WatershEDITORIAL

On hydrologic monitoring across the Big Cypress

Introduction

The diversity and multitude of hydrologic issues that emerge, submerge, and then re-emerge again unexpectedly throughout the greater Kissimmee-Okeechobee-Everglades and adjacent Big Cypress watersheds – only to rapidly retreat and later reappear yet again in the future with a new twist are truly unending and overlapping. We all know the stories as the ones that hog the headlines in our local papers. They also have the side effect of obscuring progress that that water management community has achieved over time. One case in point is hydrologic monitoring.

Consensus Opinion

Over the past decade a silent and often underappreciated technological revolution has swept through the South Florida Water Management District monitoring networks. Floridians have marveled for decades at the technologic wizardry of space flight being launched at nearby Cape Canaveral to explore those unknown universes. But many also remember a day when the vast stretches of unending Everglades were seemingly impenetrable, similarly mysterious, and weirdly more clearly seen from photographs taken from space then from plain sight on the ground.

Monitoring was once an arduous activity whose light at the end of the tunnel always seemed to be just that. The routine of strapping on the swamp boots, donning flight gear, or climbing up in an airboat or buggy for the long haul into the remote corners of the swampy wilderness – or even in the case of just driving out on a dusty limerock road at the far end of the county; for the purpose of downloading data and maintaining operational function of the hydrologic monitoring sentinels was less immediate gratification than an exhaustive exercise in long-term record keeping. Keep in mind that the trip back from the stations were equally as long, with only raw data in hand that still needed to be processed, and that was at best a month-old or more – or even worse, with no data at all because the station was knocked out by an equipment failure or a lightening strike requiring yet another trip out to repair it.

In truth, the above travails are a big part of the allure behind south Florida's hydrology, and have no doubt that all hydrologic stations require TLC to keep them up and running even today. But more and more and more, the old methods of monitoring and data collection have been upgraded and simplified with the advent of telemetry.

The District (including the Big Cypress Basin in Southwest Florida), National Park Service, Army Corps of Engineers, U.S. Geological Survey, Fish and Wildlife Service, and others have taken on the initiative of not only automating data collection, but taken the additional step of telemetering stations to remotely transmit the data right to our fingertips (nearly as fast as a snap of the same fingertips). Through the magic of telemetry, data is streamed into computer databases and onto our computer screens as quickly as they unfold on the ground and in our watersheds.

From a utilitarian level, telemetry gives us the ability to detect station problems in real-time, as they occur, allowing us to fix the problem sooner, and making sure we have the right tools in hand when we trek out there by helicopter, airboat, swamp buggy or foot to those often remote stations. More broadly, telemetry systems allows us more than ever to work across agency lines through partnerships and collaborations to bring out the best in use as institutions and individuals in our shared missions to steward our watersheds.

We should not lose sight of that telemetry is a people revolution as much as it is technological. There are unsung heroes behind the scenes making these systems work, investing in their maintenance, and interpreting their results. We are literally knocking at the door of the utopian watershed dream of decoding our position in the perpetual parade of south Florida's constantly-evolving water cycle. As Floridians we are well aware of the bounty and scarcity of our water, and the tremendous responsibility that we bear to steward our water resources wisely.

Recommendations

Now that we've made this quantum step forward, what baby steps are left in the Big Cypress area to inch farther along along the path of progress? Here are three ideas that top the list.

(1) **Add telemetry to obvious places.** There are still existing stations, many of them with long histories of data and many of them in critical parts of our watersheds, that are not yet telemetered. High priority sites include one at the headwaters of Camp Keais Strand (Keais 846). Two others are located at critical transition zones in the Okaloacoochee Slough (OKAL 858 and OK29).

(2) **Comprehensively review water monitoring network.** There is a need to comprehensively assess the regional water monitoring network in Southwest Florida in order to maximize its effectiveness and efficiency. Similar efforts are underway in the main footprint of the Comprehensive Everglades Restoration Plan (CERP), but Southwest Florida and the Big Cypress areas are under-represented in this effort. The recent move to equip our region's stations with telemetry and imminent arrival of new Total Maximum Daily Loads (TMDLs) being handed down from Tallahassee make this an opportune time to perform a comprehensive review. Collectively and individually, we need to justify locations and

parameters of importance; and clearly elucidate how these additions will complement the existing network and our stewardship missions.

(3) **Maximize efforts to translate data into useable forms.** Numbers are empowering, but they need to be translated into non-numerical forms to truly unleash their full potential. How can we best harness the never-ending stream of data to paint the pictures that need to be painted for viewing hydrologic trends and patterns. There's probably no one answer or tool to this question. Data can be decoded into different formats to answer different questions. Telemetry definitely puts the ball in our respective agency and individual courts to rise to this challenge.

Suffice it to say that telemetry isn't the end of the station. Telemetry ushers in a new world, but also puts us back on track for a new destination point ahead. Reaching that next station will require ever-increasing amounts of technology, partnerships across agency lines, and an ability to see the watersheds that transcend jurisdictional boundaries. It's exciting to have made such large strides down the path of progress, now decades in the making, but telemetry is only a tool to help us rise to new challenges and fulfill greater expectations.

Team Discussion Points

Advancement towards hydro-ecological models. How can we raise ecological criteria on par with hydrologic aspects of modeling and monitoring efforts? Output from hydrologic models are already used to calculate Habitat Suitability Index (HSI) for various ecological parameters, but HSIs are more of a post-model assessment ranking than the coveted holy grail of a fully-blown hydro-ecological model. Do such hydro-ecological models exist or are they even possible? The U.S. Geological Survey uses ATLSS (Across Trophic Level System Simulation) models in the Everglades proper to assess ecological responses to natural and managed changes to the hydrologic cycle. Another example to draw from is the use of indicator regions (IRs) and performance measures (PMs) developed by the RECOVER (Restore-Coordinate-Verify) Team for the Everglades Proper authorized under CERP and similar efforts in the Southwest Florida Feasibility Study.

ATLSS models, HSIs, PMs, and IRs represent starting points for envisioning what is needed to best synthesize hydrologic and ecologic criteria in surface-water modeling efforts here in southwest Florida – and making this information available to relevant stakeholders and the interested public.

We should not lose sight that ecological data can serve as valuable (and insightful) model calibration parameters. But how can ecological data be collected in a way that is cost effective and regionally robust enough to either be incorporated directly into models and/or used to better calibrate models. Spatial delineation of algal blooms can be used to better delineate impacts from freshwater flow discharges through our estuaries, and affiliated nutrient loads. The presence and absence of certain species can be used to calibrate flooding

regimes in deep-water refugia at more refined scales than gridded in the hydrologic model. Water quality parameters can also complement surface-water modeling refinement.

Address Gaps. Monitoring gaps are often thought of as geographic holes in the network. They can occur at political boundaries or in far-flung reaches of the watershed. However, filling needs is ultimately a better approach than filling geographic gaps. Here's points to think about.

(1) Models are great tools for guiding where and what type of monitoring is needed. Missing links in the hydrologic network are often not spread evenly across the spatial landscape.

(2) The role and geographic differences in evapotranspiration needs more attention. Evaporatranspiration is comparable to the black matter of the south Florida water cycle. It accounts for a full half of the annual water budget, but it is often relegated to a forgotten and underappreciated parameter.

(3) Surrogate parameters for water quality can serve as powerful and cost-effective ways to track water quality. Sampling water quality with grab samples has the benefit of being lab-certifiable, but spatial and temporal distribution (and costs) limit the overall utility of this approach for addressing nutrient loading and contaminant transport issues. Surrogate parameters for nutrients such as total dissolved solids can be measured more cheaply, in more places, and often hooked up to telemetry. This approach has to be carefully balanced by an awareness of sampling limitations and periodic quality control with grab samples or other methods.

Taking data to the next level. The regional telemetry network can brings data to our fingertips, but decoding the numbers into useable forms that we can read is really what empowers us. There are a number of models and graphical interfaces that can be used to help us see through the numbers into the wonderland of how the system is behaving – both historically and in real-time – and for the purpose of refining our models and monitoring network.

It is unlikely that their will be a one-shoe-fits-all-size approach. Many entities and individuals will make contributions to translating the data. A number of tools already exist for this – including the District's radar derived rainfall display, US Geological Survey Everglades Depth Estimation Network (EDEN), District's real-time water level site, USACE real-time water basin reports – and the list will grow. For example, the Big Cypress Basin is in the preliminary stages of collaborating with a consulting firm on a next-generation model that will help us visualize how the space between monitoring points – such as canals, structures, flood prone areas, and natural flow ways – are responding in real time.

Minority Opinion

Telemetry is great – it's a powerful tool for bringing data instantaneously to our fingertips – but it is expensive. We should not be lulled asleep by the ease to which telemetric data is delivered, become complacent into thinking it will answer all the questions, or use its high cost as an excuse for not to getting out in the field today and on a regular basis to collect hydrologic and ecological data.

Weekly readings can go a long way to answering very many a resource question and building long-term record. It is as simple and cheap as getting some rulers from a hardware store and nailing them to a post. Ed Carleson from Corkscrew Sanctuary collected weekly readings from 1953 to 1974 by hand which kept the water monitoring torch burning until chart recorders were installed in the mid 1970s. And most of all don't forget the important step of gathering exploratory data that serves as a pre-cursor for determining the best place to put long-term monitoring.

Critical to all monitoring is the need to archive and review the data at regular intervals. The ethic of regular data review and analysis not only keeps us on top of the resource as it unfolds, but also puts us in a position to see how data gathering can be refined and improved to better answer our questions. That's a responsibly we all need to hold ourselves to.