Participatory Climate Adaptation in Coastal Florida: Increasing Roles for Water-Users and Independent Science

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ABSTRACT

A primary attribute of coastal management in Florida is continued building in coastal flood zones, despite long-standing evidence of rising sea levels. Time is increasingly short to focus on more rigorous management policies that actualize long term adaptation to sea level rise. The real estate industry and the U.S. Army Corps of Engineers are among the primary economic and political drivers of hundreds of construction projects in coastal Florida flood zones. There is evidence of chronic differences between the professional and political cultures of real estate and engineering when compared to resident water users and scientists not dependent on consulting contracts, though distinctions are not always binary. Leading representatives of water-user groups, independent scientists, and others are now coordinating to: 1) improve the public participation of local stakeholders in coastal management; 2) increase the quantity of independent research; and 3) apply improved information towards long-term coastal adaptation needs in Florida. The recent examination and prevention of a major coastal dredge and fill permit in Lake Worth, FL, derives from these trends. Findings with state or national management significance that resulted from this litigation include: advances in sediment and reef turbidity policies, higher standards for sediment transport models, and enhanced rights for career water-users to testify as expert witnesses. Coastal management can become more sustainable if proactive strategic relocation enters the planning toolbox and if the actual water-users, independent scientists, and other actors (who don't benefit from building in flood zones), coordinate to foster more participatory sea level rise adaptation to manage natural and social capital, as well as built capital.

KEYWORDS: Climate, adaptation, public, relocation, TEK, sea level

Adaptación Climático Participatorio en la Florida Costera: Aumentando el Rol para Usuarios del Agua y la Ciencia Independiente

Una característica primaria en el manejo de la zona costera en la Florida es la construcción continua en zonas inundables, a pesar de la evidencia consistente del levantamiento del nivel del mar. El tiempo se vuelve cada vez más corto para enfocarse en políticas de manejo rigurosas que reconozcan la necesidad de la adaptación efectiva a largo plazo al levantamiento del nivel del mar en la costa. La industria de bienes raíces y el Cuerpo de Ingenieros del Ejército de los EUA se encuentran entre los principales promotores políticos y económicos de cientos de proyectos de construcción en las zonas inundables de la costa de la Florida. Existe evidencia de las diferencias crónicas en las culturas políticas y profesionales de los representantes de la industria de bienes raíces e ingenieros al ser comparadas con las de los usuarios residentes de la zona y los científicos que no están atados a contratos de consultoría, aunque las distinciones no siempre son binarias. Líderes representantes de grupos usuarios del recurso costero, científicos independientes, y otros están actualmente coordinando para: 1) mejorar la participación pública de los interesados locales en el manejo costero; 2) aumentar la cantidad de investigación independiente; y 3) someter información mejorada para equilibrar el cabildeo de intereses a "construir en zonas inundables". La reciente previsión legal sobre el permiso para las actividades de dragado mayor y relleno en Lake Worth, Florida, se derivan de estas tendencias. Los hallazgos de significancia durante el manejo estatal y nacional que resultaron de este litigio incluyen: avances en las políticas sobre criterios de sedimentos y turbidez en los arrecifes, guías en los modelos matemáticos para una representación más realista del transporte de sedimentos, y realce en los derechos de los usuarios locales del recurso para ofrecer su testimonio como testigos expertos. El panorama sobre el manejo sostenible de los recursos costeros puede transformarse si los usuarios reales del recurso, los científicos independientes, y otros actores (aquellos que no se benefician de la construcción en las zonas inundables), coordinaran entre sí para promover una mayor participación en la adaptación de las zonas costeras al levantamiento del nivel del mar.

PALABRAS CLAVES: Clima, adaptación, público, reubicación, TEK, nivel del mar

Adaptation Climatique Participatoire de la Côte Florida: Amplifiés des Rôles des Usagers d'eau et la Recherche Scientifique Indépendante

Les paysages économiques et politiques pour la gestion de construction côtière sont très différents que pour la gestion de pêcheries (par ex, les milliards annuel contre les millions annuel; le Army Corps of Engineers et les lobbyistes de biens immobiliers en opposition aux agences de pêcherie). L'industrie de biens immobiliers est le premier conducteur économique et politique de centaines de projets de construction côtière, n'importe quand dans l'est de la Floride Est en dépit des niveaux marins montant. Il y a des preuves de différences chroniques entre les cultures professionnelles et politiques des biens immobiliers et d'ingénierie par rapport aux utilisateurs d'eau locaux. Les distinctions ne sont pas binaires et beaucoup correspondent aux deux catégories. La partie prenante de proximité a émigré historiquement loin des utilisateurs d'eau côtiers locaux, non-riches (beaucoup avec TEK) en faveur des propriétaires immédiatement sur la dune en dépit des nombres inférieurs d'utilisateurs d'eau, de résidents annuels et d'enfants dans les voisinages côtiers dégradés en augmentant la densité. Les utilisateurs d'eau, les biologistes, les géologues et d'autres coordonnent afin de : améliorer 1) la participation de la partie prenante locale dans la gestion côtière; augmenter 2) la quantité de recherche indépendante; et appliquer 3) des informations améliorées aux questions importantes. La prévention légale d'une drague côtière et d'un projet de remplissage dans Lake Worth, Floride, provient des objectifs 1-3 ci-dessus. Les contentieux avec le nouvel

état et les précédents de gestion côtière nationale incluent : les avances dans la turbidité de récif et les politiques de sédimentation, en modelant des directives pour représenter de façon plus réaliste le transport d'eau/sédiment et les droits des utilisateurs d'eau expérimentés de maintenant témoigner comme les experts techniques. Le paysage pour la gestion côtière durable peut devenir plus fondé sur des informations et réceptif au climat avec plus non-traditionnel faisant équipe.

MOTS CLÉS: Climat, adaptation, public, relocalisation, TEK, niveau de la mer

INTRODUCTION

With the largest regional coastal economy in the Greater Caribbean basin, Florida's coastal culture and biodiversity is both highly valued and increasingly challenged. Despite guidelines and limited regulations, coastal planning in Florida has focused on continuous growth, with limited consideration of the long term societal consequences of promoting building in flood zones during a period of sea level rise (Ruppert 2008). There is considerable evidence that improved sea level adaptation in Florida will require an increased role for public participation in the planning processes (OAS 2001) and for independent research that is not largely funded to achieve short-term business goals (e.g., Pielke 2007).

In Florida as in many coastal areas, the real estate and development industries, and associated consulting firms are direct economic and political drivers of hundreds of coastal construction projects at any time. In addition, the push for growth in flood zones requires substantial federal assistance and this comes in part via large expenditures through the U. S. Army Corps of Engineers (USACOE) to promote and build major infrastructure projects, some of these showing many attributes of perverse subsidies *sensu* Meyers and Kent (2001) and Bagstad *et al.* (2007). There are also major, typically under-discussed, contributions from federal insurance programs (e.g., National Flood Insurance Program) which ultimately incentivize building in flood zones via subsidies that undervalue risk (Newman 2009). One might think that the mortgage industry collapse and the resulting impacts on larger financial markets would suggest greater precaution in the undervaluation of risk, but that is not typically the case in Florida coastal planning.

For decades, prevailing policies have promoted building in flood zones despite rising sea levels, the unease of local water users, and a number of other logical concerns. A push to develop in high risk areas remains not only because of private sector profits but also:

i) Local governments have become increasingly dependent on elevated property tax revenues from coastal properties,
ii) The USACOE creates new work to fund existing staff and infrastructure, and
iii) Aggressive lobbying has carved out niches to maintain the status quo.

We are in an ironic system where, despite decades of evidence that sea level will rise at least one meter by century's end (e.g., Titus 2000), powerful interest groups have long encouraged building in flood zones and skepticism about climate change. Now that denial of accelerating sea level rise is becoming more difficult, responses emphasize more of the status quo, for example, massive coastal dredge and fill projects that often are temporary, environmentally damaging and perhaps, most importantly, foster continuous avoidance of long-term adaptive planning that can lead to more flood zone development. This has developed into a classic and particularly large-scale "social trap" following Costanza (1987) and others. Though many coastal professionals have long discussed this situation off the record, understandably, there is limited commentary in meetings or articles since open consideration of all issues can endanger funding and some jobs. Extreme pushback (losing contracts, getting fired) can be an attribute of attempting to resolve social traps, as well as attempts to shift tenuous paradigms (Kuhn 1971).

After so many decades of building in flood zones, many examples of complex challenges are cascading into the future from business-as-usual (BAU) approaches (Titus 2004). Though the situation has improved, millions of dollars in BAU private and public funding have been spent on environmental assessments that were statistically inadequate and unpublishable due to methodological and analytic limitations (Peterson and Bishop 2005, Wanless and Maier 2007). BAU includes a continued reluctance at local levels to politically confront coastal climate change despite the presence of over 40 guides or reports on climate change planning for Florida alone (many in considerable detail) and over 500 such reports from other coastal areas of the globe (FIT 2010). Excellent Florida storm and sea level adaptation studies such as DCA (2005; not widely distributed though an unusually thorough review of information and ideas), Volk (2008), Beever *et al*. (2009), and many others receive relatively little attention though very important.

Despite the flood of literature on coastal management and, increasingly, climate adaptation in the technical journals, little focus is typically placed on the underlying drivers of unsustainable coastal management. We understand this: the topics are technically diverse and highly complex, and the pushback can be aggressive against those who openly discuss the elephants in the coastal policy living room. There are lots of other things to do in coastal management than to confront the landscape outlined in paragraph three. But how much time do we have left for BAU and building in flood zones in the face of climate change and sea level rise (Pielke *et al*. 2007, Bearzi 2007)? In this note, we briefly summarize some notable aspects of

the current situation and present one example of how partnerships among non-traditional partners can achieve significant results.

COORDINATION AMONG WATER-USERS AND INDEPENDENT SCIENTISTS

In the mid-2000s, a large dredge and fill (beach renourishment) project was proposed for a stretch of coastline in Palm Beach County, FL, that includes the Lake Worth Pier and adjacent nearshore hardbottom habitat. The pier is a historically iconic surfing and fishing area for generations of South Florida water-users. The type of hardbottom habitat in this area is defined as an Essential Fish Habitat – Habitat Area of Particular Concern by the South Atlantic Fishery Management Council in response to mandates of the 1996 Sustainable Fishery Act (SAFMC 1998) and can support high diversities and important life stages of nearshore invertebrates and fishes (Nelson 1989, Lindeman and Snyder 1999). The environmental issues that can arise from large coastal dredge and fill projects are abundant and are in part summarized in Bush *et al.* (2004) and Wanless and Maier (2007).

In this particular project, one of many large dredge projects that semi-continuously occur in East Florida coastal waters, a response developed that had been building due to prior frustration among water-users who felt their concerns about dredge and fill projects were institutionally ignored. Ultimately, a lawsuit against the Town of Palm Beach and the State of Florida was filed by members of the public with support from several NGOs. The suit had diverse claims including: the GENESIS coastal process model employed by the USACOE was not applicable in this area, the fill to be used was of poor quality, and the environmental impacts were underestimated.

The petitioners, experienced local surfers, fishers and divers who teamed with the Surfrider Foundation and Snook Foundation, were able to assemble an unusually robust legal and scientific team including leading geologists, habitat and fish experts, turtle experts, economists and bio-statisticians. However, financial resources were highly limited and most expert work, typically involving extremely complex preparation, was ultimately performed *pro bono*. In contrast, the Town of Palm Beach mobilized over $1,500,000 to hire one of the largest law firms in the state and its own, well-paid technical team. Only those challenging the project had to worry about hundreds or more hours of highly underpaid preparation.

The major financial resource imbalance illustrates a primary reason for an absence of prior litigation on coastal dredge and fill projects in Florida and the southeast U.S., despite the high potential for diverse negative cumulative impacts after hundreds of shallow water dredge projects (e.g., Lindeman 1997, Peterson *et al*. 2006, Peterson and Lowe 2009). The fact that a litigation event was finally happening illustrated the frustration that had built on the side of disenfranchised water-users and those desiring more rigorous and independent environmental assessment. The expert technical team included the geologists Dr. R. Young, Western Carolina Univ., Dr. O. Pilkey, Duke Univ., Dr. H. Wanless, Univ. of Miami, and Dr. R. Parkinson, Parkinson Consulting. Biologists and economists included Dr. C. Peterson, Univ. of North Carolina, Dr. M. Salmon, Florida Atlantic University, and Dr. R. Weisskoff, Florida International University.

After a trial that evaluated many diverse and complex issues, the state administrative law judge, Robert E. Meale, produced an array of findings in favor of the water-users on issue after issue in a 277 page decision and recommended that the Florida Department of Environmental Protection deny a permit to the Town of Palm Beach to initiate dredging (later upheld). Potentially new precedents at state and/or national levels include: advances in reef turbidity and sedimentation monitoring policies, higher standards for sediment transport models, and the rights of experienced water-users to testify as experts. Details can be obtained in the final ruling of Surfrider Foundation, Snook Foundation, Capt. Danny Barrow, Tom Warnke, and Terry Gibson *v.* Town of Palm Beach and the Fl. Dept. of Env. Protection at http://www.doah.state.fl.us/ros/2008/08001511.pdf. The findings included:

i) The mean grain size of the proposed fill was only approx. half the mean grain size of the existing beach and would not maintain the general character and functionality of the coastal system.
ii) The impacts from turbidity were unmitigated; the impacts from hardbottom coverage were only partly mitigated.
iii) There was a failure to show that the proposed project would produce a net positive benefit to the coastal system, in part due to the use of excessive fine sediments in the fill.
iv) Southeast Florida's coastal geological setting consists of limestone ridges covered by veneers of sand. The GENESIS model was determined to be inadequate to account for the influence of substrate on long-shore or cross-shelf sediment transport in this area.
v) Inadequate engineering data concerning shoreline stability and post-construction performance, and the potential impacts of the dredge and fill project upon the beach-dune system.
vi) Respondents failed to provide reasonable assurance that the project was is contrary to the public interest.

An additional important precedent was set in terms of public participation. The judge disallowed 11 of 14 objections against the testimony of a career fisher/surfer/diver from the Lake Worth area in regards to expert accounts of the resources. The growing awareness among

researchers of the value of the traditional ecological knowledge (TEK) among career water-users (e.g., Grant and Berkes 2007) is rarely translated into policy action. In this instance, such a transfer occurred and the opportunities for more robust public participation by expert water users have been substantially expanded.

DISCUSSION

A reluctance to acknowledge seemingly obvious challenges to long term sustainability is a well documented human trait when major and avoidable environmental and societal problems converge (Ehrlich and Ehrlich 1996, Diamond 2005). Chronically unsustainable decision tracks such as those that characterize Florida's insistence on building in flood zones derive in part from differences between the professional and political cultures of real estate and engineering, when compared to resident water users. The people who continuously use the beach and nearshore waters and pass this knowledge across generations by teaching fishing, surfing, boating, diving, etc. to their children have often been far removed from coastal decision-making. Distinctions are not binary, however, political centers of gravity have historically migrated away from the residents with lower incomes and children that historically used the ocean, in favor of older owners in structures built on the dune that often don't live in the area year-round, aren't raising coastal children, and aren't using the water on a sub-weekly basis, unlike the displaced local water-user community. As the water users have been displaced, more local knowledge is lost, including ocean-bred youth, generations of coastal culture, and traditional ecological knowledge.

In certain ways, TEK-rich water-users are the front lines of participatory adaptation and related approaches that include all stakeholders in coastal decision making. Decision Support Systems (DSS) to advance objective decision-making for beach management policy (Lindeman 1997) have become more robust and easy to use, and are now ripe for group-based evaluation of adaptive planning options for coastal communities. Generational water users are increasingly learning the details of coastal planning and construction, and the complex relationships among state and federal regulations; city, county, state and federal engineering agencies; private engineering firms; complicated financing arrangements; beach management conferences with $400 registration fees at luxury hotels; and lobbyists. There is also an intrinsic dialect within the many thick engineering and environmental documents. In addition to their technical complexity, these documents typically replace technically correct phrases like "dredge and fill project" or "dredge pit" with more marketable terms like "nourishment", and "borrow pit". The long history of technical euphemisms has been described previously, with a focus on wetlands and terrestrial systems (Houck 2001).

Management efforts by agencies, NGOs and academics in Florida have often focused on fisheries and, increasingly, coastal and marine spatial planning (CMSP). Much of the new CMSP momentum appears focused on offshore issues and, seemingly, less on shoreline spatial planning despite accelerating sea level rise. The long term economic and social implications of unsustainable shoreline spatial planning are higher even than for declining fisheries. By the end of the century, there is a real potential for hundreds of billions of dollars of property loss and over a million coastal climate refugees in Florida alone (H. Wanless Pers. comm.). The *avoided costs* of participatory adaptive response (that could have begun two decades ago) with a focus on relocation should be very prudent in terms of: a) public fiscal benefits (saving at least tens of billions of dollars) and b) minimizing multiple Gordian policy knots with even more social traps, if the problems are avoided while opportunities remain (Costanza 1987).

A conservative approach implies that we should prepare before it is too late. An increased focus on sea level rise adaptation, including strategic relocation (= strategic withdrawal or retreat) before major economic centers are flooded or uninsurable, appears warranted in the planning of governments, businesses, academics and NGOs. Some local coastal governments around Florida have considered sea level response planning, with relatively few taking explicit steps. However, municipal or county committees have been formed to explicitly examine climate adaptation in some areas (e.g., Miami-Dade County; City of Key West). With funding from an EPA Climate Ready Estuary grant, the City of Satellite Beach created a Sea Level Subcommittee (J. Fergus, Chair) within its Comprehensive Planning and Advisory Board that has generated many sea level planning edits to the coastal element of the city's comprehensive plan (this initiative awaits evaluation by the City Council). Adaptive planning beyond the status quo is repeatedly suggested in hundreds of studies on coastal planning and climate change (e.g., FIT 2010). Since progress will require work at local levels, with support from state and federal levels, advances can be made in concert with front-line water-users; many have been learning the system and can provide large value-adds for entities that want to foster participatory adaptive planning and maximize avoided costs.

Elsewhere in South Florida, non-traditional partnerships have recently generated exceptional marine sustainability products. One example is the Dry Tortugas Ecological Reserve (TER) within the Florida Keys National Marine Sanctuary that protects one of the most important snapper spawning aggregations in North America (TER – South), as well as exceptional coral reefs (TER – North). Based on explicit outreach to build relationships among scientists, fishing leaders and agencies, this initiative was ultimately endorsed by commercial and recreational fishing organizations including the Monroe County Commercial Fishermen's Organization and the West Palm Beach Fishing Club (founded in 1934). Ultimate designation of this marine reserve, one of the most important reef reserves

in North America, was based both on information and local credibility (Cowie-Haskell and Delaney, 2003) made possible by partnerships with expert local fishermen.

Once non-traditional partnerships are becoming more common; the Lake Worth dredging and Dry Tortugas Reserve products are examples. These and other case studies suggest that expanded public participation in coastal management can advance overdue sustainability initiatives, particularly if tools like DSS are brought in to increase objectivity and full public participation in adaptive planning. One question moving forward: is it too late? We suggest not, especially if traditional and non-traditional resources can be marshaled to begin open efforts at fully participatory sea level adaptation as an alternative to BAU and the avoidable costs of more building in flood zones.

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