



Cosmic Serpent - Bridging Native and Western Learning in Museum Settings

The Cosmic Serpent Story: Summative Evaluation for Final Report (NSF DRL-0714631 and DRL-0714629)

Prepared by:

Jill Stein, MA (Institute for Learning Innovation)

Shelly Valdez, PhD (Native Pathways)

Eric Jones, PhD (Institute for Learning Innovation)

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ILI



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WHERE DISCOVERIES BEGIN

OVERVIEW OF THE COSMIC SERPENT STORY

At the heart of the Cosmic Serpent project (NSF DRL-0714631 and DRL-0714629) is building relationships and collaborating with integrity. Through intensive professional development, the project helps to convey the value and integrity of different worldviews to tribal museum and science center practitioners and to support them in connecting Native worldviews to Western science. Professional development experiences were focused on learning in informal settings giving emphasis to sustainable, respectful collaboration. The primary deliverable of the professional development was a series of workshops, including an initial 5-day workshop in each of the three geographic regions of focus—Northwest US, Southwest US, and California/Nevada—followed by a 3-day follow-up workshop in each region one year later, then culminating with a 3-day conference attended by participants representing all three regions at the end of the project. Another key deliverable was a 110-page legacy document that highlighted key project outcomes, lessons learned, and stories of collaboration across Indigenous knowledge and Western science. Ten thousand copies were printed in August 2012 and were distributed to project partners, museum and science center professionals, and Cosmic Serpent Fellows and their colleagues.

The Institute for Learning Innovation (ILI), a nonprofit research and evaluation organization focused on learning in informal contexts, and Native Pathways (NaPs), an educational consulting firm specializing in Indigenous evaluation processes, worked in collaboration to support a joint evaluation effort of the Cosmic Serpent project. All aspects of the project evaluation were conducted collaboratively between ILI and Native Pathways, including instrument design, data collection, analysis, and interpretation.

The strategic planning process and evaluation framework were based on the Dine Model of the Four Directions (Maryboy and Begay, 2007, shown belows) as follows: 1) East—*Ha'a'aah*, a place of initiation; 2) South—*Shadiab*, a place of growth and organization; 3) West—*Ii'ii'aah*, a place of activation; and 4) North—*Nahookos*, a place of transformation, renewal, and evaluation leading to sustainability. In keeping with Native worldviews that honor story and holistic processes, the evaluation followed an emergent and organic process, rather than seeking predetermined outcomes. Following is an overview of outcomes based on the four directions and presented through story.

This final report primarily focuses on outcomes for professional audiences (project team, museum professionals, and evaluation team), as the majority of programming efforts happened at this level. While Fellows did incorporate their learning into existing programs, and many new initiatives began as part of their Cosmic Serpent work, the majority of the project was spent on supporting the relationship building and learning necessary to do this work. In that way, it is premature to measure impacts on public audiences. Also, while the original intent was to include evaluation of the legacy document, the timeline ultimately did not allow for this component; these resources were instead invested in documenting the three “case study” collaboration stories which are included in the legacy document itself and in this final report.



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Overview of the East (Ha'a'aah)

In the East (Ha'a'aah), a place of initiation, the project team (leadership and evaluation) and Fellows were selected and were provided with environments to stimulate and engage them in relationship building. Each team member from the three teams, began to broaden their understanding of the Cosmic Serpent aims and uncover new learning opportunities, mainly in the areas of Native ways of knowing. There was also a heightened awareness, mainly by the Leadership and Evaluation teams, that several of the initial project goals would need a longer timeframe to accomplish in a genuine and authentic way. Particularly, they realized that more time was needed to immerse all three teams in environments that encouraged and supported relationship building, which could then form the foundation for positive growth, learning, and activation around bringing Indigenous knowledge and Western science together in informal learning settings. Allowing the pilot workshop to set the course for this pathway was critical to understand what identifiable areas were needed to ground this work. In this direction, the place of initiation, the three sets of teams were experiencing learning curves and new awakenings that would help shape the pathway for future project initiatives.

Overview of the South (Shadiah)

In the South (Shadiah), a place of growth and organization, the learning experiences from the workshops identified a critical need to spend more time in this direction, focused on relationship building in particular. The Leadership team recognized through evaluation that the Fellows were not nearly as close to begin to activate the collaborative work or to work towards suggested products (such as exhibits and programs) as outlined in the proposal. As a result, the workshops were enhanced to provide more time to deepen the relationships and to create environments where open and honest dialogue could be shared around the two worldviews. Findings from the workshops showed that Fellows began to make connections with collaborating partners that may not have been

initiated outside of Cosmic Serpent, Fellows deepened their understanding of relationships from a Native worldview that reinforced these connections, and the leadership and evaluation team members began to solidify their relationships among one another. In this place of growth and organization, the growth that occurred was that all team members were provided with opportunities to learn amongst each other, exchange new knowledge and to intensify their relationships among Fellows, leadership team members, bridge people and evaluators.

Overview of the West (Ii'ii'aah)

In the West (Ii'ii'aah), a place of activation, evaluation outcomes centered on ways of implementing the learning that occurred in the first two directional areas. For Fellows, activation took on many forms, including generating new ideas, enhancing existing programs, deepening relationships, developing grant proposals, creating advisory positions, and creating docent/staff training around inclusion of multiple worldviews. While activation was initially envisioned as focused on programs and exhibits, the project shifted towards a Native-based focus on relationship, as building relationships within and beyond the regional networks became the central focus of this direction. This represents a significant paradigm shift, away from project-based approaches and towards a deeper, more sustainable approach based on relationship building and collaboration. Fellows also encountered a number of challenges in the area of activation, including funding and resource limitations and lack of institutional or community buy-in to support their work.

The leadership team also deepened their engagement of partnership, particularly personal experiences with building team relationships, engaging diverse perspectives, understanding collaboration and becoming more aware of one's own roles, strengths and weaknesses. In this direction team members began to value the high levels of trust and respect that allows discussions to be productive. Both the leadership and evaluation teams learned that "activation" would not necessarily be seen through creating or enriching programs, or could not necessarily be captured within the life of the grant for many Fellows. The reasons for this included the need for growth in the directions of the East (orientation to worldviews) and South (relationship building), especially those who were relatively new to working across multiple worldviews of science, before one could effectively move into activation.

Overview of the North (Nahookos)

In the North (Nahookos), a place of transformation, renewal, and evaluation leading to sustainability, we come to lessons learned and recommendations for future collaborative work. Through the pathway of sharing the Cosmic Serpent story and reflections on the lessons learned, future collaborations need to be considerate of the time and space needed for creating relationship, purposefully constructed into the program environment. It is the heart of relationship that stimulates and shapes the pathways of the genuine collaborative work. Another area of learning was that all project activities need to be considerate of balance of voice, creating environments where all

voices are heard, shared and experienced. With this said, sometimes there may need to be more time spent on orienting the audience to Indigenous worldviews. Consideration of where the participants are in terms of knowledge levels is recommended.

At the funding agency level, the considerations of the amount of time needed to activate these types of collaborations needs to be considered in terms of funding timelines, evaluative frameworks (e.g. intended impacts), and financial support systems. While there is an appreciation of the financial support systems from funding agencies, part of the effort to share the imbalances in this area are respectfully presented for future considerations in creating environments that best support these types of collaborations.

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Native Pathways (Shelly Valdez, PhD)

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INTRODUCTION

Project Background

Cosmic Serpent (NSF DRL-0714631 and DRL-0714629) is a collaborative research project designed to build relationships between science museums and Native communities, while increasing capacities to bring Indigenous knowledge and Western science together in informal learning settings such as museums. The primary component of the project is a series of workshops, including an initial 5-day workshop in each of the three geographic regions of focus—Northwest US, Southwest US, and California/Nevada—followed by a 3-day follow-up workshop in each region one year later, then culminating with a 3-day conference attended by participants representing all three regions at the end of the project. In addition, the leadership team made regular site visits and phone calls to participants in the workshops in order to support their professional growth. The project also includes multiple evaluation interventions—phone interviews, focus group interviews at the follow-up workshops, and paper/online surveys—as part of the effort to engage Cosmic Serpent Fellows as they embarked on this novel personal and professional journey.

Cosmic Serpent aims to create awareness of Native science paradigms among science museum and science center practitioners, and to support them in developing STEM learning experiences that are inviting and relevant to Native audiences. Cosmic Serpent is also intended to support tribal/cultural museums in integrating both Western and Native science concepts into their programming that would allow audiences to engage in science without compromising their own worldviews. Through this effort, the project helps to convey the value and integrity of different worldviews to practitioners; support them in connecting the Native worldview to Western science learning; and offer Native audiences a way of exploring STEM without compromising their cultural values.

The Institute for Learning Innovation (ILI), a nonprofit research and evaluation organization focused on learning in informal contexts, and Native Pathways (NaPs), an educational consulting firm specializing in Indigenous evaluation processes, are working in collaboration to support a joint evaluation effort of the Cosmic Serpent project. All aspects of the workshop evaluation were conducted collaboratively between ILI and Native Pathways, including instrument design, data collection, analysis, and interpretation.

As the project focused on professional development through the intensive workshop experiences, the evaluation efforts also largely dealt with the experiences and outcomes of the workshops. The evaluation also provided feedback to project leadership targeting team dynamics and effectiveness, as well as insight on reflections to the collaborative nature of the evaluation

process. The fact that the evaluation team was quite embedded in the project teams organized activities most of the time, participating in almost all planning activities as well as attending and participating in all the workshops, provides a unique process to the evaluation framework. Thus, this summative evaluation covers the experiences of the Fellows, the leadership team, and the evaluation team.

We present our findings about the experiences of the Fellows, leadership team, and evaluation team in the context of the four goal areas of Cosmic Serpent project, based on the Dine Model of the Four Directions (Maryboy and Begay, 2007): 1) East—*Ha'a'aab*, a place of initiation; 2) South—*Shadiab*, a place of growth and organization; 3) West—*I'ii'aab*, a place of activation; and 4) North—*Nabookos*, a place of transformation, renewal, and evaluation leading to sustainability. In keeping with Native worldviews that honor story and holistic processes, the structure of the report follows a narrative style and highlights the qualitative outcomes, with limited subheadings and no tables (quantitative data tables are instead included in the appendices, with appropriate reference to the findings throughout the narrative). The story is the pathway of the Cosmic Serpent experience and is meant to be read as a whole, rather than in separate parts. For a summary of the Cosmic Serpent pathway, we offer an Overview of the Cosmic Serpent Story

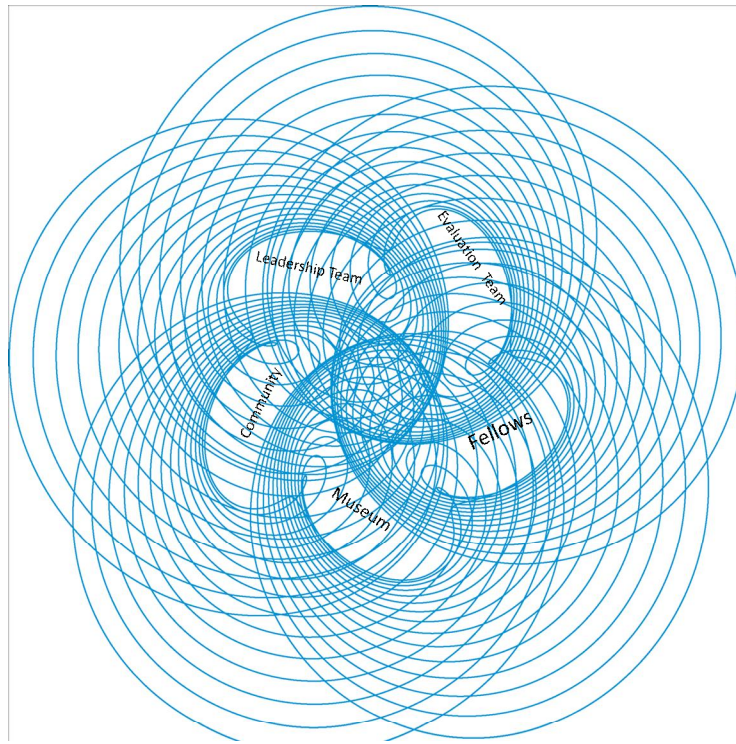
Evaluative Framework

The project incorporates a new approach towards evaluation and research, one that embraces joint interpretation of data by diverse teams with different evaluation approaches, and mirrors the type of cross-cultural collaboration that the project itself is designed to support. The evaluation framework was guided by both Indigenous evaluation perspectives and conventional, Western evaluation as practiced in the fields of informal learning and visitor studies. The overarching framework was provided by the Dine Model, developed by project leaders Nancy Maryboy and David Begay, and applied specifically to the Cosmic Serpent project during the initial strategic planning meeting for the project. This model identified goals within each directional area (shown below, p. 4), and intended outcomes for each area, which served to guide our evaluative focus throughout the project.



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Because the nature of the model is organic and emergent, our evaluative focus shifted and sharpened over time. Specifically, the evaluation deepened its focus on the process of relationship building, and the environments that support transformational change. This also included a shift in “grain size” – that is, rather than looking for completed projects, such as exhibits and programs, we looked more closely at the steps that would lead to the development of collaborative projects, but which may not be fully realized within the life of the grant. We also focused on the kinds of personal reflections and insights (sometimes referred to as “aha moments”) that are so essential to engaging in collaborative work around worldviews. Another evaluative shift – based on the project’s own pathway – was to focus most attention on the core team and the Fellows; while the original conception of the project included mentored staff at each institution and the public audiences impacted by the project, it became evident that most Fellows needed more time in the initiation and growth directions of the model (East/*Ha’a’aah* and South/*Shadiah* directions), before entering into activation (West / *Ii’ii’aah* direction). Like the spiral graphic below (p. 4), the core team’s collaboration impacts the learning of the Fellows, who then bring this learning to their home institutions, which then can lead to community and public audience impact. Much like the Native worldview, learning is continuous. Using the metaphor of a spiral for learning, there is no end to the spiral in either direction, and there is constant movement within the spiral (a breath that penetrates inward and outward). In this sense, learning is fluid and continuous. Given the time this type of fundamental change can take, it is not surprising that the strongest impacts of the project were seen within the first two communities (core team and Fellows).



Indigenous Evaluation

The evaluation efforts on Cosmic Serpent were guided by Indigenous evaluation approaches, which have often been neglected or under-utilized in conventional evaluation practice, even within contexts involving Native communities. Indigenous evaluation models are not a concept that has surfaced in modern times. They are as old as the histories of the Indigenous communities themselves. Indigenous people have always had some form of ‘evaluation’ within their societies that have perpetuated their sustainability within this world. What is different today is the use of terms and language that are now associated with the conventional approaches, tools, strategies, and methods used in today’s evaluation practices. The one uniqueness surrounding Indigenous evaluation models is the weight placed on relationship. From a Native worldview, relationship is the power of place, and without relationship there is no balance. Relationship must be seen as one of the key elements of an evaluation plan. In order to create balance and continuance of valid data, the evaluator must understand and nourish the importance of their relationship to community, and to the program they are evaluating, which must begin prior to executing evaluation methodologies. In most instances, this process takes considerable time to engage in. In order to understand the cultural context of the community the evaluator is evaluating, the time given to this area is critical.

Indigenous evaluation frameworks are steeped in holistic environments. For the most part, the evaluation environments are fluid and emergent, and organically grow within and among the programs that are being served or evaluated. This type of evaluation most often times focuses on a qualitative approach that allows the evaluator to capture the story or pathway of the program being evaluated in a way that lends itself to a more culturally appropriate environment. This does not mean

that quantitative methods and practices are left out of the environment; these areas are certainly an important part to conveying story.

Indigenous communities are rich with knowledge and contributions to our world as we know it; they have not always been treated as such. This is why it is important to change the historical practices of conveying negative outcomes to sharing and celebrating the successes in such a way that lend themselves to influencing continued pathways of success. Careful consideration to telling the story, focusing on positive outcomes, with carefully crafting a mechanism for sharing the lessons learned is essential to Indigenous evaluation frameworks. These concepts have guided the evaluation of Cosmic Serpent throughout the project.

METHODS

In an effort to bring together Native and non-native perspectives, we utilized a range of qualitative and quantitative techniques in a variety of settings for collecting feedback and data. Generally, we attempted to witness the experience of participants, as well as provide ways for them to reflect on their experiences and the goals of the project. The evaluation team gave careful consideration and respect for the communication styles and worldviews of the project participants, offering multiple methods for capturing participant's voice that included: oral dialogues (individual interviews or focus group), and written formats. Explanations follow for each of the following techniques we employed throughout the project: participant observation, written reflections, group discussions/focus groups, written/online surveys, phone interviews.

Participant Observation - There were two general domains in which participant observation occurred. First, the evaluators were frequently included in planning for the project. This involved regular team phone calls, email communication, and in-person meetings at the workshops, a retreat, conferences and other opportunities. At least one of the three evaluators—and usually all three evaluators—participated in these modes of interaction with the project team. Generally, this aspect of the evaluation relied on note taking by the evaluators with frequent guidance by evaluators to have project team focus on outcomes of greatest importance for the focus of evaluation. Second, the evaluation team participated in all of the workshops conducted by Cosmic Serpent. To conserve funds, most of the workshops were attended by one of the evaluators. Effort was made to have both the evaluator from Native Pathways and an evaluator from Institute from Learning Innovation at the pilot workshop and one initial regional workshop in order to come at the evaluation of these workshops from both Native and Western perspectives. All three evaluators and an associate evaluator from the Institute from Learning Innovation attended the culminating conference held in May 2011. Again, note taking was the primary result of participant observation, and these notes focused on experiencing what the Fellows were experiencing and reflecting on that experience. Evaluators also engaged in informal discussions with individuals at the workshops during social time about Fellows' understanding of the evaluation process, including soliciting feedback from Fellow's regarding the nature of the evaluation process. The participant-observation component was used

primarily to provide context for analyzing the responses from the focus group and written responses, in addition to providing feedback on the workshop structure and logistics.

Written surveys and reflections. We asked Fellows and workshop presenters for written reflections along with some closed-ended and scaled (e.g., Likert scale) responses concerning attitudes, understandings and skills related to project goals before attending the first workshop, at the end of the first workshop and at the end of the culminating conference (see Appendices a, b, c). Questioning focused on the Fellows' overall workshop experience, how they felt they were impacted by the workshop, and how they felt they might implement ideas or relationships as a result of the workshop. Surveys typically were distributed in paper and digital format and in a couple of cases were available as online surveys.

Phone interviews. We conducted semi-structured interviews with Fellows and some workshop presenters by phone using just the reflection questions and not the quantitative questions that also accompanied the written reflections (see Appendices d, e). The interviews focused on four main areas: 1) overall impact and continued participation in the project; 2) relationship building and partnering; 3) implementation of Cosmic Serpent concepts; and 4) identifying needs for further support. These interviews lasted 20-60 minutes and occurred approximately six months after each of the initial regional workshops, as well as after the second or follow-up workshop for the Northwest and Southwest regions. We did not conduct phone interviews after the follow-up workshop in the California/Nevada region in order to save project funds and because no further feedback on workshop development was required since the California/Nevada follow-up workshop was the last workshop before the culminating conference.

Focus Group Discussions. Near the end of each of the regional follow-up workshops, the primary method for gathering participant feedback was a 60-minute focus group discussion, focused primarily on the value of the workshop and what Fellows felt they had gotten out of the experience (see Appendix f). A Thematic Wall of Impacts was also conducted following the focus group discussion at the follow-up regional workshops, in which all Fellows still in attendance were asked to rank and discuss the impacts of Cosmic Serpent in their work (see Appendix g). Fellows were asked to rank where they were most impacted during the three-day event regarding: Understanding multiple ways of learning and learning styles, Collaborating with science museums or science centers, Collaborating with Indigenous communities or tribal museums, Readiness for developing Cosmic Serpent related exhibits or programming, Building relationships and connections to support implementing Cosmic Serpent programming, Understanding or deepening appreciation for worldviews of science, and Other. These seven impact areas were displayed on flip charts, and Fellows were asked to use the following rating scale: 1=highest through 7=lowest area. Fellows were provided with round stickers and post-it notes and were instructed to place the numbers 1-7 on the round stickers and place them in the areas according to the scale mentioned above. Fellows were invited to use the post-it notes to add additional comments. Focus group and Thematic Wall of Impact data were transcribed and content analysis was used to identify key ideas and themes.

OUR STORY

This section follows the Dine Model of the Four Directions (Maryboy and Begay, 2007; see p. 7) in order to reflect the emergent, organic nature of Cosmic Serpent and to align with the strategic planning process that informed the development of the project. Reflecting this holistic Indigenous framework, based on the four cardinal directions, we will address the project's learning in each of the four goal areas: 1) East—*Ha'a'aah*, a place of initiation; 2) South—*Shadiab*, a place of growth and organization; 3) West—*Li'ii'aah*, a place of activation; and 4) North—*Nahookos*, a place of transformation, renewal, and evaluation leading to sustainability. In each area, we will address how these goal areas played out for the project's participants (Fellows), the leadership team (PIs), and the evaluation team. It is essential to keep in mind that the pathway, the process, learning and experiences for the three audiences are fluid and weave within, around and among all four goal areas. There is no specific outline or pattern for this movement, the audiences move within each of these goal areas, crossing boundaries and in some cases returning to revisit particular goal areas. For example, an individual's learning may take place in the South but they may revisit the West to reflect or solidify how the deepening of learning occurred. Through this model there is always a time for reflection that deepens the learning experiences.

East – *Ha'a'aah*, a place of initiation



East – Ha'a'aah – a place of initiation. Practitioners will gain awareness and appreciation of a Native worldview of science that values traditional ways of knowing, and has identifiable commonalities with western science.

Measures: Evaluation will assess whether and to what extent professional development activities and products increased practitioners' science knowledge; capacity to understand, respect, and appreciate a paradigm of science that is infused by and values Native knowledge and culture; as well as their potential to address these ideas in programming.

The Foundation of Cosmic Serpent

The partnerships included in this project were purposeful and intentional to create balance of knowledge within Western science and Indigenous knowledge. The partnering institutions for the most part included a balanced representation of tribal museums and cultural centers, and western science centers and museums. Each participating institution selected two representatives to attend the workshops and program activities, and were termed Fellows. The Fellows were selected based on their backgrounds, focus areas and level of willingness to participate. The partners involved in the leadership team and evaluation team were purposeful and modeled the process for which the

project is based upon; and consisted of individuals that had strengths in Western science and individuals that had strengths in Indigenous knowledge. The intent was to provide an active exemplar that illustrated the aims of the project.

Fellows' Learning in the East

The Cosmic Serpent team held its pilot workshop in Santa Fe, NM, April 20-24 2008. The four-day workshop engaged 15 participants (Fellows) from science centers, science and natural history museums, and tribal/cultural museums and communities from the project's three targeted regions (Southwest, Northwest, and California). These were individuals who had prior interest and experience in working across Indigenous and Western worldviews in informal settings, and represented a strong foundation for growing collaborative networks in the project's three target regions. The leadership team also gathered numerous presenters and facilitators designed to open up dialogue across and between Indigenous and Western paradigms of science. Some of these, including the project leaders, could be considered "bridge people" – those who are knowledgeable in both worlds and could potentially move others along a path towards embracing multiple worldviews simultaneously.

The pilot workshop, though formative in nature, served as a successful opening to the project on many levels. Data from open-ended reflections and group discussions suggested that the pilot Fellows saw value in the opportunity to connect with other professionals and individuals and share knowledge related to Native and Western science paradigms; to learn from the high quality presentations given by experienced knowledge-holders, both Native and Western-oriented; and to expand their thinking about Indigenous ways of knowing and Western science. For many, this was a positive gathering that opened up opportunities for deepening one's understanding, building relationships, and refining or redefining one's pathway toward collaborative work. In terms of the overall workshop experience, quantitative data suggested that Fellows most appreciated the workshop facilitators and presenters, as well as the opportunities to interact with colleagues (see Appendix A, Table 1), supporting the idea that the participants and facilitators were highly valued and well aligned for the project's goals.

As would be expected with an initial gathering of this nature, there were several initial imbalances in the program experience. In reflections and discussions, Fellows suggested a need for more small-group discussion and exchange of ideas among themselves, a deeper connection to place and multi-sensory experiences (rather than lecture formats), as well as a slower pace to allow for reflection and processing of such rich ideas and discussions. Quantitative data supported these ideas, with Fellows rating "pace of the workshop" and "balance between group work and presentation" the lowest overall (see Appendix A, Table 1). There was also a sense of imbalance in regard to worldviews – some felt the workshop was too Western in presentation and focus, while others felt that Indigenous knowledge was presented as superior to Western science. Still others detected a sense of "new age" approaches that do not sit well with Native audiences.

Some of these initial imbalances opened up opportunities for team reflection and change as they moved into planning the Full workshops based on the pilot experience and evaluation. The team shifted towards a model of presenting the two worldviews side by side, each as valuable and cohesive in its own right, without the need for judgment or comparison. They moved towards a model of illustrating the complementary nature of the two worldviews; away from “bridging” per se, and more towards “juxtaposing.” The team also began working towards creating workshop experiences that were multi-sensory, immersive and participatory; allowing more time for group reflection and discussion; and varying the experiences and pace throughout the day.

Overall, the Pilot Workshop represented a successful initiation of the first group of Cosmic Serpent Fellows. While a few Fellows and presenters disengaged from the project, due to a misalignment of purpose or worldviews (e.g., due to the “new age” element experienced by some Native participants), the majority of the Pilot Fellows continued on with the project and became active participants and leaders within their regional network.

Leadership Team’s Learning in the East

The leadership team consisted of the three PIs, UC Berkley Space Science Center and Indigenous Educational Institute (IEI) staff, partners and representatives from National Museum of the American Indian (NMAI), and Association for Science and Technology Centers (ASTC). One area of the leadership team momentarily shifted when Dr. Isabel Hawkins announced her retirement from the UC Berkley Space Science Center, with Dr. Laura Peticolas stepping in to continue the collective partnership in leadership. The mentoring and support from all partners to Dr. Peticolas provided the background necessarily to step into the project’s leadership. As part of the continuous process evaluation for the project, the evaluation team conducted semi-structured interviews with members of the core’s leadership team. The interviews were conducted by phone by one of the three evaluation team members, and took about 45-60 minutes. The interviews were intended to document the varying thoughts, perspectives, realizations, and experiences of each of the projects leadership team members. This provided an opportunity for each team member to reflect on the collaboration – what they learned, where they envisioned the project going, what worked well, and what they saw as needed change – in part of an ongoing process of both documenting and “adjusting” or growing the project as it moves forward.

In this direction, several key lessons were learned that were then used to strengthen to project’s internal structure. The most significant lesson that emerged through this collective experience is the understanding that in order for the team to move forward at each new level of the partnership a collective balance and inclusiveness of voice was needed to create a strong partnership. This includes the balance of shared decision making and making sure that all key players have an active and equal voice in the decision making processes. Secondly, the team realized the need for more time to create relationships, and clarify critical agreements around the project goals was critical to the success of the projects, resulting in more frequent leadership team meetings. This understanding supports and validates the importance of the deeper understanding of relationship within the Native

world views; in order for balance to occur, there must be relationship; and in order for relationship to exist, there must be a trust built between the participants involved. Realizing this, the project shifted part of its focus to creating a pathway and process for building healthy relationships. At the heart of the collaboration (both at the leadership and project levels), were the efforts targeting multiple worldviews. It was important to continue open discussions around creating a balance and relationship between Indigenous and Western perspectives within the collaboration, and to honor both perspectives in the collaboration without one overwhelming the other. The fundamental principle of how some tribal communities are guarded on sharing knowledge due to uncertainty and suspicious of how their knowledge is shared created an important lesson learned on how the project would communicate and transfer Indigenous knowledge in future workshops. This included being cautious of who was invited to present, what their presentations entailed, and what bridge people would be most appropriate and beneficial to advocating grounded Indigenous knowledge. The leadership team also recognized that a majority of the Fellows, leadership team and bridge people involved in the pilot phase were comfortable and had strength in Western science knowledge systems, but encompassed limited knowledge of Indigenous worldviews and Native Ways of Knowing. With this realization, more efforts were included to provide nurturing environments that explored this area.

Through these lessons learned, the next direction, South (*Shadiah*) would focus on moving the leadership team and collaboration towards deepening relationships, and creating environments for continued dialogue and honoring of similarities and differences in understandings what the current balance of worldviews are among participants, with intentions of providing more opportunities to steepen the Fellows worldviews of Indigenous knowledge.

Evaluation Team's Learning in the East

Before moving to the next directional circle, the South (*Shadiah*), it is important to reflect on our own evaluative process, and what lessons were learned pertaining to this directional area. The original evaluation team consisted of Dr. Shelly Valdez (Native Pathways), Dr. Martin Storcksdieck (Institute for Learning Innovation), and Jill Stein, M.A., (Institute for Learning Innovation). During the Pilot workshop, we also piloted a joint evaluation approach grounded in participant-observation. All three evaluators attended the pilot workshop, and we met daily to reflect on what we were seeing. This was a highly fruitful effort, as we acknowledge we are each rooted in a particular worldview and each have our own “blind spots”; coming together to share our field notes and reflections allowed us to learn from one another and to paint a more complete picture of the experience through our multiple lenses. The participant-observation model was also essential for understanding the context of what we were evaluating, and also for being able to reflect on our own process as a way to better understand the feedback we were getting from Fellows. Given the complex and personal nature of engaging with multiple worldviews – especially ones that are different from one’s own – it was valuable to have a firsthand, participatory experience with which to make sense of the data. Having multiple evaluators ensured that one specific perspective did not dominate and that we constantly strive for a balance of voices and perspectives.

Several initial lessons around evaluation were learned in the early stages of the project. **First**, in a joint collaboration, budget structures need to reflect balanced input of all partners. Our initial budget structure between the two evaluation organizations (ILI and Native Pathways) did not reflect a balanced input of voices, but, rather, far more of the evaluation budget initially resided with ILI. We realized that within this limitation, it was challenging to engage Dr. Valdez in a way that allowed for balanced perspectives, and we subsequently created a new structure that allowed for much more of Dr. Valdez’s time on the project. A **second** area of learning was around the balance of Indigenous and Western worldviews within the project; while some of the initial evaluation efforts interpreted “balance” as equal time and importance devoted to each worldview, we came to understand the need to view balance within a larger social, cultural, and historical context. In practice, this meant that spending more time immersed in Indigenous ways of knowing was necessary before being able to move into connections and links to Western science, given the historical and current imbalances.

Summary: East (Ha’a’ah)

A place for of initiation, where the three sets of teams; Fellows, Leadership team and Evaluation team, were identified and relationships begin to evolve. Each team member begin to broaden their understanding of the Cosmic Serpent aims and begin to uncover new learning opportunities, mainly in the areas of Native ways of knowing. There was also awareness, mainly by the Leadership and Evaluation teams that several of their goals were not practical for this type of work. Particularly, they realized that more time was needed to immerse all three teams in environments that encouraged and supported relationship building. Allowing the pilot workshop to set the course for this pathway was critical to understand what identifiable areas were needed to ground this work. In this direction, the place of initiation, the three sets of teams were experiencing learning curves and new awakenings that would help shape the pathway for future project initiatives.

South, Shadiab, a place of growth and organization



South – Shadiab – a place of growth and organization.
Practitioners will build relationships with museum peers and “bridge people” as sources of support and joint programming.
Measures: We will monitor practitioners’ use of the project’s regional networks for continued professional networking and support, and will measure the growth, quality, and nature of local and regional partnerships between practitioners in participating science museums/centers and tribal/cultural museums, bridge people, and native communities.

Fellows' Learning in the South

Most Cosmic Serpent Fellows were initiated to the project during one of the full 5-day workshops, held in Santa Fe, NM (Southwest region) in April 2009, Semiahmoo, WA (Northwest region) in August 2009, and Barona, CA (California/Hawai'i region) in February 2010. Fellows arrived with diverse “entry narratives,” meaning there was a wide range of experience, understanding, awareness, perceptions, and emotions around Native worldviews and Western science. This diversity ranged from traditional knowledge holders deeply immersed in Indigenous paradigms to those with little experience with Native peoples and knowledge systems, creating a rich environment for growth, learning, and reflection. As the regional workshops reflect different stages in the project’s overall growth and development, we will reflect on each one separately – first the three full regional workshops, followed by the three follow-up regional workshops. In all of the follow-up workshops, there were a few changes in the faces present from the first workshops. New participants were added for any of the following reasons: turnover in participation, bringing another colleague from one’s institution, seeking of additional bridge people (Fellows who already worked in both Indigenous and Western worlds actively), and sometimes to achieve a better fit for the project (e.g., people more closely involved in museums and other informal learning settings).). Finally, we will provide a summary across all the regions in order to capture the workshop impacts from a broader, more holistic view.

Southwest Regional Workshop

Thirty-seven Fellows participated in the first Southwest regional workshop, held in Santa Fe at the Institute of American Indian Arts, in August 2009. The workshop was held in the university’s Hogan structure, which allowed even a large group to sit in a circle, setting a very positive tone of openness and inclusion. This site was selected because the environment reflected and perpetuated Indigenous cultures, which nurtured the essence of worldviews. In keeping with Indigenous, place-based perspectives, a local Indigenous elder welcomed the group and offered a traditional blessing that grounded everyone present in the local environment and culture. Recognizing that individuals traveled from multiple places, and representing a diversity of backgrounds, experiences, thoughts, and emotions, the opening to the workshop was a powerful way to bring everyone into the same space, and to set the tone for building trust and positive, respectful collaboration.

This workshop represented the team’s initial effort to translate the small, intimate pilot workshop format to a much larger group, and the team was highly successful on a number of levels. Based on the formative evaluation feedback, the leadership team made a number of considerable improvements over the pilot workshop; it included multiple strands, provided a variety of session formats, included more opportunities for interaction and discussion, and continued the successful inclusion of field trip experiences and friendlier environmental conditions that inspired participants. The workshop provided opportunities for thought-provoking, engaging discussions around topic areas of juxtaposing Indigenous knowledge and Western science; offered meaningful immersive experiences; and supported Fellows in forging relationships and partnerships from which to

continue the work of the Cosmic Serpent project. One of the key goals of the workshop was to help Fellows build foundations for cross-cultural and cross-institutional collaborations; and Fellows consistently conveyed that relationship-building and connecting with other professionals was one of the primary benefits of the workshop experience. Data from quantitative scales supported this idea, with Fellows rating this area of relationship-building the highest (see Appendix A,

Table 3).

While the workshop was vastly improved, a variety of lessons learned emerged from this first full workshop. These lessons learned included allowing even more time for knowledge sharing among Fellows, which is particularly important in building trust and personal connections for future collaboration; and ensuring that the Fellows included in the workshop were best aligned with the goals, nature, and purpose of the project. While the leadership put much thought into creating a balance of experiences and an appropriate pace, Fellows still conveyed that these were areas for improvement. For example, they rated these two areas the lowest in terms of overall satisfaction with the workshop (see Appendix A,

Table 2).

Aligning with the four goal areas of the project, impacts were documented in terms of gaining awareness and appreciation of multiple worldviews; building relationships; and the extent to which Fellows felt prepared to implement ideas from the Cosmic Serpent experience back at their home institution or community. Impacts of the Southwest workshop are summarized as follows:

- For some Fellows, the workshop expanded and stimulated their thinking around Indigenous knowledge and/or Western science, and the relationship between the two paradigms, or allowed them to see more complexity involved in efforts to juxtapose the two worldviews. This was particularly true for Fellows who came from a Western science perspective and were relatively new to thinking about Indigenous knowledge systems. However, overall Fellows reported low impacts around their knowledge of the relationship between Indigenous knowledge and Western science, and about Western science in general (see Appendix A,

Table 3) This may be due to many Fellows feeling already familiar with the Western science perspective. While Fellows expressed a slightly higher gain in knowledge about Indigenous ways of knowing, they overall did not yet feel very prepared to create Cosmic Serpent related programming. A few Fellows expressed that they were already far “beyond” where the workshop was in terms of their experience and thinking around Indigenous knowledge and Western science, so it was not as useful for them. They have thought deeply about these issues for many years, and found it harder to find aspects that could engage them at their level.

- The workshop was successful in helping Fellows begin building the relationships and networks necessary to do the work of Cosmic Serpent. In fact, Fellows indicated that the relationship building was the strongest impact of the workshop (see Appendix A,

Table 3), and many began connecting with others that they might work with on Cosmic Serpent related projects, which is a key goal of the project.

- Many Fellows left the workshop with initial ideas of how they would integrate Cosmic Serpent into their work, including exhibitions, teacher training, and educational and family programming. A few Fellows noted that they had begun to form working groups and partnerships within the Cosmic Serpent community that they have begun to activate.

Northwest Regional Workshop

Forty-three Fellows participated in the Northwest regional workshop, held in Semiahmoo, Washington, in the Puget Sound area. The site was located along a water way that was traditionally used by the Indigenous Northwest coastal tribes, and created a sense of immersion in nature, which Fellows had valued for previous gatherings. There are numerous tribal communities in this area, many of whom participated in the workshop, which helped to create an environment steeped in local place and tradition. As in the Southwest workshop, a local Indigenous elder was invited to open the conference with a blessing, setting a positive tone of connection and openness, and once again grounding diverse people and experiences in the same space. This practice made a significant contribution towards creating a foundation for positive collaboration and relationship building. The leadership team also invited everyone in the room to introduce themselves in a Native style – through family and relationship – which set the tone and pace of the gathering, emphasizing self-reflection and deep listening, and opening up opportunities for connection that would otherwise be lost. One of those areas the environment lent itself to was an openness for individuals to discuss and rethink their hesitancy and skepticism around bringing together Indigenous knowledge and Western science, which helped to create an environment of understanding and acceptance.

The gathering overall was successful on a number of levels, and showed growth in the leadership team's learning from the first full workshop in the Southwest. For example, satisfaction ratings gathered from Fellows improved between the Southwest Workshop and the following Northwest workshop (see Appendix A, Table 4). Fellows were especially pleased with the opportunities to learn and expand their thinking, and to connect with like-minded people – to share ideas and experiences, and to build potential partnerships around Indigenous knowledge and Western science. There was overall a strong sense of hope as a result of the workshop, even while Fellows acknowledged the many challenges and divergent perspectives and backgrounds present. The environment was mostly viewed as open, welcoming, and non-threatening, which is essential for supporting the kind of cross-cultural learning and growth intended for the project.

Aligning with the four goal areas of the project, impacts were documented in terms of gaining awareness and appreciation of multiple worldviews; building relationships; and the extent to which Fellows felt prepared to implement ideas from the Cosmic Serpent experience back at their home institution or community. Impacts of the Northwest workshop are summarized as follows:

- The strongest impact areas for the workshop were supporting participants in building the necessary relationships and connections to do this work (one of the primary goals of the project); increasing participants' ability to work with Indigenous communities; and increasing their understanding of Indigenous ways of knowing. In addition to qualitative feedback from Fellows, they rated these three areas the highest in terms of the workshop's impact (see Appendix A,

Table 5). The workshop had less impact on participants' understanding of Western science, likely because Fellows felt they already had a good understanding of Western science, and of connections between Western science and Indigenous knowledge. Some Fellows were still unsure of how to implement Cosmic Serpent-related programming at this time, likely due to still being on a pathway toward understanding, which takes time, and thus not yet being able to envision how this learning could be applied in their practice.

- The workshop was highly successful in bringing together a high quality group of individuals with much overlap in their work and perspectives, as well as diversity in their knowledge, background, and experience. This created a dynamic, enriching, and thought-provoking experience for many participants, in which they felt welcomed and supported in sharing their views and feelings without fear of prejudice or hostility. For many Fellows, the workshop connected them to resources (such as individuals, communities, or examples of materials and programs) which they had not been able to connect to in the past. In this way, the workshop successfully created pathways for individuals to build the relationships and partnerships need to move their work forward in a deep and meaningful way. This included cultural/tribal museums wanting to collaborate with a science museum but not knowing how, or a science center wanting to incorporate more Native knowledge, but not knowing how or where to begin.
- Participants seemed to gain a deeper sense of the complexity and challenges involved in connecting Indigenous knowledge and Western science. While many felt the workshop reinforced what they already understood and believed, the experience also deepened awareness and thinking around these ideas.
- Many participants indicated that they gained a deeper understanding of Indigenous values and knowledge systems. The experience at Tulalip was particularly powerful for some, with some individuals having an “aha moment” about the differences in value systems. One example cited by a few was realizing how elders are not valued much in Western society, whereas they were the first priority within the Tulalip community. This experience provided an excellent opportunity for grounded education, in which participants came away with a greater sense of the priorities and values of tribal communities.
- Evaluation also pointed to a few target areas that could be improved for future workshops or for the project as a whole. These included providing more opportunities for discussion and interaction among participants (while this was included in the agenda, these sessions often did not happen due to time constraints); allowing participants more time to reflect and process the workshop, rather than packing so much into each day; and supporting participants more in developing concrete ideas and partnerships to implement projects at their home institutions (see Appendix A, Table 4, for Fellows' ratings in these areas).

California Regional Workshop

The California regional workshop took place February 8-12, 2010, on the Barona reservation near Lakeside, east of San Diego. Once again, the site was purposefully selected and provided a sense of place to homelands of Indigenous people. While the workshop took place at the conference center at the Barona Casino, the grounds are landscaped with native and drought-friendly plants, and the resort has a conference center separated from the hotel and casino. The first day, and each day after that, began with a welcome prayer, song or story from members of the local tribes. The opening day included welcomes and project explanations by the PIs, followed by personal introductions, reflective of a Native way worldview, about family and place--these interviews were done in three smaller regional groups. The opening and most of the all-group sessions took place in a large hall in the conference center, with all 48 Fellows, as well as facilitators, team members and advisory board members seated at a large U-shaped table. The introductory day concluded with a Keynote address that turned into a discussion among the Fellows about the historical trauma experienced by Native Americans and why there was hesitation, reticence and even distrust on the part of Indigenous people at the workshop. This discussion allowed an important and safe space for sharing and for helping participants open up to each others' realities, but the discussion also created a tension that was difficult for some Western museum participants and some Native participants to resolve. For the vast majority of Fellows, however, the intimate and varied activities over the following days allowed people to get to know one another and begin to trust the process of engagement. By the end of the workshop, most did not want to leave and began a discussion about the potential of the Cosmic Serpent project.

Impacts of the California workshop experience were gathered around the areas of relationship building, worldviews, and activation/implementation. At the three-month and nine-month post-workshop check-ins with Fellows about their experiences at the California regional workshop, Fellows indicated that relationships and connections they had built with other Cosmic Serpent Fellows had offered guidance on developing projects; collaboration on new proposals; resources to answer questions; contacts serving as general support and encouragement; new connections between communities; and new awareness brought by learning from one another. Quantitative data supported the idea that the workshop increased Fellows' sense of readiness for building positive collaborations across Indigenous Knowledge and Western science, with relationship building being rated among the highest impacts of the workshop (See Appendix A,

Table 6).

In terms of relationship building, a majority of Fellows indicated the importance of reconnecting with people they already knew, meeting new people with new resources, and desires to stay in contact with workshop participants. Others had specific projects in process which they plan to incorporate and partner with colleagues they met at the workshop. It was noted that utility of coming to the workshop as a team increased the number of contacts and reinforces the likelihood of collaborating with others because of the support from their team members, suggesting that it is valuable to include more than one person from each organization where possible.

Fellows also shared many ways in which the workshop impacted their thinking about the two ways of knowing, including the following key areas: belief in the value of Cosmic Serpent despite it being difficult to connect the two worldviews, although some even experienced greater clarity of the connection; increased knowledge about Indigenous ways of knowing by non-native Fellows; and continued concerns about where Western Science is taking humanity, although one Fellow felt Western science has recently opened up to the interconnectedness of this phenomena. Quantitative data supported the idea that Fellows experienced a high level of impact around worldviews. For example, knowledge of Indigenous ways of knowing, as well as connections and differences between Indigenous knowledge and Western science, were ranked highest amongst all the workshop impacts (see Appendix A,

Table 6).

In terms of implementing Cosmic Serpent ideas, many Fellows shared specific ideas for projects, suggesting that the workshop offered a rich environment for thinking about putting concepts into practice. For example, some Fellows plan on inviting speakers from the workshop to do professional development or to support parts of programs at their home institutions, to jointly search for funding to support a Cosmic Serpent collaboration, and to utilize ideas from the workshop (either specific activities or broader concepts). Several Fellows have already conducted professional development activities for colleagues at their home institutions, such as sharing the learning from the workshop with other staff members.

Fellows also expressed a number of challenges after the workshop, including time and resources/funding, including locating suitable foundations or funding sources that would be interested; overcoming the perception that Western science and Indigenous knowledge are diametrically opposed; convincing the non-initiated or people without this kind of experience of the value of Cosmic Serpent (including resistance by colleagues or museum leadership or partners); achieving cultural sensitivity as they wade through complicated ideas and develop the scope of the project; sustaining visitors' interest over time after some initial effective effort/program; putting theory into practice without having a catalog of well-developed examples; portraying many different stories at once (or deciding on which ones to portray); and having limited time to build relationships between Western museums and Native communities.

Southwest Follow-up Workshop

The Cosmic Serpent Southwest Follow-Up Workshop was held in Taos, NM from April 26-29, 2010. This site was carefully considered for the energy and connection to the land; the key location for viewing the skies, which supported the astronomy activities within the workshop presentations, and the local tribal communities surrounding Taos. One evaluation team member attended the Southwest regional workshop, (Dr. Shelly Valdez from Native Pathways), mainly due to budgetary constraints – the original budget only accounted for one evaluator to attend two of the three follow-up workshops, in part due to a Western evaluation perspective that does not require as much physical presence as does an Indigenous evaluation approach. In retrospect, it would have been

valuable and more appropriate to the project to include at least one other evaluator, particularly to provide the balance of worldviews that is at the heart of this project. In future projects, it is recommended to budget for everyone's presence at all key gatherings of the program or to find alternate ways to support this extremely important value of presence and participation by all team members.

The three-day workshop engaged 36 Fellows, in addition to 9 team members and advisory board members. These Fellows hailed from science centers, science and natural history museums, and tribal/cultural museums, predominantly from the Southwest region of the US. Of the 36 Fellows who attended the follow-up workshop, 23 were returning and 13 were new Fellows (mostly from the same institutions), replacing their colleagues who had attended the initial Southwest workshop. Most newcomers indicated they were invited to attend because their institute's conceptual ideas of training includes 'shared training efforts' or their colleagues felt they were a better fit for the program. While there were a few new faces, the environment echoed the importance of relationship through reuniting the Fellows and partners to deepen the work. Through observation, there was a sense of group cohesiveness and synergy towards creating dialogue around innovative ideas for collaborating. To set the workshop on a positive pathway and to keep with the protocol of the previous workshops, an indigenous elder was invited to share a blessing.

The majority of Fellows were satisfied with the overall set up of the follow-up workshop, and several indicated positive improvements as compared to the initial Southwest workshop. They noted improvements in sufficient time for attending workshops and space for informal conversations, richness of interactive presentations and including presenters from the other two regional areas.

The Fellows keyed in on several new ideas or forms of learning that allowed for opportunities to deepen their knowledge. These included the importance and realization for including traditional knowledge holders within program activities; the worldviews of Indigenous people towards the conventional educational systems for advanced degree work don't necessarily contribute to 'knowledge capacity or ownership'; this needs to be understood when working with Indigenous communities; and Fellows recognized there is a need to understand the audience (in particular Native communities) and what types of approaches work best for museum settings for particular communities; for them, it means communication with Indigenous communities is critical.

The Fellows also keyed in on relationship building as a critical area in which they were impacted during the workshop experience. They felt that new contacts and networks were valuable for future implementation of ideas or concepts from the Cosmic Serpent, and the realization and understanding that outreach to Native tribal museums and communities is key for developing strong exhibits and sustaining relationships. While a few museums commented that they are already working on collaborative partnerships, the opportunity to build networks and expand ideas from their participation in Cosmic Serpent was an important outcome. This idea was reinforced during the Thematic Wall of impacts activity, in which relationship-building was ranked highest of all impacts (see Appendix A, Table 7).

The outcomes of the follow-up workshop clearly presented positive growth for the project and for those participants and partners involved. The workshop provided opportunities for thought-provoking, engaging discussions around themes of juxtaposing Indigenous knowledge and Western science; offered meaningful immersive experiences; and supported Fellows in forging relationships and partnerships from which they can continue the work of the Cosmic Serpent project. One of the key goals of the workshop was to help Fellows build foundations for cross-cultural and cross-institutional collaborations; and documented outcomes found that Fellows consistently conveyed that relationship-building and connecting with other professionals was one of the primary benefits of the workshop experience. Fellows also appreciated the venue for the workshop and how it inspired and allowed for engaging dialogue and thoughtful reflection. The follow-up workshop constituted a considerable improvement over the initial workshop in several ways; (1) it included many more opportunities to put theory into practice, (2) provided more meaningful opportunities for interaction and discussion, and (3) continued friendly setting/environmental conditions (including field trip experiences) that inspired Fellows. Fellows indicated a number of areas for growing the program. One important area brought to the dialogue was a need for the Cosmic Serpent leadership team to connect with the decision-makers at the local institutions that are a part of this project, mainly to provide them with a summary of project outcomes, through a follow-up site visit or telephone call. Most Fellows felt that it was important to create the idea of ‘buy in’ from their institution’s decision makers for sustaining the project’s broader goals.

Northwest Follow-up Workshop

The Cosmic Serpent Northwest Follow-Up Workshop was held in Fairbanks, AK, from September 20-24, 2010. After much investigation of various possibilities, this site was carefully selected by the leadership team for the connections to local tribal elders and communities, as well as scientists at the University of Fairbanks, and for the welcoming reception the team received during initial queries about holding the workshop in this area. This location also offered a potential opportunity to view the Northern lights, an area of specialty of Dr. Peticolas and a rich environment in which to explore a natural phenomenon through multiple lenses. As with the Southwest follow-up workshop, only one evaluator attended this workshop (Jill Stein of ILI), also due to budget constraints and the fact that the original evaluation plan was conceived more from a conventional evaluation perspective, in which context is also extremely important but not to the extent that it is within Indigenous evaluation approaches.. The four-day workshop engaged 39 Fellows; 24 of the Fellows had attended the first Northwest workshop, and 15 were new Fellows, but from the same institutions previously involved in the project. As in other regions, this was due either to the original person not being able to attend or because there was interest in bringing additional staff from the same organizations into the Cosmic Serpent community. Although there were many new attendees, the atmosphere of the follow-up workshop was one of reunion and reconnection, like a gathering of old friends. New Fellows were welcomed into the fold, and there was a sense of openness and trust among the group. As in all of the Cosmic Serpent meetings and workshops, a local Indigenous elder,

Robert Charlie (Athabasca), blessed the gathering and welcomed the group to the land, which once again grounded everyone present in the local place, culture, and history.

The follow-up workshop deepened the project's efforts to build relationships within an environment of trust and open dialogue. The presentations and experiences provided rich avenues for exploring intersections between Indigenous and Western worldviews, as well as models for juxtaposing multiple worldviews within informal learning contexts. Fellows expressed an even greater sense of openness, trust, and commitment to the project than they did at the initial gathering in Semiahmoo, WA. For the Northwest follow up workshop, Fellows from Western science institutions seemed far more willing and able to listen to the Native perspectives, without feeling blamed or defensive, and many expressed that they felt privileged that Native participants were willing to share their thoughts and experiences so openly. As one Fellow commented, "Some switch went on and we all trust each other so much more this time." This type of sentiment validated the importance of bringing the group together in person multiple times over the course of the project. It is in this face-to-face environment that trusting, respectful partnerships can be born and nurtured.

The majority of the focus group discussion centered on what Fellows found valuable about the follow-up workshop experience and what they felt they were taking away from it. Fellows offered numerous ways in which the workshop was valuable to them, and the discussion itself became a testament to how an environment of trust, openness, and hopefulness is being developed among the Northwest Fellows. Returning Fellows clearly valued the opportunity to come back together again, to continue and deepen the conversations; and new Fellows were appreciative of the opportunity to join a thoughtful, dynamic community focused on building sustainable, respectful cross-cultural collaborations. The overall sense of the discussion was one of appreciation, trust, and commitment to continue this challenging work into the future, from both the Native and non-Native perspectives. One Fellow shared this response: "It was a powerful gathering of amazing scholars, both native and non-Native with good minds and good hearts discussing and problem solving important issues in the world." Fellows especially appreciated the opportunity to hear the words and thoughts of local Indigenous elders, both through onsite discussions and presentations, and through a museum tour led by Indigenous docents.

There were numerous positive outcomes of this gathering for both Native and non-Native Fellows. Overall, there was a positive sense of connection, great respect for the Cosmic Serpent project and its community members, and a sense that positive partnerships would develop over time. Some envisioned the project serving as a model for open, respectful dialogue between Western scientists and educators and Indigenous knowledge holders, and providing a "pilot" model of how this collaboration might work for others. While there were individual learning experiences of the Fellows, there was a sense of mutual goals and vision, and recognition from all Fellows that the process of building respectful, sustainable partnerships would take time and patience. Fellows expressed that the gathering allowed space for multiple voices to truly be heard, and there was a deep appreciation for the knowledge, wisdom, and even emotions that Fellows were willing to share with one another. It was also a space in which multiple learning styles were embraced; one Fellow suggested that the workshop experience helped reinforce for him the idea of "less talk, less

direction,” particularly based on meeting Robert Charlie and his wife, and helping to prepare the moose.

Some of the non-Native Fellows in particular expressed a deepened understanding of how to be thoughtful and respectful when working with Native communities, and that they had come to appreciate that developing sustainable relationships take time and are not product-based. One returning Fellow contrasted this to the sense of “urgency” she felt during the initial workshop to produce programs or exhibits immediately. Many non-Native Fellows also expressed a deepened value for and appreciation of Indigenous knowledge, and suggested that their role was more of a listener to Native perspectives and, as one fellow put it, an “ally” and not a “leader.”

In addition to the positive learning and hopeful spirit of the gathering, there were still questions about how to transfer the good work of this community back to their home institutions. One Fellow shared this response: “How do you maintain the goals and the spirit that’s shared in this room and carry it in my suitcase back home?” This Fellow noted that large, Western institutions tend to give “lip service” to concepts like reciprocity, authenticity and sustainability, but are not willing to truly embrace what they mean. Another Fellow shared concerns that the fast pace of her museum does not allow for the kind of deep and thoughtful work required to build a respectful collaboration with Native communities.

California Follow-up Workshop

The Cosmic Serpent California Follow-Up Workshop was held in Palm Springs, CA, January 24-28, 2011. The three-day workshop engaged 38 Fellows, in addition to 11 team members and advisory board members. One member of the evaluation team (Eric Jones) attended the workshop. These Fellows hailed from science centers, science and natural history museums, and tribal/cultural museums, predominantly from the California and Nevada region of the US. Of the 38 Fellows who attended the follow-up workshop, 28 were returning and 10 were new Fellows replacing their initial colleagues from the same institutions, either because the original person could not attend or they wanted to bring other colleagues into the fold of the Cosmic Serpent community.

The California follow-up workshop allowed returning Fellows to continue building connections and relationships with other California participants, renew a sense of excitement about the promise of the Cosmic Serpent project, and, for non-Native participants in particular, to deepen their understanding of what it takes to build sustainable, cross-cultural collaborations with Native communities and organizations. New participants appeared to integrate well into the workshop; they provided new perspectives and energy and seemed to fully engage the new and varied perspectives. The perspectives and objectives of the invited participants for this follow-up workshop were very well-aligned to the goals of Cosmic Serpent and appropriate to growing the community network of cross-cultural partnerships. The people invited to this workshop were more involved in Western science and natural history museums or Tribal museums, and not just from Western or Native worlds in general.

Responses from Fellows suggested that they felt a greater sense of openness, trust, and commitment to the project than they did at the initial gathering at Barona, CA at which there was a sense among several participants of uncertainty and even skepticism and defensiveness around the idea of collaborating across Indigenous knowledge and Western science. Being a smaller group than in the first California workshop may have made the development of respect, trust and relationships easier. Also, although this group was already well aligned with the mission of Cosmic Serpent, there was visible transformation among Fellows from both Western science and Indigenous knowledge backgrounds—such as the willingness to dialogue, and to share experiences and perspectives without defensiveness or blame. People were impacted most in terms of the development of relationships, respect and trust, but there was also a certain amount of impact concerning worldviews--perhaps because there were a few new people.

The primary themes salient in the transcribed focus group recordings from the four small focus groups at the end of the workshop were mutual understanding, interpersonal connections, opportunities for using Cosmic Serpent, and clarifying the challenges and solutions.

Mutual understanding largely centered on Native and non-Native perspectives being fundamentally different as they come from largely different experiences with the world, including differences in protocols for the sharing of information. Mutual understanding partly was engendered by the opportunity to hear stories from people from a variety of backgrounds and cultures. In addition, Fellows searched for and did appreciate some commonalities between Indigenous knowledge and Western science, including empiricism, intergenerational knowledge, and respect for wisdom.

As was the case for the first California workshop, interpersonal connections were a primary interest of Fellows. Fellows noted the intensive and lengthy efforts that go into developing sustainable and long-term relationships across these diverse institutions and related worldviews, and stated that this sometimes occurs even with governmental agencies but can be hampered by turnover in personnel. Safe spaces to express oneself were fundamental to supporting an openness and trust that allowed relationships to begin and develop.

Since this was a follow-up workshop, Fellows expressed considerable desire to enact what they had learned; they hoped for opportunities to use Cosmic Serpent ideas and relationships, and even started to brainstorm ideas as well as initiate collaborations. Overlap in agreement is one way to support collaboration, but being clear about where there is room for the other group in one's own efforts is another, though related, approach. Collaboration to develop culturally appropriate use of current collections and exhibit materials in science museums was one suggestion, and another was to focus on engagement and education of youth (including heritage of young people, as well as games and gaming), and yet another was to focus on helping teachers.

Finally, the Fellows at the follow-up workshop sought to clarify the challenges facing them, and begin to think about solutions. Challenges included: institutional reticence due to conservatism or inertia; combating stereotypes of past and present Native American cultures, including

contemporary cultures; and trying to find ways to share knowledge that is inherently embedded in language and ceremony.

Leadership Team's Learning in the South

In this place of growth and organization, South (Shadiah), the leadership team experienced a deeper awareness of relationship (including relationships among leadership team members, Fellows and bridge people); strengthening of workshop environments to allow more space for relationship building and to create an environment for a discourse around the juxtaposing of Indigenous knowledge and Western science; provided additional time for follow up and support to Fellows at their local institutions; and were diligent about making sure workshop presentations significantly drew from the two knowledge systems and worldviews that captured the true essence of the project.

The leadership team broadened and deepened their understanding of collective leadership through implementing more time to discuss the pathways of the project, additional leadership team conference calls and considerable online communication. During these dialogues they began to rethink some of the goal areas of the project that may not necessarily fit within the timeline of the project, mainly within the anticipated product areas. Through the first set of workshops, team leaders understood what was needed was to create stronger environments that would enhance opportunities for building relationships and exchanging knowledge that would in turn impact long-term partnerships, networks and eventually lead to outcomes of products that may not necessarily be conceptualized within the timeline of the project. The follow-up workshops were filled with informal environments for allowing relationship building and networking.

Additionally, there was a realization to include more post-workshop follow up and support with Fellows through site visits and telephone calls to the institutions; and providing resources, such as utilizing the website for continued connectivity, newsletters that would capture stories of successful programs and exhibits targeting the goals of the project, and other networking opportunities that would enhance and strengthen the collaboration. These areas were met with budget challenges centered around time management, travel and supplying Fellows with ongoing resources in order to enhance their work. There were limitations in the budget for traveling to sites and time commitment of staff to attend site visits. Staff turn-over at institutions (particularly the tribal museums and cultural centers) made it difficult to influence sustainable efforts. These areas resulted in challenges to providing equal distribution of time for follow up to all institutions and support to Fellows.

There was also a realization that presenters were in need of deeper orientations to what was expected for presentations, which included tangible examples of interactive experiences that exemplified the two worldviews merging. As a result the lesson learned created a mechanism for deeper orientations to presenters for the Northwest follow-up workshop, and the outcomes of future follow up workshops were exemplar in showcasing interactive experiences of both worldviews, and environments for building and strengthening relationships.

Evaluation Team's Learning in the South

As before, we will take a moment to reflect on our own evaluative process and lessons learned in this directional area before moving to the next directional circle, the West (*I'ii'aaah*), a place of activation. Our evaluation team experienced a shift after the first full workshop in the Southwest region. Dr. Martin Storksdieck, who had been the project director for ILI, left the organization; and Jill Stein took over as ILI's lead for the evaluation. Shortly after, ILI brought on Dr. Eric Jones – an ILI research affiliate and researcher at University of North Carolina, Greensboro – for his expertise in quantitative analysis and social network analysis (from a western science/anthropological perspective). Eric was initiated into the project during a strategic planning meeting in November 2009, in Barona, CA, and was able to attend the California Regional workshop in that same location in February of 2010. At the strategic planning meeting, the evaluation team decided on an approach in which each of the three evaluators would serve as the lead for each region (Shelly in the Southwest, Jill in the Northwest, and Eric in California), while still working collaboratively across all regions in our evaluation approaches, data collection, and analysis and interpretation.

Growth in the area of evaluation was centered on continually striving for a balance of voices, worldviews, perspectives, and communication. Because of ILI's limited experience working within Native paradigms and worldviews, there was considerable growth on this side of the evaluation partnership. This included deepening awareness of power imbalances that privilege western thinking, communication, and protocols, which are at the heart of social and economic imbalances as well. This growth also included a deepening understanding of Indigenous paradigms and protocols, and a recognition that more time needed to be spent (both for the team and the Fellows) immersed in Native ways of knowing and being, before a balanced partnership could be achieved.

One of the tangible examples of this learning included a shift in evaluation focus to relationship and process, rather than products (such as exhibits created); we then viewed success of the project in terms of the type of environment that was created for change, signs of positive relationship-building, such as openness and trust, and what types of pathways were emerging towards building reciprocal collaborations. The evaluation began to embrace the multiple, emergent paths that Fellows would take (rather than seeking specific, predetermined outcomes), while still targeting the key goal areas of the project. Another example of this learning was that the evaluation began to take into account the long term (seven generations) time frame of sustainable partnerships, realizing that moving from the initial gathering of Fellows to producing new exhibits and programs together is not a realistic goal for a 4-year project, particularly one that brings together multiple worldviews. Much more time needs to be spent on building trust – particularly since western science and western institutions have so often fractured the trust from Native communities. Many Fellows also faced challenges at their home institutions, such as funding and resource limitations, and/or getting enough institutional buy-in to make changes. Because of these factors, the evaluation shifted towards identifying the important steps along the Fellows' pathways, recognizing that we could only capture a “snapshot” of their journey during the life of this project. These steps included self awareness (such as Fellows

reflecting on their own assumptions and worldview), sense of hope (such as Fellows beginning to embrace the possibility of collaboration between Indigenous knowledge and Western science), and initial dialogues between Native and western partners. Some Fellows who had spent more time in this space were able to move farther along in their partnerships, even writing grants and developing new projects together; so it is not the evaluation stopped looking for these more tangible outcomes, but that we also heightened our awareness towards the more subtle steps that Fellows were taking along their own path. Instead of measuring for specific, pre-defined outcomes, we embraced an organic approach; but one that paid attention to the multiple ways in which learning and growth might be demonstrated.

Summary: The South (Shadiah)

A place of growth and organization, in this direction the learning experiences from the workshops identified a critical need to spend more time in this direction. The Leadership team recognized through the evaluation documentation that the Fellows were not near as close to begin to activate the collaborative work or to work towards suggested products outlined by the proposal. As a result, the workshops were enhanced to provide more time to deepen the relationships and to create environments where open and honest dialogue could be shared on the two worldviews. Outcomes from the workshops showed that Fellows began to make connections with collaborating partners that perhaps may not have been initiated outside of Cosmic Serpent, Fellows begin to deepen their understanding of relationships from a Native worldview that reinforced these connections and leadership and evaluation team members begin to solidify their relationships among one another. In this place of growth and organization, the growth that occurred was that all team members were provided with opportunities to learn amongst each other, exchange new knowledge and to intensify their relationships among Fellows, Leadership team members, bridge people and evaluators.

West, *Ii'ii'aah*, a place of activation



West – Ii'ii'aah – a place of activation. Science museum practitioners will use *the Cosmic Serpent* theme to enrich existing earth, space, life, and environmental science programs at their institution. Tribal museum practitioners will infuse science into their art and cultural programming. Measures: Evaluation will measure the degree to which practitioners deliver new or enhanced programs that include the native science paradigm, and the degree to which these experiences lead to expanded knowledge of native science, as well as increased awareness, appreciation, and comfort on the part of practitioners in doing so.

Fellows' Learning in the West

For the Fellows, the West direction (Ii'ii'aah), a place of activation, is comprised of the myriad activities undertaken as a result of participating in the Cosmic Serpent workshops. All of the group discussions, surveys and interviews we conducted at various points with Fellows allowed us to achieve some insight into Fellows' engagement of the larger world with their honed skills, attitudes and interests. Primarily, the greatest opportunity to talk about these activities was through telephone interviews (and some questionnaires completed by Fellows with whom we couldn't speak or who preferred to send thoughts in writing) that we conducted half-way in between the regional initial and follow-up workshops, as well as in the survey that Fellows filled out at the end of the Culminating Conference held in May 2011. Fellows were asked to talk about the ways in which they were able to implement ideas or concepts at their institution as a result of Cosmic Serpent. Here, in this section, we try to be representative of the activities Fellows have undertaken, to highlight the conditions under which these activities have been undertaken, and to give a sense of the predominance of the various reported activities.

The efforts by Fellows to take what they have learned or experienced at the workshops into their professional and personal lives in a concrete manner have ranged from the focusing of their own interests, to the generation of specific ideas within those interest areas, to the development of projects or revision of existing projects, and the shoring up of projects with institutional support. Key to each of these four steps is the inclusion of partners for establishing collaborative relationships. Next are examples of the activities that Fellows have been undertaking, although this list is not exhaustive for those interviewed, nor does it include activities by those who did not participate in an interview.

Focusing Interests

An initial experience of activation for many Fellows is to dig deeper to explore personally and professionally what they are interested in. These Fellows have made a concerted effort to think more about the domains in which they would like to engage what they have learned through Cosmic Serpent. While this activity is more common for new Fellows or for people with relatively minimal background in cross-cultural experiences or understanding other ways of knowing, even very skilled and aware Fellows have taken the time to figure out in what areas they might best apply their energies given their newly developed network and motivations. In this area, generally, Fellows talked a lot about focusing on: the content of exhibits, adding to content of current education programs, dialoguing with colleagues about experiences in cross-cultural understanding and collaborative projects, helping colleagues with information and resources, seeking out project partners or colleagues, seeking out the Cosmic Serpent PIs and Leadership Team for advice or resources, building new relationships with tribes in their area to discuss the development of new exhibitions and programs. The latter two efforts in the list--engaging PIs and engaging local tribes--were slightly more common techniques for figuring out how to focus interests. Also, collaborations to produce ideas are already developing. For example, a cohort of museum professionals from several museums

in Arizona met several times to brainstorm ideas about how they might work together. Another group of Fellows are looking at raising funds to sponsor a series of “salons” – where institutions’ personnel can get together on a regular basis and discuss future project ideas. The following quotes characterizes these kinds of activities intended to focus interests and thus generate new ideas:

“We’re moving... and that will allow us to incorporate California native knowledge. So I’ve started to talk with people from the California workshop about helping with our exhibits. That’s one of the things I’ll be doing this summer is to invite the California native colleagues to meet with curators of the museums and try to allow for early input. One thing I want to do is talk to leadership of [the museum] and explain the consequences of engaging in this sort of dialogue and relationship so that we can follow through and make sure it’s something we can commit to. [Name deleted] said there’s not one museum in the Bay area that incorporates understandings on the Native people from the Bay area. We have kind of a tall order, then.”

“Before the 1st workshop, we didn’t know them, but now we’ve met to talk about things we can do. It’s still in the talking stages but that’s alright... so now we are actually talking about it, something might actually happen this time.”

Generating New Ideas

At another stage of activation are those fellows who have begun to formulate ideas. In some cases they have already gone through the process of focusing their interests. In other cases, Fellows already had focused interests upon joining Cosmic Serpent. A few others have not focused their interests per se but are excited by the prospect of developing new ideas although these Fellows may have a lower rate of follow through with their ideas or, if successful, may bounce from idea to idea without developing particular strengths in content areas or in deep collaborations.

Several Fellows mentioned wanting to bring presenters from the Cosmic Serpent workshop to their institutions for lectures or as part of programs they were starting to think about developing. Here are some examples:

- Science of dyes with traditional dying practices and song
- Inviting a Cosmic Serpent team member or participant to lead training in cultural sensitivity for museum docents
- Children's heritage may be an effective way to conduct Cosmic Serpent efforts. One group proposed to find ways to engage indigenous youth in learning experiences that provide positive opportunities for them to increase their knowledge and understanding of Native communities, and of their own Native communities.
- Games in general, especially social non-video oriented games, are a vital part of Native communities, and they are used to teach valuable lessons and bridge relationships. Games tap into the understanding of brain theory and provide a platform for multiple ways of learning.

Another idea mentioned by a few Fellows is the incorporation of Cosmic Serpent-related efforts into current school curricula, exemplified by the following:

- Incorporate more cosmology and astronomy, the sky, earth and sea, from the narrative of our oral traditions, partnering with Western science concepts to bring a well-rounded curriculum for a specific age group that could be integrated into the schools.
- How to put together science fairs for kids, in the case of a Fellow that has expertise in making things more hands on. One Fellow has been approached to do professional development for community members or teachers to share methods and classroom techniques.
- Using materials and resources from Cosmic Serpent allows for broadening audiences, targeting economically challenged groups, such as school outreach programs.

Many Fellows remain interested in designing exhibits and programs that explore different ways of knowing, comparing and contrasting Indigenous ways of knowing and Western science, or exploring the interface between these worldviews, although more science museum practitioners voiced this interest than did Native cultural practitioners. Examples include:

- One Fellow is leading the process for a concept museum, a design process for a tribe in the East. The project is not concrete, yet, but the Fellow is asking “if you were to include a science component, what would that look like?”
- Another Fellow would like to pursue the development of an exhibition and programs on techniques of scientific observation and the merits of western and Indigenous ways of going about scientific research.
- A Fellow gave the PI’s contact information to a Native cultural center that does a lot of astronomy based on western science. The center is now working with the PI and putting his work into their curriculum. They’re now looking at Native ways of looking at astronomy.
- Four museums are looking at a number of ways that they can collaborate on a number of science and culture-based visualizations using museum and tribal data and another partners’ technology.

In terms of the topic or subject material that Fellows talked about for implementation, most had to do with the biophysical environment and how Indigenous populations engaged with their surroundings. Many of these had to do with astronomy. The following are examples of the kinds of collaborations that Fellows envisioned:

- The idea of workshops that attempt to bring culture and science into a more synergistic relationship is something one Fellow would like to see developed at their center. This Fellow has discussed future collaborative project with two other Fellows having their centers focus on a program covering Indigenous astronomies, time keeping, and seasonal calendars.
- A Science Center is planning to collaborate with Alaskan Indigenous communities to produce indigenous-based planetarium shows.
- Another group has been discussing a potential collaboration on a traveling exhibit that would target their specific tribal areas.
- There is the possibility that a science center will be undertaking two new citizen science projects related to climate change: one on tidepool monitoring along the central coast and another that will tie into Project Budburst. The science center is hoping to incorporate an Indigenous component into both of these projects if they undertake them.
- One participant from a science museum contacted a Cosmic Serpent facilitator to connect with local native communities in developing a climate change project at her museum.

- Another Fellow connected with a Cosmic Serpent participant from a tribal museum to talk about how to integrate the voices of traditional knowledge holders in their museum catalog.
- Writing grants for programming or exhibits that build on a collaboration between tribal communities and science museums, featuring current Navajo artists in a new gallery space, and incorporating Mayan mathematic concepts in a new exhibition.

The preceding examples cover many of the ideas that Fellows shared with us that they hoped to implement. The following sections, however, have to do more with programs, events and collaborations that are now being undertaken and are beyond the idea stage; these activities really involve an implementation of the kinds of ideas described above.

Development of New Projects

Next, following the presentation of example collaborations, we list some Cosmic Serpent-type projects that are really led and largely undertaken by either tribal museums or by science museums. We have found that these latter activities, although not fully collaborative in the Cosmic Serpent sense, they are important steps in helping people to use their augmented skills, increased knowledge and focused interests to develop useful ways to engage respectfully across cultures in ways that meet goals of either Indigenous museums or Western science museums. That science museums appear to be over-represented is at least partially due to the fact that there were more science museum and science educator Fellows than tribal museum or Native Fellows.

Collaborations. True collaborations are difficult to come by. One partner always has more funding, more people, more energy, more motivation, more ideas, or may be unable to engage a partner in a truly collaborative fashion for a number of reasons like the phase of implementation, funding constraints, or lack of skill or interest in truly collaborating. It might be even rarer for collaborations to occur across cultures and across the divides of distrust and misunderstanding that often separate science educators and Native people. Nonetheless, several relatively egalitarian collaborations have developed as a result of the Cosmic Serpent project—and a majority of them appear to be between Indigenous institutions and Western science institutions rather than just among the former or among the latter.

- Two museums are partnering on a project to present a contemporary native art exhibit. The call for artists has already been sent out for contemporary Native American artists from the Sierra Nevada and/or Great Basin region. The theme of the exhibit will focus on environment(s) and responses to the changing environment. Some participants who attended the Cosmic Serpent workshop will assist in locating artists. An organizer has talked with Cosmic Serpent leadership team member Pamela Woodis, Museum Program Specialist, National Museum of the American Indian, regarding the possibility of having this exhibit shown as a traveling exhibit at the NMAI in Washington DC.

- One group put together a roundtable discussion on the project at the New Mexico Association of Museums' annual conference.
- A tribal museum is working with a science museum on various projects.
- A tribal museum is working with a science educational program to create the tribe's version of a Navajo Skies-type program.
- We have plans to work on their upcoming textile exhibit on southern Mexican Mayan culture, and because of my background I'm going to help with tying the geometric patterns in the textiles to astronomy.
- A science museum has a new project with a local reservation—with kids engaging oral history. The science museum Fellow is sure that the workshop lent some confidence in being clear and confident.
- A group of institutions is planning to put on a traveling 3-year exhibit on indigenous dry-land farming. One partner has 5 experimental plots. The group is looking to engage an indigenous partner. They also want to develop a video. Parts of other grants will fund this.
- A science museum has begun to work with representatives from a Native American tribe to develop collaborative funding proposals to create a series of planetarium visual narratives about the past, present, and projected future of the San Francisco Delta. Public programs and digital educational media will be produced in collaboration with Indigenous ecologists and community members to increase awareness of the unique system of the Bay Delta and its vulnerability to climate change in the future. Other short term public programs inviting Indigenous representatives to work with our programming and research staff on the public floor are also planned.
- A Fellow from a science education center curated a Native Basketry exhibit at a science museum. These partners met for the first time at the Cosmic Serpent workshop.
- A tribal museum and a science museum collaborated on a few different projects including a cultural exchange project with an indigenous group in East Asia.
- The elders and the Cultural Center have participated with a science museum in developing an exhibit together. The science museum met with the elders in the museum. As a result, the former is going to redo its orientation center. The elders suggested using a phrase at the doorway that lets people know that the Native people are here, they exist.
- A Fellow was working on an archeo-astronomy toolbox, and met some people who are interested in doing something similar, so they are working on doing something together that they can use at both institutions.

Primarily Tribal Museum Activity. The activities from the tribal museums that are steps toward Cosmic Serpent ideals, but which fall short of full collaboration, tend toward gaining

confidence with reaching out to others and with sharing their cultures or aspects of their cultures with others.

- One native participant expressed that Cosmic Serpent helped to broaden their engagement and interest in working with science, even though they are still critical of Western Science. Their tribe is now working on a climate change project that addresses the environmental impacts of their community.
- One Native Fellow is trying to establish a master list of plants that are culturally significant to my people, independent research working with Wildlife Fish and Game, to identify rare or endangered species related to my tribe.
- One tribal museum built a new exhibit about the sun and stars and moon. The museum is pleased with the work, but has not advertised it much. These museum professional hope to contribute to the spirit of Cosmic Serpent by sharing knowledge with Native and non-Native people so they can get an idea of who the tribe is and what they have been doing.
- One tribal museum has met with a state Indian museum advisory board to share the Cosmic Serpent program, with positive results.

Primarily Science Museum Activity. The activities from the science museums that are steps toward Cosmic Serpent ideals, but which fall short of full collaboration, tend toward adding a more holistic or more authentic Native voice to their exhibits and programs. Two major ways that this is done is through inviting tribal members to consult on projects that are already underway. Another mechanism is to have Native people come to their institutions as speakers or to lead a program.

- Writing a grant to add a cultural perspective to the museum's orientation area
- Involving elders from a Native community as consultants on a new exhibition on basket design and traditional symbolism.
- Getting advice from traditional knowledge holders on their interpretation of the local landscape and ecology.
- Inviting local pueblo communities to consult on interpretation of a new Climate Change exhibition, and incorporating multiple (non-Western) perspectives on sustainability and climate change.
- Working towards consulting Native communities for contributions of Indigenous perspectives on an exhibition about signs left by animals. The team is hoping to work with Cosmic Serpent project leadership to locate a partner who is interested in advising on how to best incorporate both perspectives.
- Bringing elders to bless an exhibit before opening.
- Inviting a Native Cosmic Serpent participant to speak at a docent training workshop.

- A science museum has a large collection of Native American handicrafts donated by a couple who encouraged Southwest tribes to create these crafts as an income generating project. Although not officially part of the exhibit, a Cosmic Serpent Fellow is helping give the curator ideas.
- One science museum is developing an educational/interpretive program that will discuss historical climate change events and historical changes in population distribution of various extinct and extant animals, particularly as they relate to the natural areas of California. They will try to find an effective way to include the human animal in these programs; to represent the changing human population representation in California over thousands of years; and to discuss ways in which these populations may have interacted with and influenced the change in other animal populations, etc.
- “After the workshop I was intent on finding a new way to partner with the [observatory] to include the perspective, history, and knowledge of the [tribe]. To begin this work I have met with the [observatory] to find out what their current relationship is with the [tribe] in the area. As it turns out they have dabbled here and there with the [tribe] and are very interested in any new collaboration but need a catalyst! Our discussion focused mainly on updating the visitor center/museum which only highlights the Western Way of knowing astronomy. They are open to incorporating Indigenous Knowledge of astronomy into the exhibit but had never thought about it before I contacted them. Recently, [an observatory] astronomer named 3 super nebulae after the main individuals in the [tribe] creation story and they had the tribe come to observatory. The astronomers and staff were incredibly surprised at the sacred ritual the Indians performed and the blessings the children led during the ceremony. This interaction changed the perspective of the astronomers and I think it was a good entry way to do this work in the visitor center. I can see the potential for these 3 super nebulae as a lead into an entire exhibit about the [tribe’s] creation story and knowledge of the skies. The visitor center/museum is small and creating an exhibition, in collaboration with the [tribal] community, could completely change the role of the visitor center...This work with the [observatory] is just beginning but Cosmic Serpent has empowered me to reach out and make these connections in any and all work I do in the future. I have a [tribal] college faculty member that I connected with at AAAS this spring and he is very interested in this project and is open to advising us on how we should approach the tribe for this project.”

Revising Existing Projects. Perhaps the most common experience of project development as a result of Cosmic Serpent participation is to take a look at how current exhibits and programs can be made better.

- A science museum is involved in a large collaborative informal science education program and has proposed to replicate the model in the Yosemite region. Most

importantly, the decision about how this project might be of value will come from the Native communities.

- Shifting to a seasonal approach to interpreting the Navajo Sky for a new permanent exhibit, based on input from Native participants at the Cosmic Serpent workshop.
- A tribal museum is considering a permanent exhibit that would be implemented at appropriate times of the year.
- A tribal museum consulted a Cosmic Serpent participant for guidance and interpretation in a botany garden exhibit that seeks to educate native people about healthier diets.
- A science museum has been working in close collaboration with project PIs and one participant from a Native American group to develop the museum's new exhibit focused on Navajo astronomy.
- One Fellow has worked with the PI team and several participants to help enhance programming on Mayan culture and archeoastronomy.
- One CS partner and an individual from the leadership team are working on a youth cultural exchange program that brings Native youth from across the Americas to the Southwest to engage in informal science learning, traditional ecological knowledge and discovery of commonalities within cultures.
- Another Fellow connected with a Cosmic Serpent participant to help her reach out to local native communities to participate in her museum's climate change exhibit.
- Inviting elders from a Native community to look at the museum's objects and add interpretations to their collections catalog.
- Consulting with Native participants or team members from Cosmic Serpent to help interpret a program related to Mayan culture and astronomy in more accurate and culturally valid ways.
- A tribal museum being more careful to reflect both tribal and Western knowledge in a new exhibit.
- One science museum has a Mayan exhibit and is trying to tap into living Mayans to further develop the exhibit.
- On a small scale, a Western science museum Fellow has incorporated Indigenous knowledge into some of the programming they do, including a Specimen Spotlight on the Virginia opossum and a Science Story Adventures program on marsupials.
- A Fellow is doing a Mayan weaving exhibition and another was doing a Mayan skies exhibit the next month, so they're doing cross promotion and are planning several events together since they'll both be going on for the next year or so.
- Continuing to try to build up Native resources in their science museum's library as budgeting permits.

- A science museum Fellow who put together their interpretive training for all of our volunteers at the museum, now will take all 50 or so new volunteers for docent training out to the [tribal] Interpretive Center instead of having an anthropologist come in, in order to get the native voice into it. The year before, the museum had already started doing with that with their regular 200 volunteers, having someone from the tribe come out and bring the native voice to the training, but now extended it to new volunteers.
- A science museum will re-do a permanent exhibition on local Native American people, and all of the ideas will come into play as exhibit content will come from Native people, stakeholders, and anthropologists/scientists alike.
- Since the Cosmic Serpent Workshop, a Fellow now asks teachers to introduce themselves in a way similar to how Fellows introduced themselves at the workshop with the hope that through creating an environment where teachers share about their own family culture, the culture of teaching science at their school, and their own feelings about “doing science” and thus together break down the idea that western science is the only way of knowing.
- One museum had just conducted a festival around navigation that began before participating in Cosmic Serpent but their ability to grow into a larger event was influenced by Cosmic Serpent, particularly in how they engage their community. This year they included more people from the community in the event; even Cosmic Serpent participants showed up. The Cosmic Serpent community has been part of the last 2 festivals and they have been a hallmark for the center. Being part of the community has residual benefit on the quality of the events.
- At a Field day for 4th graders, they have broadened what they can offer. Instead of 12 stations, they will have double the number of stations, which means that some kids will miss certain things, but there will be more of a menu out there. This will also require that teachers think ahead of time about what will be at each station, more “pre-science” or what we’re calling “seeds of discovery,” to enhance the experience.
- A project opened just before one of the Fellows went to the original regional workshop. But at the follow-up Cosmic Serpent workshop, this person talked with other participants about the stars and navigation and how exciting that was. To the Fellow, it was exciting to think about how people in California have used the sky. Now, they are also thinking about having guest speakers for the exhibit.
- A presentation for the Archeological Society, incorporating a lot of the handouts and experiments and thought processes from Cosmic Serpent.
- One Fellow is helping to to enhance and update their museum's Permanent Exhibit, and combining Indigenous knowledge and Western Science will influence the "today" element of the update. One important feature of the update in this area will be the

capacity to keep current on the way science and Indigenous knowledge are working together in water, timber, fisheries, and other resource management projects.

- One Fellow immediately utilized the conversations and lectures in a Native American Spirituality and Lifestyles class at the local community college, as well as enhancing science and cultural education with the local charter school on the reservation.
- A Fellow acknowledge that someone else who attended the workshop with them includes Cosmic Serpent materials in educational programming.
- A breakout session doing meteorite inquiry. To make it more meaningful for teachers, the Fellow looked to looking into the standards and bench marks and identified key areas that to target so that they would be useful to the teachers and what they need to deliver.
- One Fellow led a museum tour during which they discussed with individuals in the group the role of mountains, volcanoes, and other tall peaks play in western and Indigenous ways of knowing. It helped the Fellow gain a better understanding of how the general public attending a public program about science would engage with that subject. Overall, it peaked interest and curiosity.

Institutional Support. Institutional change is typically very slow, and both tribal museum and science museum specialists talked about how getting their boards and councils to switch directions was a slow and arduous task even when the boards or councils are amenable to the kinds of things being brought to them from Cosmic Serpent Fellows. In the North section below, we will further discuss this and other challenges. Sometimes it is easier for these changes to occur when there is a turnover in leadership. For example, one Fellow reported that their science museum has a new director and wants the Cosmic Serpent Fellow there to give a presentation to the staff.

Leadership Team's Learning in the West

Here in the West (Ii'ii'aah) direction, a place of activation the leadership team deepened their engagement of partnership, particularly personal experiences with building team relationships, engaging diverse perspectives, understanding collaboration and becoming more aware of one's own roles, strengths and weaknesses. In this direction team members began to value the high levels of trust and respect that allows discussions to be productive. There were three themes that were common growth areas in this direction for team members: personal growth and professional growth; benefit aspects of Cosmic Serpent Collaboration; and communication and exchange of ideas.

In the area of personal and professional growth the leadership team experienced increased confidence and comfort with the work environment and style in which the project challenged prior perceptions and understandings. Some leadership team members describe learning happening in cycles, where challenges, though frustrating, lead to personal growth and a deeper understanding of their role as a member of a collaborative team. Rather than following protocols or seeking

agreeableness in communication, the project structure allowed team members to trust their instincts when communicating about both mundane and important topics.

In the area of benefit aspects, the project has exposed team members to a variety of perspectives that have enhanced and deepened relationships, their understanding of worldviews and networks for their own professional areas. Some team members discovered steep learning curves in new ways of thinking and approaching decision making opportunities. A common learning curve was the willingness to listen, just to listen with open mindedness rather than providing opinions or feedback.

In the area of communication and exchange of ideas, the leadership team experienced the greatest growth in this area during this time. Specifically, leadership team members highlighted opportunities to exchange ideas, participate in open dialogue, develop trust, share a purpose, and have conversations aimed at consensus without being judged. The communication process empowered leadership team members to be honest with their thoughts and expressions without feeling isolated. This was concurred with the trust they established through relationship building.

In this direction the leadership revisited the first two directions (East, ‘Ha’a’ah’ and South, ‘Shadiah’) and with the learned lessons from the workshops agreed upon a common pathway, to proceed in providing the Fellows with rich experiences and space to deepen their relationships and create the foundational pieces needed to support collaborative projects. Encouragement and support to Fellows and institutes for building towards readiness for collaborations was one the key pathways. In considering the few collaborative projects that did get off the ground, while minimal, from a Native worldview these are seen as success stories that should be celebrated and embraced, and is an indicator that the project has influenced and ignited the spirit of the project goals.

Continuing to provide networking opportunities and communication strategies was also important to this area. While the leadership team had good intentions of supporting these areas, the networking, communication and support systems were once again met with challenges, mainly due to budget constraints and individual time to devote to everyone.

“Our own growth as a team had a direct impact on how we approached our workshops.”, Leadership Team Member, 2011

Evaluation Team’s Learning in the West

The evaluation team greatly deepened our learning in the West (Ii’ii’ah) direction, a place of activation or implementation of Cosmic Serpent ideas within the Fellows’ home institutions or communities. In the original strategic planning model, this goal area was operationalized as “Science museum practitioners will use the Cosmic Serpent theme to enrich existing science programs at their institution. Tribal and cultural museum practitioners will infuse relevant science into their art and cultural programming.” Deeper engagement with the project, and with the evaluation process, revealed that “activation” would not necessarily be seen through creating or enriching programs, or could not necessarily be captured within the life of the grant for many Fellows. The reasons for this included the need for growth in the directions of the East (orientation to worldviews) and South (relationship building), especially those who were relatively new to working across multiple worldviews of science, before one could effectively move into activation. Many such partnerships do

not flourish, in fact, because of a push toward implementation before proper time has been spent in these foundational stages of orientation, growth, and relationship-building. In this way, we see it as a strength that the project supported deep work in the areas of initiation, in which Fellows dialogued and engaged in many experiences around multiple worldviews; and in relationship building, in which Fellows were encouraged to spend time getting to know one another, building trust, and finding common ground and vision. This emphasis within the project meant that evaluation efforts, too, spent more time focusing on the first two directional areas, as well as rethinking and expanding on the interpretation of the West direction.

The evaluation team also came to realize that the intended outcome for this goal area, as conceived in the strategic planning process, may not have captured the variety of forms that “activation” of the project could take. Also, with relationship at the heart of the project, outcomes focused on “products” such as exhibits or programs do not best capture the project’s intentions. For example, many Fellows activated their learning in other ways, such as engaging in more reflective practice; sharing their learning with staff, elders, or other decision-makers; approaching partnering and relationship-building in a different way; creating new positions (e.g. an advisory board), or making site visits to local tribal communities. As the evaluation used an open-ended, emergent approach, we were able to capture the more subtle ways in which Fellows transferred their learning and experiences within their home institution or community, and also focus more on relationship in this area, and the steps that lead to sustainable partnerships.

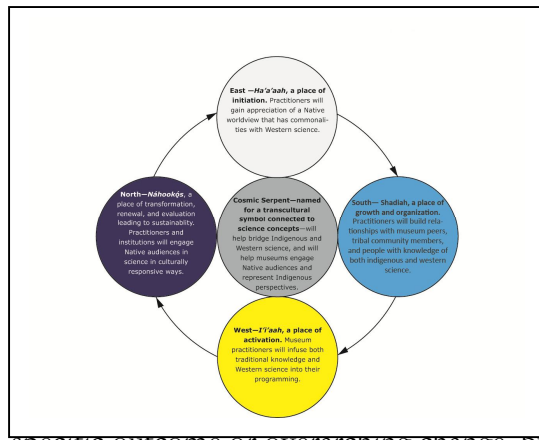
Another area of learning was around the institutional readiness of the project’s participating organizations. Many Fellows encountered barriers to activating their learning once they returned to their home sites, including budget cuts, staff cuts, and limits in institutional support for making significant changes in practice. Lack of institutional support related to conceptual/worldview areas (e.g., an institution or community not having enough buy-in from decision makers), as well as the practical (e.g. an institution being unable to take on new initiatives in a difficult economic climate.)

Summary: West (Ii’ii’aah)

Primary among the generalizations about the West in the Cosmic Serpent project is that finding a way to put into practice the bridging of cultural worlds typically requires a good fit between skills, resources, knowledge, ideas, partnerships and motivation. All are prerequisites to some extent. However, these various participants felt they had accomplished a great deal when they had made relationship-building a central part of their focus on activation. Not only did relationships provide access to resources, knowledge and skills, but such relationships and partnerships also magnified motivation plus generated ideas that participants had not thought of. This was the case for the Fellows, the Leadership Team, and the Evaluation Team. Additionally, the attempts to build successful projects or endeavors (and this includes the Leadership and Evaluation Teams) needs to be thought of as likely involving ups and downs, such that even well-thought out and well-designed applications can go wrong or can be frustrating. Good partners with good communication help reduce the negative aspects of setbacks. Finally, conceptualizing activation only as the development

of new collaborative projects is insufficient for capturing the many ways that participants put their Cosmic Serpent experiences into practice.

North, *Nahookos*, a place of transformation, renewal, and evaluation leading to sustainability



North – Nabookos – a place of transformation, renewal, evaluation and sustainability. Practitioners and their institutions will demonstrate increased capacity to engage Native audiences in science in culturally-responsive ways.

Measures: We will measure the degree to which participants perceive a cultural change in their institutions, support continued professional development of the participating practitioners, and train additional staff at their institutions. Since institutional change of any kind is a slow process, evaluation will assess the extent to which participating museums demonstrate conditions or indicators of cultural change.

specific outcome or overarching change, but is closer to the idea of “emergent” change. While for most, the project did not achieve transformation from a western sense (i.e. a complete and total change), we saw many signs of an ongoing, emergent change in Fellows’ understanding, way of thinking, and reflection on their work. So in this direction, we think of transformation as an ongoing, self-driven and emergent process that includes many steps along the way, and many possible pathways. This kind of transformation can include new realizations, deeper cultural understanding, shifts in how one thinks about their work, new personal and emotional awareness, and building relationships to support authentic collaboration.

Evaluation did not seek to find elements of transformation specifically, but did focus on Fellows’ increased awareness and understanding around worldviews, relationship building, and ability to make changes within one’s work or community as a result of their participation in Cosmic Serpent. Through the team’s own experience and reflections, supported by evaluation findings, the theme of transformation emerged as an important, and perhaps essential, element in the pathway towards creating mutually respectful, cross-cultural collaborations. The following outcome areas support this idea of emergent change occurring among the Cosmic Serpent Fellows:

- Many Fellows described becoming aware of new ideas or having new realizations about worldviews, their own way of thinking, their own cultural assumptions, use of language, and cultural protocols. The following quotes from Fellows help illustrate some of the types of new awareness and realizations they talked about:

“As a Native Person I still have a lot of questions about Western Science and where it is taking us. At the same time I am more aware of the areas that indigenous knowledge and western knowledge (science) can overlap and knowledge can be shared, in some cases.” (California region)

“I can see clearly how Indigenous Knowledge and Western science can work together and support a more holistic understanding of our world. I also think we can learn from Indigenous Knowledge boundaries and ethics we could apply to our engagement with Western science. I feel that I can speak about Indigenous Knowledge in a more authentic way because of the great conversations and the great presentations from the workshop but I also understand it is not my role to represent this knowledge. I learned so much and was so inspired by this experience.” (California region)

“Personally, each workshop I learn more about indigenous knowledge and reflect on my own understanding of what science is and why we do science.” (Southwest region)

“I wasn’t aware of all the traditions with native astronomy. Just reminding me that there are things that we (westerners) do – things that we do that we don’t intend to be biased or racist, but the decisions we make reflect that piece. Spending time in a community is really, really important because if you’re on a tight deadline for a grant proposal, you still need to be respectful. It reminded me about some of those things that we do that are not intentionally disrespectful.” (California region)

- Throughout the project, Fellows (mostly Western, in this case) shared how they gained a deeper understanding of Indigenous Knowledge and/or Native world views, such as increased awareness and heightened sensitivity towards challenges faced by Native communities, increased understanding of how Native communities have experienced or view Western science, the importance of relationship building and trust; the importance of deep listening; and a stronger framework for thinking about Indigenous Knowledge. Other areas included becoming more aware of cultural connotations of language, such as sensitivity around the use of the term “science” to describe Indigenous knowledge, and broadening perspectives beyond previously held personal biases. The following comments help illustrate this theme:

“I would say that I have a better understanding of what is important to various tribes when it comes to Indigenous knowledge. It is not (just) a cultural sensitivity, but beyond the typical ‘let’s all just get along’.” (Northwest region)

“While I knew that there was a hesitancy to write things down held by many Indigenous people, I was not aware of the depth. This is so much clearer now. It seems to me that there is still a lot of trust building that has to be done as well as a proof period. How do you build trust without working together and seeing the results over generations? How do we develop these partnerships to build that trust if not without the facilitative help of a group like the Cosmic Serpent? My hope is that this will become clear and we will start to work on projects together and continue the conversations that started.” (Northwest region)

- While this learning naturally emerged mostly from the Western-oriented participants, there were certainly examples of Native participants who came to view the culture of science and scientists with more trust, especially given a long history of Western cultural domination and oppression of Native communities in the U.S. For example, one participant noted that the

main value of the culminating conference was “Breaking down my stereotypes against Western science...my apologies”; and later, she adds, “I realize that it is not that Western scientists don’t agree with our sciences and philosophies, they are not aware of them.”

- On a professional level, Fellows shared examples of becoming more reflective practitioners. Some felt the project has made them think more deeply about their work and the complexity of cross-cultural collaboration. A couple examples are presented below:

“I think the idea of asking people [is important]. I know that sounds simple, but asking what people want to convey, what do they want to share? Do they want to share at all?”

“The workshop made me rethink whether science museums should try to present indigenous knowledge if they have not been approached by native people. I don’t think we should assume that native people want their knowledge out there for the general public to learn about. We definitely have to be very careful about how we approach this and what we choose to present.” (Northwest region)

- As described in the other directional areas, the theme of building relationships was strong for many Cosmic Serpent Fellows, and relationship can be seen as the foundation for all transformational change. Fellows talked about feeling that they had made deep personal connections, opened up to others, and made contacts with others that could support their work. There was a sense of growing openness and trust among participants in the three regions, as the following comments suggest:

“I felt like this workshop cultivated an intimate space - having created this is quite remarkable. Having created these relationships as a foundation makes the business and work come much easier. I feel comfortable contacting people and I’m genuinely interested in connecting more. I felt like we were able to establish relationships and now we have the respect and basis for accomplishing real work.” (Northwest region)

“It was important for the workshop to allow for time when we could socialize and get to know each other. At first one of the activities seemed trite, yet it worked in getting the participants talking with each and sharing conclusions. There were good building blocks for future conversations (and) relationships built into the overall planning of the workshop.” (Northwest region)

“Face to face collaboration is not something you can substitute.” (Southwest region)

- The Cosmic Serpent experience was a personal and emotional one for many participants. Some described learning more about themselves, their own assumptions and stereotypes through participation in the project, suggesting that what they learned had broader application to their personal lives, in addition to being relevant to their professional lives. Following are some comments from participants that reflect this theme:

“I have walked or paddled great distances in both indigenous knowledge and western science and have expressed this as having a foot in each canoe...it’s nice to know that once in a rare while both feet are in the same canoe!” (Northwest region)

“The more I participate the more I am realizing how little I know, how complex these issues are, and more than anything, humbling.”

Collaboration Stories

Within each regional network of Cosmic Serpent are multiple stories of collaboration that have grown and evolved throughout the four years of the project and beyond. We selected one partnership per region to feature here as an example of how Fellows used the project environment to develop deep, ongoing partnerships that bring together Indigenous knowledge and Western science in informal learning settings. Each collaboration is unique in its process and purpose, and each provides a model of collaborating with integrity across multiple worldviews. To document each collaboration story, the evaluation team followed the Dine Four Directions model and prompted Fellows during a series of phone conversations with the following questions for each goal area:

- How did this goal area play out for your collaboration?
- In what ways did the Cosmic Serpent project support this area?
- What were the challenges or lessons learned for you in this area?
- How have each of these areas played out for your institution, organization, or community?

Southwest Region

Featured Fellows:

*Marie Long, Interpretive Program Manager, Arizona-Sonora Desert Museum, Tucson, AZ
Bernard Siquieros, Education Curator, Tohono O’odham Cultural Center and Museum,
Topawa, AZ*

Eastô *Ha’a’aa*, a place of initiation

Practitioners will gain appreciation of a Native worldview that has commonalities with Western science

An ongoing collaboration between the Arizona-Sonora Desert Museum (ASDM) and the Tohono O’odham Cultural Center and Museum began at the first Cosmic Serpent Southwest workshop (held in Santa Fe, NM, in April 2008). Bernard Siquieros, Education Curator at the Tohono O’odham Museum, and Marie Long, Interpretive Program Manager for the ASDM, had the opportunity to begin conversations during this weeklong gathering, and discovered potential pathways for collaboration between their organizations. Along with other Fellows based in the Tucson and Phoenix areas of Arizona, they joined an informal discussion group at the workshop to strategize how they could create a local-based network of organizations with the goal of deepening collaboration across Native knowledge and Western science. Through follow-up meetings and site visits after the initial Cosmic Serpent gathering, Marie and Bernard developed multiple ways to bring together their two organizations. This primarily involved inviting elders from the Tohono O’odham Nation to consult and collaborate with the ASDM on infusing their interpretation of the Sonora Desert with local, traditional knowledge.

When asked how the Cosmic Serpent project supported their partnership at the initial phase, Marie felt that bringing together this group of professionals from the Southwest region was key: “Going to the conference really opened the door for me; I hadn’t really met any of the partners that I’m working with now. Just that alone was very important. It also made me start thinking...all of these things that we could be doing together and I had never really thought about it too much. It was really exciting to be able to start those conversations and make those connections.”

The workshop also opened up possibilities for the Tohono O’odham Cultural Center and Museum. In addition to conversations with the ASDM, Bernard noted that the workshop “really opened my eyes to the fact that right here on the Nation we have a very scientific center in the observatory up on Kitt Peak, and how we are not fully utilizing what they have to offer. So it helped my start to think about how we need to...develop that collaborative working relationship with all of these entities. Marie was certainly very open and willing to work with us, and so this is when our working relationship began.”

Both Fellows agreed that the financial support to attend the workshops – including room, board, and transportation expenses – was also essential to the success of their own collaboration. Bernard noted that “the fact that the Cosmic Serpent provided that financial assistance made it possible for us to go.” Marie added, “If there weren’t the funds to bring us together, I don’t think it ever would have happened the way it did.”

The initial Cosmic Serpent gathering also opened up pathways for appreciating how Native and Western science might enhance and support one another. For Marie, who felt she came into the workshop with an “awareness and appreciation of a Native worldview of science” through extensive world travel and experience with diverse cultures, the initial Cosmic Serpent conference supported “greater awareness of what was happening in my own backyard with Indigenous groups and their traditional ways of knowing, and getting to see all these wonderful examples of what they knew and how that really was science and complemented science.” The breadth of examples shared at the conference, including the complex science involved in Yucutan/Mayan astronomy and Native Hawaiian navigation, also helped Marie deepen appreciation for Native worldviews and served as inspiration for her partnership with the Tohono O’odham museum and community. Another key learning for Marie was “the whole connection of climate change and how people for centuries are so tied into nature and being connected with gathering materials for baskets or for dye-making and seeing those...seasonal changes directly related to climate change.”

For Bernard, this place of initiation created a realization of how Tohono O’odham culture and lifeways are infused with scientific understanding. He commented that before the workshop, “I never really gave much thought to the fact that many of the things that we do as a way of our life, our culture, are actually in some ways very scientific.” Listening to some of the discussions at the workshop on science versus culture helped support these realizations. “It kind of all made sense to me,” Bernard shared, “We weren’t trained scientists or anything, but we understood the environment and we took that knowledge to help us in doing the things that we did. In that sense, we were basically scientists just living the way we were.”

Southô Shadiah, a place of growth and organization

Practitioners will build relationships with museum peers, tribal community members, and people with knowledge of both indigenous and western science

Building on their initial introduction at the first Cosmic Serpent workshop, Bernard and Marie embarked on several specific efforts that nurtured relationship between their two communities. One important initiative involved bringing elders to the Arizona-Sonora Desert Museum to share the Tohono O’odham names, traditional uses, and cultural symbolism of plants living on the museum grounds. Bernard recalled that “the information was respectfully taken and helped to develop a labyrinth on the grounds where people can come and enjoy the view and relax... Since the Cosmic Serpent, we’ve done a lot with the Arizona-Sonora Desert Museum because of initial contact at Santa Fe.” Inviting Tohono O’odham elders to the ASDM opened up many pathways and important dialogue for relationship building. Marie recounts this initial collaborative project as follows: *“We asked (the elders) what they would like the visitors to know about the Tohono O’odham people, and it was a really wonderful discussion and tour of the grounds and opportunity to capture a lot of that information... It was really timely, because right after I got back from the first conference, we were starting to discuss this new labyrinth exhibit, and that’s when I stepped in and said we need to have a native voice here to talk about this...And so it was great because our executive staff was open to that. And that’s when we had everyone together -- before we made any plans or anything -- discussion on what should be done. It was really exciting because I felt like from the very beginning, there was that input (from elders). We received guidance on what design should be, and there was request for specific plants that should be part of the design. And there was a whole piece that Bernard and his team put together on what the man in the maze meant. And then we had the blessing of the site once it was done, which was really powerful. That would not have happened unless I had attended Cosmic Serpent. I just don’t think that awareness or our connection would have been there.”*

Another important collaboration between the two partners was the development of the ASDM’s Orientation Ramada, in which the Tohono O’odham elders “spoke to the importance of water in the desert, its sacredness.” The original grant to build the orientation space focused on natural history and conservation from a western science perspective; but the collaboration between ASDM and Tohono O’odham led to the integration of a Native voice into the interpretation of the desert. In addition, two tribal members/artists were invited to contribute art pieces to the space, including a poem and a piece of artwork depicting traditional knowledge of a rain ceremony.

An additional opportunity for building relationship between the two museums/communities includes a culture exchange in which refugee youths from all over the world (including Sudan, Iraq, Somalia and Peru) will spend a day at the Tohono O’odham Nation sharing and celebrating the diversity of cultures through games, arts, crafts, and other cultural traditions, as part of an ASDM outreach program. Bernard commented that “people recognize the first people here; so the ASDM decided to bring them together to share each other’s cultures.”

One lesson learned in this area of growth and organization was the challenge of engaging people who did not attend the Cosmic Serpent workshops. “It is hard to articulate the experience (to others),” Marie noted, “but it gave us the opportunity to work together.” More support may be

needed to help Fellows translate the experience to other colleagues who did not participate in Cosmic Serpent in order to continue the growth of the model and community.

Westô *Li'ii'aah*, a place of activation

Museum practitioners will infuse both traditional knowledge and Western science into their programming.

Through these multiple collaborative projects that bring traditional Indigenous knowledge together with Western science perspectives, both communities have seen benefits. Bernard explains that the impacts have all been very positive: “Our purpose here is to help people understand our history and our culture and the land. By working with the Arizona Sonora Desert Museum on these different projects, it helps us achieve that goal and it helps the visitors that come to ASDM... understand a little better about O’odham culture, O’odham views, like water... It’s reflecting Tohono O’odham culture in a very positive way by being part of the Desert Museum, because it is an internationally renowned establishment.”

The ASDM has also seen broader changes as a result of partnering with the Tohono O’odham museum. In addition to integrating Native voices and perspectives into some of their interpretation and signage, practices around docent training on Native cultures have changed. While the museum used to have an anthropologist speak to docents about local indigenous cultures, the interpretive training program has now been redesigned to involve a full-day experience at the Tohono O’odham Nation where docents experience the people, culture, and environment firsthand. Marie commented that they are “continually educating our interpretive volunteers, because they are the ones that are articulating these stories to our guests.” In addition, Bernard or his wife, Regina, come out to talk with docents every year. “It’s a good opportunity for them to ask questions, and just to have that consistent interaction is really important. That’s definitely an institutional change.”

In terms of lessons learned in this area of activation, both Fellows agreed that the follow-up workshop, which brought everyone together again a year later (in Taos, NM), was instrumental in sustaining partnerships that began during the first workshop. Marie noted, “It’s so often I attend conferences, it’s a one-time deal, you get really inspired, you go back and you start in your old patterns of working. Having that follow-up conference was really great because it brought us all back together. I think there was tremendous value in that.”

North—*Nahookos*, a place of transformation, renewal, and evaluation leading to sustainability

Practitioners and their institutions will demonstrate increased capacity to engage Native audiences in science in culturally responsive ways.

The partnership between the Tohono O’odham community and the Arizona-Sonora Desert Museum – which began at the initial Cosmic Serpent workshop -- created pathways for deepening the integration of Native knowledge and Western science and building an ongoing and sustainable relationship between two Cosmic Serpent Fellows. During the course of the 4-year project, the relationships between the two organizations deepened and resulted in numerous efforts, such as

shifts in interpretive approaches, staff training, and exhibit content. Future plans include creating a Native American advisory committee at the ASDM, which would allow for ongoing, sustained input into how the museum integrates Native voices and perspectives; and including signage in the Tohono O’odham language, in addition to English. The ASDM is also involved in the newly funded NSF project Native Universe, which will in part allow the museum to broaden and deepen its relationship with the Tohono O’odham nation.

In terms of future pathways, both Fellows felt that engaging a broader community within each of their organizations will be essential for sustaining the partnership which began through Cosmic Serpent. “Right now it’s Marie and I and sometimes (another tribal member),” Bernard noted. “I think we need to get more of our staff involved in this collaborative effort because we’re not always going to be around... We need to get more people here thinking along those same lines so that this work will continue in all areas. Right now it’s just education, but we have library and archives, and collections department, and other areas that need to come in on this. So that’s something that we need to do here to create sustainability.”

Northwest Region

Featured Fellows:

Susan Sheoships, Tamástslikt Cultural Institute

Vicki Coats and Lori Erickson, Oregon Museum of Science and Industry (OMSI)

Eastô *Ha’a’aa*, a place of initiation

Practitioners will gain appreciation of a Native worldview that has commonalities with Western science

While the Tamástslikt Cultural Center and OMSI had connected at various levels within their museum structures, the Cosmic Serpent gatherings offered a new awareness and pathway for collaboration that has greatly deepened their relationship individual and organizational relationships. The initial pilot workshop, held in Santa Fe, NM in April 2008, brought together members of the two museums who had not worked together before. Susan recalls, “I personally didn’t have any connections (to OMSI) before Cosmic Serpent... We were aware of (OMSI’s) Salmon camp, but had not participated in it.” In 2008, OMSI collaborated with the Indigenous Education Institute (IEI) and National Museum of the American Indian (NMAI) on a proposal for an exhibition on traditional ecological knowledge called Generations of Knowledge (GoK), which was not funded at that time. The next year, with technical and conceptual support from Cosmic Serpent, the project was reconceived in a much more collaborative way and including local tribal museum partners, Tamástslikt Cultural Center and the Hibur Cultural Center of the Tulalip Tribes in Washington State, resulting in the team receiving funding from the National Science Foundation. They are currently co-developing the Generations of Knowledge project, which will result in a 2,000 square foot traveling exhibit (which will first show at the three partner museums), a traveling banner exhibit, and an activity kit for Native youth, along with ongoing opportunities and resources for reciprocal collaboration among the ISE and Native American partners.

In reflecting on the collaboration,, Vicki recalled that the OMSI team met Susan from Tamástslikt for the first time during the first Northwest meeting (or was it the pilot in Santa Fe?), and that having this opportunity to meet face to face in this context was really valuable. She recalled, “I think that face-to-face meeting facilitated making a deeper connection, creating an opportunity to work together; and to explore the commonalities between Indigenous knowledge and Western science...That shared experience (of the Cosmic Serpent workshops) was helpful for us.” Susan also added, “It meant a lot for a cultural, historical museum to be on the same footing with a science museum.”

Involvement in Cosmic Serpent also led both partners to new perspectives and learning. Susan commented that her participation in two Cosmic Serpent workshops “left a big impression. The experience colored our ideas about programming here in the museum...At Tamástslikt. We gained appreciation of the science content within our cultural/historical context and that we try to give that more validation in the way we present it to the public in exhibit planning and public program planning. We realized that has a lot of value for our audience.” For Vicki and Lori, their participation in Cosmic Serpent created a deeper awareness of Indigenous paradigms and opened the pathway for authentic, collaborative processes with Native communities in the region. Vicki shared that OMSI “had been trying for years to figure out TEK (traditional ecological knowledge) content on our own, doing research, and we were really struggling and weren’t really getting to a viable project. Then Cosmic Serpent, being able to connect with people from tribal communities and museums was so much richer and so much more authentic than reading books about TEK, trying to figure it out within, or just using resources from your own culture and your own way of knowing.” Lori indicated that OMSI’s involvement in Cosmic Serpent has led to a “greater commitment to incorporating Native knowledge in more areas of the museum.”

The deep relationships and long-term work of the co-PIs Nancy Maryboy and David Begay were seen by the Fellows as contributing to the success of Cosmic Serpent. Susan noted that the Cosmic Serpent gatherings and regional networks were built on decades of relationship-building by the IEI team: “Nancy and David have so rich a history (with Native communities)... It really was a relationship-based undertaking, which has a lot to do with its success. This could not have been done as two scholars landing at the airport.” The fact that there was a follow-up workshop built into the grant was also seen as beneficial to supporting ongoing relationships and partnerships. Vicki reflected on the follow-up workshop in Fairbanks, AK (September 2010): “By the time we did Fairbanks, the (Generations of Knowledge) project had been awarded, so it was nice to have the opportunity to meet with Susan and others we had connected with; the other big advantage of Cosmic Serpent was the other advisors and partners that became collaborators of GoK. It was nice that everyone had that relationship; it wasn’t just OMSI and Tamástslikt, but IEI and NMAI and ILI, so that kind of gave everyone a feeling of knowing each other. If everyone had been new, it would have been challenging.”

Southô Shadiah, a place of growth and organization

Practitioners will build relationships with museum peers, tribal community members, and people with knowledge of both indigenous and western science

Both partners agreed that the involvement of “bridge people” – which the project defined as those partners with deep grounding in both Native knowledge and Western science – were central to nurturing and sustaining the collaboration. Susan recalled that there were “so many people who were integrators,” providing positive models and a foundation for dialogue. As an example, Susan shared, “We could actually witness Isabel (Hawkins) coming in as a scientist and she was so articulate about her experiences with native TEK, that I felt we were witnessing her journey or transformation as she gained from the experience.” Vicki added that the bridge people “were really critical to building the relationships and creating the space, the kind of experience and growth and organization that needed to happen.” Lori shared that OMSI “could not have made Generations of Knowledge successful without their help.”

While the heart of the collaboration is about building relationship, the Fellows suggested that having a specific project to work on helped to foster this collaborative work. Vicki indicated that they may not have gotten as much out of the Cosmic Serpent experience if “Lori and I hadn’t gone to Cosmic Serpent and hadn’t had Generations of Knowledge to apply it to.” She added that the “Cosmic Serpent workshops had a huge impact on us and our understanding and practice, and with the GoK project we could carry it forward ...it’s easier to make progress if you’re working on a common project. You still need to lay a lot of groundwork before you can do the process. Cosmic Serpent really did that for us... putting more focus on relationship than on the product.” She added, “having to apply my Cosmic Serpent learning to GoK also really grounded it in reality. It would have been easy to think that I had attained a real understanding of TEK after the first workshop, but once I tried to apply it or explain it to other staff at OMSI, I soon discovered big gaps and really needed the ongoing workshops to deepen my understanding enough to work on GoK coherently.”

Westô *Ii’ii’aah*, a place of activation

Museum practitioners will infuse both traditional knowledge and Western science into their programming.

The learning that grew out of Cosmic Serpent has manifested itself in many ways for both partners so far. Susan shared that from the education perspective, the project has helped the Tamástslíkt Cultural Center emphasize science more in their exhibits and programs: She noted that the project “has been a rich source of content for cross-curricular presentations to schools and school groups. Whatever we present, we know the outside consumer will appreciate the science content in TEK (traditional ecological knowledge). When we do interpretation, we try to incorporate scientific overlays; that’s something most of our interpreters do try to do... As much as we are able to, we try to pick up interpretation of science materials in existing exhibits.” The involvement with Cosmic Serpent has also led the cultural center to “broaden our horizon” to feature the cultural knowledge of other Indigenous cultures. For example, they recently brought in a Mayan exhibit which focused on the scientific knowledge imbued in Mayan culture, and they also featured a film about Chaco Canyon (in New Mexico). “We view things more regionally now,” Susan noted. “Our geographies have expanded and we now have a more global view.”

The Generations of Knowledge project has also been a rich ground for putting the learning of Cosmic Serpent into practice. Lori, who is serving as lead exhibit developer and co-PI of GoK from the OMSI team, shared that she is “constantly referring to things that I learned in Cosmic Serpent for Generations of Knowledge. Really often, something will pop into my head. (Cosmic Serpent has) influenced the focus of the exhibit, and I think it will be very different than it would have been before the workshops... it’s going to be much more successful in conveying the idea of traditional knowledge and western science working together, and focusing on communities.”

For OMSI, their work on Generations of Knowledge has become much more based on relationship and face-to-face interaction than it had been when they first began the project, several years before getting involved with Cosmic Serpent. Vicki noted, “We’ve just done a whole bunch of trips to each of our partners to do research. I know that Lori and I were nervous about being involved, or saying the wrong thing. But having all those experiences (through Cosmic Serpent) and meeting with people from different cultures, it makes it so much easier when we go to the field. We have a much higher comfort level.” This has also led to a “bigger picture of what’s going on in your state and field,” said Vicki. “Now, if we happen to be traveling to eastern Oregon, we’ll stop and visit (Tamástslíkt), which is a nice feeling.”

Northô *Nahookos*, a place of transformation, renewal, and evaluation leading to sustainability
Practitioners and their institutions will demonstrate increased capacity to engage Native audiences in science in culturally responsive ways.

Through their involvement in Cosmic Serpent and the deepening partnership to develop the Generations of Knowledge exhibit and programming, the Fellows hope to build pathways for future work. Vicki notes that the OMSI team invited partners into Generation of Knowledge that were geographically close to the science museum’s base in Portland. She commented, “We wanted partners that were nearby, so that we had an opportunity to build the relationship. Now we are more aware of future opportunities and how we might collaborate because now we know each other, we have a shared focus in Oregon.” The fact that Cosmic Serpent was structured around a regional network was beneficial, she added, “it did give us the opportunity to connect with a lot of people in our region that we could stay in contact with and look for other opportunities” to collaborate. OMSI is already seeing the network of relationships starting to expand through the Generations of Knowledge project, which has helped the Cosmic Serpent Fellows begin to share their learning with other staff at their institution in a meaningful way. Vicki commented, “What’s great about Generations of Knowledge is that a lot more people are involved, so a lot more relationships are being connected; so now Liz (an OMSI evaluator), and Tim (program developer for the GoK project) have spent more time at Tamástslíkt; so other people at OMSI are now getting involved with Tamástslíkt.” Lori noted that OMSI is working on making other local connections with tribal communities in the urban areas as well.

Susan shared her vision for sustainability of the Cosmic Serpent project in her own education work with Tamástslíkt: “This is something that has a lot of potential. Having the opportunity to meet and listen to native scientists...was very eye-opening as far as being aware of existing resources

in native science and reveal how much work there is to be done to expand young peoples' knowledge. As for me, it will be the next generation of museum educators to come along and activate what we learned.”

California Region

Featured Fellows:

*Lindsay Irving, Production Coordinator, Visualization Studio, California Academy of Sciences
Chuck Striplen, Associate Environmental Scientist, San Francisco Estuary Institute, and Science Adviser to his tribe, the Amah Mutsun Tribal Band*

Eastô *Ha'a'aah*, a place of initiation

Practitioners will gain appreciation of a Native worldview that has commonalities with Western science

Stemming from the first California regional workshop (held in Barona, CA, in February 2010), the California Academy of Sciences and the San Francisco Estuary Institute (SFEI) began an ongoing relationship that has resulted in a number of activities that have brought together Indigenous knowledge and Western science to develop onsite programming at the California Academy of Sciences, off-site programs, professional networks, and support of biological and cultural conservation activities. Lindsay Irving is the Production Coordinator for the Worldviews Network project (a visualization and outreach collaboration of science centers and planetariums funded by the National Oceanic and Atmospheric Administration) at the California Academy of Sciences. Chuck Striplen is an Associate Environmental Scientist at the San Francisco Estuary Institute, and is a Science Adviser to his tribe, the Amah Mutsun Tribal Band from the Monterey Bay region of the central coast of California. Chuck and Lindsay had not worked together before meeting at the initial California regional workshop for the Cosmic Serpent project in February 2010.

The initial regional workshop created an environment for building relationships and creating connections around common goals. Lindsay describes the workshop as a “catalyst” or “spark” for her subsequent collaboration with Chuck and others, which resulted in a planetarium program and live event focused on telling the story of an iconic California tree species, the Valley oak, through ecological, historical, and cultural lenses. She recalls:

From a science center perspective, the Cosmic Serpent workshop was that catalyst for me. As a visualization practitioner at California Academy of Sciences, my job was to tell stories visually about the research that was going on in the museum here, but bringing in different perspectives was something I was interested in learning more about; and I was also interested in what were the dynamics and the work that was going on in tribal communities in this area. I always thought it was strange that the Academy never really had a formal relationship in the area or even an informal relationship that I was aware of in the eight years of working here with any specific tribal group, and yet we're a natural history museum in San Francisco. When I got there (Cosmic Serpent regional workshop), just having time at the workshop not only to hear the wonderful presentations, but to have the time to visit and talk and build relationships with people during the conference was really fun. Chuck and I just met each other and decided to stay talking the entire week. I got to learn more about the research that his organization is

doing at SFEI which is visually very rich and full of history and culture as well as science, and which I thought could support research that is going on at the Academy. Then learning about what he's doing with the tribes and with his tribe and the issues they're dealing with all over the Bay area, we just kind of put two and two together; so we said we've got all these visuals but we need help crafting these stories and also coming up with ways to engage audiences in different ways. Our work just sort of grew from there.

Southô Shadiah, a place of growth and organization

Practitioners will build relationships with museum peers, tribal community members, and people with knowledge of both indigenous and western science

Both Cosmic Serpent Fellows felt that they were pushing the boundaries at their organizations in terms of typical approaches to projects -- particularly approaches to engaging collaborators or other people outside their institutions -- but that their efforts were generally supported. This institutional support helped create a pathway for the collaboration to grow. Chuck shared how this worked at SFEI:

Coming from an institution where I have spent the past 10 years trying to help change its culture, many of the staff were predisposed to thinking about traditional knowledge and native management of natural resources going back 10,000 years, because they are very advanced environmental scientists. I've found the more advanced and nuanced a person's understanding of where society's current scientific understanding of environmental is, they tend to realize that they don't know as much as they think they do, or that there's more to the story or that there are more perspectives of the story that need to be investigated further. So, when I started talking to SFEI folks 12 years ago, I found a very welcome audience. The way that project has ended up flourishing—as directly through Cosmic Serpent and then flourishing through Cosmic Serpent—has been really appreciated by my organization and my tribe both.

Lindsay and Chuck together developed ideas for a collaborative project right away, and found that part of the process of growth and organization for them was actually supported by attempts to quickly put their ideas into action. Lindsay recalled that shortly after the Cosmic Serpent workshop in Barona, “I applied for a small grant to the Yahoo Employee Foundation to produce a planetarium show and live event. So (Chuck and I) said, let's bring in something concrete, let's do a show of some kind of story that would utilize the digital assets from SFEI and the digital assets of the California Academy of Sciences and blend them together in a western science and indigenous knowledge kind of perspective...And we said let's bring people together people at the Academy that normally would never come together—conservation organizations, policy makers, tribal groups and let's get everybody together around a theme. It was a small amount of money and we got it.” They received less funding than they requested, so they started calling foundations, including the Christianson Fund in San Francisco, whose portfolio includes biocultural conservation in the Bay area. They ended up with funding support through these organizations – one of which was the additional support to launch the “Valley Oaks” program. Lindsay noted, “It was a lot of pavement

pounding and blood, sweat and tears on the front end to really nurture the collaboration in a concrete way.”

The experience of Chuck and Lindsay is one where the directional goals of the Dine Model (initiation, growth and organization, and activation) are merged and interconnected. They sought project funding for specific projects which then increased their networks of activity to yet other tribal groups and science centers, as well as their own institutions’ capacity. Chuck reflected on this period of growth and organization: “For the Valley Oaks project, we had some key partners that included three local tribes that were involved and that were present at the final presentation – the Chair of the Michwal Wappo Tribe from Napa was there, the Chair of the Sacred Sites Committee for Graton Rancheria and their eldest Council member were there (their territory is from the Golden Gate north to the Russian River), and then my Tribal Chairman was there. There were a variety of native folks that are affiliated with various organizations in the Bay area, Cosmic Serpent folks were there, and then a lot of local partners that are pursuing this re-oaking idea, like from the city of Napa planning commission.” Lindsay added, “There were people there who are really engaged in putting oaks in the ground from all different sectors of society. That was great. And in our production process, we were able to bring them in and craft the narrative and the storyboard and we had a number of advisory meetings and review sessions with academics and a number of people from Chuck’s network—researchers and practitioners—so it was wonderful to have them be a part of the our storymaking and the live event, which was kind of the celebration of everything we had put together.”

Cosmic Serpent supported the growth and organization of the Academy/SFEI collaboration by providing the “intellectual environment and some of the tools to actually be able to sit down and develop these relationships.” Then, given that each partner had the knowledge, skills, and relationships in place to move to a stage of activation (in this case, creating the “Valley Oaks” planetarium project), Chuck recalls “that then turned into something almost immediately.” In keeping with Native perspectives, the heart of the collaboration is relationship rather than the project itself. Chuck continued:

These relationships are such that we will be turning those relationships into other manifestations of these ideas, and new ways to express some of these themes. The Valley Oaks program was just the first experiment from us having created these new relationships—coming out of the process that David Begay and Nancy Maryboy and all these folks started. We are trying to strategize, and think of other institutions in the Bay area. You know, [David and Nancy] are aware that Indian country is diverse and there are diverse scenarios and tribes with different capacities and there is not a cookie cutter approach that fits all of this. They are very aware of that we have to be very flexible and more agile and think creatively in all these different environments with different tribes and institutions where there are different levels of creativity or willingness to work outside the box. That’s one of the things I really appreciate about the Indigenous Education Institute team; they are continuing to grow as they see their children grow.

Lindsay indicated that the support of the leadership team from Cosmic Serpent was very helpful, even though she only attended the first of the three workshops (she had a baby just after the first workshop). She noted:

In terms of the role of Cosmic Serpent in making any of these things happen, the Worldviews Network project is developing frameworks for engagement and production that are based on a number of innovative models out there and Cosmic Serpent is a major source of inspiration. Throughout our production and after the live event I was in contact with Laura, Nancy, and Chuck and we had a number of conversations over email as things came up. I got some really great feedback from them after the event as well. For example, some people would say that the presentation made them feel uneasy about how Indigenous peoples and their relationship with the land were portrayed and that they weren't sure how to think about it. Nancy let me know that this is exactly what Cosmic Serpent is for—working through these feelings. Some non-indigenous members said 'you need to have better representation of the Native American story,' and I thought we had failed. But then Chuck and Nancy said that the whole story was infused by Native practitioners and Native people. So, if the audience can't recognize that, then maybe it's because this isn't a typical way of telling a story about Indigenous peoples...it wasn't as obvious or dramatic or romanticized as some people might expect, but it was something we felt was authentic even though it wasn't perfect."

Westô *Ii'ii'aah*, a place of activation

Museum practitioners will infuse both traditional knowledge and Western science into their programming.

Around the same time that the California regional workshops of Cosmic Serpent were taking place, a national community of planetariums and science centers, including Lindsay at the California Academy of Sciences, got together and wrote a grant to the National Oceanographic and Atmospheric Administration (NOAA) in their environmental literacy program for a project called The Worldviews Network, which received funding for three years. It is a collaboration of scientists, educators, artists and indigenous groups developing best practices on how to use the digital immersive environment to bring together communities to talk about environmental change issues from a cosmic context down to a local level. Lindsay shared her thoughts about the ways in which the Cosmic Serpent project has influenced activation of the Worldviews Network:

The Cosmic Serpent process has actually informed the ways the Worldviews Network—our planetarium network of scientists and educators and visualization people—works...The whole process that started with Cosmic Serpent has made us shift as a network and in the ways we are thinking of engaging our audiences and our communities. Instead of focusing on a big splashy planetarium show, it's more about using those visuals to build conversations and to support and nurture relationships; and that's totally from Cosmic Serpent. It's responsible for some of the lessons that we've learned in this first year and a half of this project, and so we turn to and recognize Cosmic Serpent for these things. We're about to start going through a design science process to come up with an engagement model for our future productions with different science centers across the United States. We're definitely going to be looking to our experience with Cosmic Serpent to help us draft that.

A number of other public programming efforts are underway through Lindsay's colleagues at the California Academy of Sciences. Geoffrey Willard and Eileen Harrington, also Cosmic Serpent Fellows from the Academy, have been incorporating Indigenous programming into their existing programming, including the use of talks, visits, guest speakers, cultural demonstrations, Specimen Spotlights; programs on Indigenous usage of various plant species that are part of the Academy's collections. This work was sparked at Barona for them and they have continued to do this work without requiring a lot of extra resources. Chuck has also collaborated with other Academy staff outside of his work with Lindsay, such as when he and his family built a tule boat, his culture's traditional watercraft, as part of a program and exhibit at the Academy. Chuck highlighted the complementary nature of his and Lindsay's work on capacity building in the community with the work of the public programming personnel that is focused on building awareness and appreciation more broadly: "That's another kind of interesting outcome that's different within the same institution, where Lindsay and Healy (the former director of the Center for Applied Biodiversity Informatics at the Academy) and the planetarium actually went the extra step to develop additional resources and develop more formal relationships with the tribes in the area. And it sounds like Geoff and Eileen are taking a more global perspective that is focused on highlighting the concepts and the ideas from Cosmic Serpent and pulling from a much broader set of cultures and communities."

Northô Nahookos, a place of transformation, renewal, and evaluation leading to sustainability
Practitioners and their institutions will demonstrate increased capacity to engage Native audiences in science in culturally responsive ways.

In reflecting on future directions and sustainability of the relationship which began through Cosmic Serpent, Chuck and Lindsay discussed how management issues can affect these relationships and especially active projects that require support and oversight. Focusing on the upper management level, Chuck offered, "While I do feel we have a tremendous amount of support from certain individuals, the higher echelon of management and ownership is not always on the radar. The same could be said for a variety of museums and science centers—we can have good line-level relationships with people, but not always with the institutions. And that's another level of influence and education where Cosmic Serpent or Indigenous Educational Institute (IEI) as an organization can have an impact." Lindsay added that a strategy from the front-line level should also be considered, "I'm a believer that you have to teach people by showing and to lead by doing, and the Academy has all kinds of great programs. So it's up to me and my colleagues to bring our new ideas and energies to the museum—like taking our portable planetarium and showing "Valley Oaks" to other groups off-site. This is definitely something that everybody at the Academy is supportive of."

Both Fellows feel supported by the Cosmic Serpent network, which helps to sustain an ongoing connection to this community of shared practice. Lindsay reflected, "I'd like to say that the newsletters are wonderful, as well as the emails that come out from the Cosmic Serpent community. It's a great community and it feels like a family or like a home where we can say that we had this shared experience. Even though I might not have met everybody, I feel like there's a foundation that

I can always turn back to, to vet ideas and to experiment with, and that's exciting." Chuck added, "And not all networks are good at that. I'm a member of a number of networks and they're all over the board. So I focus my energy on the ones that are doing what I feel are interesting things and that are doing things to actually empower people in the network to do good things. As you can see, Cosmic Serpent is one of those."

While the Cosmic Serpent project has completed its 4-year funding period, the network which was created by the project continues to be active, and the leadership continues to be a helpful part of maintaining momentum for ongoing relationships and projects. Chuck shared this thought: "I see all of this very much as a product of the environment that Cosmic Serpent created...At the same time, the organizing team continued to keep myself and others involved in the next iteration and evaluation. That created an atmosphere more of permanence, a movement or strategy that is working and is credible."

Culminating Conference

The culminating conference, held in May 2011, in Taos, NM, served as a key point in the renewal and sustainability of the Cosmic Serpent project. The gathering brought together Fellows from all three regions to connect as one large community, along with team members, facilitators and "bridge people." This was an opportunity to renew connections within one's network, build new relationships across the other regions, and to share knowledge and showcase new and pre-existing collaborative work that models the Cosmic Serpent process and themes. The gathering was well received by Fellows and infused a positive energy in the community as a whole, generating a sense of appreciation for the various pathways that Fellows had taken on the project and generating hope for future pathways and sustainability of this collaborative work.

The Cosmic Serpent Culminating Conference created an open, welcoming atmosphere in which attendees continued their personal and professional growth around what it means to work across multiple worldviews, and to collaborate with integrity and respect between science museum educators, tribal museums, and Native knowledge holders. In the overall narrative of the Cosmic Serpent project, the conference brought together Fellows from across regional and cultural perspectives and integrated a small but enthusiastic group of new members into the Cosmic Serpent community. The culminating conference also strongly supported intended project outcomes, with Fellows highly rating their impacts in the areas of knowledge/understanding of Indigenous ways of knowing, ability to build relationships to support cross-cultural collaborations, appreciating multiple worldviews of science, knowledge and understanding of how to respectfully collaborate with Indigenous communities, and awareness of their own perceptions, beliefs and attitudes around Indigenous ways of knowing and westerns science (See Appendix A, **Table 9**).

In a project built around growing long-term and sustainable relationships, particularly in face-to-face settings, the conference served as both a culmination and a continuation of this ongoing process. At times, the conference had an atmosphere of a family reunion, with Fellows warmly greeting one another; and even those from different regions, who had not necessarily met in person,

conveyed a sense of camaraderie and joint participation in a community. In this way, the culminating conference served as a way to reinvigorate and recharge attendees, some of whom are not yet finding the support systems they need in their efforts at their home institutions. For ongoing relationships and partnerships, the conference was another opportunity to build trust and connection, which will help the Cosmic Serpent community continue to grow and evolve. Quantitative analysis supported the fact that relationship-building was a strong outcome of the gathering, with the majority of attendants (nearly three-quarters) mentioning the opportunity to build relationships and collaboration as the main value and benefit of the conference (See Appendix A, Table 10).

The environment also played a key role in bridging and strengthening relationships. Taos, New Mexico, is considered by many to be a spiritual place that ignites a certain kind of energy. Hosting another conference at this site helped to facilitate a stronger connection to the people of Taos and, importantly, the Taos Pueblo community. Pueblo people are oftentimes closed to visitors and to sharing an intimate side of their culture. The connections made with the Taos Pueblo tribal council and having them on site for the opening and closing events solidified the continued relationship between the Cosmic Serpent family and the tribal community. To further strengthen this relationship, the council personally invited the group to visit the Pueblo, in addition to providing personal time set aside for participants to visit the Pueblo and learn from the people. This exemplified the idea of creating space to build relationship, and intimately learning from one another.

The culminating conference also supported attendees in deepening their understanding and appreciation of Indigenous ways of knowing, and hope for creating and continuing productive conversations between Indigenous knowledge holders and scientists and/or science museum educators. While attendees expressed less growth in their understanding of Western science (see Appendix A, Table 9), they did feel enabled to reflect upon their own worldviews and walked away with multiple ideas about how this experience might change their everyday practice, such as in being more sensitive to use of language, more thoughtful about how they develop programming, and more able to build long-term, respectful, collaborative partnerships (See Appendix A, Table 11).

Overall, the culminating conference invigorated the Cosmic Serpent community, helping to build connections across the three project regions, cross-pollinate ideas for project implementation, nurture ongoing relationships, and build a foundation for continued collaboration beyond the life of the grant.

It is in this key area -- the continuation of the community -- that project partners should direct their energies in the final months of the project, such as by providing opportunities or mechanisms to support continued communication and collaboration among the Cosmic Serpent Fellows (whether online, through listservs, or in person where Cosmic Serpent Fellows may be gathering), so that the momentum and pathway generated during the project can continue into the future.

Areas for Growth towards Sustainability

When thinking about the ways to support ongoing growth of Fellows and groups of Fellows as they seek to build mutual understanding between Native and Western worldviews as well as collaborations between tribal museums and science museums and related institutions, it is appropriate to consider the challenges faced by Fellows. We say that challenges are worth focusing on because they are potential limitations to the transformation engendered by Fellows, but they are also directly the avenues by which growth will occur—through effectively addressing these challenges—particularly in creative ways—Fellows will be part of a process of transformation and renewal. And to the extent that Fellows have the opportunity to reflect on their engagement with challenges, they can also be part of the North's component of evaluation. Fellows have shared numerous challenges with us through our surveys, interviews, group discussions and informal conversations, and we've noted others through our participation in the project and engagement at the workshops.

Challenges have included: reducing defensiveness about one's own worldview; not knowing where to start or, alternatively, being overwhelmed when wanting to focus interests or develop collaborations; getting institutional buy-in or getting support from organizational leadership; funding.

Reducing defensiveness is not a problem that is unique to this project, and is of equal importance to interdisciplinary and cross-cultural efforts in general. However, the goal of reduced defensiveness in this case is not necessarily about opening up one's mind or one's ideas to change. Here, opening one's own worldview is not about opening one's worldview to questioning or contamination; rather, it is about allowing partners safe places to express their own understandings. The general effect desired is one of increased trust and respect rather than a melding of worldviews. Fortunately, Cosmic Serpent Fellows in general are a self-selected group interested in the Cosmic Serpent goals and thus they are less defensive than would be the general populations from which they came. However, this reveals exactly the challenge that Fellows face in this area. Their job from here on out is to engage other professionals and institutions, many of which will not have participated in Cosmic Serpent and will not necessarily have low levels of defensiveness nor understand that the goal of lowering their guard is for engagement, not for changing their mind.

When activating their knowledge, skills and attitudes for bridging cross-cultural gaps in understanding or collaboration, a challenge is that Fellows might feel overwhelmed or not know where to start. The two workshops in each region and the culminating conference were meant as steps toward helping Fellows overcome this challenge. As Fellows engage in a process of transformation and renewal, goals could include broadening their repertoire of content, process and partners. To start with, their efforts might include their content that is familiar territory, revising current projects and engaging Cosmic Serpent colleagues or past partners from Indigenous knowledge or Western science backgrounds.

Getting support from the leadership at one's institution can be a 2-3 step process, each step with different strategies and timelines. First of all, if the section leader or museum director will certainly

be amenable to a Fellow's suggestions based on Cosmic Serpent, then the first step is to provide a well-documented and convincing proposal for the area of interest (e.g., docent training, volunteer training, staff training, newsletter column, exhibit revisions, educational program revisions, new programs/exhibits including new partnerships with tribal museums or science museums, lending institutional assistance or even just advertising for a potential partner institution, diversification of outreach efforts, and training or adding to advisory board, board of director or tribal council). The director then helps garner the support of the board of directors. But if the institution is not immediately amenable to the Fellow's main ideas, then the effort might be to focus on something relevant to the museum's interests but that still achieves goals of Cosmic Serpent. This involves developing interest among colleagues and directors over time for a variety of small changes clearly within the scope of the museum's work, at some point trying to point out the success of these endeavors to leadership when looking to propose the project(s) of greatest interest to the Fellow.

The challenge of funding is not unique. The growth of Fellows in this area will relate to the creativity with which they approach the resource limitations they experience. Such efforts involve: collaborations that rely on unique and diverse skills and resources of partners; inexpensive revisions of existing projects while also engaging partners; and dissemination through low-cost media; among others approaches.

Leadership Team's Learning in the North

In this direction, the North (Nahookos), a place of transformation, renewal and evaluation leading to sustainability, the leadership team went through a transformation of building the leadership skills along the pathway of the Cosmic Serpent. While they deepened their knowledge in both worldviews and relationship, the main growth was in strengthening their understanding of the Dine model and the areas that support Indigenous worldviews needed to bridge this collaborative effort. As stated in the previous direction, the leadership team's own growth had a direct impact on the approaches used in the workshops. In order to get to the place of transformation, they had to invest in the time to experience relationship building and a deeper understanding of the Dine model. They also needed to factor in an awareness of where the Fellows were at in their understanding and perceptions of worldviews of Western science and Native Ways of Knowing.

One area recognized by team members is an agreement that the team came in with some background on Native Ways of Knowing. The degree of this background knowledge was dependent on the individual's learning experiences; because of this everyone brought a different strength to the collaborative effort and organically, it morphed into a strong collaborative partnership based on trust and consensus of team members. It was also an environment where the team members experience collective leadership from a Native worldview. In this case, it wasn't about the individual benefit, rather about becoming a vehicle for the community's voice to accentuate and demonstrate through active engagement and creating environments for this model to unfold. The leadership team realized they had to model the very process they were encouraging the field to embrace. It was about benefit to the communities within this project. Because the leadership team believed in the

vision and mission of the project, and modeled this through creating a platform for the voices of the Fellows to be heard in developing and growing the workshop experiences, this contributed to the strong foundation that resulted in positive collaborations within the project. As a result, in this direction, Fellows did gain awareness of Native ways of knowing, and awareness of how scientific thinking and inquiries do happen; both have their own method on how to get answers, and both unfolded within this project to be perceived as valuable disciplines. The Fellows did create environments for partnering, to collaborate on exhibits that put into practice applications to the Cosmic Serpent model.

As the team moved forward, they invited other partners representing the regional areas to engage as key players to echo the worldviews through applied knowledge and voice during follow up workshops and the culminating conference. The exposure to individuals representing other regional areas created more awareness of other programs who model and support the visions and goals of the Cosmic Serpent (putting theory into practice), which in turn influenced potential partnerships, collaborations and networking. Through bringing the unique strengths of the leadership team together the team transformed into a strong collective partnership for continued pathways of collaborative work.

Examples of leadership voice for deepening the knowledge:

“Another thing, I became much more aware, when Native people talk about tradition, every time when that word is spoken, tradition – science, science of survival is embedded in that tradition, has served that community well and kept them alive for many years, so that science lives within tradition. Gave me a new understanding and new awareness of what tradition really implies.”

“...when the foundation is solid, then you can evolve, develop, grow within it; when you go back, you go back full circle (no pun intended) you ground yourself in that same foundation.”

“I think everyone brings a different strength to these, and I think and I hope that our organic structure allows peoples strengths to come out.”

“CS has done that – has organically evolved into a model of collaboration, consensual decision-making, with a buy in and feeling that what we each think is important..., from my point of view that’s what’s happening; I think of everyone’s talent and skills and what was brought...”

Evaluation Team’s Learning in the North

In this area of the North (Nahookos), a place of transformation, renewal, and evaluation leading to sustainability, the key outcome here has been the sustainable relationships built on trust and respect for one another’s knowledge and perspectives, and a shared commitment towards carrying this learning into future work together. As stated above in the leadership team area, the evaluation team also needed to spend a good deal of time in the other directional areas before transformation or renewal could take place. Like the leadership team, without significant time in these other areas (initiation, growth, and activation), the learning and the impacts of the project would not have been

as rich. In other words, summative evaluation--a main goal of the evaluation team--in this case also required participating in the experience through exposure to new people and worldviews, growing in skills and knowledge, engaging Fellows in their development of projects before coming to a point where mere data collection could serve as the basis for a summative evaluation. Our understanding of the collaborative processes that were the focus of our evaluation was greatly deepened because of our own experiences on a similar pathway.

In terms of sustainability, the evaluation team has nurtured a long-term relationship that extends beyond the Cosmic Serpent project and is shaped by commitment to an ongoing process of learning and growth. Rather than perceiving our work as project-based, our partnership is an ongoing process that will continue into the future in multiple ways. On one level, Native Pathways and ILI are involved in numerous other projects – Native Universe (NSF DRL 1114461), Generations of Knowledge (NSF DRL 1010559) and Navajo Sky (NASA) --, in which we continue to nurture and refine our joint evaluation process. On another level, the partnership is not just about a series of projects, but an ongoing pathway toward learning from one another's worldviews together and supporting one another and other people in this cross-cultural collaboration through our reflective and evaluative practices. It is important the evaluation team share this story with the field of evaluation in order to influence cross-cultural competence and a commitment to having stakeholder's voices at the center of evaluation.

We have all experienced different levels and types of transformation through our involvement in the Cosmic Serpent project and, in the evaluation team, those levels included substantial learning curves from both worldviews. Depending on where we were in terms of evaluation practices and influences, some learning experiences were more independent and then such knowledge was transferred into the collaborative evaluation efforts to deepen the evaluation process. From the western evaluation side, much time was needed in the initial directional area of initiation, which involved a very steep learning curve around Indigenous paradigms and perspectives. This involved a paradigm shift towards holistic, emergent pathways, rather than a linear approach that is based on predetermined steps. It involved much self-reflection on one's own worldview and cultural biases – such as recognizing that many of our assumptions around communication, leadership, and evaluation processes are cultural in nature and based in a specific worldview. Much learning in particular was experienced around the importance of relationships, leadership and balance of voices. ILI, as the lead evaluation institute in the grant, initially assumed an approach to leadership that likely led to imbalances in perspective and voices in the evaluation; this led to the team finding ways to be more balanced and consensus-oriented, each bringing our own strengths and taking responsibility for different aspects of the evaluation. While, in retrospect, the project would have gained greatly from a balanced approach from the beginning, it was necessary to go through a deep learning process to gain awareness and appreciation of what this meant and how to create balance of voices in an authentic way. We are still on this learning path – paradigm shifts are not something that happen quickly or are every fully complete -- but the collaboration strengthens, and our capacity to listen to and understand Indigenous perspectives increases as our learning continues.

For too long, indigenous worldviews in the evaluation field have been minimized or not included at all. From the indigenous evaluation side, the appreciation of being afforded an opportunity to work alongside an evaluation organization that is nationally recognized significantly weighed in on the importance to create a well-defined and balanced voice for allowing the process to emerge. This included the willingness and openness of the individuals involved in the evaluation team to experience this unique collaboration. The first piece was to create the strong relationship that would ground the work. This meant spending time in the first two directions until the team had an understanding of the holistic model developed through joint experience, and it meant recognizing that new learning plus paradigm shifts would continue to occur through this process. As a result, the collaborative evaluation work housed within this project provided a rich example of how worldviews typically do not merge but they align to achieve a collective voice. This evaluation effort documents a snapshot of validating the concept of indigenous evaluation models and collaborative partnerships bringing two worldviews of evaluation together. The greatest learning was experienced through being invited to share an equal voice within this evaluation pathway and uncovering ways to respectfully share this voice, learning how to share this deep knowledge found within the indigenous paradigm in a way that was understandable, practical, appreciated and accepted without creating barriers; and realizing that both worldviews are needed to ground this type of work.

LESSONS LEARNED

As the Cosmic Serpent project is unique in its approach to relationship building and professional development around juxtaposing Indigenous knowledge and Western science in informal learning contexts, we present the key lessons learned at all levels of the project. We start with lessons learned around cross-cultural collaboration, as this underpins the experience of all three groups focused on in this evaluation: Fellows, Leadership Team, and Evaluation Team. These commonalities in collaboration are followed by specific discussions relating to each of the three groups. These lessons learned are not meant as a one-size-fits-all model, nor are they necessarily prioritized over other experiences and time-tested strategies in this area of work, but rather as a means to share our own learning on the project with the larger field, and as inspiration for future pathways in bringing these worldviews together. .

Cross-cultural collaboration

Through their own collaborative work and through evaluative feedback from participating Fellows, the Cosmic Serpent team gained insight into conditions and contexts specific to collaboration across Indigenous knowledge and Western science. The key lessons learned centered on the time, commitment, dedication, and openness that are required by all partners to lead to successful and sustainable partnerships. Specific lessons learned in these areas include:

- Collaboration is filled with complexities, but is valuable and rewarding. Each partner needs to be open and willing to engage in complexities, and in an emergent process that may not be clear at all times. An enriching environment of learning and growth is created

only when each partner is open, trusting, and committed to building the collaboration. Ample time must be allotted for in-person gathering (relationship building); it is in the context of physical presence that trust can best be built, and mutual understanding and learning can take place. An annual meeting is generally not enough, rather, multiple gatherings throughout the year and at key points throughout a project.

- Facilitating partnerships with a Native paradigm can be effective and is generally inclusive. In environments that bring together Native and western knowledge, it is fruitful to let the Native worldview guide the collaborative process. As a holistic, emergent approach aimed at inclusion and balance of voices, the Native paradigm naturally creates an equitable environment that allows for multiple perspectives. This approach also serves to help right the historical imbalances between Indigenous and western paradigms by spending time immersed in Native ways of knowing. Finally, while Native partners are well aware of western protocols, there is often a much steeper learning curve on the side of Western partners, especially those with little or no experience in Native cultures and worldviews.
- Participants should engage with a positive, hopeful attitude, and a belief that things will work. In terms of historical trauma of Indigenous people there is evidence that research has perpetuated harmful documentation, to the point that despair has infiltrated into community environments, resulting in unhealthy impacts. Culturally, Indigenous people used practices and concepts of celebrating experience that allowed for positive nurturing of a particular environment. With this said, it is important that activation, engagement, and sharing of story be focused on celebrating the successes of experience. Scientific research shows the more you apply the positive, the more positive outcomes surface. Indigenous communities value this concept of celebrating story and believing in positive pathways.
- Collaboration often requires willingness to commit personal interest in the mission/goals of the project. This type of collaboration involves a “whole person” approach, in that it is not merely an engagement in one’s professional life, but a willingness to reflect on and engage with one’s whole self. Partners and Fellows on the project often spoke of the personal growth they experienced, in addition to what they learned in relation to their professional work.
- Personal transformation may be needed in order to achieve project or collaborative goals. As mentioned above, this type of collaborative process can be deeply personal, touching on deeply held beliefs and understanding of the world and our place within it. With partners entering collaborations at very different levels of understanding and experience, it is necessary to allow time for personal growth, learning and reflection, as these are essential to the success of this work. Personal transformation can happen in small, iterative steps, and is an ongoing process that will evolve over time. It is important

to allow space for this to happen, and to make room for the personal and the emotional within this space.

- This type of collaboration takes trust, respect, time, commitment, frequent communication, and many in-person visits to develop and sustain. This is necessary and desirable for creating a truly collaborative process in which we value and give voice to all perspectives; and it supports an evaluative process that is also inclusive of many voices. It is our strong recommendation to build in the time and financial support needed to allow such a collaborative relationship to develop, particularly when partners have not worked together in the past.

Fellows

A few of the lessons learned in the area of sustaining Fellows' transformation and renewal centered around combating cultural stereotypes, engaging schools, relationship building, and managing collections. A large area of interest to Fellows and one around which they were able to convey considerable understanding was the impact of stereotyping. Most salient is the stereotyping of Native Americans and Indigenous cultures from both the past and present. Museums in particular have the challenge of providing digestible information to visitors without engendering harmful stereotypes. We consider this an area of lessons learned for Fellow renewal because stereotypes can easily creep into anyone's thinking as a way of shorthand, even if intended as a positive way of remembering how a group of people live or what they need or express or advocate. Through their work with Cosmic Serpent, Fellows identified several ways to combat stereotypes in museum settings. One way is to show how contemporary Native Americans live; that is, for museum programs and exhibits to display living knowledge and current lifeways of Native Americans. There is a need to transform stereotypes into richer and more diverse depictions of Native Americans. One Fellow illustrated this type of learning as follows:

"One thing that I was aware of before, but now when I talk about Native people, I talk about them as contemporary, before I would add that, but now I am very conscious of it."

In terms of the ways that Western science and Indigenous museum practitioners interact thoroughly for dealing with stereotypes, their displays of living knowledge in museums could show multiple approaches to solving problems, including scientific and Indigenous ways of thinking.

Engaging schools, where youth can be taught about the importance of understanding multiple ways of thinking, as well as engage in this practice, was frequently mentioned as important. We consider this an important area for renewal and transformation because engaging youth requires constantly updating one's understanding of youth culture and useful modes of interaction. One discussion in the focus groups covered the importance of educating and sensitizing teachers, even creating networks between schools and various Native resources and developing packets of materials for teachers and providing them web links to resources as a part of the process of reaching youth. Still, there are challenges to bringing schools into collaborative relationships. Below, one

Native Fellow talks about the problem about being viewed only as a resource and not as a partner in educating youth:

"We do have people from certain schools that have requested to do projects with us, and I say no because they want to do projects on their terms. They want to do their own science, but they want to do it on our canoe. I say, 'let's see what we can do together. This is the type of learning that we offer. Wrap your head around that and incorporate it into what you want to teach while respecting our culture.' I think that there are others that have heard about what we do. Before people would call, "[Our] education. Take us on your canoes. Now, it's more 'we understand that you're a cultural group, how can we work together? Work together, shifting paradigms; [we] didn't have much patience for the old request."

A traditional Native way of engaging youth is not only via teachers at schools, but also through involving the elders of a community. It would be worth examining whether this tradition can be supported through the schools, such as via foster grandparent-type programs that exist in some elementary schools, engaging elder centers, cultural programs that are lead by elders, or via some other mechanism.

Relationship building among participants was probably the most noted impact by Cosmic Serpent Fellows. Participants strongly need ongoing opportunities to connect, network, and share ideas with other Cosmic Serpent participants (such as through listservs, online forums, and more frequent face-to-face contact). Many participants described initial and positive efforts at building connections within the regional network, but some had not followed through for a variety of reasons. Some felt they lacked direction in terms of where to go with the collaboration, and others simply lacked time, funding, and/or staff resources to devote to new collaborations. It is easy to lose the initial excitement and momentum created at the workshop if relationships are not actively supported and nurtured. One fellow offered humility and generosity as a general approach to building productive collaborative relationships, or generally thinking of one's potential collaborators first and trying to "put together a design that could benefit everyone, give them more ownership, be less condescending, something that amounts to 'what we can do for you?'"

Managing collections came up a few times as a topic of interest to Fellows. Most felt that it would not be possible, or even reasonable, to return all collections to the earth where they were found or to return them to the most closely associated cultural group. Nonetheless, there was great concern on the part of most Native Fellows about collections and them having been removed from the cultural context or having been removed from the cultural group itself. Most non-Native Fellows expressed notable respect for this position, and many of them also had strong concerns of this type about collections. Common throughout the workshop was the point of view that information acquired from Native peoples must be acquired in a culturally appropriate and non-exploitative way. One suggestion was that science museums should reach out to Native communities about the current museum collections; at first, this might be done by trying to document how materials in the collections were obtained. Then a process by which an agreement or consensus can be developed

regarding the maintenance and use of those materials would involve deciding whether those were culturally appropriate mechanisms for obtaining the materials, and then going to engage the appropriate Native communities about the collections. As evaluators, we think this may be one way to develop trust and to develop common goals. However, individuals engaging in this or any other dialogue with a Native group should beware of the political nature of these communities, as was stated by a few Native Fellows. One suggestion reiterated by a few people in a focus group was to invite everyone possible to the table (using local protocols)--to use "a broad brush" for interacting with the community, thus giving all the chance to have their voice heard. This is not meant to exclude or disrespect leadership of the group--such meetings would necessarily involve them, but not only them--and this is also meant to avoid favoritism. Another suggestion is to form advisory committees that would include respected knowledge holders from the communities targeted in the exhibits. One Fellow shared the following anecdote:

"And my chairman said, 'No, we won't collaborate on this exhibit unless you ask all of the [tribe's] people to collaborate on it, because it won't be meaningful to everybody unless everybody has a voice.' Because we can't tell the story of everybody without them giving their own input."

Nonetheless, we can think of times where local protocols for decision making are not so inclusive, or do not involve engaging all stakeholders in the same setting. Thus, the way that inclusiveness is sought can be modified in different settings so as to respect local protocol while still engaging diverse voices and relevant stakeholders.

Leadership Team

As stated previously, the leadership team was purposeful and invited to be a part of the collaboration due to the strengths they encompassed. This included a balance of partners who comprised of strengths in Western science systems and partners who comprised of strengths in Indigenous knowledge systems. In this case, most of the team members had some level of understanding Indigenous knowledge systems and had sound levels of knowledge of Western science systems. These individuals also had a willingness to step into the collaboration with an open mind and understood that paradigm shifts may potentially occur along the pathway. This is essential to creating a balance of collaborative partners.

What transpired was a team that created a collective voice and synergy for advocating the aims and goals of the project, and using these strengths to grow the project. There were significant outcomes in continuation of the collaborative efforts of the team members, found within current projects to continue the pathway of the Cosmic Serpent or projects that are being developed.

One of the most significant successes of the collaboration was the willingness to model the very process of the aims of the project. Moving through the same learning experiences as the Fellows moved in efforts to ground the work. This is important to evolving and strengthening the collaborations found with bringing worldviews together.

The team also learned that more time was needed for not only the Fellows, but the leadership team as well to spend in the two first areas of the Dine model. Because of this, impacts to the budget challenged financial balance. It is important to consider this area when the collaboration is centered on implementing Indigenous worldviews. It takes considerably more time and commitment to move through this type of environment.

Evaluation Team

The Cosmic Serpent evaluation involves new and innovative approaches to evaluation that aims to be responsive and effective within both Indigenous and Western paradigms. Given the unique nature of the evaluation, we are including some of the “lessons learned” around the joint evaluation process specifically:

It is important for the evaluation team to encourage conversations with participants around the evaluation topics in addition to soliciting written feedback. Verbal interactions, such as focus group discussions or phone conversations, allow more trust-building, which is foundational to the development of relationship that is at the heart of the Native paradigm. Also, we found it very useful to build-in discussion with participants on the evaluation process itself, covering what evaluation means in the context of the Cosmic Serpent project. We recognize that evaluation can be a loaded and potentially negative term, particularly from Native historical perspectives. The team may identify other terms, perhaps drawing upon Native languages, to explore other ways of defining the evaluative process. Overall, evaluators should reduce the sense of judgment associated with evaluation, and to build clarity with participants around what we are asking them to evaluate.

The evaluation team needs to build in a strong sense of reciprocity in evaluation, which is another key element of the Native paradigm and essential for relationship building. Participants must feel and understand clearly how their feedback will be used, and how this evaluation will benefit their museum and community. In the Native worldview, Indigenous people hold breath as sacred, because of this Fellows and those involved in the evaluation need to respectfully be honored for the breath (voice and thought) they provided to the evaluation documentation. So, reciprocity included ‘gifting’, in terms of a small gesture of thankfulness for this breath.

In documenting how participants utilized and experienced the Cosmic Serpent community, we found it necessary to focus more on the “smaller” ways participants may have integrated Cosmic Serpent concepts, such as by building on existing programs, initiating discussions at their home institutions, building partnerships, etc. rather than on building new exhibits or programs, which are more likely to occur for most Fellows in a longer time frame, after relationships have been built, interests have been focused, salient ideas have been generated, skills have been honed, and funds have been procured.

Finally, budget structures must support the nature of cross-cultural collaboration and the time it takes to build relationship, trust, and a true balance of voices. This means that significant time and budget must be built in to support frequent communication and in-person meetings. Particularly in Native environments, physical presence provides opportunity for the richest and most authentic

work to take place. In a joint evaluation structure, involving teams from both Indigenous and Western evaluation perspectives, the budget must reflect a balance of voices and input, rather than one side having significantly more support than the other. Equity and balance must be reflected at all levels of the project.

RECOMMENDATIONS FOR FUTURE COLLABORATIVE WORK

Through the pathway of sharing the Cosmic Serpent story and reflections on the lessons learned, future collaborations need to be considerate of the time and space needed for creating a relationship prior to activation of program activities. It is the heart of relationship that stimulates and shapes the pathways of the genuine collaborative work. As a result of designating this as the main gateway for creating a foundation, the consideration of time, financial support and key individuals involved needs to be strategic.

The physical environments where the partnerships unfold are also critical to the success of these types collaborations. Being deliberate in considering environments such as: places that provide positive energies; indigenous communities where accessibility to community is at hand; rural settings where access to significant cultural places that could be used in on-site activities, and consideration of lodging accommodations all factor into the success of the collaborative pathway.

The activation of activities need to be purposeful and with meaning to the collaborators, so that application of these learned experiences can happen within and around their local institutions. With this said, the activities and presentations always need to be considerate of balance of voice. Creating environments where all voices are heard, shared and experienced will help with sanction and influence more opportunities for this type of work. With this said, sometimes there may need to be more time spent on orienting the audience to Indigenous worldviews. Consideration of where the participants are in terms of knowledge levels is recommended.

At the funding agency level, the considerations of the amount of time needed to activate these types of collaborations needs to be considered in terms of funding timelines, and financial support systems. While there is an appreciation of the financial support systems from funding agencies, part of the effort to share the imbalances in this area are respectfully presented for future considerations in creating environments for future support to these types of collaborations.

It is also recommended that more emphasis and budget support be placed on process evaluation and research at the team/project level in order to more deeply understand the nature of this work and share that learning with the broader field. Given the long timeframe needed to build relationship for effective and sustainable collaboration, focus on public impacts can be less effective and can even enforce models that we know do not work, such as one-shot partnerships focused on specific deliverables (e.g. an exhibit or program).

At the heart of this collaborative work, the Fellows and collaborating partners that have been involved in shaping the pathway of the Cosmic Serpent have encouraged the continuation of current partnerships. Strategically thinking about efforts to continue providing support systems to these

Fellows is recommended, and possible consideration to consider Phase II of the project should be considered. For this reason, the efforts of continuing to document the story are critical to informing and validating these types of future collaborations and partnerships.

APPENDIX A:
DATA TABLES

Table 1: Participants' ratings on workshop components (Pilot Workshop)

Workshop Component	Mean Rating
	1=poor 2=fair 3=good 4=excellent
Workshop facilitators and presenters overall	3.09
Opportunities to interact with colleagues	3.00
Overall organization and structure	2.91
Overall content	2.82
Duration and length of workshop	2.64
Usefulness of workshop for your future work	2.36
Materials and resources provided	2.27
Pace of the workshop	2.27
Balance between group discussion / work and presentation	2.09
Workshop overall	2.55

Table 2: Participants' satisfaction ratings (Southwest Workshop 1)

Item	N	Poor	Fair	Good	Excellent
Overall organization and structure	17	12%	24%	53%	12%
Overall content	17	--	12%	65%	24%
Materials and resources provided	18	6%	11%	50%	33%
Duration and length of workshop	17	6%	18%	65%	12%
Pace of the workshop	18	17%	44%	33%	6%
Balance between group discussion / work and Presentation	18	11%	33%	39%	17%
Opportunities to interact with colleagues	18	6%	6%	50%	39%
Usefulness of workshop for your future work	18	--	33%	33%	33%
Workshop overall	17	--	6%	59%	35%
Workshop facilitators and presenters overall	18	--	6%	44%	50%

Table 3: Participants' ratings (0-5) on increase in knowledge and ability (Southwest Workshop 1)

Statement (rate 0 to 5, with 0 = %no increase+and 5 = %strong increase+)	n	mi n	max	mean
Knowledge about...				
Indigenous knowledge and Indigenous ways of knowing	19	0	5	2.68
Western science and Western ways of knowing	19	0	4	1.84
Differences between Indigenous knowledge and Western science	19	0	5	2.53
Connections between Indigenous knowledge and Western science	19	0	5	2.47
Indigenous protocols for research and collaboration	19	0	5	1.79
Ability to...				
Work with Indigenous communities	19	0	5	3.21
Develop Cosmic Serpent related programming	18	0	5	2.94
Build relationships and connections to support implementing related Programming	19	2	5	3.63

Table 4. Participants' satisfaction ratings (Northwest Workshop 1)

Item	N	Poor	Fair	Good	Excellent
Overall organization and structure	25	--	11%	54%	31%
Overall content	26	--	8%	54%	38%
Materials and resources provided	26	--	19%	50%	31%
Duration and length of workshop	26	--	19%	54%	27%
Pace of the workshop	26	4%	27%	42%	27%
Balance between group discussion / work and Presentation	26	8%	35%	38%	19%
Opportunities to interact with colleagues	26	--	15%	27%	58%
Usefulness of workshop for your future work	26	--	8%	39%	54%
Workshop overall	26	--	4%	46%	50%
Workshop facilitators and presenters overall	26	--	8%	39%	54%

Table 5. Participants' ratings (0-5) on increase in knowledge and ability (Northwest Workshop 1)

Indigenous knowledge/ways of knowing	3.6
Western science/ways of knowing	2.0
Differences between Indigenous knowledge and Western science	3.0
Connections between Indigenous knowledge and Western science	2.8
Indigenous protocols for research and collaboration	2.9
Work with Indigenous communities	3.7
Develop Cosmic Serpent related programming	3.3
Build relationships and connections to support implementing related programming	3.9

Table 6. Fellows' Average Rating of Workshop and Its Impacts (California Workshop 1)

Question	Average Rating by Fellows
Please RATE the degree to which this workshop influenced your KNOWLEDGE ABOUT (scale 0-5)	
Indigenous knowledge and Indigenous ways of knowing	3.8
Western science and Western ways of knowing	2.2
Differences between Indigenous knowledge and Western science	3.8
Connections between Indigenous knowledge and Western science	3.6
Indigenous protocols for research and collaboration	3.2
Please RATE the degree to which this workshop influenced your ABILITY TO (scale 0-5)	
Work with Indigenous communities	3.1
Develop Cosmic Serpent related programming	3.4
Build relationships and connections to support implementing related programming	3.6
How would you RATE the following components of the workshop? (scale 1-4)	
Overall organization and structure	3.4
Overall content	3.5
Materials and resources provided	3.1
Duration and length of workshop	3.2
Pace of the workshop	3.1
Balance between group discussion/work and presentation	3.0
Opportunities to interact with colleagues	3.3
Usefulness of workshop for your future work	3.3
Workshop overall	3.6

Workshop facilitators and presenters overall	3.7
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Figure 1: Thematic Wall of Impacts Ratings (Southwest Workshop 2)

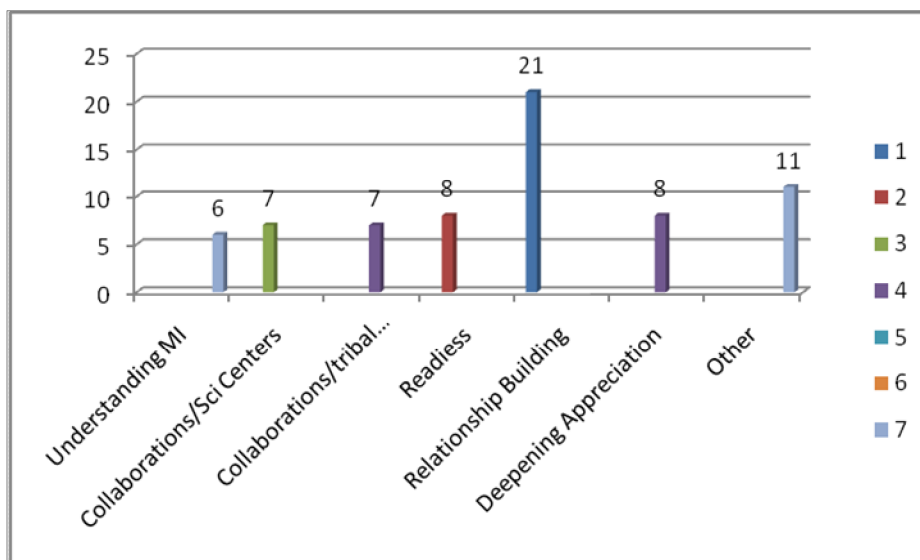


Table 7: Thematic Wall of Impacts Ratings (Southwest Workshop 2).

Impact Area	Rank and Percent
Building relationships and connections to support implementing Cosmic Serpent programming	1 = 21 (70%)
Other	2 = 11 (37%)
Readiness for developing Cosmic Serpent related exhibits or programming	3 = 8 (27%)
Collaborating with science museums or science centers	4 = 7 (23%)
Collaborating with Indigenous communities or tribal museums	5 = 7 (23%)
Understanding or deepening appreciation for worldviews of science	6 = 7 (23%)
Understanding multiple ways of learning and learning styles	7 = 6 (20%)

Rank indicates the frequency of that impact being mentioned, and percent indicates the percent of the Fellows mentioning the specific impact.

Table 8. Thematic Wall of Impacts Ratings (California Workshop 2)

Workshop Result	Number Giving a 1	Number Giving a 2	Number Giving a 3	Number Giving a 4	Number Giving a 5	Number Giving a 6	Number Giving a 7
Understanding Multiple Ways of Learning	5	3	2	4	4	5	2
Capacity to Collaborate with Science Museums	0	1	3	3	6	8	2
Capacity to Collaborate with Tribal Museums	4	3	5	5	7	0	0
Readiness to Implement Cosmic Serpent	3	4	5	5	2	2	0
Development of Relationships	8	7	6	4	0	2	0
Deepening Appreciation for Ways of Knowing	4	6	4	3	5	3	1
Other	1	0	0	0	0	2	18

Number of Fellows Rating Each Impact Area by the Score They Gave

Table 9: Impacts of Cosmic Serpent Culminating Conference

Statement (0 = “Not at all impacted”, 5 = “highly impacted”)	n	Minimum	Maximum	Mean
Knowledge and Understanding of Indigenous ways of knowing	47	3	5	4.40
Ability to build relationships to support the development of cross-cultural collaborations	45	2	5	4.40
Appreciating multiple worldviews of science, or multiple ways of knowing	47	3	5	4.36
Knowledge and understanding of how to respectfully collaborate with Indigenous communities and/or tribal museums	46	3	5	4.33
Awareness of your own perceptions, beliefs, and attitudes around Indigenous ways of knowing and/or Western science.	47	1	5	4.30
Knowledge and understanding of how to present Indigenous ways of Knowing and Western Science in museums and other informal learning settings	47	2	5	4.02
Knowledge and understanding of how to effectively collaborate with science museums/centers and/or Western scientists.	46	0	5	3.54
Knowledge and understanding of Western science	44	0	5	3.25

Note: Minimum = the lowest rating given; maximum = the highest rating given; and mean = arithmetic average of all ratings

Table 10: Main Value and Benefit of the Culminating Conference (coded)

Themes	n	Percent
Relationships / Collaboration	34	72%
Knowledge / Awareness / Appreciation Overall	16	34%
Knowledge / Awareness / Appreciation IK	12	26%
Cross Cultural Collaboration: best practices	11	23%
Knowledge / Awareness / Appreciation WS	6	13%

* Total % is higher than 100% because some respondents listed more than one value and/or benefit

Table 11: Changes in Everyday Practice (coded)

Themes	n	Percent
Cross Cultural Collaboration: best practices	19	40%
Increased Awareness of Personal Beliefs and Perspectives	16	34%
Maintain and/or Use Cosmic Serpent Relationships	13	28%
Share Cosmic Serpent Mission with others	5	11%
Suggestions for Improvement	3	6%
Other	1	2%

* Total % is higher than 100% because some respondents listed more than one change in everyday practice