Terraforming the middle ground in ancient Florida

Asa Randall & Kenneth Sassaman

Asa R. Randall, Department of Anthropology, University of Oklahoma, 455 W. Lindsey St., Room 521, Norman, OK 73069, USA
ar@ou.edu

Kenneth E. Sassaman, Department of Anthropology, University of Florida, 1112 Turlington Hall, PO Box 117305, Gainesville, FL 32611, USA
sassaman@ufl.edu

Abstract: All societies face contradictions between experienced pasts, imagined futures and the reality of the present. Changing social and ecological contexts are catalysts for intervention by communities hoping to restore or assert structure during turbulent times. Terraforming is one mode of intervention in which large-scale modifications to land reference ancient times, events and persons to create new opportunities for the future. At the landscape scale, terraforming is a form of futurism that reproduces or redirects the relations between communities, ecologies and cosmologies as historical process. In North America, ancient Floridians engaged in a wide range of landscape modifications to navigate the diverse relations between underworlds, upperworlds and the day-to-day. Over 6000 years ago on the St Johns River, communities deposited shell, earth and objects in ridges over assemblages of massive pits dug by their predecessors, arguably restructuring the relationships among wetlands, the living and the dead. Later communities of the Florida Gulf coast constructed mounds and ridges, which were conjoined with celestial events, at a time of rapid sea-level rise to redirect their social capital towards landward communities of lesser vulnerability.

Keywords: Florida, shell mound, climate change, futurism, archaeoastronomy

1. Introduction

Terraforming – nominally, the modification of landscapes to make them habitable – was a core experience for many ancient hunter-gatherer communities (Grier and Schwadron, 2017 this issue). This was certainly the case for denizens of Florida, and indeed peoples across much of southeastern North America irrespective of mode of subsistence (Kidder & Sherwood 2016). For these

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communities, acts such as pit digging, landscape clearing, mortuary ceremony and monument construction were all ways through which social landscapes emerged as a historical process. Traditions of terraforming in ancient Florida can be traced back to the beginnings of shellfishing and the erection of shell and sand mounds before 7000 years ago, with a number of variations occurring during subsequent millennia in many locations across the region by diverse communities. In ancient Florida, terraforming cannot be reduced solely to increasing habitat productivity or to specific configurations of social organisation or community networks.

Terraforming, however, has never been about only making a space biologically habitable, but also about imagined futures. Human inhabitability requires that places be incorporated into cultural domains with established values. Furthermore, all societies face contradictions between the perception of how the world was in the past or should be in the future, and the material realities of the present (Koselleck 2004). Terraforming thus presumes that communities crafted futures that provided socially inhabitable places, and which were necessarily in dialogue with ecology, tradition, place, person and cosmos. As a form of futurism, terraforming is one way to intervene in contradictions to the remembered tempo and structure of inhabitation. Communities modify spaces, but by extension communities also reference and reorient ancient times, events and persons to create new opportunities for the future.

In this contribution, we follow the thread of futurism inherent in terraforming and consider how ancient hunter-gatherer communities resituated themselves in time, the landscape, and the cosmos amid what we call here the 'middle ground'. The middle ground is a multi-temporal conceptual space, where cosmology, history and landscapes intersect. The middle ground materialises, and is imagined from, a constellation of social and cosmological referents. We consider two case studies, the re-siting of new shell mounds on ancient grounds during the Middle Archaic (c 8900–5800 cal BP) on the St Johns River, and the movement, modification and siting of mortuaries and shell mounds during the second millennium BP on the Gulf coast. Ancient hunter-gatherers of Florida engaged in new terraforming projects during moments of unrest and uncertainty brought on by ecological, social and cosmological change. We argue that terraforming was an intervention to assure new futures, but which was made possible through citations to tradition, encounters with the ancient and conjunctions with celestial phenomena. The middle ground was the intersection of these diverse threads that were materialised during landscape manipulation. Before presenting the case material, we briefly explore the relation between terraforming, historicity and the middle ground.

2. Terraforming, futurism and the middle ground

Terraforming is a recent concept that traditionally refers to the geoengineering of planets or regions to make them habitable for humans. The term can be traced to science fiction literature of the late nineteenth and mid twentieth centuries (Pak 2016:2). In these narratives, terraforming enables different futures through the alteration of places to increase their suitability for human pursuits, often due to fears regarding impending or ongoing catastrophe. In this usage, terraforming provides a space for imagining alternative futures in new locales, while also presenting the context to evaluate anxieties (Pak 2016:8–9).

Importantly, indigenous scholars have criticised science fiction, and terraforming in particular, for reproducing colonial tropes of ownership, appropriation, exploitation and annihilation (Cornum 2015; Dillon 2012). They argue that indigenous futurism, today and arguably in the deep past, is inherently relational and multi-temporal (Dillon 2012). Communities and persons are enmeshed in a variety of relations with other non-human persons, places and processes throughout the world (Cornum 2015). The creation of new spaces necessarily involves a dialogue with traditional understanding of place, but it also affords new opportunities for (re)creating relations between things. Terraforming similarly provides the opportunity to observe the ways in which otherworldly or celestial phenomena have conjunctions with the social landscape (Parker Pearson 2013). Collectively, the manipulation of spaces provides for the navigation and juxtaposition of alternative temporal or cosmological domains, what Dillon (2012:3) calls the 'native slipstream'.

Taking indigenous critiques seriously, terraforming has always been a relational construct through which real and speculative experiences in time and place are negotiated, with the ever-present potential for new perspectives to emerge in the course of landscape manipulation. By extension, terraforming is not a socially neutral practice; the spaces that people inhabit, and the substances that make up terrains, are neither without histories nor without citations to other places, times and domains (Hodder 2011; Ingold 2012). That is, terraforming is not so much the creation of new land, but the generation of new topologies when things that have histories and citations of their own are rearranged. Landscape modification opens up opportunities for places to be resocialised. Because practice is in part structured by the configuration and history of places, terraforming sets in motion path dependencies (eg Sewell 2005:100) for emergent ecologies and future habitation. Strategies such as digging provide encounters with prior places and things, while during

monument construction substances and their referent domains such as land, water and air can be juxtaposed. So, too, anxieties about contemporary and future community relations may be laid bare and redirected. We call this the creation of the 'middle ground', a physical and relational place that lies at the intersection of diverse practical and cosmological concerns.

In our own examples that follow, communities terraformed through digging and fishing, collecting and processing and depositing shell, earth, the remains of the dead, fragments of old places and other substances. Such 'shell-scaping' created what Ian McNiven (2013:553) refers to as 'living architecture': these were locations that grew, but which also embodied and structured social relations. Perhaps much of the record of experience materialised in the archaeological record regards day-to-day relations. However, as living architecture these locations bridged diverse domains. As materials from the water and land were combined they could also make reference to the broader cosmos. As a historical process, these same places were transformed to reposition social bodies amidst these many references. Terraforming in ancient Florida, then, resulted in a middle ground that represents locations that are both new nodes of diverse citations and yet places where the foreground of everyday life and the background of history and cosmology intersect. In another way, the middle ground is very much the middle world in a cosmological sense, arranged in relation between underworld and upperworld, a configuration known to be prevalent in Native American societies (eg Lankford 2007), and among Northern European hunter-gatherer communities as well (Zvelebil 2008).

3. Terraforming on the St Johns River

In northeast Florida, terraforming's impact is evident in numerous mounds of shell and earth situated along the freshwater channels of the St Johns River (Figure 1).

Shellfish exploitation commenced as early as 8900 years ago, was intensified during the Middle to Late Archaic between 7500 and 3200 cal BP, and continued in varying intensities for the next three millennia (Randall 2015). Shell mounds have complex histories, often registering distinct modes of deposition, and ranging in uses such as residences, ceremonial platforms, mortuaries and other gathering places. Our understanding of ancient terraforming is very much inflected by the creation of a modern middle ground. Beginning with the first European colonists, shell-bearing sites were targeted as resources to be exploited. Untold tons of shell from ancient sites were mined and used to

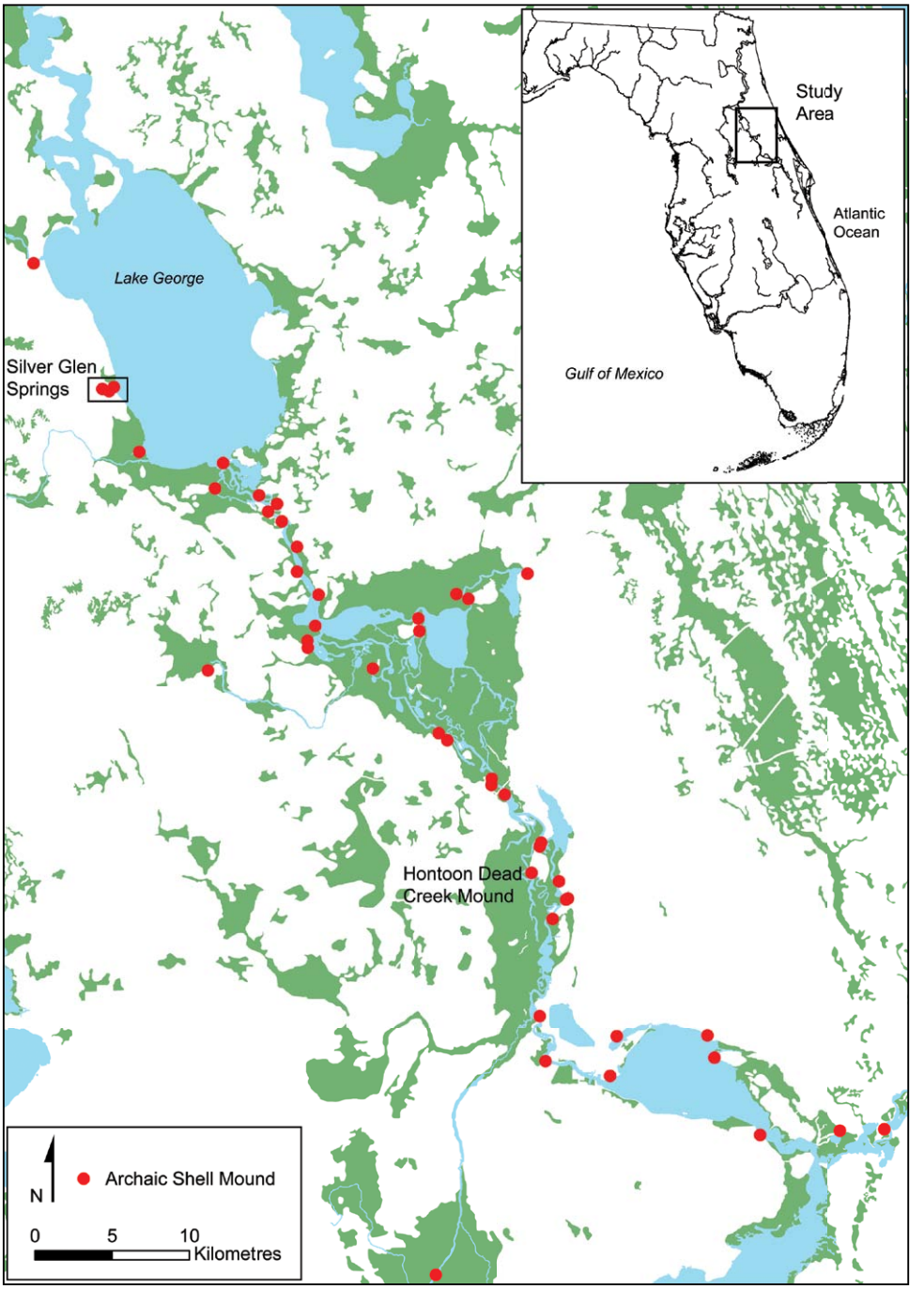

Figure 1 Map of the middle St Johns River region showing the location of Archaic shell mounds

build roads throughout the region. Modern terraforming conformed to the needs and perceived futures of Euro-American inhabitants by providing profit for landowners and the foundation for developments enabled by roadways. Our research has emphasised the reconstruction of the topography and history of mined locales.

Much of the known range in terraforming is encapsulated in the watershed associated with the 1 km long Silver Glen Spring and Run (Figure 2; Randall et al 2014). As reconstructed through survey, testing and remote sensing, this locale contained no fewer than four shell mounds. Two shell ridges measured roughly 200 m long and 100 m wide. At least one was a place of residence 6000 years ago. Two larger arcuate mounds, both 300 m or more in length and each containing upwards of 75,000 m^3 of materials enclosed a spring pool and run. During the Late Archaic these were serially places of mortuary activity, and then of ritual gatherings involving mounding of shell alongside the use and deposition of commemorative ceramics (Gilmore 2016). Two earthen mounds that post-date the Archaic, and which were likely sited against the spring pool and residential areas, are known. Finally, a variety of non-mounded deposits representing special purpose food preparation and feasting grounds, as well as Archaic and later Woodland period (3200–1000 cal BP) circular villages are distributed across the landscape. Here we will explore how a middle ground was established by terraforming in the age of uncertain futures instigated by social and ecological challenges between 8900 and 5800 years ago. Focusing on the shell ridge known as Locus A (Figure 2), we highlight the ways in which pit digging, earthmoving and shell deposition enabled alternative futures and the re-indexing of different horizons in the middle ground.

The St Johns River valley was definitely inhabited at least intermittently before 8900 years ago. The region was likely quite arid, with surface flow of the river, and perhaps springs, considerably lower or more sporadic than today. Sometime soon after 9000 years ago, northeast Florida experienced a sea-change, literally and figuratively. The once arid landscape became increasingly well-watered. Now-inundated Paleoindian (13,000–11,500 cal BP) and Early Archaic (11,500–8900 cal BP) settlements adjacent to the river channel attest to the drowning out of established places (Thulman 2012). These changes were wrought by increases in sea-level and atmospheric precipitation that enabled the flooding of the basin with freshwater, most directly due to decreased river velocity and apparent increase in artesian flow from springs (O'Donoughue 2017). Arguably, inhabitants of the St Johns River valley were confronted with new landscapes of unknown futures, and which problematically had no material precedence in the past.

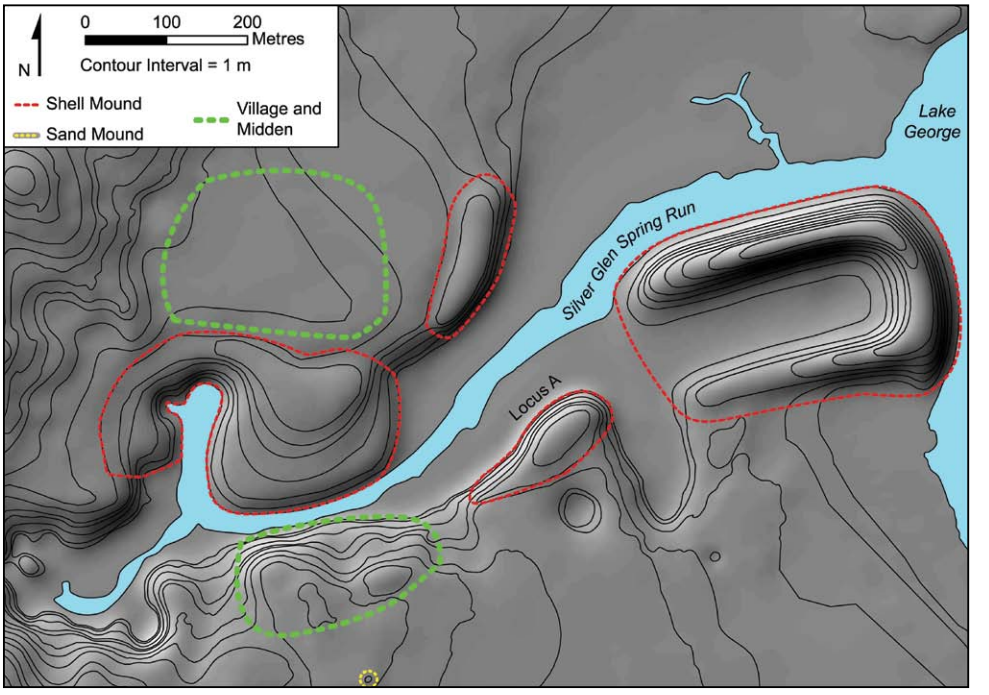

Figure 2 Reconstructed topography (c 1872) of the Silver Glen Springs watershed showing the location of shell mounds, a sand mound and villages and midden deposits

In this age of uncertainty, communities historicised water and substances from this underworld through their selective combination. At Locus A, the earliest evidence for terraforming is the intensive excavation and filling of pits (Figure 3).

Today these pits are preserved in a 1 m thick deposit of organically enriched and shell-bearing soils that extend in a linear fashion 130 m across the landform. Radiocarbon dates situate the onset of pit use coeval with the establishment of wetlands and substantive spring flow between 8900–8600 cal BP (O'Donoughue 2017; Randall & Sassaman 2012). Structurally, the deposit is an amalgam of perhaps hundreds of pits, resulting from nearly two millennia of repeated visits of unknown duration.

Where we have isolated them, the 50–100 cm wide basins are sparsely filled with freshwater shell, vertebrate fauna and botanical remains (Figure 3). These same materials, two thousand years later, became the media with which communities constructed monumental shell mounds. We continue to analyse the pits and their contents, and the social context of pit-filling is currently hard to parse. Regardless, others have argued that pits or other deposits should

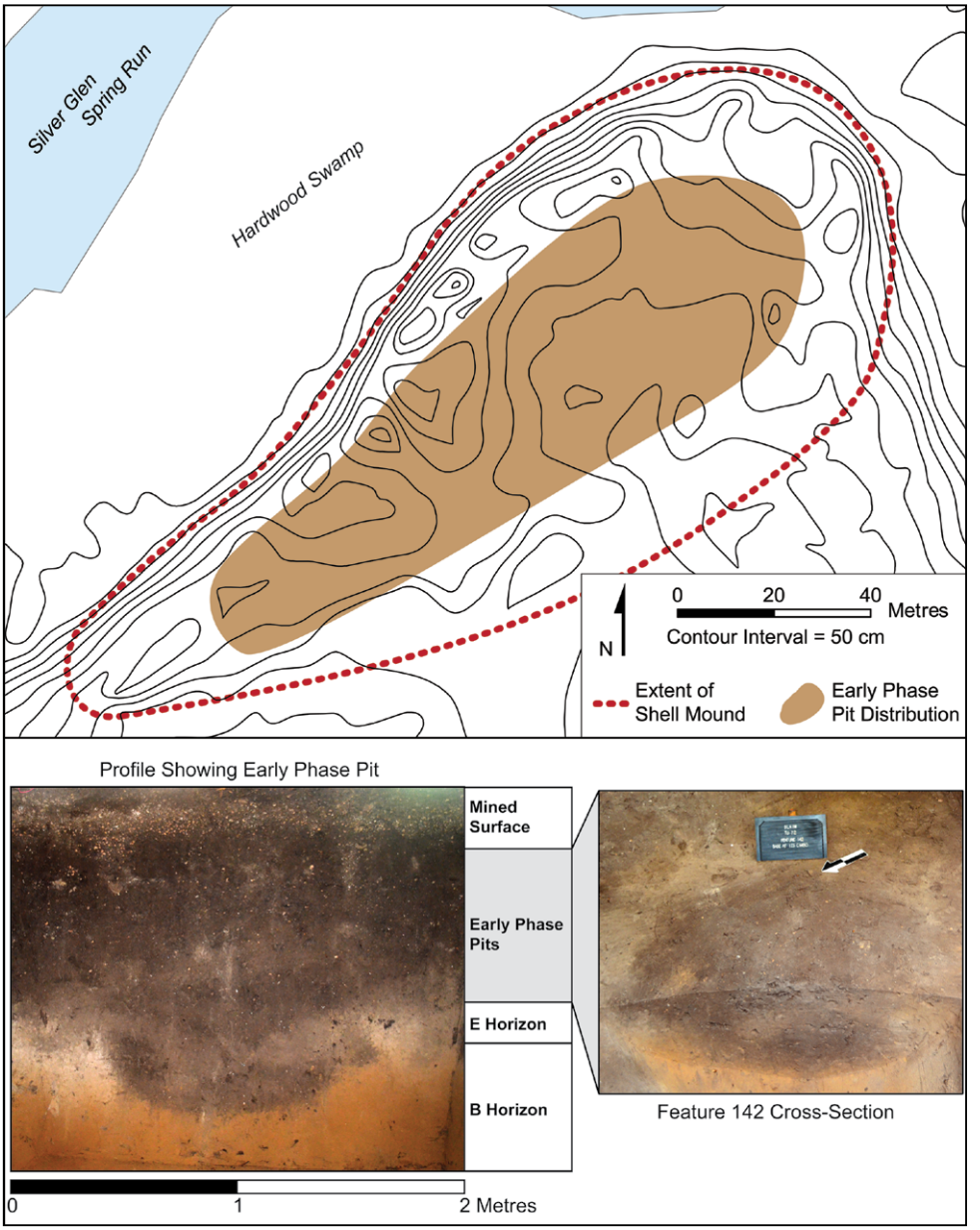

Figure 3 Early phase of occupation at the Locus A shell mound (c 8900–7000 cal BP), showing the distribution of pits with respect to contemporary topography (above) and structure of pit deposit (below)

not be reduced to refuse deposits *a priori* (Gilmore 2015; McNiven 2013). Pits open up and intercept the below world, while at the same time they bundle matter and social relations when they are filled. We suggest that this new, and long-lasting tradition of pit digging provided the context for reworking the relationships between community, new ecologies and time. Not only did the bundling of substances from different worlds in pits provide one basis for socialising the broader landscape in the context of gatherings, these practices generated pasts and future horizons where before there were no terraformed material referents. That neither water nor substances from it were historically inert is attested to by the coeval mortuary practices at Windover Pond in the upper reaches of the basin. At Windover, the dead were placed in shallow pits excavated into the mucky substrate of the knee-deep pond (Dickel 2002). We cannot know for certain whether those persons interred at Windover were the same as those participating in pit digging at Silver Glen Springs. Yet, it is hard to ignore that both burial in water, and consuming foods from water and interring their remains on land in pits were traditions initiated 8900 years ago.

By 7000 years ago, the traditions of both pit digging and mortuary ponds ceased locally. Indeed, Locus A appears to have been avoided altogether, only to be reactivated a thousand years later. Elsewhere in the river valley, communities began constructing ridges out of shell that were, we argue, monumental in scale and significance. Places such as Hontoon Dead Creek Mound, for example, were converted from residential middens into large ceremonial platforms that were resurfaced with shell (Sassaman & Randall 2012). These appear to have been constructed at a time of increased unpredictability in water, perhaps due to higher frequency or magnitude flood events. In this case, the repeated resurfacing of mounds enabled both the renewal of community and the materialisation of durable pasts that projected future continuities (Randall 2015). Sometime after 6500 cal BP, however, these early ridges were themselves abandoned. Elsewhere we have argued that the steady relations between pasts and futures were disrupted by the infilling of adjacent lagoons (Sassaman & Randall 2012). Communities forced from participating in ridge-top commemorations sought out new locations. In the case of Locus A, they returned to a place with great antiquity, but which also afforded the adjacent slack-water embayments required for both the placement of settlements and the acquisition of shellfish and other aquatic resources.

Our investigations of Locus A reveal that communities did not simply emplace a new residence on top of an old place. Instead, places migrated to locations that had to be extensively manipulated in preparation for future inhabitation. Prior to the deposition of shellfish and the construction of the mound during day-to-day

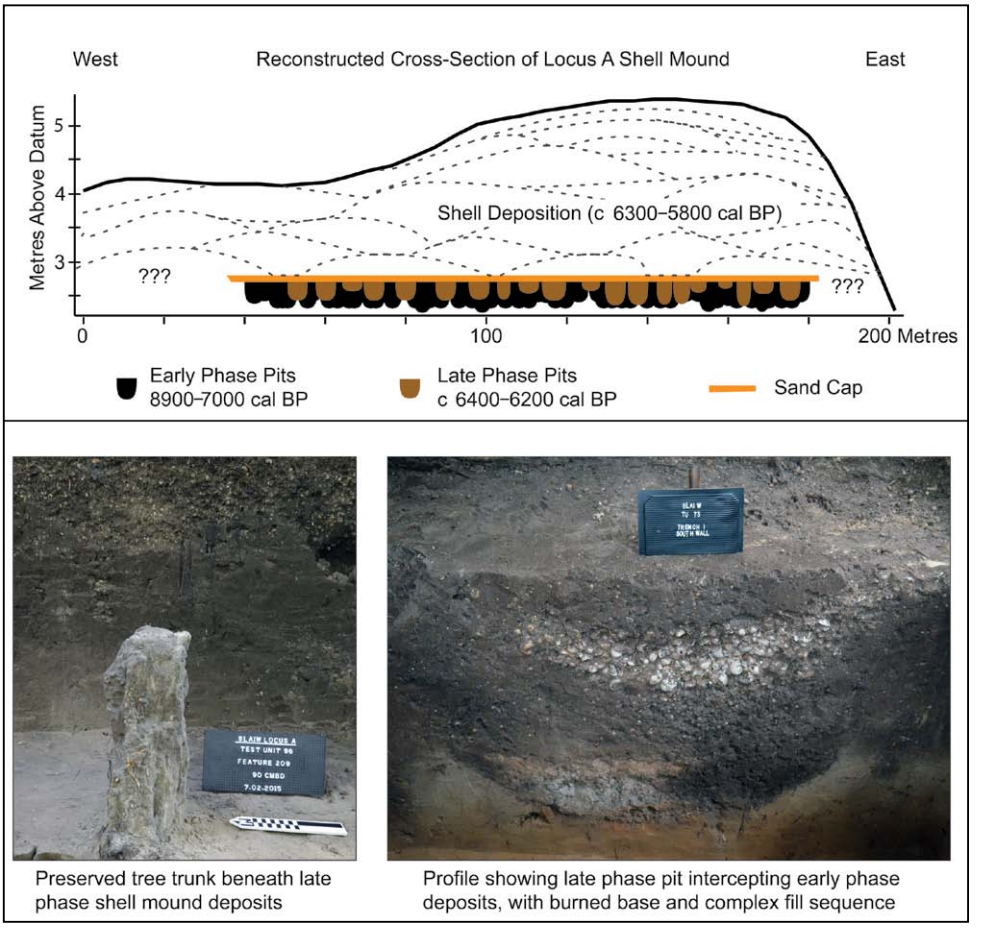

Figure 4 Later phase of occupation at the Locus A shell mound (c 6400–5800 cal BP), showing a reconstructed cross section (above), photograph of preserved tree root system (below left), and example of pit feature that truncates early phase deposits (below right)

activities, terraforming of Locus A involved at least four components: locating the earlier deposits, clearing vegetation, digging pits that both mirrored and provided encounters with earlier deposits, and capping these activities with a layer of earth. Considerable effort was expended in the establishment of this location. For example, during basal excavations we encountered a near-fossilised tree trunk and root system (Figure 4). The roots of this tree extended throughout the early pits, but not those post-dating 6400 years ago. So, too, we have encountered shell tools used for wood working at this contact. We read this as indicating that participants cut down at least one tree, and likely many others. Once cleared of vegetation, participants engaged in the excavation of innumerable pits in an area

conformant with the earlier deposits. How these new inhabitants knew there were pits there remains a mystery, but we cannot rule out intentional excavations and dialogues with the materiality of the past. Indeed, once the landform was cleared, the pit digging appears as a mimesis of the earlier pit sequences. Unlike the earlier pits, the new pits show evidence for thermal alteration at the base, and were likely used for earth ovens (Figure 4). All those documented show clean margins, indicative of rapid infilling. Importantly, the pit fill sequences are structured with an apparent depositional grammar. Most show evidence for micro-scale depositional events, and some involved the layering of particular species of shellfish remains. In some sequences, the old fill and new fill were juxtaposed in ways suggestive of purposeful opposition (Figure 4).

We cannot say how much time elapsed during the pit digging phase. That it was likely eventful is attested to by the final dedicatory deposition. Present in all excavation units thus far is a mantle of brown sand, up to 20 cm in thickness (Figure 4). This mantle thus covers over the entire earlier pit deposits, an area at least 150 m long and 45 m wide, and is the foundation upon which future deposition could occur. We argue that this mantle is the equivalent of the sand layers used in coeval burial mounds to sanctify old shell deposits prior to interring the dead (Randall 2015). In this case, however, the mantle encapsulated the ancient, and at the same time provided the foundation for future habitation. Over the next 500 years this location became a site of intensive settlement replete with communal middens and apparent household compounds. As with the earliest pits, then, terraforming at the larger scale acknowledged uncertainties, but provided the conditions for continued living once the tensions between pasts and futures were reworked here and at the scale of the broader landscape.

4. Terraforming on the northern Gulf coast of Florida

The northern Gulf coast of Florida was home to communities of the second millennium BP that constructed civic-ceremonial centres at locations spaced 10 km or more apart (Figure 5; Sassaman et al 2016). Each of the centres started as locations of human interment. By about 1800 cal BP they also became locations of large settlement, as well as places of ritual gathering, not unlike those of the middle St Johns River valley. The best known among them, Crystal River (Pluckhahn et al 2010), to the south, and Garden Patch (Wallis et al 2015), to the north, have components of terraforming with parallels to civic-ceremonial centres of the interior of Florida and beyond.

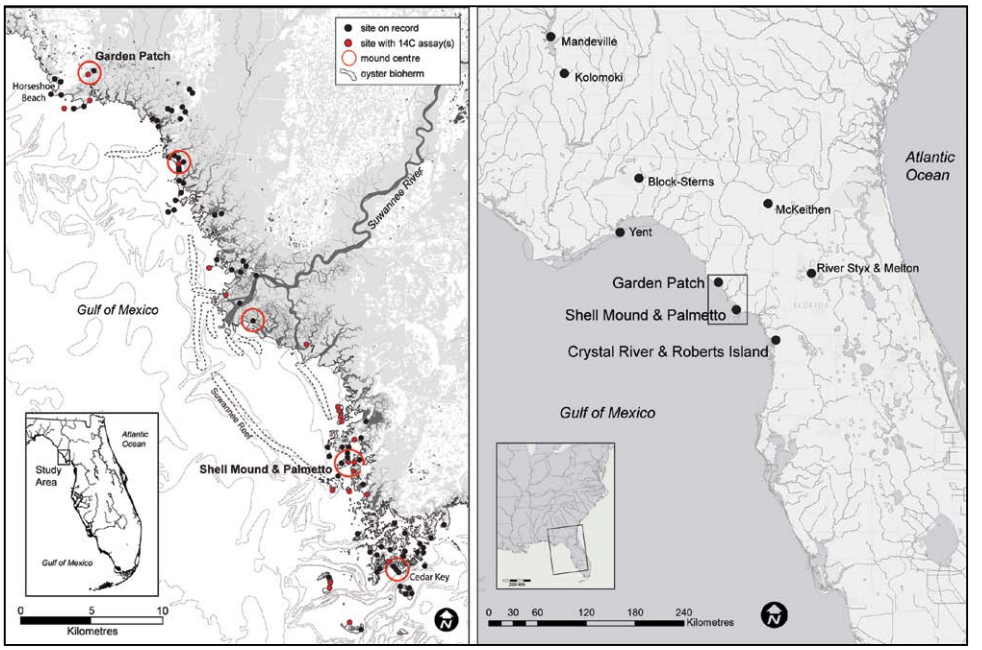

Figure 5 Map of the lower Suwannee study area on the northern Gulf coast of Florida, showing locations of civic-ceremonial centres of the first millennium AD (left), and larger map of the region, showing locations of other civic-ceremonial centres (right)

Among the parallels are platform mounds, conical mounds, U-shaped settlement plans and central plazas. Associated nonlocal objects affirm the influence of people and places from as far as 320 km to the north. However, any 'outside' influence and its materialisation in mounds and cemeteries on the coast had to be reconciled with local histories and the physical realities of what came before. Some characterise this moment as a separation between sacred and secular living (see Sears 1973), the former a matter of ancestor veneration. Let us consider instead that the 'middle ground' of terraforming in Gulf coastal Florida was the reconciliation of futures past with the uncertainty of futures yet to come.

The uncertainty of futures on the coast at c 1800 cal BP involved climate change and its consequences for sea level. We know from modern observation that climate change was not usually a slow, gradual process but rather a punctuated one (Donoghue 2011), with events that disrupted the balance of many interdependent variables. Sea-level rise attending global warming was especially unpredictable, owing largely to the intricate balance among freshwater input, oyster reefs and marsh aggradation in a biome of extremely low gradation. Every few centuries the balance between aggrading substrate

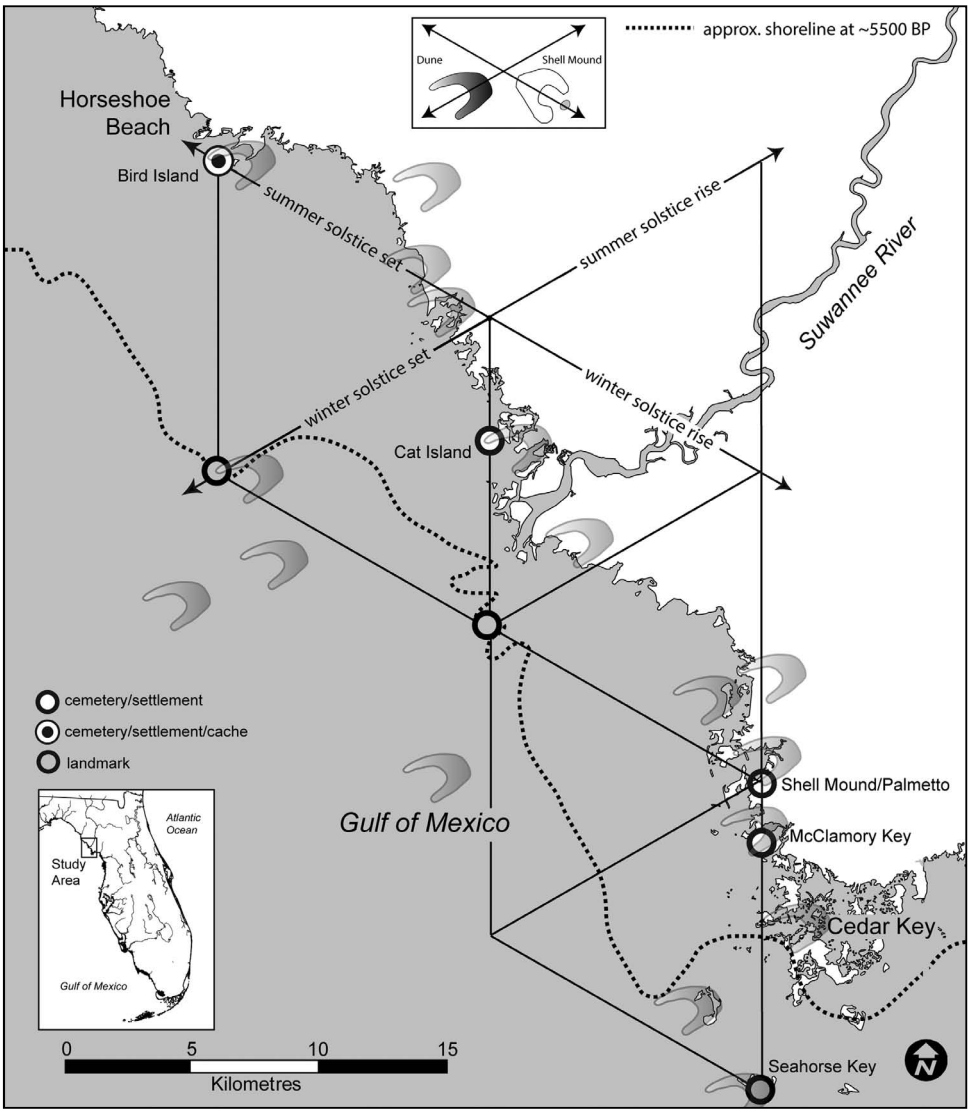

Figure 6 Landmarks, settlements and cemeteries of the fourth millennium BP arrayed in a solar grid that conforms to solstice-oriented dunes of the northern Gulf coast of Florida

and rising water was tipped and the sea transgressed quickly, some 2–3 km in cases documented in the study area (Goodbred et al 1998; Wright et al 2005). One such 'overstep' event took place between 1900 and 1800 cal BP, just before Crystal River and Garden Patch arose as civic-ceremonial centres. It is noteworthy that both places were established back from the open coastline

– 3 km from Garden Patch and 7 km for Crystal River – at tidal creek locations that were established as mortuaries in prior centuries of lower seas.

Moving cemeteries back from the coast ahead of relocating settlements had a history at least three millennia old, and it is here we find clues to the 'middle ground' of coastal terraforming (Sassaman 2016). Three cemeteries dating to about 5000 years ago have eroded from near-shore islands in recent decades (Figure 6). They were established when sea level was down at least 1 m from its present elevation and the coastline 3–5 km seaward from its present location. All cemeteries were placed on the distal ends of parabolic dunes that formed during the Pleistocene and have since been reworked by rising sea (Wright et al 2005). Because the major freshwater source of this coastal regime – the Suwannee River – carries little sediment to the ocean, eroding dunes have supplied the sand necessary for marsh aggradation and productive estuarine habitat.

Evidently, parabolic sand dunes were more than convenient places to bury the dead and a source of marsh sediment. As prevailing winds dictated, dunes prograded in the direction of the rising summer solstice sun, roughly 60° east of north (Figure 6). Humans worldwide look to movements of the sun to gauge the passage of time or the rhythm of cycles, as in its daily rise and fall or its seasonal migration along the horizon. Parabolic dunes in the area have arms (ie ridges) that are open to the southeast, 240° east of north, the direction of the setting winter solstice sun. Thus, dunes materialised the two standstills (solstices) that bracket the annual solar cycle. The orientation of these dunes did not likely evade the notice of ancient wayfinders; indeed dune fields prior to inundation by sea must have been impressive, with some dunes up to 2 km long and 17 m tall.

The significance of dune orientations to ideas about the cosmos finds a possible analogue in the siting of Stonehenge, England. Observed recently in the bedrock underlying Stonehenge are periglacial fissures with solstitial alignments, much like those of the parabolic dunes of Gulf coastal Florida. According to Parker Pearson (2013), during the Neolithic the orientation of these fissures may have warranted the placement of burials, posts, and eventually the eponymous stones. Natural features such as these fissures likely provided observers a point of 'conjunction', to use Parker Pearson's term, between sky and earth. That the greater Stonehenge area was sanctified during the Mesolithic before any stones were erected to form the famous monument (Pollard 2017, this volume) suggests that these features alone indexed cosmic principles of enduring significance.

A meaningful conjunction between movements in the sky and 'natural' features of the earth can be considered a form of geomancy, herein defined

as interpreting patterning on the ground to divine futures. In the context of sea-level rise, parabolic dunes of the northern Gulf went beyond solar calendrics to materialise long-term, directional change. The earliest coastal inhabitants had to deal with the consequences of sea-level rise and shoreline retreat that were noticeable in their lifetime. Relocating back from the coast no doubt involved practical matters of inhabitability, but attending to cosmic principles was equally important. A growing body of evidence suggests that coastal cemeteries were relocated landward in anticipation of the inevitable relocation of settlements subject to flooding (Sassaman 2016).

Judging from the distribution of cemeteries and other places of significance, solstice orientations involved the measurement of movement, of change, along meridians. Subordinating time to space, this solar grid afforded fifth millennium communities the means to connect futures past with futures yet to come, or, more simply, lessen the uncertainty of futures by anticipating, indeed activing, change through movement. These same communities did not terraform mounds and ridges at particular places like their contemporaries in the middle St Johns River valley or the descendent communities of c 1800 cal BP, because their settlements, like their cemeteries, had to be moved. But they did terraform the regional landscape in a relational grid of past, present and future dwelling, all animated by movement of the sea, the sun and the people.

One of the last relocations was to a relict dune that would later house one of the region's civic-ceremonial centres, Shell Mound, and its associated cemetery, Palmetto Mound (Figure 7). Palmetto Mound is today separated from Shell Mound by shallow intertidal water. The timing of this watery separation is uncertain, but the overstep event of c 1900–1800 cal BP is a good candidate. Occupation of the dune arm at this time was at low elevation and ephemeral. By 1600 cal BP settlement intensified as it moved to the top of the dune arm, about 3 m above modern sea level. Into the sand of this dune inhabitants dug and then back-filled massive pits for processing oyster and other resources that were consumed, we suspect, in the context of mortuary ritual (Sassaman et al 2016). By about 1500 cal BP the volume of in-filled pits and oyster midden grew enormous. Over the next century much of the accumulated residues of feasting, as well as daily living, was mobilised to transform Shell Mound into the C-shaped configuration we see today (Figure 7). Added to the dune arm was the southern ridge, an entirely anthropogenic component made from extant oyster midden. Similar redeposited midden was emplaced on the dune ridge itself to accentuate the height of the landform. At the same time, at least one, and likely two conical mortuary mounds were erected from shell midden and sand. Dennis Creek Mound is especially notable for its position

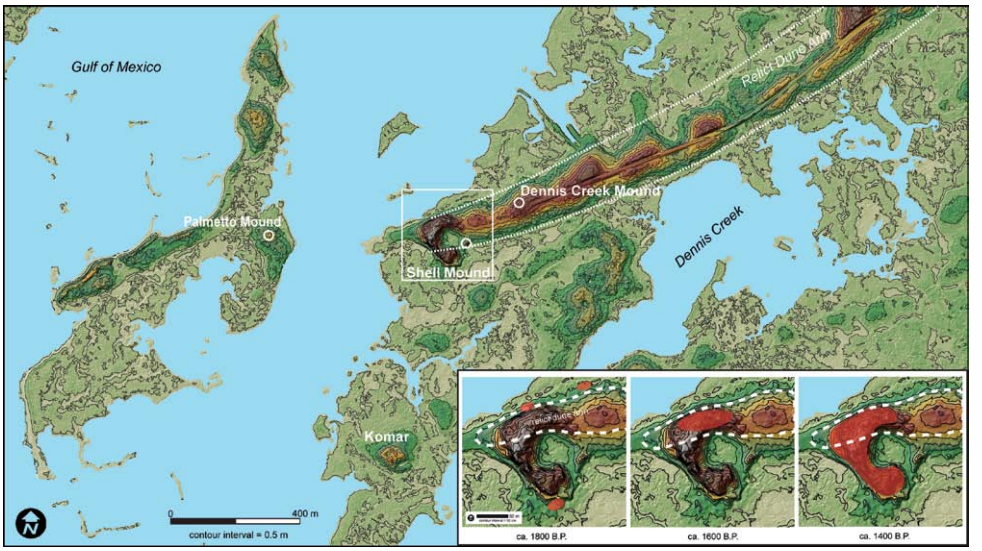

Figure 7 Topographic map of area surrounding Shell Mound, showing relict dune arm on which it lies, and inset schematic (bottom right) showing the evolution of Shell Mound, 1800–1400 cal BP

250 m northeast of Shell Mound, along the dune arm (Boucher 2017). Stratigraphic testing of this mound reveals a sequence of redeposited shell midden overlain with buff-coloured sands mixed with oyster shell into which human remains were interred. The buff-coloured sand of this stratum is a mixture of the white and orange sands of the natural substrate. This same matrix appears at Palmetto Mound, where it dates several centuries earlier, at the outset of mortuary mounding (Donop 2017).

Ritual activity attending mortuary practice had its material costs in the scale and intensity of food procurement and processing. Infrastructure for feeding large groups is conspicuous in the assemblage of massive pits noted earlier, accompanied by large cooking vessels that arguably were made, used, and deliberately broken for such events. The vertebrate fauna from the pits reveal a diverse mix of fish, turtle, bird, deer and other mammals. Notable among fish are abundant mullet, a schooling species that can be harvested en masse with the right technology. A probable fish trap for this very purpose is located 2.5 km south of Shell Mound, on Richards Island (Figure 8).

The sea wall that impounds several tidal pools consists of poorly sorted oyster shell dating from 1700–1400 cal BP, coeval with terraforming at Shell Mound. The configuration is reminiscent of fish traps in South Africa to harvest mullet, among other taxa (Avery 1975). Located in areas with tidal

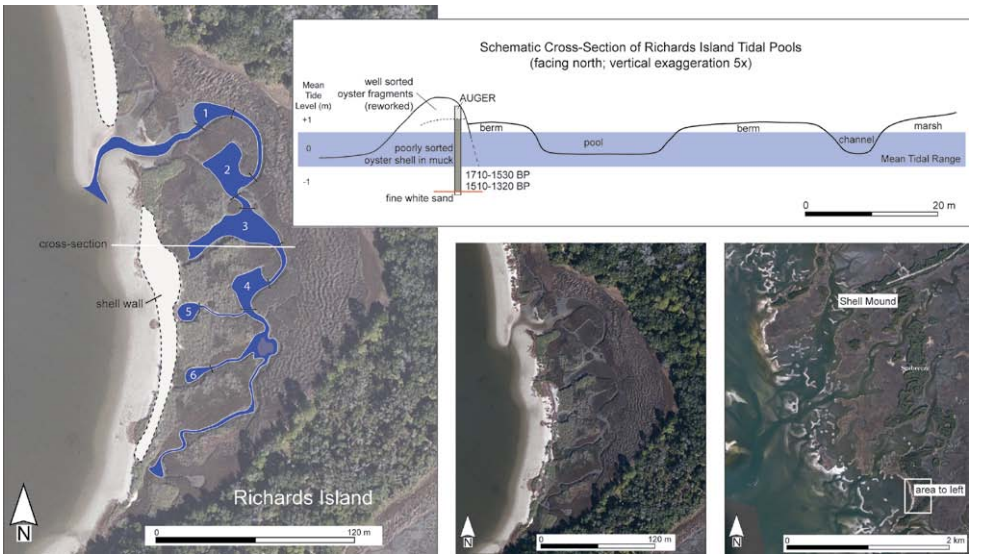

Figure 8 Tidal pools and shell sea wall of Richards Island (left), with inset of schematic cross section (upper right) of these features, and Google Earth image of greater vicinity (bottom right), showing location of Shell Mound

ranges of ~2.2 m, South African fish traps were activated only during spring tides, just after a new or full moon, when tidal range was maximised. Although the average tidal range on the northern Gulf coast of Florida is only ~0.9 m, during spring tides, tidal range can approach 1.7 m. Ongoing research aims to test the hypothesis that the Richards Island fish trap was used for large-scale harvests when spring tides coincided with the solstices, about every four years. Juvenile water birds in pits associated with abundant mullet were also collected in June, reinforcing the inference that feasts were timed to the summer solstices (Goodwin 2017). In addition to the intensification of fishing and bird collecting, Shell Mound residents engaged in oyster maricultural practices that likewise involved the emplacement of shell, in this case in water, to propagate the species (Jenkins 2016).

In sum, over the course of several millennia, coastal dwellers ameliorated the vagaries of climate change and sea-level rise by referring change to the cycles of the cosmos that conjoined the earth with parabolic dunes oriented to the solstices. They witnessed the conversion of dunes to sandy shoals and marsh sediment, as sea rose, and they disinterred and reinterred their ancestors to lead them into the future. The establishment of civic-ceremonial centres at 1800 cal BP was the convergence of an ontology of change going back millennia, when sea-level rise was rapid, with the extralocal influences of a religion based on

ancestor veneration that tethered generations to places terraformed for that very purpose. The final phase of occupation at Shell Mound, from 1450–1350 cal BP, was the penultimate act of terraforming because it reconfigured the landscape to address new social premises and the cosmological rationale for accepting them. The transformational nature of this act is evident in the reorientation of Shell Mound: its south ridge turned the geometry of dunes 120 degrees eastward, away from the Palmetto Mound cemetery. Inasmuch as the cemetery did not receive burials and pots during this century of terraforming, the reorientation of Shell Mound was a reworking of the relationship between the past and the future. Shell Mound was abandoned by 1300 cal BP, as was Garden Patch and Crystal River. Palmetto Mound would be activated again, nonetheless, as increasingly nonlocal persons and pots were interred by persons who may have descended directly from those who abandoned the coast (Donop 2017). In this case we cannot blame the shift on rising sea per se, but perhaps instead on the contradictions between local and nonlocal interests, between tradition and innovation.

5. Conclusion

Ancient Floridians reoriented social bodies in time and space by terraforming the middle ground. The spaces created through the manipulation of shell, earth and other matter enabled navigation through diverse relations between underworlds, upperworlds and the day-to-day. In both cases presented, the rearrangement of relations was, we argue, a strategic act to resolve contradictions of tradition when places and ecologies were variably exposed and submerged by surface waters. Along the St Johns River, early pit digging first centred the middle ground where no historical precedents existed, while in later times of concern, this same middle ground was performed, commemorated and reworked as the foundation for future living. On the Gulf Coast, communities constructed mounds and ridges at a time of sea-level change. Whereas ancestors in mortuaries provided guides to action during earlier times, later communities invested in centre places that were conjoined to celestial events. The movement of ancient persons, and manipulation of space, was enabled by the materialising cosmological principles. Taken together, these two examples highlight how the 'middle ground' of terraforming in Florida was the reconciliation of futures past with the uncertainty of futures to come.

Terraforming is a widespread, if not ubiquitous, practice of hunter-gatherer communities as this special issue of *Hunter Gatherer Research* discusses.

Broadly speaking, landscape alteration opens up new possibilities for action, and sets in motion historical path dependencies that enable or constrain future engagements with place. In this sense, terraforming now joins the ever-shrinking list of practices thought to separate those who we label as hunter-gatherers, from those we do not. A focus on terraforming provides new opportunities for examining societies across the hunter-gatherer/other divide. Yet we should heed the critiques of indigenous scholars, particularly the tendency for terraforming narratives to reproduce colonial values of appropriation, ownership and conquest. As an example, in our own case material, Euro-American settlers viewed ancient shell-bearing landscapes not as a historical resource, but as a source of profit. An alternative, highlighted in our study, is to examine how terraforming enables a middle ground, in which materials of diverse agencies, cosmic referents, places and human and non-human actors intersect and generate relations.

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