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## Key Considerations in Federal/Tribal Collaboration

**N**ASA has a long history of working with tribal nations and with tribal colleges and universities to build workforce capacity in science, technology, engineering, and mathematics (STEM) in ways identified by tribes. The two primary NASA programs involved are the Applied Science Capacity Building Program (CBP) (<https://appliedsciences.nasa.gov/>) and the Minority University Research and Education Program (MUREP) for American Indian and Alaskan Native STEM Engagement (MAIANSE; <https://neptune.gsfc.nasa.gov/maianse/>). Both of those programs welcome inquiries from PE&RS readership about how to become involved in this work. (Contact the authors, below.)

For spiritual, cultural, social, political and economic reasons, tribal nations are closely tied to the land they live on. From a purely practical stand-point, many Native American tribes live within the boundaries of their federally or state recognized reservations. This ties the tribe to a finite piece of land and the natural resources within it. Many tribal communities depend on those local natural resources to sustain their economies. Tribal peoples express a deep responsibility to care for the land, water, plants and animal populations, which play such direct, important, and daily roles in their cultural and spiritual practices. Changing climate conditions are impacting many tribal communities and their lands, from coastal nations that rely on ocean food sources, to tribal nations in the drought-prone Southwest dependent on land-based agriculture.

NASA's Applied Science CBP helps to enhance the capacity of communities and organizations to utilize satellite Earth observations through in-person trainings, webinars and internships. The CBP aims to work with tribal governments and other regional tribal organizations as well as non-tribal organizations that work with tribal nations. MAIANSE's mission is to enhance the research, academic and technology capabilities of Tribal Colleges and Universities (TCU) through authentic learning experiences related to NASA missions, thus contributing to a diverse future STEM workforce and sustainable tribal nations. Through their experiences, the CBP and MAIANSE present key considerations when working with tribal nations followed by examples of the two programs.

### Key Considerations

Engaging with tribal nations requires an understanding of each nation's culture and values, as well as an awareness of the history of engagement between non-Tribal organizations and Tribal nations. There are several key considerations when working with tribal nations:

1. Tribal nations are sovereign and distinct states and need to be worked with as such. As of December 2015, there were 567 federally-recognized tribal nations, some with members living on reservations and ancestral territories that reach far outside the boundaries of the reservations. Tribal nations are fundamentally distinct from one another in culture and geography. Even within the same broader tribal group there may be differences in the cultural practices of different communities.
2. Tribal and "western" approaches to understanding the world are fundamentally different. Tribal or native science is based on faith, reliance on the past, and intuition; it is about wholeness, spirituality, and relationships.
3. Tribal members have developed extensive knowledge built on a deep understanding of local environments and complex ecological processes that have been passed down through many generations. That knowledge is based on living on the land, observing the interrelationships among humans, plants, animals and their surrounding environment.
4. Tribal education tends to be based on personal experience and observation. It considers the whole of a student and his/her learning rather than separate parts. It is community-based, requiring an explanation how an activity will contribute to the tribal community being served. In the tribal colleges, students need to understand how their academic subjects relate to one another,

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their community's problems and to the surrounding universe. Competency is tested in a real-world context.

5. For effective collaboration between tribal and non-tribal organizations, tribal peoples' ancestral knowledge and understanding of nature must be respected as equal in value to western knowledge. Tribal communities must be full partners in the design, implementation and evaluation of programs and projects, including training curriculum.
6. Over 40 years of research on best practices has been published on ways that tribal and western science-based educators, researchers, academics, and government agencies can work together. Successes and failures have been documented; successful models have been created. It is important to build on this work.
7. Building trusting relationships is fundamental to federal work in tribal capacity building and education. This takes long periods of time, particularly given the tumultuous history of the U.S. federal government and tribal governments. Successful programs to build tribal capacity and education should be of sufficient duration to allow the building of relationships and establishment of trust.
8. The ultimate measure of success for any capacity building or education program with tribal nations should be the sustainability of the tribal nation or tribal college to acquire and use the tools, data and technology themselves.

## Success Stories

The NASA CBP has worked with tribal nations in two different ways. It has worked with the Bureau of Indian Affairs (BIA) Office of Geospatial Services (BOGS) to develop remote sensing workshops and trainings. Currently, BOGS provides GIS training to any federally recognized tribe on a request basis. The NASA CBP recently designed and conducted two introductory remote sensing trainings for BOGS training staff. This train-the-trainer approach enables the BIA to offer remote sensing trainings to tribal nations on a regular basis. The CBP has also worked with tribes directly, developing and providing remote sensing trainings to tribes in the Pacific Northwest and Southwest. These trainings were co-created with tribal members, focusing on topics of interest to the tribes. For example, the tribes in the Pacific Northwest monitor kelp beds because they provide habitat for critical fish species. Long term goals include developing internships for tribal students to use remote sensing technology and geospatial tools to address natural management and cultural issues of importance to tribal nations.

NASA's program, MUREP for American Indian and Alaskan Native STEM Engagement (MAIANSE) works both directly with TCUs and in partnership with other NASA activities such as the CPB and NASA's initiative for interns, fellows

and scholars (<https://intern.nasa.gov/ossi/web/public/main/>). MAIANSE's success stories include support for geospatial technology and culturally relevant climate change education at Turtle Mountain Community College in North Dakota, where faculty, pre-service teachers and other students, and high school and elementary teachers participate in workshops that strengthen laboratory skills and STEM knowledge; support for STEM camps with Fond du Lac Tribal and Community College in Minnesota, where Ojibwe youth build self-confidence, community, understanding, and skills in both tribal lifeways and science (<http://gidaa.gidaa.org>); and for robotics engineering at Southwest Indian Polytechnic Institute (SIPI) in New Mexico, where students have designed and built a "Mars yard" with which they test robots for adaptability to our sister planet. In all cases, programs were designed by the tribal leaders involved with the program. To learn more about MAIANSE, please visit: <http://neptune.gsfc.nasa.gov/MAIANSE> and <http://www.nasa.gov/esteem> or contact Torry Johnson, MAIANSE's Program Manager, at: [Torry.A.Johnson@nasa.gov](mailto:Torry.A.Johnson@nasa.gov).

To conclude, NASA's CBP and MAIANSE build the capacity of tribal nations and TCUs to utilize NASA's tools, data and technology. Building long-term trusting relationships and understanding that tribal knowledge and approaches to science and education are worthy of respect are key to achieving this goal. Remote sensing data and technology provide a unique and important means of monitoring tribal lands. CBP and MAIANSE work with tribal nations and tribal colleges to develop these capabilities through a variety of activities.

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