Grand Challenges for Archaeology - Crowd Sourcing Report

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Keith W. Kintigh – 21 June 2013

This document reports the results of a crowd sourcing effort to identify the grand challenges facing contemporary archaeology. The crowd sourcing was accomplished through email requests and listserv postings by the major North American and European professional associations. Organizations agreeing to disseminate the request were: American Cultural Resources Association, Archaeological Institute of America, Institute for Archaeologists (UK), Canadian Archaeological Association, European Archaeological Association, Paleoanthropology Society, Register of Professional Archaeologists, Society for American Archaeology, Society for Historical Archaeology, and World Archaeological Congress. In this request, we asked our colleagues to identify problems of broad scientific and social interest that could drive cutting-edge research in archaeology for the next decade and beyond. We received input through a Web-based survey (included here) that sought a concise statement of a grand challenge problem or question and, optionally, a justification of the importance of the problem and demographic information for the respondent. Survey results from 1 April 2012 to 30 June 2012, were analyzed. An additional 5 responses were received prior to 20 June 2013 are included here, but not in the demographic summary of the respondents.

The body of this report consists of the text of the challenge and justification provided by the respondents. The challenge and justification text are provided verbatim with the exception that obvious misspellings and some obvious grammatical problems were corrected, British spellings were Americanized, and occasional information identifying the author of the entry was deleted. For presentation, I have organized the entries and assigned brief topical labels. These organizational elements are all after-the-fact additions and had no bearing on the responses.

The purpose of the survey was to identify fundamental problems in science and the text of the request excluded disciplinary challenges with respect to the practice of archaeology. Nonetheless a substantial fraction of the responses was focused on the issues of practice. The scientific questions and methodological challenges are reported in the first two sections, the issues of practice (with less organizational detail) in the final section. A summary of the topics—in which one topic may have several included responses is provided first, followed by the text of the responses, in the same order. The ID numbers are unique and were randomly assigned in the course of the analysis.

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Grand Challenges for Archaeology - Responses

I. Scientific Questions
A. [Q-A&D] Agriculture & Domestication
1. ***[Q-A&D] Domestication & Sedentism ID:** 341*
   - **Challenge:** What role did domesticated plants and animals play in the development of permanent village life (the Formative) in the western hemisphere? Was permanence predicated on the emergence of dependable food supplies, or did the development of dependable food supplies follow permanence that developed for other reasons?
   - **Justification:** We still do not know why people settled down and became farmers and herders in the New World. The factors and critical resources were apparently different in North, Middle, and South America. The role of diffusion, especially of maize, north and south out of its heartland in Mexico needs to be better understood, given its critical importance to later societies. In South America, it is evident that plants and animals were domesticated in many different regions, then diffused outward as well, mixing and combining in different regions to led to the Formative. In addition, marine resources played a critical role in the development in western South America, and perhaps in Mesoamerica as well. If we are going to understand why people settled down in these regions and forsook the highly successful hunting and gathering way of life that had existed previously, then these questions need to be answered. Research on the origins of the Formative has lagged considerably in recent years, though these questions remain. To understand humanity's shift to this way of life, we need comparative data from this hemisphere to compare to that of the Old World.
2. ***[Q-A&D] Origins of Agriculture ID: 225***
   - **Challenge:** When, where, how, and why did humans first start to domesticate plants and animals?
   - **Justification:** The "Neolithic Revolution" had profound effects on human biology and culture, many of which we are still trying to comprehend today. Furthermore, the nature of human-environment relations have been forever affected by the adoption of agriculture.
3. ***[Q-A&D] Origins of Agriculture ID: 231***
   - **Challenge:** Provide a detailed chronological framework to aid the better understanding for the transition from hunter-gatherer/'subsistence' economies to an agricultural-based societies across the globe.
   - **Justification:**
4. ***[Q-A&D] Origins of Agriculture ID: 273***
   - **Challenge:** I'd suggest a renewed focus on some of the big-picture questions that used to drive the discipline: ¶ Why did people begin farming?
   - **Justification:**
5. ***[Q-A&D] Origins of Agriculture ID: 313***
   - **Challenge:** The origin of agriculture (food production) across different regions of the world.
   - **Justification:** Human ability to domesticate certain plants and animals represents a major transition in human history, but the timing, causes and motives of such innovation are less well understood.
6. ***[Q-A&D] Origins of Agriculture ID: 364***
   - **Challenge:** The most important problem facing archaeological researchers is to determine why plant and animal domestication did not get started until the last 10,000 years, along with how and why it grew and spread in more recent millennia, and how it came to be indispensable.
   - **Justification:** Research has shown that the shift to domesticated plants and animals was not revolutionary in the sense that it took a long time. The success of modern domestication has led us to assume without much criticism the idea that the benefits of domestication had to have been obvious, but the evidence so far suggests otherwise. ¶ Modern humans (homo sapiens sapiens) have existed for at least 30,000 years but food production was not part of human culture until the last third of that long period. What took them so long? Boyd and Richerson have had some ideas. I am guessing that plant cultivation and animal domestication did not occur until circumstances drove

humans in that direction. The circumstances were almost certainly ecological changes brought on by both climate change and human activity. We know that early modern humans hunted and that many of the species they hunted dwindled to extinction near or just after the close of the Pleistocene. Many productive plant species depended upon those animals for seed dispersal, to the extinctions of the animals led to the contraction of ranges (or worse) for the plants that had depended upon them. Humans had to adapt to biomass reduction in both the animal kingdom and the plant kingdom taking over certain roles in species propagation. Consider what would have happened to avocado or Osage orange trees if humans had not perceived their values. ¶ Recent research has shown that animal extinctions in Australia occurred soon after (and probably because of) the arrival of humans there. The evidence grows stronger that the same was the case in North America, despite the protestations of some of my most experienced colleagues in archaeology. Thus the question of why plant and animal domestication took so long to occur is almost certainly bound up with the ecological implications of human predation, global climatic change, the extinction of certain animal species, and the resulting forces that compelled humans to intervene in plant and animal biology. This view of ecology, which has humans playing a central if unconscious role for many millennia, is one that will require enormous coordinated effort to be understood. The eastern and western hemispheres fortunately provide us with independent comparative laboratories in which archaeologists and allied researchers in other disciplines can explore this central question.

7. **[Q-A&D] Origins of Agriculture ID: 372**
   - **Challenge:** Why did humans begin farming?
   - **Justification:** Without the food surpluses created by agriculture, civilization would never have developed. Yet, agriculture introduced poorer diets, created additional strain on the back and joints. Understanding why humans would undertake an activity that, at least initially, was detrimental to the health of individual humans is important. Although agriculture might have had a negative effect on individual humans, it has had a huge positive effect on the human species. Increasing the numbers to unprecedented level for large animals.

8. **[Q-A&D] Transition from Slash & Burn to Plow Agriculture ID: 332**
   - **Challenge:** The decision making process by which farming shifts from slash and burn to plow (or plantation) agriculture is of central importance to the present world and to the development of complex society in many parts of the Old World. This transition is more than a simple technological shift, with necessary changes in social organization, notions of property, and demographic choices.
   - **Justification:** The transition from slash and burn to plow agriculture was long ago identified by Ester Boserup, however, it has not been taken as a major axis of cross cultural study (as have plant and animal domestication, urbanization, etc.). The transition from slash and burn to plow agriculture (or plantation) is occurring in many parts of the world today, and it is anthropological archaeology that is best equipped to deal with the multifaceted social aspects of this transition, rather than seeing it as a question for "development" or "peasant" studies.

9. **[Q-A&D] Transition to Agriculture in the Americas ID: 297**
   - **Challenge:** Reassessment of the transition to agriculture in the Americas with an emphasis on identifying the character and duration of mixed (wild and domesticated) subsistence systems in this process.
   - **Justification:** The adoption of intensive agricultural systems in the Americas now seems likely to have occurred 4000-6000 years after the initial domestication of maize and other food plants. Abundant aquatic and terrestrial resources in coastal areas, however, appear to have been capable of supporting larger complex societies well before the rise of staple based agriculture. In spite of the growing amount of evidence to suggest that considerable social complexity may have been supported by mixed horticultural and wild food collection regimes during late Holocene, standard introductory texts continue to emphasize an older monolithic model of early complexity based on staple agricultural crops. A grand revision of the transition to agriculture in the Americas seems in order, particularly given the importance of subsistence mixtures of wild and domesticated foods

now increasing recognized throughout the Holocene world-wide.

B. [Q-C&C] Conflict & Cooperation

1. *[Q-C&C] Development of Warfare ID: 208*
- **Challenge:** Development of patterns of warfare in both complex and non complex societies. There have been an increasing number of studies of patterns of warfare by archaeologists. However, for the most part, they have been limited in scope to particular regions and/or time periods. The explanatory models "borrowed" from the field of Ecology have inherent limitations.
- **Justification:** Archaeologists have the unique opportunity to analyze the development of all forms of human behavior. The manifestation of social conflict in the form of warfare is not well understood. Why do groups of human beings engage in conflict with each other? Are there definable underlying causes? How has conflict shaped the course of societal functioning? ¶ If archaeologists can better understand or explain the causes and consequences of warfare, can this knowledge be applied, such as to reduce human conflict in the modern world? Probably not, but it could go a long way in helping us to have a better understanding of the reasons why through the course of human history groups of people have taken the lives of other people.

2. *[Q-C&C] Development of Warfare ID: 273*
- **Challenge:** I'd suggest a renewed focus on some of the big-picture questions that used to drive the discipline: ¶ When and why did warfare begin?
- **Justification:**

3. *[Q-C&C] Development of Warfare ID: 289*
- **Challenge:** War and peace.
- **Justification:** Social and political violence and war began in deep pre-history, and despite changes in scale and technology, the pre-history of war has much to say for peace and conflict studies, and for policy.

4. *[Q-C&C] How Cooperative Groups are Constituted ID: 339*
- **Challenge:** To examine the causes and consequences of variation in how human socioeconomic networks and cooperative groups are constituted. Why are some human groups more inclusive and equal, while others are characterized by marked inequalities in power and access. What factors contributed to these different social relations and ties, and how do groups of these different properties respond/adjust to different challenges, including environmental hazards, inter-group contacts. To address this kind of question requires broad, cross-temporal and cross-spatial sets of information accessible to archaeology. This focus would expand scientific perspectives on human cooperation beyond experimental games.
- **Justification:**

C. [Q-CA] Cultural Affiliation

1. *[Q-CA] Develop Method & Theory of Understanding Identity Formation and Historical Connections of Groups ID: 311*
- **Challenge:** I think a grand problem is documenting the historical connection between the ancient groups that lived in the past and their descendants today. We need to develop the method and theory to theorize and analyze the material correlates of social identity that underwent substantial transformations.
- **Justification:** This grand problem arises from the challenge of NAGPRA but transcends that into intellectual questions about social identity through time and space everywhere on the planet. The research would have both immediate political relevance and much broader anthropological significance.

2. *[Q-CA] Tracing Cultural and Biological Relationships ID: 380*
- **Challenge:** Illuminating histories of peoples through time, via ethnogenetic (i.e., via the process of ethnogenesis) trajectories, like Scott G. Ortman did in his Ph.D. dissertation ("Genes, Language and Culture in Tewa Ethnogenesis, A.D. 1150-1400", University of Arizona 2010).
- **Justification:** From my experience, we cannot continue to advocate unilaterally for DNA analyses

and other "destructive" scientific assays of human skeletal material, for a number of reasons. Further, if we are to engage American Indians in archaeological research, a la Indigenous Archaeology, toward issues and questions of common interest, then we need to prioritize the kind of research which both Anglo and Indian archaeologists will be interested: the study of population changes through time and ethnogenesis, from the archaeological past to the historic/protohistoric present. We simply cannot engage them in this kind of research based on DNA analysis or other "destructive" assays -- it is culturally and morally abhorrent to them. And, at the end of the proverbial day, DNA (etc.). -- which is strictly biological data -- is just one line of evidence within one of the three major groups of evidence (language, biology and material culture patterns). The beauty of Ortman's research is that it uses language first, archaeological evidence second and non-destructive biology effectively and in a way that illuminates the HISTORY of a population in a way that interests both Anglos and Indians and doesn't alienate either group. We simply need more studies just like Dr. Ortman's landmark dissertation.

3. *[Q-CA] Tracing Cultural Relationships ID: 369*
   - **Challenge:** Beyond that, cultural affiliation of the Late Prehistoric period is particularly applicable today.
   - **Justification:** In today's archaeological climate, as well as business environment, with Native American tribes become more vocal and active in their participation in cultural resource management, and with the difficulties associated with culturally affiliating human remains, it is important to attempt to identify cultural groups of the precontact past with those in existence today. This area of research also allows for testimony when land claim lawsuits are filed.

4. *[Q-CA] Tracing Genetic Relationships and Peoples and Domesticated Plants and Animals of the Americas ID: 207*
   - **Challenge:** Genetic relationships among the peoples of the Americas and the plants and animals they used. This information will help us understand how the continents were settled, population movements of later prehistory, and trade relationships. Many narratives have been constructed based on fragmentary data, and a comprehensive effort to understand not only how people moved into the continents but how they they interacted later on would enable us to better interpret the stories constructed by both archaeologists and native populations.
   - **Justification:** To understand our deep history, we require empirical data about ourselves. One important source for this data comes from our genes and the genetic makeup of the plants and animals we have used in past times. Presently, we often refer to the tales documented by the first explorers and settlers, but these are commonly distorted by the political, social, and economic circumstances of the emerging colonial experience; thus, information that is entirely independent of these stories would be particularly relevant to the study of populations movements both into and within the territory of the Americas. This data could help us differentiate between constructed legends and historical reality, and in addition, generate new ideas and ways of looking at the long-term human past.

5. *[Q-CA] Understanding Biological Relationships Among Groups ID: 345*
   - **Challenge:** What is the genetic relationship between ancient skeletal remains?
   - **Justification:** Human bones contain the data to demonstrate historical relationships, and the lack of a relationship, between ancient populations. Archaeologists would benefit from reliable ways of identifying ancient relationships, quickly and reliably, as demonstrated by the analysis of ancient bones, and with minimal disturbance to the preservation of the bones themselves.

D. **[Q-CC] Climate Change**
   1. *[Q-CC] Environmental Events and Organizational Change ID: 228*
      - **Challenge:** What is the role of abrupt environmental events on the rise and collapse of ancient states?
      - **Justification:** Researchers across a broad range of fields now study global climatic change, and a large group of those researchers are concerned with long-term change. Archaeologists are uniquely

positioned to study the dynamics between short-term and long-term climatic variability and organizational change. In several of the world's regions, interdisciplinary research has investigated the nature of long-term environmental variability and human organizational response. In some of the world's best-studied arid regions, archaeologists have suggested direct correlations between abrupt climatic events (volcanic eruptions, earthquakes, mud slides, and protracted droughts are some examples). In most cases, they have focused on a single geographic region (or cluster of related societies or states) in such work. Few archaeologists, however, have engaged in the kind of long-term, macroregional research needed to understand conditions under which different kinds of societies respond directly to abrupt environmental events. Some regions of the world experienced both long-term environmental instability inherent in their climatic regimes (particularly in the tropics) and a series of short-term climatic events; one of these is Southeast Asia. Although some archaeologists and historians have directly linked the rise and fall of particular states to individual volcanic eruptions or drought regimes, no archaeologist has yet worked on the macroregional scale necessary to also incorporate social factors like peer-polity relations, imperial expansions to the east and north, and unrelated shifts in trade networks.

2. *[Q-CC] Frequency and Effects of Asteriod/Comet Strikes ID: 315*
   - **Challenge:** 2. Seek archaeological evidence bearing on the probability of asteroid/comet strikes on the earth over the last ca. 10,000 years and use to elucidate their frequency and effects.
   - **Justification:** 2. Bruce Masse at Sandia Labs has conducted some fascinating interdisciplinary research on this question. While archaeology obviously cannot do much to ward off asteroid/comet strikes, it could help clarify how often they happen and how widespread and serious their effects have been in the past, as a basis for refining predictions about future hazards.

3. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 234*
   - **Challenge:** All over North America the mid-Holocene experienced climate change of a magnitude on par with what we may experience in the next couple f centuries. These events of 8000-5000 years ago are our best laboratory and archaeology is the keystone discipline for understanding human response. We propose a continent-wide research effort to create a multiscalar model.
   - **Justification:** The last greatest global climate event analogous in magnitude to changes foreseen in the next few centuries was the mid-Holocene Altithermal/Hypsithermal. Environmental change affected all biomes, from the deserts of the Great Basin to the Woodland-Prairie interface, to the coasts and pine barrens. Knowing what actually happened requires that archaeology step up and be central to coordinating research, because archaeology is essential to understanding environmental proxies and because only archaeology can provide the information on human response. In addition to targeted local and regional data gathering, the effort will involve a continent-wide collation of archaeological site file data and over a hundred thousand existing reports in the gray literature. A spin-off benefit will be a revolution in the capacity of every practitioner to access, know, and use this vast body of unexplored data.

4. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 241*
   - **Challenge:** Understanding how past climate change has effected cultural adaptations, demographics, and population movements to better predict the reaction to future climate change.
   - **Justification:** Environment and its constantly changing nature provide the driver for natural selection. Humans are not exempt from this selection and our extant cultures reflect cultural adaptations to changing environments, which also must be considered within their historical context. Archaeology plays an important role in helping understand human cultural, biological, and demographic adaptations to climate change.

5. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 256*
   - **Challenge:** Focus on past impacts of climate change on society as well as sustainable practices with the goal to cull lessons useful at present.
   - **Justification:** We need to go beyond platitudes regarding 'lessons from the past' and provide concrete cases and solutions. Not only might this approach help solve the problems we increasingly

face in view of global climate change, decreasing resources, and growing populations. We also need to increasingly justify archaeology; thus, taking the above direction will address two problems at once.

6. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:** 269*
   - **Challenge:** Reconstruct paleoclimate change and human responses to it over large geographies and during different periods of significant climate change in order to anticipate challenges posed by global warming in the modern world.
   - **Justification:** We are entering into a period of unprecedented climate change--brought about largely by the products of our own cultural practices. But the peoples of the past also faced periods of dramatic change in terms of sea level fluctuation, temperature, ecology, etc. and the decisions they made in grappling with the new conditions they faced may be of interest in the modern world. Of particular interest should be broad-scale shifts in a regional ecology (species representation, diversity, population levels, etc.) and implications for humans in that environment.

7. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:** 278*
   - **Challenge:** Human Adaptation to Climate Change
   - **Justification:** The archaeological record is replete with data from human behavior as well as contextual geoarchaeological and paleoenvironmental data to investigate human-environment interaction relative to continually changing climate regimes. Like a mirror flipped into the future, responses and interactions over the past few million years may contribute to adaptive strategies for imminent human-induced climate change in the near future.

8. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:** 287*
   - **Challenge:** Identifying the social, cultural and demographic impacts of earlier climate change and other major environmental change episodes, world wide.
   - **Justification:** Earlier climate change episodes, and the adaptations that allowed local populations to survive them, or their failure to do so, can inform our reactions to present environmental changes. Examples might include the northern European Little Ice Age, or its preceding climatic optimum. Major environmental change episodes, including disasters such as pandemics, tsunamis floods and droughts, and their impact upon populations, may help us to assess the potential impact of the predicted increasing numbers of such events over the next few decades. This is an area where taking the archaeological long view has clear and immediate benefits for modern society.

9. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:** 312*
   - **Challenge:** Human populations have undergone long-term social and cultural evolutionary changes, sometimes in response to changing climatic factors such as rising or falling sea levels, shifts in Holocene climates throughout the world. The challenge is to document the effects of long-term climatic change on human populations, from those who participated in foraging, to the early development of farming, and to the rise of urban communities.
   - **Justification:** 1. The past can inform the present with respect to human-environment interactions as related to earlier episodes of climatic change and possible environmental degradation. ¶ 2. How small-scale human populations were resilient to the effects of natural disasters, environmental perturbations, and climatic change may be modeled using computational methods. ¶ 3. Archaeologists working across all areas of the globe have these kinds of information through the fine-grained analyses of human systems. ¶ 4. We are now in the position to collect these data from archaeologists and place these data within the scope of measurable paleo-proxies from ice or sea cores, pollen records, temperature and moisture records, tree-ring data, rates of sedimentation and erosion.

10. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:** 314*
    - **Challenge:** 1. Predict the effects of global climate change in different regions of the world by determining how such change has affected human society, economy and history in the past.
    - **Justification:** 1. This is a question that others and I explored briefly in the 1980s as part of an abortive initiative to establish "National Archaeological Research Topics" to guide the expenditure of

federal and other moneys on archaeological data recovery under the National Historic Preservation Act and other authorities. Archaeological evidence is pretty clear for climate change and its effects in different parts of North America, and doubtless is in other parts of the world as well. The beauty of archaeology as a predictive tool (relative to things like sea-bottom cores, ice cores, etc.) is that it can elucidate how large scale climate change (e.g. global warming) is expressed regionally/locally, and how it affects human societies. Thus archaeology can contribute to a more nuanced understanding of such change.

11. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 327*
    - **Challenge:** Assessing the impact of major and minor climate change and extreme weather events on ancient human societies in the context of today's and future concerns about the impact of long-term warming on the world.
    - **Justification:** Climate change is one of the major issues facing humanity in a world that is increasingly crowded, with tens of millions of people extremely vulnerable to a projected high incidence of extreme weather events like tropical cyclones, also to tsunamis and other natural phenomena that affect coastline populations, this quite apart from rising sea levels and the effects of major volcanic eruptions on humanity (i.e. the summer of AD 1816). The on-going revolution in paleoclimatology, especially that in the study of tree-rings and ice cores (the study of which is becoming very refined and will become even more so in the future), have turned archaeologists' attention to the impact of climate change on ancient societies in ways that go far beyond the climatic determinism of earlier decades. A multidisciplinary archaeology has an enormous contribution to make to future debates and policy initiatives surrounding global climate change in a world which is facing mass climatic refugee problems. Such research requires close cooperation with other sciences, for it is the combination of both the scientific evidence and the human aspects of the problem that are central to future debates on climate change. Until recently, people were almost invariably omitted from the climatic change equation, and certainly the ancient climate change equation. Archaeology, with its unique ability to study human cultural adaptations and changes over long periods of time, has a central role in such research, which, among other things, will involve the management and deployment of enormous quantities of primary data.

12. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 337*
    - **Challenge:** How have responses to environmental and climate change shaped the development of past human societies? To what extent has environmental change in the past been the product of human activity, and how have the choices we've made to work with or against these changes affected the course of history?
    - **Justification:** Climate change, anthropogenic or otherwise, is a major concern in the modern world. In the past, it may have been just as important. In Iceland, for example, massive environmental degradation resulted from unfettered resource exploitation. Current research into the origins of agriculture is is suggesting further ties to global climate events. By understanding how social and economic practices both shaped and were shaped by environmental change in the past, we can improve the ways in which we enact positive change in our own modern society as part of a dynamic global ecosystem.

13. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 374*
    - **Challenge:** Document the nature and timing of climate change, and the nature of human responses (adaptive or otherwise) to climate change.
    - **Justification:**

14. *[Q-CC] Leveraging Past Human Responses to Climate Change ID: 382*
    - **Challenge:** Effects of climate change on human societies, especially complex societies, in long-term global perspective.
    - **Justification:** Current geological, climatological and archaeological data support the visibility of at least three and probably four natural cycles of climate change: (1) the 100,000 year Ice Age cycle through the Pleistocene (the Holocene is an interglacial); (2) Probably a 6000 year cycle of which the

Altithermal/Hypsithermal/Jomon Transgression/Scandinavian Mesolithic high sea stands represent a high part of the cycle; (3) a 600 year cycle, exemplified by the Roman Optimum, Vandic Minimum, Medieval Optimum, Little Ice Age, and modern optimum are examples; and (4) a 70 year cycle, which we experience in a human lifetime (remember discussions of the coming ice age in the 1970s?). Charting the 600-year cycle against the rise and fall of northern hemisphere complex societies makes it clear that this cycle has a profound impact on complex societies, as do punctuations such as the AD 536 event which reorganized the complex societies of the word. Modern climate change is driven in part by the natural cycles and in part by modern human activity such as burning fossil fuels. This perspective has profound policy implications: we need to stop polluting, but even if we do, we cannot stop the natural cycles. We have to plan to adapt, and invest in infrastructure, not obfuscation. The long term view of climate and society puts the current trends in perspective and also makes sense to broad audiences who are tired of the oppositional sound-bite simplicity of the popular media. This topic also fits well into Hardesty's (2007 American Anthropologist) call for an emphasis on global change archaeology. This makes archaeology relevant and could affect national policy if presented well.

15. ***[Q-CC] Leveraging Past Human Responses to Climate Change ID:*** *383*
   - **Challenge:** The role climate change plays in creation and collapse of cultures and civilizations.
   - **Justification:** As modern humanity faces global climate change humans will be faced with many climate related challenges. For example, rising sea levels may cause coastal migration and large numbers of refugees. Long term shifts in rainfall will change the currently available arable land (some areas will see and increase some a decrease). ¶ How have past civilizations been helped by climate change and how have they been hindered? How quickly has the climate changed in the past? And how quickly does this change affect a culture/civilization. Archaeology is in a unique position to answer these questions. Examining past growth and collapse of various cultural centers like Choco Canyon or Cahokia many help answer these questions. ¶ Looking at the long term change in climate in North America (from pollen data or preserved plant remains) can help today's people understand how quick climate can change in region, and what effect these changes will have on a region. Archaeological data can be used to examining both large and small scale effects.

E. **[Q-CH] Culture History**

1. ***[Q-CH] [P-TP] Development of SW Cultures and Relationship to Traditional Histories ID:*** *216*
   - **Challenge:** Development of the major prehistoric cultures of the American Southwest, including the timing and origin (local vs. migration vs. both) of genetic and cultural populations and how these groups correlate with oral history of modern tribes (e.g.. migration traditions).
   - **Justification:** Archaeologists have developed stories about the origin and development of prehistoric populations that may or may not correspond to traditional histories of modern tribal groups. It is in the interest of both groups (archaeologists and tribes) to explore where those sometimes disparate stories overlap and intertwine and where they diverge because there is useful and valid information to be gained from both perspectives. There can never to a complete correspondence among the various stories and traditions but any robust interpretation of the past must consider all lines of evidence. This type of cooperation also has the potential to decrease animosity among researchers from various backgrounds, which will in turn improve future collaboration.

2. ***[Q-CH] Demise of St Lawrence Iroquois ID:*** *236*
   - **Challenge:** What happened to the Saint Lawrence Iroquois and what happened to them?
   - **Justification:** Saint Lawrence Iroquois pottery is found on the east shore of Lake Champlain as far south as Cornwall, VT and as far east as the Old Point point bar formation on the Kennebec River in Maine. What was the extent of their culture area, its duration and what happened to them?

3. ***[Q-CH] Documenting Disappearing Traditional Lifeways ID:*** *360*
   - **Challenge:** 2 - The disappearance of traditional lifeways with direct links to the prehistoric past in many parts of the world.
   - **Justification:** Although excellent ethnoarchaeological study of many important traditional activities

have been undertaken over the past half century, much more remains to be done. Once again, time is of the essence as many of these surviving traditional lifeways are disappearing at an accelerating pace.

4. *[Q-CH] Medieval Norse Exploration of North America ID: 335*
   - **Challenge:** To what extent did the medieval Norse actually penetrate and explore North America?
   - **Justification:** Evidence exists that people from Greenland, Iceland, and Scandinavia made deep explorations into North America in the period from 950 to 1450 AD, far beyond what is generally acknowledged on the coast of Labrador and Northern Newfoundland. All of the evidence for this has been generally dismissed in academia, in some cases for clearly legitimate reasons, but in a significant number of cases the dismissal appears unwarranted and wrong. A serious, thorough, detailed, fair, and scrupulous effort should be made to definitively evaluate this evidence with the full panoply of modern forensic archaeology. ¶ Without implying bias towards any expected outcome for this investigation, but based on public perceptions of their potential relevance, a list of artifacts to investigate should include: the Kensington Rune Stone, the Spirit Pond Rune Stones, the Yarmouth/Fletcher "Runic" Stone, the Newport Tower, various small artifacts found in Minnesota, Wisconsin, and Michigan.

5. *[Q-CH] Oldest Foundations of Civilization ID: 230*
   - **Challenge:** You must discover the Oldest Foundation All ancient civilizations are built upon to understand the true origins of mankind, art and religion.
   - **Justification:** I have made a discovery of the Oldest civilization ever discovered with many advanced forms of artifacts unlike any ever discovered. I have made a connection of metal artifacts from many different parts of the world that claim extreme age far older than accepted by established archaeology. Your investigation of ancient history has to be told by the ancient artifacts and not a preconceived picture. I have not only discovered ancient metal artifacts that are not suppose to exist but I have discovered a whole civilization. If you would like to investigate, examine, or test these artifacts I am sure they will speak LOUD and CLEAR to the world the truth of our most ancient times.

6. *[Q-CH] Prehistoric Plant & Animal Utilization in Mid-Atlantic ID: 261*
   - **Challenge:** There is a need for a better understanding of prehistoric plant and animal utilization patterns in the Middle Atlantic region.
   - **Justification:** There is not a lot of specialized analysis of starch grains, lipids, phytoliths and other microfossil data in the middle Atlantic region for the prehistoric period. Also the amount and quality of macrobotanical analysis is not great in NJ, MD, DE. The bone preservation is poor in PA, MD, NJ, DE, VA so our faunal database is limited for non-shell midden deposits. We need better data on what people are eating and using in terms of plants and animals which will help use under settlement pattern data and temporal trends.

7. *[Q-CH] Relationship of Brazilian and Hopewell Earthworks ID: 244*
   - **Challenge:** Examine the relationship between recently discovered geometric earthworks in Brazil and Hopewell earthworks in eastern U.S. As this previously unknown, but obviously extensive, South American civilization emerges, is it coincidental that there are strong physical similarities, or was there some cultural link?
   - **Justification:** Because of their many similarities in design, construction techniques (earthen embankments, ditches, parallel lines, etc.), and general time period, one wonders if there is a direct relationship between the cultures who created the works. So little is known of civilizations in the western Amazon area, and these recently discovered works seem to indicate quite a large population in that area around 2000 years ago. Researchers have also suggested that as much as 90% of the total existing earthworks may still be hidden by forests. Along with ongoing traditional research, it would be interesting to use technology such as LiDAR to examine the forest floor to discover these hidden works, without having to wait for more deforestation to occur (for better or for worse). Just how large was the population, and how widespread the culture? What was the

landscape like before the current rain forests? Was there population movement between the Hopewell heartland and Brazil? Are there other cultural similarities between the two groups? What might the next chapter hold for the western Amazon basin if it is determined large agrarian populations once thrived there? Where did the civilization come from - east, down the Amazon? - west, down from the Andes? - north, from the gulf or central America?

8. *[Q-CH] Religious Origins of SE US Mound Builders ID: 232*
   - **Challenge:** What were the religious origins of the mound builders in the SE USA?
   - **Justification:**

F. [Q-CNH] Coupled Natural & Human Systems

1. *[Q-CNH] Dynamics of the European Colonization of the Americas ID: 262*
   - **Challenge:** Understanding the causes, timing, demographic dynamics, and environmental, social, political, and economic processes contributing to the collapse and reorganization of human ecologies coinciding with the European invasion, conquest, and colonization of the Americas, AD 1400-present.
   - **Justification:** The European invasion of the Americas in the sixteenth century touched off an unprecedented cycle of socioecological collapse and reorganization. The disastrous introduction of European pathogens, combined with heavy handed colonial demands for labor and resources produced demographic declines among native populations estimated at 90% in many areas. Introduction and differential adoption of European cultigens and domesticated animals altered existing mutualisms and predator prey relationships. New technologies further altered hunter-gatherer and agrarian ecologies, as well as craft specialization, commodities production, distribution and marketing patterns, and consumption. Macroregional political and economic organization was reconfigured drastically under colonial regimes, only to be reformulated again in the postcolonial era with the industrial revolution. ¶ We still do not understand how variation among these processes produced different trajectories of loss and recovery across the Americas. Nor do we know how legacies of socioecological collapse and reorganization continue to affect potential, development, and conservation for descendent native communities in the global era. Archaeological and paleoenvironmental data are the only sources of information that span both sides of the sixteenth century European invasion - not historical written records, not ethnographic information - and therefore these should be used in combination to model cause and effect, to articulate how short term changes articulate to the longue duree at local, regional, and macroregional scales.

2. *[Q-CNH] Dynamics of the European Colonization of the Americas ID: 350*
   - **Challenge:** Understanding of contact- era interaction between Native Americans and Europeans as the two cultures collided and altered each other in the New World.
   - **Justification:** This very broad questions encompasses a plethora of sub-questions-everything from population genetics to the spread of smoking culture.

3. *[Q-CNH] Long term Social & Ecological Dynamics of Major World Regions ID: 354*
   - **Challenge:** Comparative assessment of long term (millennial) sociopolitical/economic trajectories of cultural growth within major world regions, with special attention to environmental patterns, the ecological relationships human communities have developed with them, and the degree to which culture-historical connections are and are not significantly associated with the development of cultural developments across space and time.
   - **Justification:** Important because such studies could give us a comprehensive and long-term perspective on the large geographical, economic, and sociopolitical patterns that affect us every day. The world needs a concrete and long-term perspective on the enduring characteristics of human society that will transcend the blooming, buzzing confusion we are increasingly immersed in and clarify the trajectory we are on.

4. *[Q-CNH] Long Term Sustainability ID: 355*
   - **Challenge:** Understanding how human societies have sustained themselves considering the ecological, economic, social aspects of their interactions with their natural and social environments.

- **Justification:** Archaeology is the one science that can track human interactions with their natural and social environments over long periods of time. Analysis of archaeological data about these interactions and whether societies were able to maintain themselves or change in a sustainable manner will be of interest and importance to contemporary humans.

5. **[Q-CNH] *Relationships of Human Population Growth, Technology, and Economy with Benign Sociopolitical Formations ID: 319***
   - **Challenge:** What is the relationship between human population growth, technology and economy as it relates to the formation of sociopolitical systems that encourage cooperation rather than conflict, equality rather than inequality, and tolerance rather than intolerance?
   - **Justification:** Fact 1: Many anthropologists see archaeology as their poor, country cousins: can't record kin terminologies, mythologies, language, cosmology, and so on; what's the use? All (usually) true. But archaeology's great strength is its ability to look at a wide variety of human systems (the world) over long spans of time (the entire range of human evolution) within a common data framework (material culture). Fact 2: although many factors enter the picture at the scale of a single case study, it is clear the population growth is a common driving factor in human cultural change. Fact 3: Human population growth will continue at least through 2075, and move from the current 7 billion to 10 billion. We should know something about how such growth impacts human society; one way to do so is to use the effects of past population on human society to not only predict but hopefully "prescribe" the (unique) future so that it comes out the way we would presumably like it to. Archaeology is the only field positioned to do this. ¶ Conveniently, at the same time that this important question and challenge confronts us, we have both the data (generated by thousands of individual research projects) and the synthesizing computational ability (through databases and GIS) to use the common data of archaeology to examine the effects of population growth under a variety of different conditions, including environmental, social, and cultural. The challenge comes in synthesizing the data -- thousands of dates (of differing resolutions), and different classifications of material culture generated by different paradigms of analysis.

6. **[Q-CNH] *Sustainability and Waste ID: 366***
   - **Challenge:** How can archaeology--through its methods and results--contribute to our understanding of the ways in which the chemical and physical remains of past human activities contribute to the formation of modern landscapes and present-day quality of the earth's soils? This is especially important considering the crises ahead in agricultural sustainability and in feeding the earth's populations.
   - **Justification:** Past human activities leave tangible remains (industrial waste, processing debris, human waste, dead bodies, residual waste, rubbish, land fill, abandoned buildings, construction debris, roads) which break down and contribute to both soil and land formation processes. Yet this aspect of archaeology has been virtually ignored. The emphasis has been on using remains to reconstruct past activity. But there is also the question of the transformative properties of what people, cities, and civilizations have left behind. Given present crises in agricultural sustainability, resilience of land, and energy inefficiency (too much land devoted to animals and biofuels rather than crop production for people), it is critical to assess how human activities, past and present, affect soils and land configuration in quantifiable terms. If principles can be established and recognized, practices and policies can be developed that would apply to guidelines for industrial waste, human waste, land fill, or any other process in which remains are generated and deposited that can be expected to interact with soils and water.

7. **[Q-CNH] *Sustainability ID: 223***
   - **Challenge:** How can archaeology address questions of sustainability, vulnerability and resilience?
   - **Justification:** These are important issues, with direct bearing on policy. Failure to understand these issues can lead humanity into dire situations in the future, with bleak outlooks for near-term amelioration. Looking at modern societies to understand these issues is not sufficient, since 1)time depth is limited which is a problem since some policies/actions appear good in the short term and

prove disastrous in the longer term, and 2) we know the ultimate outcomes and can examine trajectories in archaeological cases, whereas for modern cases we can only project outcomes, which are really guesses given the limited understanding of these issues.

8. *[Q-CNH] Sustainability ID: 226*
   - **Challenge:** In terms of human social organization and ecology, is there a stage of social development wherein a population can or will remain at equilibrium with the carrying capacity of its environment? Can that social stage be maintained or is it in flux? What maintains it? Can knowledge of past social/ecological successes and failures inform contemporary policy?
   - **Justification:** If knowledge of the past cannot inform the direction of contemporary social policy, archeology is a destructive vanity.

9. *[Q-CNH] Sustainability ID: 227*
   - **Challenge:** What can archaeology help us learn about sustainability in the past and about how past sustainable or unsustainable practices have relevance for present and future societies?
   - **Justification:** Huge investments are being made in sustainability, yet much work on the subject lacks a deep-time perspective. Archaeology provides long-term contexts that can help us understand the sustainability of various types and scales of certain practices (e.g., land use, water management, agricultural diversity) in a variety of cultural and environmental contexts.

10. *[Q-CNH] Sustainability ID: 265*
    - **Challenge:** Examine the archaeological record of ancient societies around the world for their successes and failures in sustainability. Components such as environment, ecology, demography, adaptation, political and social organization, and religion should be included. And I suggest a minimum of a millennium be used as the time period to judge a society/adaptation as successfully sustainable.
    - **Justification:** For the past two years I have used sustainability as the core theoretical framework in my undergraduate classes, and in some of my graduate classes. This forces students to examine the archaeological record of each society in a very different way. They need to know about climate, environment, soils, and other resources, and how they were utilized. Decision making in egalitarian, ranked, and stratified societies are very different, and societies that experienced increasing warfare (e.g. Classic Period Maya) found it to be a short-term advantage for populations to increase past that sustainable threshold. We then turn to our society, and begin examining it starting about AD 1900, when our adaptation began to be fundamentally reliant on fossil fuels. We are now slightly over 10% of the way to the 1000 year marker, and students really "get it" that if we do not make some fundamental changes in population-resources-energy sources, the future is problematic.

11. *[Q-CNH] Understanding Implications of Cultural Diversity for Sustainability ID: 229*
    - **Challenge:** The implications of our understanding of past societies and human cultural diversity for predictions about the long-term future of human civilization
    - **Justification:** Over the past 200 years or so archaeologists have in many ways and often in great detail been adding to a steadily improving understanding of past societies around the globe. Archaeologists have also learned to appreciate the significance and consequences of human cultural diversity in time and space. ¶ Although you often read phrases like "learning from the past for the future" when it comes to justifying archaeological work, it has until today remained largely unclear precisely what prediction value for the future archaeological knowledge actually has (with the possible exception of some environmental studies). What is missing is a sophisticated bridge linking knowledge about the human past with knowledge about the human future, in particular regarding trends in the evolution of society and likely future patterns of human cultures. ¶ This suggestion should not be read as a call for a return to the search for law-like generalizations about human societies which have been proven to be impossible to gain in any meaningful way. Instead this is a call for methodological inspiration and systematic co-operation with the interdisciplinary field of Future Studies (or Futurology). ¶ Gaining such knowledge is not only of strategic value in assisting fund-raising and other PR-initiatives. It is also a matter of profound epistemological significance for a

field like archaeology that endeavors to the study the past in order to contribute to the study of what it means to be human on planet Earth.

12. *[Q-CNH] Understanding Individual and Small Group Decision-making at Different Scales ID: 379*
- **Challenge:** understanding the nature of human interaction in terms of individual and group decision making at a variety of scales in different cultural and historical contexts within human history/prehistory
- **Justification:** individual and small group decision making is the basis of all other organizational structures. Understanding how this operates at a variety of scales and within different cultural and historical contexts allows us to investigate dynamic human structures.

13. *[Q-CNH] Understanding Long Term Population Growth ID: 283*
- **Challenge:** The need to determine cause and effect variables, timing, and environments in human population growth. This is an area of research that can only be approached through archaeological research as archaeology is the only discipline that can study cultures and populations over long time spans.
- **Justification:** Science must have relevance to today's culture to be considered valuable. ALL worldwide problems (hunger, wars, etc.) stem from over exploitation of resources, unequal distribution of resources, and environmental change and degradation. All of these are the result of human over-population. We can either continue to over-populate, assuring a continuance of the above listed problems until nature steps in and resets the system... or we can develop a plan for population control and reduction in hopes of avoiding nature's more radical correction. Knowledge of past patterns of human population growth and decline will help address this worldwide problem.

14. *[Q-CNH] Understanding Technological and Economic Transformations ID: 293*
- **Challenge:** The timing and nature of broad technological and economic transformations in North America and their means of transmission/dissemination. This is a broad topic that would address the timing and nature of broad shifts in hunting technology (i.e. spear to dart and atlatl to bow and arrow technology) and groundstone technology along with changes in economy from hunting and gathering to horticulture. At the same time this topic could address the pace and means of transmission of these changes into different environments and across different cultural groups.
- **Justification:** The topic is broad enough to apply to North America (and could be applied to any large region). It looks at the broad nature of the means and rate of technological and economic change and how this occurs and is transmitted or delayed. The results can have diachronic application beyond the field of archaeology itself.

15. *[Q-CNH] What Drove Population Expansion Across Continents ID: 251*
- **Challenge:** What drove people to expand across the continents? Or, were ancient hunter-gatherers living below the environment's carrying capacity?
- **Justification:** As best as we can tell from archaeology and genetics, hunter-gatherer population levels were quite low at least until two or three thousand years ago. So why did they rapidly expand across every continent? People tend to assume, explicitly or as part of evolutionary explanations, that they were forced to emigrant by population pressure. But population levels, even in the areas left behind, seem to be well below carrying capacity. If that's true, we have to reject most ideas about why the continents filled up. If it's not true, then we really don't know anything about past population levels.

G. [Q-OT] Other Theme

1. *[Q-OT] Social Change ID: 202*
- **Challenge:** 1) the social change in the past
- **Justification:**

2. *[Q-OT] Understanding Relationships Among Languages ID: 286*
- **Challenge:** Discovering and understanding the relationships between languages.
- **Justification:** The world has thousands of languages. For many, historical connections have been demonstrated, but there is a large number that are called language isolates, with no known

historical connection to any other language. If only there were some meaningful way to compare languages to discover historical relationships beyond what seems possible now. There must be cognates that go unrecognized.

3. *[Q-OT] Understanding scale at which the unpredictable behavior of individuals transforms into the more predictable behavior of groups ID: 302*
   - **Challenge:** Identifying the scale at which the unpredictable behavior of individuals transforms into the slightly more predictable behavior of groups, as seen in the archaeological record.
   - **Justification:** Although the nature of archaeological data means that we examine the debris of "groups", the material culture record is nonetheless an agglomeration of the behaviors of individuals. There is no standard agreement within the discipline on where the line is between aggregated individual remains and broader social groupings; indeed, many contend that it is only possible to investigate individual pasts, or that behaviors are so contingent that analogy and parallels are nearly meaningless. However, world historians and animal behavioralists study their subjects at scales which do not recognize individuals, only groups. It is therefore possible to draw back from individuals to groups, but at what point in the data collection of standard archaeological practice can this be recognized, as an "industry standard"?

4. *[Q-OT] Understanding Settlement Pattern Change ID: 254*
   - **Challenge:** One general challenge is understanding how and why settlement pattern change occurs, when areas are abandoned or when nucleation or dispersion of settlements occur. These kinds of understanding are related to but not always driven by subsistence, so the two should be decoupled when trying to address this kind of question. Specifically, in many parts of the Eastern Woodlands, Woodland period settlement changed from dispersed to nucleated and, in some areas, Mississippian period settlement shifted to dispersed again, then back to nucleated.
   - **Justification:** Explaining such changes and shifts requires large-scale archaeological survey data that has been acquired systematically and in a manner that assures that dispersed settlements will be identified. This has not always been the case with existing survey data. For example, Stephen Williams' Vacant Quarter hypothesis for late Mississippian abandonment of large areas of the Central and Lower Mississippi Valley only has credibility if one believes that survey was done appropriately to find and record small dispersed occupations. T. R. Kidder's idea that the LMV was abandoned because of increased episodes of large-scale flooding at the end of the Late Archaic Poverty Point period also might be thrown into doubt by similar uncertainties.

5. *[Q-OT] Understanding the Adoption of New Nationalities by Immigrants ID: 308*
   - **Challenge:** Adoption of 'new' nationalities by emigrants/immigrants throughout the 19th and 20th centuries
   - **Justification:** This is a grand challenge because it requires work in two spheres; 'historical' archaeology in Europe (the 'Old World') in a way that it has rarely been carried out - in order to create meaningful comparisons in the 'New World' - the US, Canada, Australia etc.

6. *[Q-OT] Understanding the Role of Psychotropics ID: 358*
   - **Challenge:** To identify and interpret evidence for mind-altering/psychoactive substances in the archaeological record, ranging from the micro- (chemical and physical trace residues on artifacts) to the macro-scale (carbonized plant remains and rock art imagery).
   - **Justification:** The occurrence of altered states of consciousness among proto- and prehistoric peoples have been neglected in archaeological studies. Ethno-historical data shows that altered states, such a trance experience and dreaming, has been common and cherished among Native American Indian groups, for example. The role that psychotropics have played in human physiology, cultural notions, social organization, religious experiences, and inter-personal relationships, the identification of alkaloids and residues found on artifacts, and the impact that these substances have had on society in general. Archaeological, chemical, paleoenvironmental, ethno-historical, ethnographic, and rock art research provides a framework for understanding why humans appear to have had a physiological need for mind-altering experiences and the technologies and objects they

developed for harvesting, producing, and consuming a compendium of various substances. Numerous advances in residue analysis (e.g., gas chromatography) and chronometric techniques over the last 20 years now provide a much stronger framework for examining the role that psychoactive substances played in proto- and prehistoric societies.

7. **[Q-OT] When did humans occupy the high mountain regions of the world? ID:** *326*
   - **Challenge:** When did humans occupy the high mountain regions of the world? What cultural and biological adaptations were required?
   - **Justification:** The Himalayas, Alps, western cordillera of North America and the Andes provided enormous challenges to the adaptability of humans as they spread across the world. We need to know the timing of these occupations as well as the mechanisms for doing so. The ability to live at high altitude is one that requires fundamentally different biological activities and energetics. Broadening our knowledge of this movement will provide useful information about the biological and cultural shifts needed that will enhance our understanding of humanity and its evolution.

8. **[Q-OT] Demography of Early Populations ID:** *389*
   - **Challenge:** The demography of early populations
   - **Justification:** Archaeological research and interpretation are based on a series of implicit assumptions regarding population levels (as well as other demographic issues). These are seldom made explicit and often demonstrate variety between practitioners, but are fundamental to how we understand the past. Placing population levels and other demographic questions for any period (particularly for prehistory) on a scientific footing is essential in moving to robust understandings of past societies.

H. [Q-PA] Peopling of Americas

1. *[Q-PA] Explore Submerged Sites ID: 250*
   - **Challenge:** The early habitation sites of the first migrants to the Americas are likely submerged due to rising sea levels since the LGM. An underwater search for these sites should be conducted.
   - **Justification:** Discovery of Pleistocene submerged habitation sites would confirm that the first people were maritime adapted and would give us an understanding of what they ate and what tools they used. We could understand their lifeways through a study of their tools and answer questions about how they secured their food, how they travelled and how they camped. We may learn about their social structure from any prestige goods found. The discovery of the remains of a watercraft would be particularly interesting as no ancient watercraft has survived from those times.

2. *[Q-PA] Explore Submerged Sites ID: 371*
   - **Challenge:** The study of now-submerged prehistoric coastal settlements. Inundated terrestrial sites.
   - **Justification:** Submerged prehistoric sites have the potential to illuminate the settlement of the New World, as well as increase our understanding of settlement patterns, resource use, and material culture (preserved organic materials).

3. *[Q-PA] First People of NE North America ID: 237*
   - **Challenge:** Who were the first people in Northeast North America and how did they get here?
   - **Justification:** There are several manifestations of Paleoindian culture in Maine, Quebec and the Maritime Provinces. What is there temporal relationships (as they are poorly dated)? Who were the pioneers? What resources did they follow?

4. *[Q-PA] Role of Women and Lifeways in PaleoIndian Period ID: 239*
   - **Challenge:** What were people's lives like during the Paleoindian period in North America, especially the women's involvement in the information systems operating across Paleoindian society(ies)?
   - **Justification:** Much of our information about Paleoindian society(ies) is still based on a fast-moving male hunter big-game-focused model of who the people were and what they did in those societies. We have not given significant attention to the women in those societies, in their roles as food-acquirers, tool-makers, nurturers, birth mothers, communicators of cultural/technological/subsistence information, etc. We probably can't find a lot of evidence that specifically says "girl" on it, but we can use a multi-disciplinary approach (history, psychology,

sociology, anthropology, biology, etc.) to interpret the now-almost-missing 50% of human communities during the Paleoindian period. The role of information sharing and generation across Paleoindian societies is critical, and even recent discussions of this do not pay much attention to the female half of any culture. These are the people who were adapting to a new hemisphere in markedly changing climates from the Arctic to the tropics, and we need to understand the sophistication with which they must have used (and modified?) the resources that they encountered. Understanding the extinction of some game animals during this period is a part of this puzzle--all of which need a strong understanding of the female portion of these societies.

5. **[Q-PA] *Timing and Origins of Peopling of the Americas ID: 267***
   - **Challenge:** Timing and origins of the peopling of the Americas. Are there multiple migrations from different areas? Which of these migrations represents the ancestors of historic native American populations.
   - **Justification:**

6. **[Q-PA] *Understanding Peopling of the Americas ID: 309***
   - **Challenge:** The great challenge is to connect North American archaeology with that of East Asia in order to assess just what came with the peoples who traversed the Bering land bridge. When? Who? How many times? More links are waiting to be discovered but they require much greater communication and command of non-European languages in the American archaeological community.
   - **Justification:** Both the peopling of the Americas and the early cultural development will become accessible by broadening the comparative perspective. Cultural evolutionary theory depends on the American analogy for support. Pre-Columbian European contacts are evidently not supported and Asian origins seem confirmed but no one looks beyond vague similarities to see what they mean in cultural terms.

7. **[Q-PA] *Understanding Peopling of the Americas ID: 325***
   - **Challenge:** The human settlement of the Americas is an issue which requires a broad multi-disciplinary approach, and an unbiased, open mind. In the past, rather dogmatic ideas about how this occurred, stifled a lot of research. New technologies are also now available to help with this question.
   - **Justification:** Why is the question of " what were the first Americans like and where did they come from" important? For one thing it provides important information on how and when humans spread throughout the world. It should tell us about the means by which crossings over large areas of what is presently oceans took place. Early technologies may have been far more sophisticated than we currently acknowledge.

8. **[Q-PA] *Understanding Peopling of the Americas ID: 346***
   - **Challenge:** Timing, routes, and sequence of the peopling of the New World. If "Clovis First," we must account for differential expression of immediate post-Clovis (Folsom, Great Basin Stemmed Tradition, etc.). And we must explain the presence of Clovis contemporaries on the Santa Barbara Channel Islands.
   - **Justification:** It is apparent that Clovis is differentially expressed in differing parts of the New World. In California, for example, "Clovis-like" points are a better description of the signature artifact; contemporaneous sites, on Channel Islands, for example, are entirely without Clovis Points. It begs the question, "How many sites are Clovis-contemporary but unidentified as such simply in view of a missing point type," not just for California (or South America), but for the Clovis strongholds in the remainder of North America as well.

9. **[Q-PA] *Understanding Peopling of the Americas ID: 368***
   - **Challenge:** Peopling of the New World, as always, is an area that requires extensive research.
   - **Justification:**

I. **[Q-PAQ] Paleoanthropology Questions**
  1. *[Q-PAQ] Art & the Origins of Human Behavioral Modernity ID: 281*
     - **Challenge:** The origin(s) of human behavioral modernity is a fundamental archaeological problem. The ability to create complex art is a diagnostic attribute of this archaeological modernity. Rock art worldwide provides the most accessible and obvious evidence of this behavioral trait. New and improved techniques for rock art dating are required to exploit this key line of evidence.
     - **Justification:** African evidence has demonstrated that human anatomical modernity preceded behavioral/cognitive modernity by 100,000 or more years. The timing, cause and variables involved in the transition to cognitive modernity-what has made us "human"-are fundamental archaeological problems. Initial research focused on Europe, where complex cave paintings in preserved contexts demonstrate sophisticated symbolism and artistry by ~40k YBP. Research has shifted to Africa, with various archaeological evidence, of different ages, argued to demonstrate modernity, perhaps by ~70k YBP. But missing from the African evidence is the kind of complex art and symbolism that are a key component of the European evidence-rock art. Despite the importance of early engraved African ochre tablets, e.g., it is difficult to compare their cognitive, behavioral and social significance to the elaborate paintings at Chauvet, France. Yet surely elaborate and complex art, and the religious beliefs and practices that this usually expresses, are required for behavioral/cognitive modernity. The difficulty is that potential early African rock art primarily consists of open-air petroglyphs. A series of petroglyph dating techniques were developed in the 1980s. Their development and utility foundered during the 1990s, due to an unfortunate controversy involving only one of the techniques. This controversy has been resolved, but it derailed archaeological use of the other dating approaches. Meanwhile Lamont-Doherty has made significant advances in one of these, varnish micro-lamination dating, though used almost exclusively for geomorphological research. In order to adequately address the origins of modernity problem, a program of open-air rock art dating needs to be established. This should involve basic research to develop new techniques and improve existing ones, as well as substantial empirical work on African, southern Asian, and Australian petroglyphs.
  2. *[Q-PAQ] Subsistence, technology, and cultural innovations of the earliest anatomically modern humans ID: 240*
     - **Challenge:** A grand challenge problem in archaeology is to gather multidisciplinary information concerning the subsistence, technology, and cultural innovations of the earliest anatomically modern humans in eastern Africa, especially Ethiopia and Kenya.
     - **Justification:** Fossil evidence collected and described by research projects working in Ethiopia have shown that the earliest anatomically modern humans are known from sites in Ethiopia, including Herto and Omo Kibish. The archaeological record associated with this momentous biological transformation is poorly understood, however, so we cannot know to what degree behavioral modernity accompanied anatomical modernity. Large-scale, multidisciplinary and long-term research in eastern African deposits dating to ca. 200,000 ybp would be indispensably valuable for our understanding of modern human origins. Sites, some of them as yet uninvestigated or even discovered, yielding hominid fossils, fauna, and tools (stone as well as bone) would be uniquely informative about the emergence and subsequent dispersal of modern humans.
  3. *[Q-PAQ] Understanding Demographic Dynamics of Expansion of Modern Humans ID: 266*
     - **Challenge:** Understanding the origin, timing, routes, and demographic dynamics of the expansions of modern humans from eastern and northeastern Africa to Europe and Asia during the last interglacial and last Ice Age.
     - **Justification:** Anatomically modern humans apparently expanded out of Africa in two distinct periods: first during the last interglacial (128-75,000 years ago), and again during the middle of the last glacial (60-50,000 years ago). ¶ Out of Africa 1: The interglacial expansion over 100,000 years ago may involve two routes: (1) north from Egypt via the Sinai Peninsula and (2) south/east across islands at the south end of the Red Sea. Evidence for the northern route is mainly found in two

famous burial sites in Israel (Skhul and Qafzeh). The associated artifacts are not correlated with specific African artifact industries. Genetic admixture between modern humans and Neanderthals may have occurred at this time. However, alternative hypotheses proposed by the geneticists have not been tested. Evidence for the southern route is found in several archaeological sites in Oman that have a distinctive and unique Nilotic/Ethiopian Nubian Mousterian stone tool Industry. No human fossils are associated with the Omani artifacts. Whether these early African populations disappeared during the subsequent early glacial era, or persisted and interacted with, or were replaced by Neanderthals are fundamental outstanding questions. Diagnostic African technologies are claimed to exist in India, but this evidence is contested. ¶ Out of Africa 2: Genetic evidence shows that the ancestors of all living human populations outside of Africa are descendants of east Africans that expanded out of Africa during the middle of the last ice age. Whether the only the southern or both northern and southern routes were used is contested. Genetic molecular clock dating suggests expansion ~60,000 years ago via the south route to Australia by 50,000 years ago, and expansion ~50,000 years ago to northern and western Eurasia, reaching Europe 43,000 years ago. Diagnostic evidence of antecedent Eastern African archaeological cultures is entirely lacking for both expansion routes, as are diagnostic human fossils. ¶ The foundations of modern human behavior outside of Africa were laid in Eastern Africa, but the lion's share of research and funding has gone to southern Africa. Archaeological and paleoanthropological evidence for these expansions in eastern and northeastern Africa and the Arabian Peninsula is sparse to non-existent. Well-dated archaeological and fossil evidence from East Africa, the Nile valley, and along the routes out of Africa is needed to evaluate the timing, routes and demographic dynamics of these two expansions out of Africa during the last Interglacial and glacial eras. In order to amass the amount of evidence needed evidence a Manhattan Project scale of archaeological field research is needed in eastern Africa. ¶

4. **[Q-PAQ] *Understanding Demographic Dynamics of Expansion of Modern Humans ID: 298***
   - **Challenge:** The good/bad/neutral paleecological effects of globally dispersing modern Homo sapiens during the Pleistocene
   - **Justification:** In many landmasses, the earliest appearances of modern H. sapiens occurred around the same time as the largest terrestrial mammals in those continents and islands became extinct. The two processes -- human dispersal and large-mammal extinction -- seem too synchronous to be coincidental. Were the processes both end-results of other events such as climate-change? Were they linked as cause and effect? Were they independent of climate change? Did human hunting or habitat-alteration lead to the extinctions?

J. [Q-SC] Social Complexity

1. **[Q-SC] *Dynamics of Complex Societies, technological Development, and Economic Growth ID: 365***
   - **Challenge:** 1.Understanding how and why complex societies grow, what makes them tick, and what leads to their decline. The variability of complex societies is the secret to answering the questions, and hence comparative work is critical. ¶ 2.Economic and technological "development", or economic "growth" in the past affected the lives of whole populations.
   - **Justification:** Complex societies have largely "won out" in the human past, they have far-reaching effects but are not very stable, and appear in a myriad of organizational variants. They provided the contexts for increased economic and technological complexity but not at a very imposing rate. They transformed settlement systems and led to a wide variety of urban centers that become a new context of social life. It is in a comparative frame when we examine trajectories of change that we have a chance to see underlying processes and determine what checks or promotes the processes. Of particular interest is the (debated) extent to which they promoted economic change that might be referred to as "growth" or "development" that made an aggregate impact on the daily lives of most of the population. The extent to which they were exploitative, constructive, or differential in their effects on life chances is important to understand because they have created the conditions of modern life. ¶

2. **[Q-SC] *Emergence of Leaders with Coercive Force ID: 342***

- **Challenge:** The transition from leaders whose authority was based on kinship ties, bonds of reciprocity, or links to supernatural powers to leaders who governed by force transformed the nature of human societies. How did such leaders gain and, perhaps more importantly, legitimate their ability to use coercive force?
- **Justification:**

3. **[Q-SC] Emergence of Social Hierarchies ID:** *218*
   - **Challenge:** Understanding of the different contexts of the emergence of centralized social hierarchies, including the state, across the world.
   - **Justification:** This is an important question because it relates not only to events that happened in the past, and are therefore potentially studied by Archaeology, but also because it address contemporary political questions related to the weak presence or absolute absence of the state in many contexts around the word, as it is the case of the so-called "failed states". The study of this question should also highlight the many contexts were the state never developed in the past, and which were the mechanisms through which local populations prevented that from happening.

4. **[Q-SC] How Peripheral Populations are Incorporated in Formative States ID:** *357*
   - **Challenge:** Understanding the processes by which people outside the population centers are incorporated into a formative state
   - **Justification:** In order to understand state formation processes, the archaeologist needs to understand the ways in which people outside the population centers are incorporated into the state through political, military, economic, social, and ceremonial processes. Archaeological excavation has traditionally focused on the large sites which were the population centers. Many of the small sites outside the population centers are not fully documented or the documentation is scattered in hard-to-access reports.

5. **[Q-SC] Origin of the Early States ID:** *273*
   - **Challenge:** I'd suggest a renewed focus on some of the big-picture questions that used to drive the discipline/ How did the first states emerge?
   - **Justification:**

6. **[Q-SC] Origin of the Early States ID:** *344*
   - **Challenge:** The development of "state" level societies.
   - **Justification:** Addresses questions of how our species transitioned from small extended family or corporate groups based on simple economies to the point that human impacts on the environment challenge out planet's survival.

7. **[Q-SC] Origins of government ID:** *206*
   - **Challenge:** Origins of government
   - **Justification:** Governments arose in pre-historic times, and continue today. Much Political Science proceeds forward from the Greeks; there's much, much more to the story.

8. **[Q-SC] Relevance of Ancient Urbanism ID:** *351*
   - **Challenge:** Urbanism.
   - **Justification:** Urbanism began in pre-history. Cities are still with us, and encompass more and more of our populations. Much Urban Planning proceeds forward from Antiquity, or perhaps Mesopotamia, but urbanism was older and broader.

9. **[Q-SC] Origin of Cities, Governments, and Civil Society ID:** *391*
   - **Challenge:** What is the origin of cities, governments, and civil society?
   - **Justification:** From the political philosophers of the eighteenth century to archaeologists today, many writers agree that the transition from egalitarian societies to states was the most momentous social transformation in the history of our species. Known in archaeology since the 1930s as the "Urban Revolution," this momentous change saw the origins of governments, the growth of institutionalized inequality, and the creation of new and complex social patterns. Through history these innovations have spread and expanded, creating both positive and negative consequences for people. Today their legacy dominates life on earth. As one of the few scholarly disciplines with

abundant empirical data on this change, archaeologists have a responsibility to document and explain the Urban Revolution. Yet in the past two decades, scholars in other disciplines—notably economics and political science—have usurped archaeology as the major source of theories and models for the rise of state societies and complex economies, producing accounts that are blatantly inaccurate and ethnocentric. It is time for archaeology as a discipline to re-take this territory. We need to re-assert our scientific credibility and demonstrate that we have and will continue to generate the best data and models to understand the single most dramatic transformation in the history of our species.

10. [Q-SC] Origin if Cities; Rise and Fall of Cities ID: 392

- **Challenge:** Why do cities form?
- **Justification:** Cities are neither ubiquitous nor inevitable among human societies. Researchers across academia are trying to learn why cities develop among some societies but not others, and why processes such as settlement aggregation or occupational specialization are sometimes but not always associated with urbanization and cities. Archaeology has a unique contribution to make to these broad social-scientific questions. This question has two domains. The first is the origins of the first cities. Archaeology has unique and important data bearing on the origins of cities in a number of world areas. The second domain is the rise and fall specific cities and urban systems after the Urban Revolution. Although this domain is currently dominated by the fields of economic history, geography, and urban history, archaeology also has an important part to play in documenting the rise and fall of cities in numerous urban traditions not traditionally considered by other disciplines. There is a broad consensus in urban scholarship that answers to basic questions of urban growth and decline—why cities are founded, why they grow and flourish, and why the decline—can help us explain urban and social dynamics today.

11. [Q-SC] Using Urban Landscapes to Understand Social Organization ID: 390

- **Challenge:** How can the historical and archaeological urban landscape and building remains aid our understanding of social interactions, examining what insights they give into the organization and operation of past societies and how urbanism shaped those societies.
- **Justification:** Urbanism is a major element of many societies, and often has a profound impact on both the organization of those societies and their subsequent development. Conscious choices in urban planning and the layout of both towns and individual buildings and structures can have a large impact on the way social interactions will be conducted and indeed whether certain interactions are possible at all. For instance, examination of wheel ruts in the Roman city of Pompeii indicate that an organized system for directing traffic was in operation, which provides insights into both social organization and governance. ¶ Another contrasting example could be the urban centers of the Indus Valley (Harappan) Civilization. These cities clearly are planned and organized, but unlike other examples of past urbanism such as Roman cities like Pompeii which show quite a degree of social stratification, buildings and dwellings in these cities generally have a fairly uniform size and layout, with the exception of certain larger structures such as the Great Baths of Mohenjo-Daro, with little evidence of large differences between structures and subsequently of social stratification. This again can provide evidence of social organization and how urbanism both shaped societies and was shaped by them.

II. Methodological Needs
A. [M-DA] Dating
1. ***[M-DA] Refine Dating Frameworks ID: 213***
   - **Challenge:** Precise dating frameworks on which to base the resulting thematic, artifactual, theoretical or practical solution. For example the recent Bayesian statistical assessment undertaken in Britain on C14 dating from early Neolithic Causewayed Enclosures that has enabled a rigid chronological basis to be applied on what was previously only poorly understood and has allowed local and regional differences to be recognized in the spread of this Neolithic phenomena.
   - **Justification:** Chronological accuracy is a crucial issue whereby in areas lacking scientific dating methodologies, either dendrochronological, carbon 14, OSL or similar, and are reliant on typological or diagnostic criteria, or even poorly assessed C14 dates where they may not have been subject to rigorous assessment in either their quality or provenance of the sample, resulting theories regarding the societies are based on a generalized chronology.
2. ***[M-DA] Refine Dating Frameworks ID: 295***
   - **Challenge:** Refining existing dating techniques and developing new ones to assist study of artifact-poor regions and periods and in particular periods of change. In the UK that would include Roman to post-Roman.
   - **Justification:** Taking the end of the Roman period in Britain as an example we see a loss of chronologically diagnostic material and in some areas an apparent absence of material culture that survives on conventional dry land sites. In addition some areas of Britain and/or site types during the Roman period have very little material culture, for example rural sites in north-western England despite the identification of increasing numbers, or sites of probable Roman-period and presumably also post-Roman date. Extensive c14 dating, coupled with Bayesian statistics and archaeo-magnetic dating etc. can go so far in addressing the issues but often the expense and sample requirements are inhibiting factors. A consequence of the problem is that it is often impossible to do more than conclude that a site is Iron Age/Roman and post-Roman sites are rarely identified leading to a poorly nuanced understanding of key periods of change. My assumption is that it is possible to transfer these issues to other countries and periods where chronologically diagnostic material is sparse or poorly understood.
3. ***[M-DA] Refine Dating Frameworks ID: 322***
   - **Challenge:** Chronometric capabilities: refine the ones we have (e.g., greater precision for radiocarbon), further develop newer ones, and combine methods for greater rigor.
   - **Justification:** Most of the sites in my area are un-dateable with current methods. Placing a site/features/artifacts into a time frame is usually the first order of inquiry upon which other research questions depend.
4. ***[M-DA] Chronometric Ceramic Dating ID: 367***
   - **Challenge:** A challenge for archaeology is chronometric dating. We are currently limited to either historical means of dating or radiometric means. It would be useful to have developed a widely available dating method developed for ceramics, a near-ubiquitous facet of much of the world's archaeological record. So, a method relating to the rearrangement, possibly, of microstructures in ceramics when they are fired. I think something along these lines is already being developed in the U.K.; improving that nascent research would be quite helpful and tie in with pottery-sourcing -- bringing together the where and when of archaeology, the field's two most central aspects.
   - **Justification:**
B. [M-DACS] Data Access, Comparison & Synthesis
1. ***[M-DACS] [P-IR] Access to Archaeological Information***
   - **Challenge:** Further comment - Crucial issues for understanding past societies require a longer, more stable cycle for research productivity than we have now. Academia rewards short-term gains and partial publishing/republishing to the detriment of long-term vision, work on key problems, and related infrastructure. Collaboration and team-work (accepted as essential in fieldwork, usually

through marshaling students) is extremely challenging for analysis that crosses departments or campuses. A related challenge is making basic data readily accessible for comparative research (not rewarded sufficiently in the publish-or-languish/perish environment). Collaboration often needs skill sets for analysis of new spatial and environmental data (we now have imagery sources that have detail and scope not readily available before); these skills are not widely distributed in our field. The competitive academic environment is good for archaeology, but it needs some checks and balances to protect the necessity and potential of longer-term and collaborative efforts.

- **Justification:**

2. *[M-DACS] Ability to Do Comparative Research ID: 306*
    - **Challenge:** With respect to archeology, anthropology, astronomy, similarities of cultures, years of existence, language both written and spoken, and calendar sites all need to be collected by place and dates in a form that would allow comparisons and perhaps see connections that are currently not known or noticed between all the developments of civilization.
    - **Justification:** There is a strong tendency in science to hone in on a subject and delve into that subject or micro-subject to where we "can't see the forest for the trees". After reader for years about every imaginable related areas I have had the thought many times that I saw a reference or similar information somewhere else but about a different place, culture or time. There is a need for a way to see and refer back to all the developments of mankind for comparison.

3. *[M-DACS] Access to Archaeologcial Information ID: 304*
    - **Challenge:** Managing the archaeological information from the excavation to the scientist or the reader of the 22snd century
    - **Justification:** Managing the information in archaeology does not only mean computational archaeology. Improving the access and the use of data for contemporary scientist is a thing. Preserve the right information coming from the field in 2012 to the scientist in 2123 is another problem to solve. If archives from the fields are not rightly preserved, in a trusted form, the archaeologist of the 22nd century will not be able to reconsider the results of previous excavations in his field on the light of the primary data (=archives + objects). ¶ Managing the information in archaeology means hardware, software and enough money, yes, but most of all, it means know-how and education.

4. *[M-DACS] Access to Archaeological Information ID: 299*
    - **Challenge:** Sufficient funds & technology -- beyond digital, film, & cloud formats -- that will allow future researchers to READ all the data & report records collected at state and federal levels once these media formats are obsolete.
    - **Justification:** Gov't agencies have been storing archaeological data in non-paper media formats since the floppy disc in the 1970s. Many of these data & reports are now inaccessible because we no longer have the technology to read them or translate them into more current media formats. What's the use of collecting & storing these data if future researchers cannot easily read them? Better to return to paper formats or develop a "universal translation software" that will apply to ALL the media used since 1966..

5. *[M-DACS] Access to Archaeological Information ID: 316*
    - **Challenge:** In regions where there is great variability in site size and deposit type, we lack programs that allow us to access and use data from several prior excavations in a useful and synthetic manner across geographic space and over periods of time.
    - **Justification:** Archaeologists often investigate each site as if it was unique, without really knowing if that is really the case (at least until one is senior enough to have experience working at dozens of archaeological deposits). As a result, much time is taken up excavating small sites, sites that could be examined and defined through minimal probing and a review of digitized grids of already investigated sites. These smaller sites have greatest importance in patterning cultural land use and should be approached through geo/temporal assigned to a grid of site types. Such sites could be revisited to confirm various hypotheses constructed to examine geo/temporal cultural patterns. ¶

Conversely, it would help advance the profession if major sites were investigated in greater detail and over sufficient time to allow for changes in investigative methods and strategies. The notion that a 5% of even 10% sample of a large site is sufficient to define a major site is nonsense. ¶ Whatever program is used to accomplish this geographic and temporal site data assembly needs to be adaptable to new input and have the capacity to shift data sets into new categories as they arise. The program also should be adaptable for input of ethnographic and historic document data and oral history records.

6. *[M-DACS] Access to Archaeological Information ID: 377*
   - **Challenge:** (1) The different, unmergeable databases across states and regions in the US. For instance, AZ alone has at least five primary site and project databases (AZSITE, ADOT Portal, INFRA, ASMIS, IMACS) and associated archives used by different land managers/agencies for data entry/upload, storage, research, and form generation. No central repository and data stored and retrieved differently in each instance.
   - **Justification:** (1) Have to physically go to respective agencies or have special remote access permission (which comes at a cost) for accessing much of their stored data in these different databases. Only two of the five listed above is accessible online (both with paid and applied permission applicable), and only partial information can be retrieved in this manner. Only one of the two allows the user to retrieve actual reports. AZSITE=Arizona State Museum (old site forms, project cover sheets, site and project locations); ADOT Portal=Arizona Department of Transportation (project reports and associated correspondence organized by highway); INFRA (Region 3 US Forest Service, have to apply for and obtain permission and access at a Forest location; can access site and project info including GIS database information, though not specifically linked);ASMIS (National Park Service site and collections database); IMACS=regionally based and no central database; depends on how different agencies use it and whether they have you do data entry, typically into an Access database.

7. *[M-DACS] Access to Gray Literature ID: 291*
   - **Challenge:** The ability to compare assemblages and features from historic sites especially those available only in the "gray literature."
   - **Justification:** Science proceeds in a step by step fashion that includes the use of comparative data to broaden the scope or depth of research topics. Within the US almost all historical archaeology is funded by agencies or institutions with very narrow, specific objectives. There are few readily available, comprehensive and detailed data bases--an exception are those published by Sonoma State University in California and a few others. But when one looks for minimum vessel lists, macro-botanical or faunal information in other regions, it becomes clear that very little is available on-line and that, because of cost, final printed reports for sites excavated under the aegis of CRM studies are stored in very few places, generally local repositories near the location of a given site. When professional archaeologists give papers and publish in journals, they pick and chose the aspects of their site that they wish to highlight. Their topics are highly variable, dependent on assorted theoretical paradigms, and the personal interests of the people involved. Often, the information another researcher needs is 'locked away' in a final report that is not readily available; equally often it is not presented in a standardized form that allows one to look at different data sets and make comparisons. It is all rather higgledy-piggledy despite efforts to impart order. This closes off the type of research that will ultimately allow the discipline to advance, to know where gaps exist, and how to fill them.

8. *[M-DACS] Access to Gray Literature ID: 305*
   - **Challenge:** Given the massive amounts of contract work, contract reports need to be digitized and made universally available to the entire profession. In digital form, they can be widely circulated and are keyword searchable. Without that, they serve a miniscule and largely local subset of archaeologists and have at best a tiny impact on the advancement of the science. Given the millions of dollars spent annually on contract-related archaeology, the expenditure is not justified by the

resulting contribution to archaeology.
- **Justification:**

9. *[M-DACS] Access to Gray Literature ID: 333*
   - **Challenge:** Assemble, organize and synthesize the gray literature for North American archeology for the past 50 years. An enormous amount of information languishes in unpublished form, creating redundancy of effort.
   - **Justification:**

10. *[M-DACS] Access to Gray Literature ID: 352*
    - **Challenge:** Getting all the CRM gray literature in the country scanned, digitized, and indexed; and setting up a controlled access system that allows qualified archeologists online access to this database.
    - **Justification:** Information contained in previous CRM reports is effectively lost if it cannot be readily accessed by researchers. The next generation of contract archeologists is losing touch with the results of earlier work. Synthesis is desperately needed in many regions but can only be done if the data are accessible.

11. *[M-DACS] Access to Information on Artifact Collections ID: 384*
    - **Challenge:** Inventorying, documenting and making accessible to search the already-existing cultural collections held in the nation's museums and repositories.
    - **Justification:** In other disciplines major infrastructural initiatives often support ambitious facilities generating new information--the large hadron collider, for example. In many of the social sciences an equally ambitious and interdisciplinary project would be documenting and making available the information already present in existing facilities, including both museums, repositories and university departments/archives. ¶ The fundamental question is what data are already available but unknown in the nation's museums and repositories? At this point it's known that the scale is enormous, but little other substantive data are at hand. Current research competitions in the field-based social sciences support projects which generate new data (in some cases, such as archaeology, by impacting remaining in situ cultural resources) without clear knowledge of whether the data to address these questions may already have been collected. These collections may be housed in different kinds of institutions and categorized under a range of rubrics (art collections, ethnographic collections, historical collections, anthropological collections, archaeological collections, or natural history collections, among others), making the relative significance or even existence of important datasets relatively unknown to scholars. Surely knowing what kinds of data are already available should be a necessarily precursor to determining what kinds must be collected next? ¶ A survey of extant collections to determine the scope and character of existing collections, and to make these resources more readily available to researchers of all kinds, would be a truly grand challenge, transforming our understanding of both cultural institutions and how their collections could be used to document and interrogate processes of social and environmental change. It would represent the single largest, most ambitious and most transformational infrastructural improvement possible in the field-based social sciences--and especially archaeology, which accepts preservation of the in situ record as an ethical precept. NSF has previously demonstrated a commitment to the development of metadata standards and cross-institutional data access in the biological sciences; such an initiative involving cultural collections is in many ways more crucial because of the greater diversity of descriptors and nomenclatures currently used in collections documentation, but in some senses may prove more tractable because of advances in both flexibility of database architecture and the prior existence of cultural metadata standards (CIDOC, Dublin Core, etc.,) in several forms. The challenges previously faced by many museums in complying with provisions of the Native American Graves Protection and Repatriation Act (NAGPRA), particularly those requiring full survey, identification and reporting of objects actually or potentially covered by the Act, may also prove instructive in this regard, and much of the institutional memory regarding how the provisions of the Act were originally met is now being lost. An ambitious, long-

term project of this kind is thus timely both in terms of the research questions being asked and the human resources necessary for its completion.

12. *[M-DACS] Access to Literature ID: 204*
   - **Challenge:** One of the key challenges in the move to digital archaeology is ensuring the access of all parties to digital resources. Enhancing access to both synthetic writings and data reports will help promote good research, and perhaps help prevent redundancy in sampling and data collection efforts, by ensuring that archaeologists simply "know what is out there."
   - **Justification:** 1. All archaeology conducted in the US should be informed by research and be conducted with the intention of increasing knowledge and scholarship. ¶ 2. There are some strong barriers created by our job settings, that undermine our ability to do top quality research archaeology. Archaeologists working in private sector settings and in some government positions do not have easy access to digital publications, such as JSTOR and other aggregator packages or articles. We can become visiting scholars, and in the future we may be able to increase our access by becoming AAA members and partaking of their new initiative. However, these are individual solutions, done at individual expense, and don't solve the larger problem. ¶ One the other side of the equation, archaeologists working in academic settings, particularly when they work in departments away from their research areas, do not know what work has been done by CRM that could inform their research. They are unaware of new excavated sites, new collections, etc., As such the technical reports written by CRM authors are not being used to their maximum potential. ¶ The lack of knowledge about what has gone before in both scenarios makes for more redundancy of work and effort. ¶ 3. Encouraging archaeology to be conducted with the research questions always in mind, is good for public benefit, as our questions about human history, behaviors, and actions are a good place to engage the curiosity of other stakeholders and other interested parties. Archaeology that is focused upon only meeting the development challenges, no matter how well done, and that simply creates inventories of artifacts and features without creating a story isn't moving us forward as needed. So, I think that creating bridges between digitally available data, technical reports, and published articles helps to create meaningful research designs and field strategies that will allow the day to day work of applied archaeologists to be integrated with the work of the scholars -- in any job setting -- who write those bigger stories.

13. *[M-DACS] Access to Reports and Data ID: 276*
   - **Challenge:** Ensuring open and preferably free access and reuse of information created through archaeological work for the benefit of research rather than profit.
   - **Justification:** The historic environment faces unprecedented challenges in remaining relevant and effective in a tightening financial climate. Primary evidence gathering is costly to undertake but informs research yet as a profession we do not share information readily in formats that enable interoperability and reuse. Constraints include protection of Intellectual Property rights (IPR), silo mentalities and inertia. Yet the internet offers novel approaches to the rapid publishing of data, and new technologies provide mechanisms for making sense of the vast amounts of information we collect. Organization of information, unbound by the constraints of IPR is thus essential to stimulate research.

14. *[M-DACS] Archiving and Access ID: 255*
   - **Challenge:** Archiving and dissemination of archaeological data
   - **Justification:** As data accumulates, access is increasingly inadequate. Traditional publications fail to give readers the detail they need. Suggest providing financial support for efforts to provide digital data through such efforts as tDAR. TDAR is currently funded with seed money from Mellon. Thereafter people will pay. Suggest providing financial backing to keep fees low and insure future viability of tDAR.

15. *[M-DACS] Data Comparability ID: 348*
   - **Challenge:** Attaining comparability among archaeological data sets.
   - **Justification:** Archaeology is unlikely to obtain or deserve respect or to be able to develop (without

enormous efforts) broad regional syntheses without coming to terms on the data classes, units of measure, etc. We need to move beyond Munsell!

16. ***[M-DACS] Data Integration ID: 233***
    - **Challenge:** Integrating observations from archaeological, ethnoarchaeological, and ethnographic work done at varying temporal and geographic scales in order to promote comparison, to identify patterns indicating similar adaptive states, and to develop generally applicable descriptions of processes of culture change.
    - **Justification:** Answering any of the big questions in archaeology requires we draw upon observations made by multiple researchers working across considerable space and time. Anyone who has attempted to build a dataset for comparative work must have encountered the frustration of having to figure out how descriptions (take lithic tool types for example) made in one time/place relate to those in another time/ place. A systematic attempt to organize existing data to facilitate large scale comparative work multiplies the value of existing data and opens the possibility that archaeologists of the future can address much bigger questions.

17. ***[M-DACS] Data Standards ID: 249***
    - **Challenge:** Greater methodological standardization to facilitate productive dialogue between researchers and maximizing the comparability of datasets and research results between multiple regions and time periods.
    - **Justification:** While many innovative approaches to several longstanding questions have and continue to be developed and applied as part of modern archaeological research, many projects retain a traditional tendency towards methodological isolation. While most researchers are well aware of what other archaeologists in their area of specialization are doing, they still tend to proceed on their own in terms of developing new approaches. In the case of lithic use-wear analysis, some truly wonderful techniques and technologies have been brought to bear regarding the question of quantifying forensic evidence of tool using behavior. These include several different forms of optical microscopy (e.g. traditional incident light and laser confocal scanning microscopy), several variants of scanning electron microscopy (e.g. traditional SEM, environmental SEM), atomic force microscopy, and infinite focus microscopy, as well as digital image and GIS analyses. However, as innovative and forward thinking as these approaches are, they usually do not offer any means of relating one study to another, and therefore of evaluating one set of results against any other. As important as furthering our understanding of a particular culture in a particular place and time is, we also need to pay equal attention to the 'bigger picture'. That is, developing a means for establishing broader contexts for interpretation that cover multiple geographic regions and time periods. As long as we continue to focus our energies on a methodologically piecemeal approach to archaeological research, we limit our ability to reconstruct the larger story of human technological and cultural evolution. With a proper and widely accessible computational infrastructure in place, greater methodological standardization will become a far more attainable goal, and the interpretive fruit that such standardization will surely bear, can be more effectively disseminated globally.

18. ***[M-DACS] Data Standards ID: 317***
    - **Challenge:** How can cultural resource management projects (survey and testing as well as data recovery) be compelled to conduct and present recovered data in a manner standardized enough to be be used in cross-project regional synthesis?
    - **Justification:**

19. ***[M-DACS] Data Standards ID: 361***
    - **Challenge:** Archaeology needs a concise set of data standards and methodological transparency that would allow comparison between sites. Additionally, safety standards need to be broadly applied to sites.
    - **Justification:** Excavation methodology in Americanist archaeology is a product of outmoded ideas regarding stratigraphy and deposition. Creating a set of standards in line with English Heritage or the MoLAS system would greatly benefit our understanding of the past and would increase

professionalism in both academic and professional archaeology.

20. *[M-DACS] Importance of Synthesis ID: 323*
   - **Challenge:** Trends in American archaeology particularly compliance archaeology, have left us with fragmented databases, that have resulted in inter-site comparisons and syntheses that have become the exception rather than the norm.
   - **Justification:** With cuts in funding for archaeology and archaeological regulations likely over the next decade it is important that we wisely choose the most useful archaeological projects, the best methodologies, and the best practitioners for investigating those projects. Decades after the adoption of the NHPA and NEPA there is still only limited guidance as to what the "Best Practices" in the field of archaeology should be. We need to start figuring out better ways for comparing data collected from thousands of different sites, at different times, in different states. Right now it is almost impossible to compare raw data collected from different sites. There is no standardized terminology, nomenclature, collection methodologies, or databases for collecting artifact and feature level data. With so much of the research of the past decades locked within inaccessible "Gray Literature," it is next to impossible to know what has already been done, what is archaeologically important, and to develop testable models. Finally, there is a wide spectrum of quality among archaeological practitioners in the US. These range from people, companies, and agencies that conduct excellent work to those whose work could be considered egregious examples of archaeological malfeasance. This combination of incompetence, shady business practices, and corruption introduces bad data, and results in a lack of faith among clients and regulators about the importance and relevance of archaeology. We need a mechanism with "due process" to protect individuals, yet will result in the removal of poor archaeologists and companies from continuing to conduct "business as usual." Currently, the only professional industry standard is RPA membership which is relatively easy to obtain and almost impossible to remove, once obtained.

21. *[M-DACS] Management of Primary Data ID: 294*
   - **Challenge:** I think that one of the biggest challenges in archaeology is the adequate management of primary data.
   - **Justification:** I am observing that often students and other researchers are using a large proportion of their time and resources finding and getting access to primary data that have already been collected but are often in obscure places and poorly organized. If those data were organized in an orderly manner and available, or at least indexed, in a well publicized website, much more time and resources could be used for study instead of looking for the data. David Anderson's PIDBA website is a good example for others to imitate.

22. *[M-DACS] National Artifact Database ID: 301*
   - **Challenge:** Construction of an artifact database for all of North America that will permit comparisons through time and space for the entire continent. Degrees of similarity must be determined and maintained to insure that oranges are not confused with grapefruits, and could be organized using a taxonomic structure.
   - **Justification:** The large volume of archaeological data that has accumulated over the last 60 years in all time periods and places has significantly reduced the " absence of evidence is not evidence of absence" argument and permits widespread comparisons both within and across geographic and cultural boundaries that could lead to evolutionary, adapational, or historical conclusions. Without a standard database such conclusions lack validity.

23. *[M-DACS] National Database ID: 275*
   - **Challenge:** Work towards a national database compiled IN COOPERATION WITH competent programmers.
   - **Justification:** This witches brew of every archaeologist working up their own is absurd with current computing power. Bifurcating system s can be devised to include prehistoric and historic sites as well as the historic architecture side which is a idiotically American approach.

24. *[M-DACS] Preservation and Access to Data ID: 279*

- **Challenge:** Anthropology in general, and archaeology in particular, must focus on developing tools to ensure long-term preservation and public availability of cultural data.
- **Justification:** Anthropology requires, by definition, cross-cultural comparative data. Archaeology is no different. Unfortunately, too often are data only published in summary form, they languish in obscure technical reports, or they are simply never distributed. This problem is not new, and has been commented on during almost every generation of archaeologists since the 1940s. Technological advances have now made it possible to develop cyber-solutions both to make data openly available and to ensure that these data are not lost over time. Sadly, as a discipline, archaeology has not kept apace of these changes. Recent mandates from funding sources (e.g., NSF) regarding data sharing agreements are a step in the right direction; however, in the absence of any single repository or data-format standards, we risk creating a plethora of disparate, unconnected, and incompatible on-line data sources. What is needed is a large-scale repository for archaeological data, including research- and compliance-based archaeologies.

25. *[M-DACS] Unit Comparability ID: 353*
- **Challenge:** I see the issue of unit comparability to be a grand challenge for the field of archaeology. While flexibility of unit construction contributes to investigator freedom and autonomy, clear methods for comparisons have not emerged within the discipline. Quantitative methods for dealing with this or some type of unit standardization seems like a logical next step within the discipline.
- **Justification:**

26. *[M-DACS] Collaboration within Regions ID: 388*
- **Challenge:** Collaboration within regions on small projects including CRM.
- **Justification:** Collections themselves become specialized knowledge. The formidable nature of reanalyzing collections on the front end only to find they are not suitable for a particular research question deters graduate students from tapping into these resources as data.

III. Issues of Practice

A. [P-AEM] Analytical & Excavation Methods

1. *[P-AEM] Classification ID:* 336

- **Challenge:** Classification
- **Justification:** I consider one of the biggest challenges is adequate classification. Why? ¶ 1. All objects considered by archaeologists were made, used and understood in terms of a folk classification. Trying to devise a scientific classification that realistically replicates this is exceedingly difficult. I have been working since 1996 (and have a publishable manuscript on this study, but owing to professional considerations (i.e. the need to eat) have not yet been able to put my results to practical test. ¶ 2. What is needed is a classification system that both maximizes the information that our informants can provide us with (i.e. a system that we think is one that the people of the past might actually be able to agree with in part) and a system that allows us to use the relevant aspects of this system for specifically archaeological purposes. ¶ 3. This is sometimes achievable using the folk classifications - for example Roman pottery forms are known by their Roman names, and these are used as part of archaeological classification; similarly, Chinese bronze forms. My stand is that wherever a folk classification is available (e.g. all Pacific Island groups) then it should be utilized. ¶ 4. Archaeologists must therefore work from the ethnographic interface backwards in time when constructing a classification of the products of technology that we call 'material culture' and artifacts. ¶ 5. Artifacts are the visible products of a huge system of technology (c.f. Jacques Ellul etc.). Even a chimp using a stick to fish for termites has to know a great deal about the materials, their properties, when to use the tool, how to use the tool, etc. etc. ¶ 6. I call my proposed system Technological Classification. ¶ More information, if needed can be sent directly to organizers.

2. *[P-AEM] Excavation Standards ID:* 253

- **Challenge:** Compelling cultural resource management companies to conduct research to a consistent scientific standard.
- **Justification:** Cultural resource management companies do the bulk of archaeological research in the US, however there are only sparse and unevenly applied state and federal guidelines to dictate how they do their work. One example of this is the stringent regulations NAGPRA applies to the investigation of Native American graves, effectively preventing their excavation, while the standards are much more vague for any other cultural group, resulting in colleagues speaking of historic burials which were "yanked out of the ground" in the space of a week. ¶ In order to be competitive, many successful CRM companies work to a lower standard than academic institutions, cutting corners and even violating OSHA when it suits them. From the outside, such companies appear to be successful, winning awards and contracts for consistently finishing projects on low budgets and on time. In many cases, their clients are ignorant of archaeological technique, and are more concerned with getting an "ok" from professionals so their inventory or construction projects can stay on track. Since archaeology is by nature, destructive, it is relatively rare for a company to be called to account for their procedure: if they write a report saying they used a specific technique consistently throughout the project, no one can replicate their work to see if different findings are achieved. ¶ Not only do companies get away with shoddy work in this manner, the contract nature of many projects also leaves them at liberty to treat professionals unprofessionally. The competitive nature of permanent hiring within companies often means that PI's are highly educated but under-experienced PhDs, or those whose experience is outdated. This may lead to an environment of maintaining unreasonable expectations and attempting to manage projects remotely by people whose time is too expensive, who don't have the time or stamina to travel into the wilderness for 10 10-hour-days in a row and gain a realistic perspective on working conditions. Techs on the other hand, though usually no less than college-educated, frequently travel from another state at their own expense to take work for a few weeks to a few months. In these circumstances it can be financially impossible to leave a project if upon arrival, one discovers that a company is behaving unethically, exposing the crew to undue risk, compelling them to work extra hours to finish on time,

skirting single occupancy regulations etc. With the irregular nature of archaeological work, one is not always able to choose not to work for a company that has treated its employees poorly in the past.

3. ***[P-AEM] Geospatial Techniques for Subsurface Cultural Resource Discovery ID:*** *378*
   - **Challenge:** (2) As to improved data acquisition, the use of non-destructive geospatial techniques to investigate subsurface cultural resources in the US and American Southwest in particular.
   - **Justification:** (2) Geospatial methods are being used to locate and assess subsurface manifestations of cultural resources extensively internationally, and by comparison, little in the US, especially in the western States. Would like to see more use of such non-destructive data retrieval tools. We have the specialists with the necessary experience in the US, but they end up traveling internationally or only using a small suite of their capabilities, skill set, and instrumentation when working in the US.

4. ***[P-AEM] Identifying Natural Resources ID:*** *205*
   - **Challenge:** To gain an understanding of the use of the Prehistoric cultural landscape by identifying ethnobotanical and natural resources in a geographic region. Using geodata and GIS overlays one can identify the natural resources and then overlay the cultural properties as identified by State Historic Preservation Offices (SHPO) and land management agencies.
   - **Justification:** As an agency archaeologist I have access to the geodata and cultural property inventories that would be the source data to conduct the study. The cultural landscape project would be valuable in identifying the prehistoric use of resources and establish a basis for identifying Traditional Cultural Properties (TCPs) for Native American groups. One of the goals would be assist the Native American groups who claim cultural affiliation to the region in connecting TCPs with their ancestral past.

5. ***[P-AEM] Lithic Assemblage Variability ID:*** *242*
   - **Challenge:** The scientific analysis of lithic assemblage variability.
   - **Justification:** Stone tools and manufacturing debris are the oldest artifacts ever recovered, are found world-wide, and dominate the archaeological record for much of human existence. Yet, archaeologists fail to adequately record the variability in lithic assemblages and rarely work to minimize inter- and intraobserver error. The problem is especially keen in American CRM, which is a "billion-dollar industry" that fails to provide such basic data that allow for comparison. How can archaeology call itself a comparative science when there is no control over the most basic data?

6. ***[P-AEM] Negative Space in Stratigraphy ID:*** *222*
   - **Challenge:** Understanding how to incorporate negative space into stratigraphy. For example, in profile, how can an erosion surface or an unconformity be represented? How can a time period of non-deposition be understood and graphically represented.
   - **Justification:** It seems, at least to me, that archaeologists are either not considering or not showing erosional surfaces as units on their graphics. We're limiting ourselves to only thinking about stratigraphy in a depositional sense. In certain environments, erosion is a major formation process. Profile graphics (1 or 2 per report/article) are often the main figures in an archaeological document and people quickly glance at the pictures to get the general conclusions and data. We need to talk about erosional surfaces as their own units representing time.

7. ***[P-AEM] Research Design ID:*** *210*
   - **Challenge:** Funding for archaeology in the U.S. is mostly centered on salvage of sites to be impacted by federally funded projects. Yet, most sites caught in this process are of limited value and contribute very little to our understanding of North American prehistory. At the same time, high-value sites not threatened by federal projects, are still rapidly disappearing due to expanding urbanization, modern agricultural techniques and generally from the impacts of an ever increasing population. The challenge would be to shift funding to a grand strategy to preserve or salvage key sites in the U.S. irrespective of the traditional concerns of federally-mandated salvage projects.
   - **Justification:**

8. ***[P-AEM] Research Design ID:*** *271*

- **Challenge:** Proportionality: how do we justify expenditure of public funds in a time recession
- **Justification:** At a time of public funding constraints and developer conservatism how does one justify or at least ensure proportionality in developer led archaeological endeavors ?. ¶ One answer is to ensure appropriate actions and justification would be an objective to define spatially driven research agendas (local, regional, national, international frameworks) to drive acceptability from developers and public, proportionate activity, and efficient, more effective, use of funding; using the presentation of gains and value by academic achievement to counter the argument of archaeologists as collectors, with more data than they know what to do with, and full museums. ¶ Alternatively we can keep with the current UK situation of monitoring based on guess work and scanty or unevenly distributed evidence, poorly explained justifications and remain in conflict with our clients.

9. ***[P-AEM] Residues ID:*** *362*
   - **Challenge:** Residues on artifacts should be routinely identified and analyzed, just like the artifacts themselves.
   - **Justification:** Chemical residues on potsherds excavated in Chaco Canyon indicate the ancient ceramic vessels contained a chocolate beverage. The ancient beverage undoubtedly contained other ingredients as well, as yet not identified. Artifacts of all kinds should be routinely examined for chemical traces of their ancient use.

10. ***[P-AEM] Taphonomic Processes ID:*** *307*
    - **Challenge:** To better understand the taphonomic processes that happen on archaeological sites. Too many archaeologists assume that material culture is redolent with cultural information. (We all think this is important.) But in reality most cultural material has undergone an enormous amount of physical movement, fragmentation, decay (diagenisis) so that the detectable traces very distant from the lives of the people who occupied sites in the past. We need more forensic style research to explore this. Sieving, biochemical analysis etc. all have important roles. We also need to ensure that enough material is preserved in situ for future generations of archaeologists.
    - **Justification:** I hope the above says it all concisely. However, Michael Schiffer's cultural and natural transforms is a good place to start for those interested. Site formation processes, geoarchaeological techniques and proteomics all have a role. ¶ I'd also suggest a programme deliberately searches out sites where you have a range of depositional environments. Shipwrecks (time capsules), waterlogged settlement sites, gradual accumulation with excellent preservation of organic material to dry sites where only most robust materials are preserved. ¶ Burial sites, habitation sites (long term and transitory) all important. ¶ I'd like to see the programme use sites from a wide range of ecosystems.

11. ***[P-AEM] Research Design ID:*** *219*
    - **Challenge:** In my opinion the biggest problem facing archaeology (worldwide) is the accumulation of data with no research plan-- artifacts, samples, associated materials that are collected because they are there, because the more stuff the more one can charge for processing & analysis. Research design has fallen out of fashion even in many academic settings and is nearly absent in most CRM projects I have been involved in. Digitizing data for the sake of having digitized data is neither scientific nor helpful.
    - **Justification:**

B. **[P-DTT] Deficiencies in Theory & Training**
   1. ***[P-DTT] [P-IP] ID:*** *321*
      - **Challenge:** I believe a grand challenge is to develop a broad inclusive philosophical perspective of how, why, and who does the archaeological interpretation of the past. This entails not only accepting the values, input, and controls of descendent communities but a willingness to make our work relevant to the broadest public possible so that public resources can be spent on effective and meaningful work. This would be greatly facilitated by a centralized information storage entity that could keep track of all kinds of existing and future data. The system would have to be one that

would allow for significant variability in data format as it does not make sense to rework information to fit database boxes

- **Justification:** There already exists an enormous amount of summary and raw data as well as extant curated collections of artifacts and samples that are inadequately used for contemporary research and thus inadequately curated. We should consider a significant reduction if not a moratorium on new data collection until this situation is corrected. This includes consideration of non-traditional approaches to site impact mitigation measures associated with construction and other resource disturbing activities. Better awareness of, and access to these resources, as well as meaningful oversight of their use by descendent communities would do a great deal toward making our work valuable to the public. The general perception is that archaeological studies are still primarily the playground of the upper-middle class, male, WASPs. We need to make our work relevant to more people and to more contemporary global environmental and cultural issues.

2. *[P-DTT] ID: 201*
   - **Challenge:** To de-construct the boundary between theoretical and scientific archaeologies
   - **Justification:** To integrate more comprehensively findings from different archaeological subfield, especially between those that fall on either side of the humanities/natural sciences divide.

3. *[P-DTT] ID: 224*
   - **Challenge:** Archaeological Foundations: exploring the veracity of popular assumptions in archaeology that form the basis to important issues in our discipline.
   - **Justification:** Archaeologists use a variety of assumptions to link method, theory, and grand ideas. These include concepts such as "efficiency," "mobility patterning," and "village." Efficiency is a term that is so broadly used in so many different contexts that it's meaning is no longer clear. For example, lithic efficiency implies conservation of raw materials such as using bifaces as cores. Yet this key concept is an assumption with little hard data to support or negate the idea. Efficiency is also used to in the contexts of human ecology and energetic efficiency, and many other contexts. Do humans really strive to be efficient? Mobility patterning is often reduced to logistical vs. residential systems although ethnographic and theoretical literature may indicate a much more complex construction. Simplifying what may be complex construction could be obscuring critical insights on modeling prehistoric lifeways. Similarly, the term village is frequently used without rigorous definitions. For some, a village is occupied six months out of year, while essentially permanent for other scholars. Also of importance, how do we recognize a village in the archaeological record and distinguish it from an aggregation site or a site that was annually reused for a short time. Archaeologist often assume midden soils, high artifact density, and a large site size are a defining factor in identifying villages although this could also be a result of annual reoccupation or aggregation for a short period of time. Unless we come to better understand the variety of assumptions archaeologists are using along with the validity of those ideas, our foundations to answering the grand ideas will remain just out of reach. Grand ideas in archaeology deserve grand/solid foundations to get there.

4. *[P-DTT] ID: 260*
   - **Challenge:** The major objective or peril of the archaeologists and their works: from academic perspective to professional on environmental studies.
   - **Justification:** Increase of remains without good analyses; professionals with a poor formation and background; low time to study and interpret the findings; absence of good researchers and theory because of this challenge of perspective.

5. *[P-DTT] ID: 263*
   - **Challenge:** Education, education, education! And the humbleness that comes with education. American archaeologists are among some of the most poorly educated bourgeoisie I know, yet they are the ones who drive CRM. They know nothing about art, philology, literature, logic, or even theatre. It is not amusing hearing them parrot Europeans who are way more educated, and have been inculcated in their own cultural history since high school.

- **Justification:** Science, and critical intelligence, is the biggest challenge facing archaeology in the 21st century. In the face of the most rapid change in technology and social organization since the early 20th C., archaeologists apparently have almost nothing to contribute to public policy or have nothing to say about how to live the good life in a democratic capitalist society - in fact, most Americanist archaeologist seem to have no idea they are living in an historically unique society. For a historical discipline, that's inexcusable.

6. *[P-DTT] ID: 270*
   - **Challenge:** To encourage archaeologists to see that the discipline is a science, not an arts subject.
   - **Justification:** There is a tendency for archaeology to be taught (at least in the UK) effectively as an arts subject - and as an extension of the history of art. Studies are heavily artifact based, and those in the commercial sector use terminology and methods of thinking from the mid-20th century, such as culture-historicism and migrationism. There is a need for thinking to be updated, for the discipline to become much more science based in terms of thinking and methodology (as opposed to a call for more scientific techniques to be used).

7. *[P-DTT] ID: 277*
   - **Challenge:** Creating a solid basis for the contribution to contemporary society formation archaeology can make: this includes addressing long term processes connected to the present, finding a scientific process to study empirical information with the aim of social and cultural understanding, and disseminate the inherent contradiction in the natural and social side of archaeological conduct.
   - **Justification:** The discipline is currently increasingly dragged into the study of particulars and details which are seemingly detached from societal interest, whereas the big questions on ongoing human processes and the evidence for their development that can only be studied by archaeology are often ignored. The scientific conduct within the discipline suffers from two main related issues. The first, is the unclear separation of the knowledge production of natural science and the knowledge production of social science. Both the scientific process and the type of knowledge produced are incommensurable and currently cause a lot of confusion in the way research is designed and funded. At the same time future development of the discipline should make sure a separation will lead to mutually constructive collaborations. The second is the suffering of the development within disciplinary thought of the 'tolerance trap' or the concealed relativism and separatism of eclectic approaches in theory and method. Currently the discipline at large seems to accept uncritically that incommensurable ideas will lead to solid arguments on the basis of loose connections to subsequently employed methods. Students are currently taught to blindly follow this trap and this stalls the development of the discipline and critical thought. The disciplines reaction to post-modernism currently results in very similar, unsupported research constructions. This contributes to the inability of the discipline to prove its societal relevance and to address the core comparative intellectual challenges through time and space.

8. *[P-DTT] ID: 282*
   - **Challenge:** I think the biggest challenge for archaeology is its lack of an overarching conceptual framework that would allow us to assign meaning to pattern derived empirically. As things stand now (and I am speaking globally), and unlike the life sciences, there are 4-5 competing paradigms (e.g., culture history - dominant world-wide; behavioral ecology, evolutionary archaeology, dual inheritance theory, etc.) that differ profoundly from one another in terms of their preconceptions and assumptions about what the past was like. Not a particularly good way to 'do science', but 'doing science' is not the goal of many archaeologies.
   - **Justification:** I will confine my remarks to an archaeology that aspires to be 'science-like'. I define science as a collection of methods for evaluating the empirical sufficiency of knowledge claims about the world of sense experience. Epistemology (how we know what we think we know about the remote human past) in general, and the logic of inference, in particular, are practically always implicit in archaeology, yet the biases, preconceptions, and assumptions that underlie them affect

research at every level or stage in the research process (what constitutes data, how pattern is to be defined and interpreted). If explanation is our goal, we can only assign meaning to pattern in terms of an overarching conceptual framework. Evolutionary biology is the overarching conceptual framework that unifies the life sciences world-wide. Archaeology doesn't have a unifying conceptual framework; it's still waiting for its Darwin. Since meaning comes from humans, and not from nature, meaning can only be assigned to pattern. It is not an intrinsic feature of pattern. Since archaeology doesn't have such a framework, we have no basis for assigning meaning to pattern. Meaning is 'up for grabs', so to speak, and we usually resort to post-hoc accommodation (meaning derived inductively after an analysis is completed) in order to explain pattern. The problem with these purely inductive approaches is that explanation acquires credibility only within the confines of a research tradition, and might be absurd outside it. This is a complex problem bound up in implicit differences in the meaning of a central concept like 'culture' across distinct, but overlapping, research traditions; our lack of a universal meta-language (like mathematics) that might transcend research communities, and a number of other historical factors. While post-hoc accommodation is to some extent unavoidable in a poorly axiomatized discipline like archaeology, our research designs would be stronger if we were to build a deductive component into our research protocols. That would help, but the biggest problem is the lack of a conceptual framework. I've argued that we don't have one, we need one, and whatever form it might take, that it's parameters should be consistent with the core concepts of evolutionary biology, the most powerful conceptual framework ever devised to account for the origins and development of life on earth. There are some 'proto-paradigms' floating around that are consistent with evolutionary biology. They include behavioral ecology, evolutionary ecology, evolutionary psychology, and dual-inheritance theory. Methodology by itself, no matter how sophisticated (and I'm thinking here of agent-based modeling and other simulation approaches), can never overcome the lack of an overarching conceptual framework.

9. *[P-DTT] ID: 285*
   - **Challenge:** Combining theory and practice. There is a lot of theoretical discussions in archaeology, but mostly it is an isolated branch of its own. Archaeological practice (e.g. excavations, laboratory examinations) is hardly influenced by theoretical discussions as well as theories are hardly ever tested against and applied to practical work and/or concrete examples.
   - **Justification:**

10. *[P-DTT] ID: 288*
    - **Challenge:** Apathy prevailing amongst academics and institute technicians, leading all the way back to school formation and universities general education in archaeology maybe one reason is the holding of old archaeological theoretical regional models prevailing over. I will like to see more aperture in universities, institutes, more flexibility towards themes less explored or totally unknown but that are important to archaeology operation and functionality within the society. I will like to see more evolution in concepts, ideas, behaviors of professionals and technicians. More preparations in English and less fear to the American neighbors, or other concepts, ideas and behaviors from the outside word.
    - **Justification:** there is a huge hole in which Mexican archaeology is in...but is not new... this has been going on since the last decades. but no one can or do nothing, why is that? I may ask. what is it that universities are teaching that aren´t changing the curricula towards the incorporation of new ideas, behaviors and concepts? is not the main scenario o formation again, based in the universities curricula provide us with the means and ways to make better things... I believe university can be the scenario from where we should act.

11. *[P-DTT] ID: 290*
    - **Challenge:** Observation is re-cognition. Methodologies derive from paradigms, which are embedded in our socialization as well as training. The grand challenge is to get archaeologists willing and capable to think outside these boxes, our customary paradigms.
    - **Justification:** Archaeology has been gradually shifting toward postcolonial perspectives. American

archaeology was ill-served by the pseudo-scientific ("physics envy") New Archaeology of the generation passing. Encompassing non-Western worldviews is slowly opening the practice of archaeology, and a grand challenge is to meld a non-Western worldview with the practice of archaeology (as Eldon Yellowhorn is attempting). Archaeologists need to understand the sociology of science, the rhetorics commonly used, how hypotheses should derive from empirical observations (as C.S. Peirce argued, not the other way as Hempel claimed). Archaeologists need familiarity with cultural and historical geographers and ethnohistorians. Perhaps RPA could conduct regular in-service conferences --such as lawyers and doctors attend to maintain their licenses-- to broaden practitioners' base of anthropological knowledge and capacity to hypothesize from non-Western worldviews as well as conventional Enlightenment rationality.

12. **[P-DTT] ID:** *292*
   - **Challenge:** Abandon the post processual mantra that permits archaeologists to honor any idea of what constitutes an explanation. Focus upon developing an archaeology whose practitioners actually do science. Of course there are many definitions of science. But, the productive sciences (whatever their intellectual, historical, justifications) always rely upon the ability to organize empirical data to demonstrate functional interrelationships subject to intersubjective testability as the foundation upon which to decide which puzzles to try to solve, which interpretations of those interrelationships they chose to support, and which other to accept as not yet shown to be false.
   - **Justification:** Forget the analysis of history, archaeology, philosophy of science, and detailed methodological discussion underpinning some conclusion that there are 1,000,000 instead of 1,000,500 angels dancing on the head of a pin. ¶ Much of the negative reaction to the beginning of a scientific archaeology called processual-new-whatever archaeology was a result, in my opinion, of the emotional, subjective discomfort with "ignoring the human, psychological component" of human experience. That discomfort resulted in many forms of post-processual archaeology whose adherents accepted virtually any "explanation" as valid even though its proponent had no interacting empirical data that could be tested and the proposed explanation refuted ... making those forms of archaeology composed of pictures that any other person was free to interpret as they chose, again with no empirical substance to their different interpretation. The result: an archaeology whose proponents were/are an analog to the proponents of creationism. If that is what the profession chooses to call archaeology, then it should be called an "art," not an endeavor that seeks "explanation and understanding" of anything.

13. **[P-DTT] ID:** *320*
   - **Challenge:** The grand challenge for archaeology in the immediate future is to bring it back to the basics of fieldwork and artifact study and away from the obsession with abstract pseudo-sociological theorizing based on minimal evidence. To achieve this more thorough, rigorous, groundwork for students needs to be given; they should be taught the distinction between imaginative interpretation and unsubstantiated storytelling.
   - **Justification:** A survey of university reading lists shows the urgent necessity for this

14. **[P-DTT] ID:** *328*
   - **Challenge:** Creating a more inclusive archaeology which challenges and involves the entire diversity of citizens in the investigation and learning about our past including non-material aspects of our heritage and cultures.
   - **Justification:** Science, including archaeology, needs to find ways to engage the public, increase scientific (and archaeological) literacy, by making findings and opportunities to participate in investigations more accessible to all people. After all archaeology is about people.

15. **[P-DTT] ID:** *338*
   - **Challenge:** Merge techno-history into all facets of archaeology
   - **Justification:** Training in historical arch is domestic sites oriented, so when confronted with something outside that realm, chaos ensues, there is no theoretical or practical underpinning to technology and how it changes the archaeological record.

16. *[P-DTT] ID: 340*
    - **Challenge:** Computational infrastructure will not address the key scientific problem in archaeology, which is to develop a natively archaeological theory rather than borrowing and misapplying theory developed in other disciplines. It can assist by providing archaeologists who are trained in programming methods to apply new theoretical constructs to the vast data sets that have developed in public archaeology. I see the problem primarily in providing the needed training to the entire upcoming generation of archaeologists rather than any grand hardware based initiative or an attempt to have a computationally -trained elite provide tools that the rest would apply with limed understanding of their purpose
    - **Justification:**
17. *[P-DTT] ID: 343*
    - **Challenge:** The grand challenge in archaeology today is "knowing what we know" Students, consultants, and academes (not necessarily mutually exclusive) produce an immense amount of data every year; without broad syntheses and centralized indexing, we have no way to know if our studies are new and innovative, or repetitious and redundant.
    - **Justification:**
18. *[P-DTT] ID: 376*
    - **Challenge:** Incorporate industrial archaeology into the mainstream.
    - **Justification:** Archaeologists tend to be trained in domestic site archaeology and don't know anything about industrial archaeology and tend to vastly underestimate the problems with the result that they read a few secondary sources, get it wrong and because SHPO staff also are unaware, inaccuracies perpetuate themselves.
19. *[P-DTT] ID: 386*
    - **Challenge:** 2. Archaeologists are increasingly letting their scientific analyses do their thinking for them.
    - **Justification:** For item 2, we are cranking out large numbers of 'pilot' studies using increasingly sophisticated analytical techniques, but all too often on the basis of a handful of samples on one hand, and a lack of understanding of the limitations of the methods on the other, as archaeologists we are coming u with poorly supported conclusions.

C. [P-IP] Indigenous Perspectives
1. *[P-IP] ID: 221*
    - **Challenge:** Consideration of above ground stone and earth sites, astronomical alignments, and oral tradition from Native American people need to be considered as well as digging in the ground for artifacts.
    - **Justification:** Archeology comes from the broader study of Anthropology, the study of people. Archeology needs to consider a broader base of information to get a true picture of how people long ago lived. Astronomical sites exist world wide as a calendar system. Above ground stone sites and earth sites are key to figuring out ceremonial sites that are often astronomically aligned. Native American oral tradition is vital to follow threads of important legacy. Without a greater consideration of information archeologist are only getting a partial picture. The time is now to enhance the field work to include this.
2. *[P-IP] ID: 318*
    - **Challenge:** Adequately addressing and teaching upcoming professionals how to deal respectfully and appropriately with diverse perspectives on the past and ways of knowing. Currently, the lessons/approach seem to be "Be PC" and "just ignore these differences."
    - **Justification:** My experience has been predominately in dealing with different perspectives on Native American knowledge and input on archaeological issues in the United States. Sadly, rather than recognize that, even though there are many diverse perspectives, and that these will not always reconcile, several other approaches seem to prevail: Ignore the issue and make sure our paths don't cross; Give in to "this" (usually some issue dealing with human remains) and maybe we'll

be allowed to do "that;" We have so much to be guilty about, let's not argue and use that as our mea culpa. ¶ Such approaches are in themselves disrespectful and patronizing. They also ignore the opportunities to share knowledge, learn from a different perspective, and interact as professionals. I'm not saying we haven't made progress in this regard, but I do believe that, not only does this need to be part of the explicit dialogue of the field, but that the leadership of SAA in particular has spent many recent years head-in-sand so that it doesn't have to wonder about how to address the issue of whether its actions and approaches reflect those of its membership, and whether it could or should affect positive change in this regard.

3. **[P-IP] ID:** *329*
   - **Challenge:** How can archaeology move away from its Euro-centric colonial bias and encourage and promote indigenous archaeology? ¶ How can archaeology move toward encouraging participatory action research between archaeologists and descendant communities?
   - **Justification:**
4. **[P-IP] ID:** *363*
   - **Challenge:** How do we remain professionally and ethically relevant to descendant groups, the general public, students of all ages, and ourselves?
   - **Justification:** Our profession often seems self-serving and directed toward research questions that are of interest to archaeologists but are either not understood or not of interest to descendants of cultures we study and the public (usually curious about archaeology and in many cases paying the bills for either CRM projects or university salaries). How do we generate interest in cultural and site conservation throughout the educational system and with the public to ensure that archaeological resources are protected because of both their cultural and scientific importance.
5. **[P-IP] ID:** *381*
   - **Challenge:** Integrating Indigenous perspectives into interpretations of the archaeological past without sounding imperialist or colonialist
   - **Justification:** This is a significant problem in Australia due to its history of colonization, denigration of Indigenous culture and the fracturing of that culture by past (and present) colonial practices that leave Aboriginal people marginalized and disregarded by the dominant culture.

D. **[P-IR] Interdisciplinary Research**
   1. **[P-IR] ID:** *246*
      - **Challenge:** Integrating the many and varied fields of anthropology and archaeology and natural sciences and computer sciences.
      - **Justification:** The Dept. of Integrated Biology at U. Calif.-Berkeley is an example of a truly 21st-century scientific enterprise that understands the importance of ramifying research. Its founder and chair, Marvalee Wake, crusades for this. Wake and I have organized a session for this year's Am. Anthropological Association meeting, in San Francisco, to bring members of her faculty and anthropologists together to explore integrating research in this ever-ramifying model. She can provide some of her papers on integrating biology and biology with other sciences. A very major problem in anthropology/archaeology is the expectation that only single-authored books or major papers should count for tenure, promotion, or employment. This counter-productive criterion must be combatted, and NSF is a good agent to do so.
   2. **[P-IR] ID:** *247*
      - **Challenge:** The integration of archaeological information with ethnographic, historic, and traditional information.
      - **Justification:** As currently practiced particularly in CRM circles, archaeological information is isolated from other sources of information rather than integrated into the whole of available knowledge. This results in a narrowing of the field and a growing disconnect from the social utility formerly touted by practitioners.
   3. **[P-IR] ID:** *248*
      - **Challenge:** Archaeology is an invaluable tool as part of a larger structure of "pre-historic" studies. It

is, however, too narrow a focus to stand alone in the challenge of understanding the undocumented human past.

- **Justification:** It is imperative that additional highly structured sciences of genetics, physics, architecture, engineering, biology, sociology, etc. be applied for the most comprehensive interpretation of evidence from antiquity. Each of these sciences has its own evolved language, accumulated body of learning and network for sharing new research. Objective interpretation is impossible if the methodology is confined to only one modern discipline.

4. *[P-IR] ID: 257*
   - **Challenge:** The technical achievements of ancient civilizations are largely not recognized, understood or reported accurately due to lack of technical subject matter in archaeological coursework. Consequently field data taken is largely descriptive rather than analyzed for engineering/scientific principles that ancient civilizations had understood on an empirical basis and put into practice.
   - **Justification:** As many archaeological discoveries in years ahead lie at the interface of different disciplines, archaeological training needs to be deepened to include some basic physics, mathematics and engineering coursework otherwise students with only classical training will be unable to understand specialist contributions and their relevance to interpretation of a society's use of technology to solve sustainability problems. In short, too many social interpretations and speculative theories for societal change absent of an understanding of the technologies and innovations employed by societies to solve sustainability problems and deliver progress to their people.

E. **[P-MJG] Money, Jobs & Government**
   1. *[P-MJG] ID: 235*
      - **Challenge:** In order to slash prices and stay competitive in the CRM world, I see a growing trend of compliance over science.
      - **Justification:** CRM companies often use formulaic approaches to projects of similar nature such as cell towers, or solar farms, writing 75% of the report before the take a step onto the project area. Projects are carried out with thin and inexperienced crews, with some companies using single person shovel test crews or conducted surface collections using 30 foot intervals. This only hurts the legitimate companies trying to do the right thing.
   2. *[P-MJG] ID: 245*
      - **Challenge:** 1) permanent job positions for those archaeologists w/ m.s. or PhDs ¶ 2) federal land management agencies not following cultural resource laws
      - **Justification:** 1) permanent job positions for those archaeologists w/ mos. or PhDs ¶ I and others with my qualifications (M.Sc./ABD and 13 years experience can't get better than a temporary job with no benefits), which is a paltry return on such an expensive educational investment. ¶ 2) federal land management agencies not following cultural resource laws. ¶ BLM consistently begins projects in WA/OR without completing survey work -let alone reporting.
   3. *[P-MJG] ID: 264*
      - **Challenge:** One of the biggest problems in archaeology in the UK is the lack of jobs, many people are leaving university with a degree in archaeology and no chance of a job in the industry. One of the other biggest problems is lack of storage for archaeological artifacts.
      - **Justification:** The job market in the UK is not good at present and for anyone in archaeology is non-existent. It is a real shame as people will go into other areas and we will lose expertise.
   4. *[P-MJG] ID: 272*
      - **Challenge:** Government regulation over archeological sites.
      - **Justification:** Abuse of power in our government is protecting many sites from excavation and or study.
   5. *[P-MJG] ID: 280*
      - **Challenge:** Representing archaeology to the public as not exclusively limited to Indiana Jones/male

practitioners. This will be tough given that despite more than 50% of archaeologists being female the ratio of your own panel is 5:1 male. Sigh.

- **Justification:** Most social sciences and most sciences are acutely aware of the representation of the discipline through its practitioners. Yet archaeology is one of the least diverse fields (in terms of the ethnicity of practitioners) and least attentive to representation (despite the fact that more than half of archaeology graduate students, for example, are female). Our field loses credibility when we appear to be stuck in 19th century paradigm of highly educated males using an authoritative voice to explain the past.

6. ***[P-MJG] ID:*** *296*
    - **Challenge:** Poor pay and working conditions for field archaeologists caused by competitive tendering for projects and intense undercutting by archaeological contracting companies.
    - **Justification:** Poor pay and conditions for field staff in contacting archaeology. Some archaeological contractors exploit field archaeologists by offering short term contracts or expect staff to be self employed at well below IfA approved day rates knowing that with the economy in its current state and archaeological jobs at a premium they will be able to 'get away with it'. Lack of pension provision, unpaid travel time and use of volunteers in place of employed staff all further highlight the problem. The problems are exacerbated by the attitudes of some archaeological consultants who appear to have no interest preserving/recording the archaeological resource, just saving their clients money. Archaeology is a service most developers do not wish to pay for so price not quality nearly always determines the award of contracts. Most clients do not know how to distinguish quality of the archaeological 'product'. ¶ Low pay and conditions leads to low morale for site staff which in turn leads to a poorer quality of archaeological fieldwork as there is a constant loss of skilled field archaeologists who seek more stable jobs outside archaeology. The skills base being lost to archaeology now will be sorely missed 5-10 years in the future. Skilled field archaeologists should be seen as integral to the success of a project, not a disposable resource that can be easily replaced. It is possible to create a different structural model for an archaeological company where the excavators are the key to the success of the company and are suitably rewarded with a structured career grade however this would never work in the present archaeological market. ¶ The IfA appears toothless, unable or unwilling to deal with these issues.

7. ***[P-MJG] ID:*** *310*
    - **Challenge:** NAGPRA regulations in the U.S. and similar regulations in other countries hinders the collection of archaeological and physical anthropological data.
    - **Justification:** Unless NAGPRA or similar regulations are reversed or loosened, archaeologists and physical anthropologists will not be able to collect new data. Furthermore, existing material in museum collections will be returned to local people, and therefore lost to future researchers.

8. ***[P-MJG] ID:*** *349*
    - **Challenge:** What are the American people going to do with the growing number of archaeological sites that have not fully evaluated for National Register eligibility?
    - **Justification:** Public land management agencies at all government levels face a huge backlog of unevaluated sites that they choose to manage as eligible, and many sites that were determined eligible by archaeologists who failed to provide the research questions to validate their determinations. As recreation and resource needs expand, these sites might eliminate thousands of acres from access or development. While not necessarily a bad thing for archaeology, these stumbling points for future use of public resources might turn an already anxious citizenry against the protection of valuable sites. There is already talk of turning some federal public lands back to the states to use as they see fit, and the budget for cultural resource management is stretched very thin. This non-renewable resource, hidden in our Nation's forest, park, and open lands, needs to be assessed for future protection, data recovery, and loss.

9. ***[P-MJG] ID:*** *356*
    - **Challenge:** The lack of experienced/seasoned mentors in CRM firms is leading to a generation of

professionals who do not grow professionally and produce worthless or inaccurate interpretations.... if an interpretation is given at all.

- **Justification:** Examine the number of firms doing CRM who are staffed by people almost entirely under 30. I relished working for firms with accomplished archaeologists so that I could learn from the best. Too many firms are run by people who are not trained to work in the region they are in and hire inexperienced principal investigators fresh out of a MA programs to save a buck. These PIs are typically running crews with more experience than they have!

F. **[P-PRP] Physical Resource Protection**
  1. *[P-PRP] [P-ITP] ID: 373*
     - **Challenge:** Archaeologists need to develop guidelines and to give far more consideration to the question of when excavation is appropriate and when excavation puts archaeological remains at great risk. The discipline needs to sort out its roles and responsibilities in terms of data recovery versus preservation in place. A related challenge is that archaeologists need to approach their relationships with indigenous people and descendent populations with perspectives influenced by equitability and meaningful partnership.
     - **Justification:** A range of recent events have illustrated the vulnerability of archaeological property in various regions of the world. Whether it is looting activity in the American west or the effects of conflict on archaeological property throughout the Middle East, we are finding that archaeological sites, even in areas that we thought were stable and protected can be gravely endangered with very little warning. One of the unfortunate realities is that archaeological sites that have been excavated - even excavated sites that have been prepared and hardened for tourism are more vulnerable than sites that are still buried. At a recent conference at the American Academy in Rome that focused on preservation in crisis areas, there was a consensus that excavation was not a solution for future archaeological preservation in these situations. There are also examples where sound partnerships between western archaeologists and host nation personnel have resulted in site preservation and regional stability. Archaeologists who work in crisis areas are discovering that there is a tremendous amount of work that can be done in terms of inventory and capacity building for heritage management programs. These approaches can also result in impressive and unexpected site discoveries as well as new knowledge. Responsible archaeologists may be looking at a paradigm shift where approaches to new research may need to move away from excavation as the primary tool for data collection.
  2. *[P-PRP] ID: 203*
     - **Challenge:** 2) problems in archaeological practice in countries where original population are
  3. *[P-PRP] ID: 209*
     - **Challenge:** The grand challenge I foresee is to develop and orient the scientific technology to study climatic change, sea temperature fluctuation, and the rising sea levels around the North American continent before the exposed archaeological sites in the 0 to 4 meter elevation are inundated and unavailable for study. Scripps Institute of Oceanography has scientific evidence these forces have been in process for the past 5,000 years and are accelerating with predicted sea level rise of at least 4 meters in the next century, yet few archaeologists have responded to the crisis that thousands of archaeological sites, buildings, and real estate will be lost when the U.S. Army Corps of Engineers responds.
     - **Justification:** Global sea level rise from rising temperatures, sea level temperature fluctuations, melting glaciers, and other forces threaten entire coastal cities and will virtually eliminate thousands of archaeological sites. The response of federal agencies to attempt to protect those cities will result in massive landform damage that will impact coastal archaeology sites. The opportunity to study coastal archaeology sites for evidence of the rise of this process over the past 5,000 years will decrease as this process accelerates in the next five decades. Scripps Institute of Oceanography began collecting marine shell, diatom, and other data from archaeological sites in the 1950s, yet few archaeologists have focused modern computer technology toward studying these effects or building

models for interpretation. Pat Masters of Scripps Institute of Oceanography has been working with California archaeologists for the past 35+ years to compile baseline data, but few researchers have joined in this grand challenge or sought assistance from federal agencies. The problem will become a national crisis the next 30-years and will affect human population demographics, food chain supply systems, and have an enormous impact on the national economy.

4. *[P-PRP] ID: 211*
   - **Challenge:** Providing funding for the storage and archive of archaeological finds, with public access and written documentation of every excavation/exploration
   - **Justification:** There is a clear shortage of storage and accessibility for many artifacts, in many voluntary organizations such as the Council for British Archaeology, they look to fund archaeology from grass roots level upwards, but the main hindrance is what to do with the finds afterwards, in an ideal world industrial knowledge (say from a corporation who has a catalogue of many items) could educate and pass on their business program to aid archaeological "warehousing" in each country so that research, business and education could utilize the resources. A central system is required

5. *[P-PRP] ID: 238*
   - **Challenge:** In California archaeology and ethnography many artifact collections and field notes of early ethnographers remain in dusty archives or in less than adequate University labs and archives. Although some efforts have been made over the last couple of decades to inventory and accession these materials, it remains unpublished. Instead of creating new research projects, have students, and their professors for that matter, address this shortcoming in a serious fashion.
   - **Justification:** It really is not complicated to understand the importance of primary data. This data is what generates the research questions. To simply get the information into useable descriptive formats can be a huge contribution.

6. *[P-PRP] ID: 268*
   - **Challenge:** England: protecting the buried heritage; ensuring archaeological considerations are properly safeguarded in current and forthcoming town and country planning measures - a high point was PPG16 and subsequent replacement legislation and guidance are weaker for archaeology; somehow raising standards in archaeological fieldwork and dissemination - 'regulators' cannot achieve this as evidenced by recent failures of regulators in other sectors, e.g. banking
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7. *[P-PRP] ID: 274*
   - **Challenge:** Verifying the locations of the remaining, probably significant archaeological sites in the United States, and devising measures for their protection.
   - **Justification:** While we have over 100 years of archaeological survey to identify sites, subsequent development and natural activities have eliminated many sites. We need to know what we have left in order to prioritize the preservation of those rare survivors.

8. *[P-PRP] ID: 303*
   - **Challenge:** Basic archaeological inventory, salvage/rescue fieldwork, dating, establishment of type series and setting out some initial cross-boundary research agendas for African archaeology, particularly in sub-Saharan Africa. This would involve close collaboration between local expert archaeologists, long-term training programs in capacity building & archaeological skills for the next generation of in-country African archaeologists, enhanced and enactable legislation/institutional strengthening and targeted funding to assure the long-term conservation of sites and archaeological archives.
   - **Justification:** At present, research is restricted to a few very limited 'keyhole' views or short-term

projects initiated by foreign academics. The complicated flows of prehistory and protohistory are neglected in favor of the pat and emotive narratives of early man, rock art, pyramids, Islam and slavery. Ongoing industrial and commercial development is leading to the irreplaceable loss of swathes of information about Africa's roots, and limited university funding for archaeology means that the next generation of African archaeologists is increasingly thin on the ground. ¶ In the face of growing industrial development, 'cultural heritage' is often only addressed as a very minor sub-topic in Environmental & Social Impact Assessments. It is frequently tackled by sociologists or environmental generalists. Combined with limited governmental/funder scrutiny, this can lead to extensive damage of archaeological resources. ¶ Given diminishing world resources and increasing investor focus on Africa's 'untapped' wealth, the continent with the weakest active heritage protection regimes is facing massive environmental challenges from powerful interests. Establishing local, community based and sustainable archaeology and cultural heritage protection, inventory, research and management programs is key to the long-term survival of sites, the proper investigation of archaeological remains and the appropriate, truthful and enthusiastic dissemination of the stories of Africa's pasts.

9. **[P-PRP] ID:** *347*
   - **Challenge:** protecting the resource until research can take place
   - **Justification:** If sites don't exist, the most elegant research designs can't take place.

10. **[P-PRP] ID:** *359*
    - **Challenge:** 1- The curation and conservation of archaeological collections -- artifacts, notes, photos, etc. -- worldwide.
    - **Justification:** Funding agencies have always given top priority to fieldwork. This is important, of course, but so too is the long-term integrity of collections and their supporting documentation that have been collected throughout the world over the past half century, often with NSF support. Existing storage and curatorial facilities are inadequate, especially outside the "First World", and many important collections have been lost. This is especially important given the rapid destruction of the archaeological record in many parties of the world: in many cases, existing collections are all the archaeological material we will ever have from many prehistoric sites and features and landscapes.

11. **[P-PRP] ID:** *385*
    - **Challenge:** 1. Archaeological sites are a non-renewable resource, rapidly declining.
    - **Justification:** My concerns are about pragmatic issues of 'how' we do archaeology, not 'what' we should be doing in research. ¶ For item 1, look at Mexico City, for example the the difficult of finding formative cultural information owing to the intensive urbanization.

12. **[P-PRP] ID:** *387*
    - **Challenge:** Almost all scientific disciplines are judged at base by how they value, and take care of their data. Examination of their data through time is used to further the discipline and frankly structures the discipline. Archaeologists in general do not value their collections and it shows. If we are to move forward and not keep excavating the same kinds of sites then we need to have a national strategy and series of goals on what to collect and what to curate. It is sad to report that currently less than 40% of our collections have ever been studied and reported.
    - **Justification:** A national strategy for curating our collections flows from three indisputable facts. We do not know what we have. We have an incomplete idea in North America of what we know(less than 40% of the collections scientifically examined), and we definitely have an incomplete idea of what we do not know. How can this be a science? ¶ To right our discipline we need a national curation program that works with practicing scientists. The program should first identify the universe and composition of collections. Second, the program should identify collections that have scientific potential, and then scientists should be strongly encouraged to study these collections. Third, we should identify gaps/surpluses nationally in the data that currently resides in our national collections. Fourth, using this data we should develop a national collections policy that encourages

our scientists not to collect data we already have, but more importantly target the gaps. ¶ If we do this or something like it our discipline will move forward. I am sure of this. Or we can continue to go to our meetings and hear our students give versions of papers we gave 25 years ago.

G. [P-PE] Public Education & Relevance of Archaeology

1. *[P-PE] ID: 212*
   - **Challenge:** How does archaeology benefit society as a whole? How do we as archaeologists justify the funding spent on archaeology? If we cannot argue to our challengers that archaeology provides insights into the past, that if it is not useful in terms of immediate concerns, how then do we at least overtly demonstrate its benefit to humanity?
   - **Justification:** With shrinking funding, an increasingly conservative society and government, providing an explicit justification of the importance of archaeology is crucial for our survival. If we are to betaken seriously as an academic discipline, I believe we have to do a better job of translating what we learn from the past for public consumption.

2. *[P-PE] ID: 214*
   - **Challenge:** Funding from the NSF comes from tax dollars. Tax dollars come from citizens. As anthropologists, archaeologists have to understand the root issues of any problem. Because the root funding source is Joe/Josephine Citizen, archaeologists should be looking at developing the image of archaeology as a science. The government and the NSF will be more willing to have money earmarked for archaeology if archaeology is better marketed as a useful (to the general public) discipline and as a science.
   - **Justification:** Find the number of high schools that teach or present archaeology as a science and you will see the root of my suggested Grand Challenge issue. 4.7% of the school districts in the major metropolitan area I live in have anthropology as an elective in their high school curriculum; 0% as a required course. The general public learns about archaeology in the main educational system (high schools) through a social studies course, a Sociology course, or a Geography course. Over 80% of our districts have Sociology or Geography as electives. Course learning objectives listed for these courses rarely list anthropology/archaeology as a topic. So, the public is left to learn about archaeology through television. TV chooses shows that have "WOW" factors. Often these factors, while interesting and very cool, leave the average person with the thought that this stuff is only for people who can speak four languages (two of them dead) or can use military-grade SCUBA gear. The grand challenges you are looking for probably do not include something like what I am suggesting. Your goals appear to be aligned for the scientific community only and therefore assume that archaeology is an accepted science in the first place. That makes this project meaningful to (relatively) very few people. Archaeology must make itself known as a meaningful science to many more people so funding will be more plentiful. A project that helps this endeavor will serve our discipline the best in the long-run.

3. *[P-PE] ID: 215*
   - **Challenge:** How do we make archaeology and what we learn through archaeology more than a scholarly or legal exercise; one that generates information for the profession or provides the base necessary for clearance under Section 106? How can what we learn benefit people, descendant communities, and make a difference globally?
   - **Justification:** As individuals, we do archaeology because we like it, because it satisfies our curiosity of who we are and where we came from, not for how it can benefit communities or improve life. Most archaeology that is done in the US is done through CRM, with the purpose of clearance for the agency to proceed with their project. The product of archaeological investigations is a technical report. How can we get beyond the project and the report? How does what they are doing on a project relate to other projects? How can information generated by projects be of benefit to people? How can the knowledge gained through archaeology be made relevant within a global context? We need to stop taking the doing of archaeology for granted and start thinking beyond. Part of the solution lies in how archaeologists are trained, part lies in how projects are funded, and

part in the structure of legislative and grant requirements.

4. ***[P-PE] ID:*** *217*
   - **Challenge:** The grand challenge for archaeology is to interpret the material record in a socially meaningful manner for contemporary communities without losing sight of the empirical basis of analyzes.
   - **Justification:** Archaeology is data-driven, formed from archaeological excavations and observations of the material world. The plentiful insights into the human past and the theoretical insights into the materiality of our species, past and present, have made fundamental contributions to science and to contemporary communities. The ability to collaborate with contemporary communities toward social justice is the moral imperative. While there have been tremendous discussions, the intersection is still an important problem so that the present generation of scholars can inspire the next generation.

5. ***[P-PE] ID:*** *220*
   - **Challenge:** One 'grand challenge' is to show the public that archaeology is not treasure hunting but the study of past human activity that is pertinent to themselves. The concept of an historic landscape is generally not understood by the layperson. Instead, archaeological investigation is perceived as a means to retrieve artifacts that are of monetary value.
   - **Justification:** Everywhere has archaeology, but few realize that where they live is almost certainly part of an historic landscape. The latter can be diverse: perhaps remains from the infrastructure of a relict industry or the archaeology of early settlers and the evidence of their toil to create the villages, towns and cities we have today. ¶ For many, archaeology needs to be dramatic and immediate; the sudden discovery of gold or finding a lost, legendary, tomb. Such perceptions alienate the individual from the true purpose of archaeology. There is a need to address this problem through better public involvement and media exposure.

6. ***[P-PE] ID:*** *243*
   - **Challenge:** One of the biggest challenges to archaeology is selling it to the taxpayers and public, but in a way that doesn't link it to alien invasions or New Age blather, and combatting the concept that "pot hunting as legitimate archaeology." It needs to be portrayed as a legitimate science that is done by real scientists who are trained academically and have credentials, just as any other science or engineering discipline works.
   - **Justification:** Taxpayers are the ones that are funding the majority of archaeological projects in this country, whether they are aware of it or not. This includes CRM, federal grants, projects undertaken by public universities and entities like the Smithsonian. If we can't sell them on the importance of "real" archaeology, down the line, in fiscal austerity initiatives, the field will lose out big time. ¶ We also suffer from an image problem. I have never heard of the general public being too crazy about having an "amateur doctor" do cancer surgery on their loved ones, but many people have the idea that going out and digging a hole in the ground somewhere, and then dragging out artifacts, putting them in a shoebox and then selling them at a collectors festival or on eBay constitutes legitimate archaeology. ¶ With shows like the ones National Geo just (thankfully) put on hold, this problem is only going to get bigger. Here in Kentucky, we fought hard and avoided getting a vote this March in the statehouse that would have allowed metal detector enthusiasts to go "treasure hunting" in our state historic and prehistoric site parks. Someone will probably re-submit the same legislation or a similar set of bills next year in legislative session, so this problem won't be going away soon. ¶ We somehow need instead to convey that archaeology is a legitimate science (hard for a good bit of the United States population to comprehend, since many believe the world is just a few thousand years old, and that climate change is a ploy by the liberals to shut down coal mining and drilling for oil by legislating anti-pollution regulations). The irony of all this is that these resources are "fossil" fuels - so how in the heck did it get there in the first place, if natural selection and evolution did not create the prehistoric plants and creatures that formed the oil and coal deposits? ¶ I firmly believe that educating the public about the legitimacy of archaeology as a science worthy of funding, and respect

for preservation of archaeological resources are two of the most important issues confronting our field.

7. *[P-PE] ID: 252*
   - **Challenge:** Making archaeology relevant among the general public, lawmakers, and general populace. Often archaeology is seen as not being relevant or contributing to our current lives.
   - **Justification:** In order for archaeology survive and avoid severe budget cuts, we need to have a public that is willing to advocate for archaeology and make sure that is survives attempts to remove it from funding and legislative oversight. In addition, universities need to continue to teach archaeology and promote why such work is important in the 20th century.

8. *[P-PE] ID: 258*
   - **Challenge:** How to inform the public and provide them with detail of their past - direct or indirect - without having them take over the agenda by, for example, metal detecting because it 'is their past'.
   - **Justification:** Getting increasingly important as potential archaeological sites are destroyed by treasure seekers and materials are lost to academic enquiry.

9. *[P-PE] ID: 259*
   - **Challenge:** Archeological relevance -or what have we learned from the thousands of projects and collections generated that will help define the issues facing our modern society.
   - **Justification:** We have spent untold tens of thousands on Section 106 inventory and mitigation, and in research projects that have resulted in a developing curation crisis, largely unused reports, and promises that our bits of information gleaned from fieldwork may someday result in a finding a piece of some puzzle that may tell us something about the past. We need to be much more relevant in confirming the past, utilizing research, and in helping to solve the problems that vex society today.

10. *[P-PE] ID: 284*
    - **Challenge:** The greatest challenge to American Archaeology is making our field of study relevant to the general public.
    - **Justification:** In an era of government cutbacks and economic distress, our greatest challenge is finding a way to make our discipline more relevant to the general public. Why should the public care about funding our research when unemployment is high and there are families struggling to provide basic needs? Funding for research is tight right now, and we need to find new ways to engage the voting public before they decide that our field is not important enough to waste their public funds to support. ¶ I highly encourage the support of new public education programs in archaeology - we need to find new and exciting ways to capture public interest.

11. *[P-PE] ID: 300*
    - **Challenge:** A recent problem, which will likely grow with time if not addressed, is the popularizing of artifact "hunting" through reality shows and magazine articles. The SAA should develop short films or interviews with archaeologists that popularize the value of documentation and working with professional archaeologists. While this may not be a "major scientific challenge" it would be a way of protecting a limited resource for professional research, while including non-professionals.
    - **Justification:**

12. *[P-PE] ID: 324*
    - **Challenge:** to align archaeological research and all the wonderful information it provides on past peoples with modern human problems, useful ideas, and PRACTICAL solutions, and educate both the general public and policy-makers and governments to its amazing potential. For example, archaeologists could contribute tremendously to climate change studies, not only in learning past processes and human responses but also in proposing some solutions for today based on that past knowledge. In other words, we should move from knowledge to wisdom (see book of same title) and make archaeology both exciting research and applied anthropology.
    - **Justification:**

13. *[P-PE] ID: 330*

- **Challenge:** The grand challenge of archaeology for me concerns public education and perception. Generally we are like all the rest of the sciences in that we need to do a better job of explaining what science is and how we contribute to society. More specifically, we need some way to convey to the general public that archaeology is not about simply about gold and pyramids and not about dinosaurs at all. I like dinosaurs (and who doesn't?) but that's not archaeology.
- **Justification:** I have spent most of my 20 year career in archaeology in CRM, both as a field archaeologist and now behind a desk. The challenges listed above have been some of the basic issues I have dealt with on a consistent basis throughout this time. What is archaeology? Why you don't need to have a pyramid to have an archaeological site. We don't study dinosaurs. We are not Indiana Jones. I know you are probably looking for something about the peopling of the Western Hemisphere, approaches to pre-Clovis and possible Late Pleistocene connections with Western Europe, etc... but this is all too academic for me. I can't tell you how many times I have been faced with the following statement, "Why should we have to do archaeological survey, we all know Indians lived here." The grand challenge for me, then, is a very fundamental issue of public education and perception of what we study, what we do, and why.

14. **[P-PE] ID:** *331*
- **Challenge:** gaining public support
- **Justification:** based on the relationship archaeologists and communities have

15. **[P-PE] ID:** *334*
- **Challenge:** For many years, anthropology and archaeology viewed "applied" approaches as somehow compromising the field and appropriate only for those less well schooled. Anthropological archaeology needs to project its knowledge base of what has already been learned about the past and suggest ways that our research can address issues of sustainability and resilience today. A major challenge.
- **Justification:**

16. **[P-PE] ID:** *370*
- **Challenge:** Our greatest problem is gaining broad support for scientific archaeology from the public at large.
- **Justification:** Current and future mass communication is increasingly focused on sensationalistic aspects of many endeavors, including archaeology. Our goals and methods will be misunderstood and we will lack support to go forward with scientific investigations unless we address this problem with comprehensive programs to communicate with the broader public.

17. **[P-PE] ID:** *375*
- **Challenge:** One the the toughest challenges facing archaeology is that we lack the ability to justify why the past matters in contemporary society.
- **Justification:** Archaeologists and other historiographical experts take for granted that the artifacts, sites, buildings, and information from the past MATTER in contemporary society. But in the United States, and to some degree across the globe, we are not very good at demonstrating that taken-for-granted assumption. As a result archaeologists are seen as obstructionists, as anti-development, and caring more about the past than the present, and as not RELEVENT. Our funding and public support is diminishing accordingly, and more importantly, the results of our work our languishing on shelves, in museums, on computers. We need social science data--quantitative and qualitative--to demonstrate that the past DOES matter for things like ontological security, for psychological well being, as conflict resolution, and even for such challenges as global warming. As social scientists we should be able to demonstrate this if we work with other social scientists and other historiographical fields, such as history. Archaeology is only one way to access and interpret "the past," such that the goal should be to promote an appreciate for and conservation of collective memory, with archaeology as one tool with which to do that.

Grand Challenges for Archaeology – Respondent Demographics[1]

```
SECTOR
                         Consulting
Academic   Avocational   Archaeology   Government   Museum   Student   Total
-------------------------------------------------------------------------------
    79           5            56           25          8         4      177

RESIDENCE
Australia   Canada   Europe   Mesoamerica   South America   US    Total
-------------------------------------------------------------------------------
    4          6       22          3              3        139    177

AGE                                          GENDER
30-49   50 or older   Under 30   Total       Female   Male   Total
----------------------------------           ---------------------
  57       117           3        177          68     109    177
```

```
RESIDENCE(rows) by SECTOR(columns)
                               Consulting
              │ Academic   Avocational   Archaeology   Government   Museum   Student   Total
--------------+----------------------------------------------------------------------------------
Australia     │    3           0             1             0          0        0        4
Canada        │    3           1             1             0          0        1        6
Europe        │    8           0             7             5          2        0       22
Mesoamerica   │    3           0             0             0          0        0        3
South America │    2           0             1             0          0        0        3
US            │   60           4            46            20          6        3      139
--------------+----------------------------------------------------------------------------------
Total         │   79           5            56            25          8        4      177
```

```
AGE(rows) by SECTOR(columns)
                             Consulting
            │ Academic   Avocational   Archaeology   Government   Museum   Student   Total
------------+----------------------------------------------------------------------------------
30-49       │   24           2             15            11          2        3       57
50 or older │   54           3             39            14          6        1      117
Under 30    │    1           0              2             0          0        0        3
------------+----------------------------------------------------------------------------------
Total       │   79           5             56            25          8        4      177
```

```
GENDER(rows) by SECTOR(columns)
                         Consulting
        │ Academic   Avocational   Archaeology   Government   Museum   Student   Total
--------+----------------------------------------------------------------------------------
Female  │    34          1             22             6          2        3       68
Male    │    45          4             34            19          6        1      109
--------+----------------------------------------------------------------------------------
Total   │    79          5             56            25          8        4      177
```

```
AGE(rows) by RESIDENCE(columns)
            │ Australia   Canada   Europe   Mesoamerica   South America   US    Total
------------+-----------------------------------------------------------------------------
30-49       │     0          1       12          1              2         41    57
50 or older │     4          5        9          2              1         96   117
Under 30    │     0          0        1          0              0          2     3
------------+-----------------------------------------------------------------------------
Total       │     4          6       22          3              3        139   177
```

```
GENDER(rows) by RESIDENCE(columns)
        │ Australia   Canada   Europe   Mesoamerica   South America   US    Total
--------+-----------------------------------------------------------------------------
Female  │     3          1        9          2              2         51    68
Male    │     1          5       13          1              1         88   109
--------+-----------------------------------------------------------------------------
Total   │     4          6       22          3              3        139   177
```

```
GENDER(rows) by AGE(columns)
        │ 30-49   50 or older   Under 30   Total
--------+----------------------------------------
Female  │   25        41           2         68
Male    │   32        76           1        109
--------+----------------------------------------
Total   │   57       117           3        177
```

[1] Responses through 30 June 2012.

Identifying Grand Challenges in Archaeology

This NSF-funded research project seeks to identify a suite of "grand challenge" problems of broad scientific and social interest that can drive cutting-edge research in archaeology for the next decade and beyond. We are soliciting discipline-wide consideration of these challenges in order to determine what investments in computational infrastructure by the US National Science Foundation (NSF) would be most likely to effect scalar transformations of our ability to address major problems in archaeology, and in science more broadly. The results of this effort will be published and disseminated on the Web.

"Grand challenge" is a term used to mean "a fundamental problem in science or engineering."* For example, in archaeology a grand challenge might be: "Understanding the origin, timing, routes, and demographic dynamics of the peopling of the Americas." In this sense, grand challenges would not include disciplinary challenges with respect to the practice of archaeology, such as changes in financial and legal frameworks. While the current project will use the grand challenges identified here to argue for investment in computational infrastructure, others may find them useful in arguing for funding, policy, or other changes.

This first stage of the research seeks professional perspectives on the major scientific challenges facing the discipline. Following a synthesis of the results, we will return to the community to rank the challenges that emerge most clearly from this initial call. Two project workshops will then explore the data and modeling requirements of highly ranked grand challenge problems to develop a formal argument for major NSF investments in computational infrastructure for archaeology. Computational infrastructure includes improved data acquisition tools for the field and laboratory, digitization of existing data, documents, and reference collections, improved ability to discover, access, and integrate digital data and documents, tools to facilitate modeling and visualization, and training and community building necessary to exploit this infrastructure.

The survey generally takes from 2 to 10 minutes and is completely anonymous; no personal identifying information will be associated with the individual responses. No benefit or disadvantage will accrue to respondents, from NSF or any other entity. You may exit the survey at any time; answers are not recorded until you press the "next " (>>) button at the end of the survey. Questions about the survey can be directed to Keith Kintigh (principal investigator; kintigh@asu.edu). If you have any questions about your rights as a participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Research Integrity and Assurance, at (480) 965-6788.

The project steering committee thanks you in advance for your participation.

Keith Kintigh, Arizona State University   Jeffrey Altschul, Statistical Research, Inc., and SRI Foundation
Ann Kinzig, Arizona State University   W. Frederick Limp, University of Arkansas
William Michener, University of New Mexico   Jeremy Sabloff, Santa Fe Institute

*_A Research and Development Strategy for High Performance Computing,_ Office of Science and Technology Policy, November 20, 1987.

By selecting **Continue** I acknowledge that I am at least 18 years old and that I voluntarily agree to participate in this study. Please press the >> button at the bottom right of the window to proceed.

◉ Continue   ◉ Exit Survey

Survey

Your answers may be used as is or edited, in reports generated by the project. Because the survey is anonymous, we cannot provide attribution of any content contributed. You may cut and paste text into the query fields if you wish.

Concise statement of a grand challenge problem or question (suggested limit: 40 words; survey limit: 700 characters, about 100 words):

Concise background and justification of the importance of the problem or question (optional; suggested limit: 200 words; survey limit 7000 characters, about 1000 words).

Optional Demographic Information

This Information will allow us to assess the general sources and representativeness of the responses.

Primary Professional Work Setting (if retired, please choose what you would consider to be your primary pre-retirement work setting)?

Academic	Avocational	Consulting Archaeology	Government	Museum	Student
○	○	○	○	○	○

Resident of?

US	Africa	Asia	Australia	Canada	Europe	Mesoamerica	South America	Other
○	○	○	○	○	○	○	○	○

Age?

○ Under 30   ○ 30-49   ○ 50 or older

Gender?

○ Male   ○ Female

Save the Completed Survey

Thank you for offering your grand challenge.   If you would like to suggest another challenge, please finish and then retake the survey.

To receive a report on the results of the survey, please provide your **email address**. Your email address will **not** be associated with your answers to any questions above, and will only be used in communications directly associated with this project, including a possible request to participate in a followup survey to prioritize the challenges identified in this survey.

Please click on the Next button (>>, below) button to save your completed survey.