Breakout 4A - Ecological Engineering: Remediation and Restoration for 21st Century Open Space

This talk was delivered by Katrina VanDeusen, who is a Senior Project Manager with EWMA doing remediation work throughout the Northeast. Katrina opened up discussing the basics of ecological engineering and how the use of specific vegetation can offer solutions to some problematic remediation strategies of the past two decades. Phytoremediation, or the use of green plants to mitigate environmental contamination in soils and water, offers not only a sustainable alternative to hard infrastructure, but also reclaims open space while giving back to the community.

The standard remediation strategies of excavation and pump and treat have been practical solutions for many sites in the northeast but by no means can be the only remediation tactics. A site with extensive contamination may be too costly to develop and one located near a wetland may be too susceptible to harmful ecosystem impacts. Sites like these are ideal for ecological engineering to play a major role in remediation. Kat noted that the sensitive banks along the Hudson River would be ideal for this form of remediation as their hydric soils are essential to the ecosystem but high real estate values press the case for development.

The themes of environmental understanding and the effects of remediation on adjacent land were very much at the heart of the talk. It is essential for remediation professionals to understand that work done on any site will have impacts on surrounding land and to take this into account when drafting work plans. Sensitive Receptor Areas are locations where this understanding is particularly critical due to the presence of resources proximal to the site. For example, the presence of manufactories in New Jersey's wetlands and the subsequent dumping that took place left extensive contamination in sensitive areas, making excavation near impossible and the possibility for remediation small. Steps can still be taken to clean up the site, like the introduction of phramites, a common reed that is great at breaking down heavy metals in soil. This technique has been employed in the meadowlands with great success. Another success story includes the use of sunflowers to mitigate levels of radiation in the land surrounding Chernobyl, Ukraine.

Katrina was sure to make note that there is a tremendous understanding necessary to accurately employ this strategy. Not just an understanding of the land but also of the biota that inhabits it. The root structure of certain trees, porosity of soil, and presence of natural or invasive plants are just a few of the factors that can dramatically affect the success of phytoremediation. In order to acquire such in depth understanding of a site it is necessary to gather an abundance of data on the geology and biology of the site as well as that of the surrounding land. It is essential to the economic feasibility of ecological engineering that the remediation is done correctly the first time and sites do not need to be revisited do to unintended consequences.

The specific processes in plants that remediate land can vary dramatically by plant. In other words, some are great for phytostabilization, the use of plant root structure to mitigate erosion from runoff, and others are great for rhizofiltation, the process by which plants remove contaminants from water by filtering it through their root systems. Phytoextraction is another process where plants uptake and accumulate contaminants for removal and phytovolitilization breaks down contaminants and exhausts them into the atmosphere.

The potential for cost savings are huge with this remediation strategy. Using plants to remediate dramatically reduces energy costs as 'equipment' runs solely on solar power. Costs of monitoring and maintenance are decreased or even eliminated as well as costs of excavation and fill material. However, the benefits go beyond the balance sheet as plants provide a more sustainable environment and an aesthetic quality that communities can appreciate.

Katrina mentioned that what is in best interest of the environment does not always align with the ideas of a landscape architect who have their own prerogatives. Many weeds, for example, are great at breaking down contaminants in soil but are seldom greeted with intrigue by architects because they are ugly. It is vital for ecological engineers and architects to have open communication when it comes to selection of vegetation.

So of all possibilities, how does one know which plants to remediate with? It is all to do with the information yielded from site investigation into soil, geochemistry, hydrology, plume dynamics, sunlight, soil type, seasonal aspects, and assessment of flora and fauna. Once data has been collected, plant species should be chosen based on COPEC degradation capabilities and other specifics like root structure, life cycles, and metabolism.

Kat shared a few site characterizations to show how these ideas were being implemented on sites today.

A former landfill in New Jersey that had fill in a wetland was prevented from any redevelopment for 20 years. Operations at the site had left a plume of chlorinated volatile organic compounds migrating toward the wetland. Aside from the footprint of the site being excavated, it was deemed to invasive to excavate further and backfill wasn't permitted in wetlands. Kat developed a plan that could bring results to the site in a cost effective and sustainable manner. She installed trees on the leading edge to decrease CVOC migration toward the wetland and specific grasses and other hydric understory to stabilize a constructed edge of the property and prevent erosion. Using deciduous trees with long taproots it was possible to remediate water all the way down to the water table.

Another site located in Connecticut which had undergone major remediation work has residual inorganic and organic contaminants at low concentrations. It was not feasible to excavate due to logistic and hydrology concerns but phytoremediation was certainly possible. An ecologically engineered solution was worked out in which hot spot excavations carved out of monotypic stand of phramites left open vernal pools. Remediation not only improved biodiversity of wetland but also left an access road that is utilized by the community for hiking and bird watching.

A third and final site located in New Jersey had been rezoned from industrial to residential and had site dormant for 10 years as redevelopment costs were too high. The local community had complained that nature was taking back the land with a rash of rodents and coyotes. Due to the size of the site excavation wasn’t feasible so a vegetative cover was proposed in wetland buffer areas along the river. Maintain hydrology of the wetland hydric soils while reducing vegetative cover requirements. A jogging trail was proposed in the wetland transition buffer area to demarcate transition zone and provide community improvement.

So we see that plants can be very useful for remediation when given the right site parameters and skill set. Phytoremediation can be cheap, naturally pleasing and cost virtually nothing to maintain. The major setbacks to ecological engineered remediation lie in the specific type of site it requires. Large sites with high surface area are ideal, unlike most urban sites and remediation can take long periods of time.