix, U.S. Virgin Islands, August

Determine the effects of elevation, tidal amplitude, salinity, and soil nutrients on growth and zonation of brackish water marsh vegetation. Evaluate the effect of tidal marsh vegetation on improving water quality by removal and accumulation of sediments, nitrogen, and phosphorus. Determine the amount of sand accumulated and the plant species composition of long-term dune experiments. Project Methods Establishment and growth of marsh vegetation planted in a created tidal marsh will be measured to evaluate the effects of elevation, tidal amplitude, salinity, and soil nutrients on growth and zonation of planted and volunteer vegetation,and the role of the vegetation in improving water quality. Sampling at the end of each growing season will assess plant survival and growth by plant species in each salinity and elevation zone. Sampling will include stand counts, number of stems, percent cover, and height measurements at the end of each growing season. Upper and lower elevation limits of each plant species or plant assemblage will be determined by surveying. Belowground biomass will be assessed at the end of years two and three by taking soil cores to a depth of ten centimeters and separating the roots and rhizomes by screening, washing, oven-drying and weighing. Sub-samples of dried above and belowground plant material will be analyzed for N and P to determine the potential of the riparian vegetation to take up and store nutrients from agricultural drainage. Field experiments will be established to determine growth and survival rates of trees in Juniper Bay, N. A randomized complete block design with eight replications will be planted with tree species as the treatments. The tree species to be tested are those characteristic of Carolina Bays: Trees will be planted on 7 x 7 feet spacing with plots 35 feet wide 5 rows wide and feet 25 trees long. The experiment will be planted on both the organic and sandy soil areas of the Bay to evaluate soil effects. Growth measurements will include survival, height, and diameter at the root collar recorded at the end of each growing season between the first of December and the end of February. Volunteer vegetation in each plot will be noted to determine any effects of species planted on invading species. Sand accumulation, and plant species composition and zonation will be determined across cross-sections of long-term dune experiments that were transplanted on Ocracoke Island in and Sand accumulation and changes in dune configuration will be measured by recording changes in elevation across permanent transects. Plant species composition will be determined by assessing square-meter quadrats in the front, crest, and rear dune plant communities. Current aerial photography will be compared with photography from the past to determine changes in vegetation that may have occurred. Existing Lidar data and surveys on the ground will be used to determine the relationship of elevation, depth to water table, and soil characteristics to plant species and cover, and to estimate the volume of sand accumulated due to vegetation. Target audiences reached included students, individuals, environmental groups and scientists. Science based knowledge was delivered through journal publications, extension meetings, classroom instruction and presentations at scientific meetings. Nothing Reported What opportunities for training and professional development has the project provided? Presentations at professional meetings provided opportunities for graduate students and faculty to interact with other scientists. How have the results been disseminated to communities of interest? Information and experience gained through this research has been disseminated to the publicby North Carolina Extension and the North Coastal Federation, a non-profit organization. What do you plan to do during the next reporting period to accomplish the goals? Nothing Reported Impacts What was accomplished under these goals? Impact Increasing human population and development activities produce impacts that result in degradation or loss of wetlands and other coastal ecosystems. Tidal marshes are valuable natural resources that provide habitat for wildlife, birds, and fish. Other important ecosystem services that tidal marshes provide include contributing organic carbon to the estuarine food web, capturing, and storing atmospheric carbon, and serving as filters that improve water quality by removing sediments, excess nutrients, and other pollutants. The loss and degradation of tidal marshes due to development, led to an interest in restoring or creating marshes to replace lost functions and values. During this research project, farmland, which was wetland before being drained, cleared, and used for growing crops, was converted back to wetlands to mitigate wetland losses and reduce nutrient inputs to the adjacent estuary. The riparian areas associated with the created drainage system were graded to the elevations required to support intertidal marsh vegetation. Native plant species adapted to each elevation and salinity zone were planted and successfully established, which created new fish and wildlife habitat and filtered water draining from adjacent crop land. Effects of elevation, hydrology, and salinity on growth of planted marsh vegetation Spartina alterniflora, Spartina patens, and Juncus roemerianus were evaluated. The effectiveness of the restored wetland in improving quality of water draining from crop land was determined by intensively monitoring stream flow and concentrations of pollutants. Results indicate that the restored wetland reduced the total amount of nitrate-nitrogen in drainage water from upstream by 9 percent. However, there was a net export of phosphorus, total nitrogen and dissolved organic carbon. These results lead to the conclusion that restored tidal marshes can be designed to contribute to reduction of nutrient enrichment and eutrophication of estuaries, but other management practices should be used concurrently to significantly reduce non-point source pollution. Goals at Project Initiation: Marsh vegetation was successfully established on a hectare flood plain of a constructed tidal creek, and data were collected to measure biomass, lower and upper elevation limits of native plant species, and soil nitrogen and phosphorus required for optimum plant growth in areas without topsoil. Surface elevation relative to tide range is the most critical factor affecting successful establishment of vegetation, especially in a micro tidal environment. The elevation requirements for each plant community should be determined by surveying a nearby reference marsh. In areas where topsoil was not replaced, applications of nitrogen and phosphorus fertilizers were critical to success of vegetation. Soil testing before planting is necessary to determine if soil phosphorus is adequate. Stockpiling topsoil before construction for spreading after construction is recommended. High salt levels due to evaporation of tide water trapped in surface depressions may kill plants or reduce growth during periods of high temperatures and low rainfall. Activities and Experiments Continuous flow monitoring and high frequency sampling of water entering and leaving the constructed tidal marsh were used to determine volume and nutrient concentrations in water. Flow through the marsh was affected by daily tidal fluctuation as well as drainage from cropland; however, major rainfall events accounted for most of the nitrate flux in the marsh. Retention or removal of nitrate was reduced by the short residence time of water in the marsh during high rainfall events. There was a net export from the marsh of total nitrogen, phosphorus, dissolved organic carbon, and total suspended solids during the sampling period. Constructed tidal marshes can play a role in reducing eutrophication of coastal waters, but other management practices should be utilized concurrently. Design modifications that increase residence time of drainage water on the marsh surface during major rainfall events should be investigated. Determine the amount of sand accumulated and the plant species composition of long term dune experiments. Lack of resources restricted new research on coastal dunes during the reporting period. Conference Papers and Presentations Status: Long-term nutrient and suspended solids mass balance for a restored brackish marsh in eastern North Carolina. June 10 - Quantifying the water quality benefits of a constructed brackish marsh and tidal stream using continuous water quality and flow monitoring. State University, Raleigh, N. Awaiting Publication Year Published: Evaluating responses of four wetland plant species to different hydrologic regimes. Monitoring was continued to determine the effects of wetland restoration and creation on quality of water draining from land used for crop production. Water, marsh vegetation, and soil were sampled in a ha brackish-water marsh and a m tidal stream that were created on prior converted cropland adjacent to the North River estuary. Water draining from adjoining crop land was routed through the restored creek and marsh with the objective of reducing sediment, nitrogen, and phosphorus loads. The created tidal stream is connected to the estuary resulting in bi-directional stream flow due to lunar and wind tides. Accurate measurement of water volume and nutrient loads was difficult due to the complex flow and nutrient dynamics in the micro-tidal system. Volume of flow was monitored using Doppler flow meters, and the concentration of nitrate in water in the creek was measured on minute intervals using recently developed spectrophotometer technology. Results indicated that the restored wetland system removed or retained significant amounts of N based on reductions of concentrations in water flowing out of the wetland compared to concentrations in water flowing from field ditches into the wetland. The reduction in N was likely due to denitrification, plant uptake, and deposition and accumulation of organic sediments. The restored tidal wetland was less effective in reducing P concentrations in drainage water. The restored marsh soil contains residual P from fertilization while the land was being farmed. Solubility of the residual P increased as soil redox potential decreased when wetland hydrology was restored. Possible mechanisms that would remove P from drainage water include deposition of sediment, plant uptake, and accumulation of organic matter. A separate study of the effects of N and P fertilizer on plant growth was continued in a small area of sparse vegetation where topsoil was not replaced after grading. Plots where both N and P were applied maintained a complete cover of Spartina patens after four growing seasons, while unfertilized plots remained un-vegetated. These results indicate that N and P were growth-limiting factors in the subsoil, and that success of the marsh restoration project was enhanced by stockpiling and replacing topsoil before planting vegetation. Individuals who worked the project were those listed as principal investigators, their technicians and graduate students. The principal partner organization was The North Carolina Coastal Federation, a non-profit organization. Nothing significant to report during this reporting period. Not relevant to this project. Impacts Documenting the efficacy of tidal wetland restoration and creation, and the ecosystem services that are provided will encourage and justify use of this practice. Applying results from this research to future wetland restoration projects will enhance the chance of success and maximize their environmental and economic benefits including improving water quality, increasing wildlife and fishery habitat, providing flood buffers, and accumulating sediments. Broome , and J. Changes in wetland soil morphological and chemical properties after 15, 20, and30 years of agricultural production. Research activities were focused on sampling water, vegetation, and soil in a ha brackish-water marsh and a m tidal stream that were created on prior converted cropland. One objective of the wetland restoration project is to improve water quality in the North River Estuary by diverting agricultural drainage water from an adjoining farm through the restored creek and marsh to reduce sediment, nutrient, and bacteria loads. Because the created tidal stream receives agricultural drainage water and is connected to the estuary, stream flow is bi-directional due to lunar and wind tides. Accurately measuring reduction in nutrient loads is challenging due to the complex flow and nutrient dynamics in the micro-tidal system. The flow is being monitored using Doppler flow meters, and the concentration of nitrate in water in the creek is being measured on minute intervals using recently developed spectrophotometer technology. A study of the effects of fertilizer on plant growth was also continued in a small area of sparse vegetation where topsoil was not applied after grading. Plots where both N and P were applied achieved complete cover of Spartina patens after three growing seasons, while unfertilized plots remained un-vegetated. These results indicate that N and P were growth-limiting factors in the subsoil. A new study was begun to assess carbon sequestration and to investigate the effect of salinity on greenhouse gas methane, carbon dioxide, and nitrous oxide emissions in the restored marsh. Impacts Results from this research will be applied to improve wetland restoration and monitoring techniques used for restoring prior-converted cropland. Documenting the removal of nutrients and other pollutants from drainage water from crop land will encourage and justify use of tidal wetland restoration and creation. Assessing carbon sequestration, nitrogen removal, and greenhouse gas emissions will add to the understanding of ecosystem services provided by tidal marsh restoration and creation.

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Possible uses for restoration in the conservation of biodiversity include not only the creation of habitat on derelict sites, but also techniques for enlarging and redesigning existing reserves. Restoration may even make it possible to move reserves entirely in response to long-term events, such as changes in climate.

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