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Authors

Miranda-Begay, Donna

Tomlinson, Char

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UC GIS Week
Wednesday, November 19, 2025
1 PM – 1:50 PM
Indigenous Geographies

Speakers:

- Status of California Native American Tribal GIS Knowledge Build | Speaker: Dr. Donna Miranda-Begay - COEQWAL and CA Public Domain and Allotments Association | Pg. 1 | Video Timestamp: 00:00:32.210
- (Re)Thinking the 'Z Axis': A Case for Relational Ontologies in Vertical Worlds | Speaker: Char Tomlinson - UC Berkeley | Pg. 14 | Video Timestamp: 00:28:58.400

Maggie Tarmey, Moderator: Hello, everybody. Welcome to UCGIS Week Day 2. I'm really excited for this session that we have this afternoon on Indigenous geographies. We have two presentations today. We'll actually do questions between... after each session.

Maggie Tarmey, Moderator: And up first, we have Dr. Donna Miranda Begay, and she joins us from California Tribal GIS. Dr. Donna, take it away.

Status of California Native American Tribal GIS Knowledge Build

Speaker: Dr. Donna Miranda-Begay - COEQWAL and CA Public Domain and Allotments Association.

Abstract:

This past July 31st and August 1st, 2025 – the 1st California Native American Tribal GIS Summit was held in Sacramento in the Cal/EPA Building. There were 22 presentations that included CA Tribal perspectives of their uses of GIS based technology, federal and state agencies collaboration in working with Tribes, Tribal non-profits utilizing GIS – all using GIS to help manage Natural Resources, protection of cultural landscapes, and environmental justice support. This summit was first of its kind in California. Both UC Davis and UC Berkeley also participated

and provided their efforts in working with CA Native American Tribes with the usage of GIS based solutions and potential new water governance model. The concepts of Tribal GIS data sovereignty, rematriation, ground-truthing, land back, traditional ecological knowledge (TEK), decolonizing mapping, and cultural burning were discussed and explored. This summit provided to provide the need for the government to provide GIS based data for future natural resources changes, including CA Tribes in water and natural resources management policy making, and more GIS based training for CA Native American Tribes – both federally and non-federally recognized.

The proposed presentation will provide a summary of this important and historic summit. The concepts of “Tribal GIS data sovereignty, rematriation, ground-truthing, land back, traditional ecological knowledge (TEK), decolonizing mapping, and cultural burning” will be discussed. Mapping solutions and concepts will also be illustrated. The presentation should take about 25 minutes. Planning for the 2026 California Native American Tribal GIS Summit is underway, and we encourage UC participation – presenter, exhibitor, or participant. www.catribalgis.org – location of the 2026 summit status.

Transcript: Video Timestamp: 00:00:32.210

Donna Miranda-Begay CA Tribal GIS: Yes, can you see my PowerPoint? It's up on the screen.

Maggie Tarmey, Moderator: Yes.

Donna Miranda-Begay CA Tribal GIS: Okay, well, hello, everybody, to Medec, Tangwang Naung, Donna Miranda Begay, Tabatae, Navajo Key, Halaki, Lake Isabella, Weldon, California. Just introduce myself in Tabotalabo language. I'm actually...

Donna Miranda-Begay CA Tribal GIS: connecting, from Kern Valley, about an hour northeast of Pakersville, and I just wanted to, to talk about, the,

Donna Miranda-Begay CA Tribal GIS: the effort that we had made in having the first California Native American Tribal GIS Summit.

Donna Miranda-Begay CA Tribal GIS: And also talking a little bit about decolonizing mapping and ground-truthing efforts, example by North Fork Mono Tribe, one of the presentations that was at the summit, and also a little bit about GIS data sovereignty. So I'll get started here. Moving on to the second slide here, our summit was about,

Donna Miranda-Begay CA Tribal GIS: The theme was Honoring Place and Empowering Nations.

Donna Miranda-Begay CA Tribal GIS: And, July 31st and August 1st was when we had the, the summit, and it was free.

Donna Miranda-Begay CA Tribal GIS: And, we also made sure that we were focusing on natural resource management, environmental justice support, and protection of cultural landscapes. Again, it was our first time having this in California for mainly the California Native American tribes.

Donna Miranda-Begay CA Tribal GIS: We did have a lot of offers for different topics in the very beginning, and we were able to narrow them down to these six major categories. I won't read them all off here, but you can see the focus of the conference there.

Donna Miranda-Begay CA Tribal GIS: And then, yes, we asked the question, why do we need to have a California tribal GIS Summit? And pretty much, I was looking at the fact that there's 109 federally recognized tribes in California, and about 40-plus tribes that are seeking federal recognition.

Donna Miranda-Begay CA Tribal GIS: And there was a... there's a lot of movement and activity in the areas of land back.

Donna Miranda-Begay CA Tribal GIS: Rematriation, co-stewardship, Cultural burns, also known as good fire, conservation, and protection of cultural landscapes.

Donna Miranda-Begay CA Tribal GIS: Also, tribes were obtaining natural resource-based grants that required GIS-based reporting and file creations, and so they needed to understand about the use of the applications, and CAL FIRE is a good example, who require this when you get a grant.

Donna Miranda-Begay CA Tribal GIS: With them. And then also, tribes understand the strengthening of their sovereignty by managing their own GIS environments and their cultural sensitive GIS data.

Donna Miranda-Begay CA Tribal GIS: Tribes also wanted to correct, historical mapping, such as brown truthing and truth and healing, and this requires up-to-date, mapping and story map narratives.

Donna Miranda-Begay CA Tribal GIS: Also, we all experience, of course, the federal changes in services and funding, and so in order to be more resilient during these times, it's important to build up our GIS knowledge, and so, tribes were looking at that as, supporting their... today's tribal sovereignty and their communities.

Donna Miranda-Begay CA Tribal GIS: In the past couple years, I've had an opportunity to experience, going out and taking a look at post-cultural burns, such as Sedgwick Reserve, and up in the north, the Yurok Women all-led women crew that, helps to teach folks on cultural burns.

Donna Miranda-Begay CA Tribal GIS: And, very nice to see that. They also have a documentary called, I think it's called something, Fire... Good Fire.

Donna Miranda-Begay CA Tribal GIS: And then on the right, UC Davis, researchers are out there doing, land surveys for, the

Donna Miranda-Begay CA Tribal GIS: California tribal allotment Lands. These are lands that a lot of folks don't realize that there's reservations, rancherias, and allotment lands in California. There's about 300 of them, and they're sitting there under... right below my property, there's a cultural site, and they're... they're... I'm taking them on a cultural tour.

Donna Miranda-Begay CA Tribal GIS: And in the center there, there's, conservation bearers, we call ourselves, that are with the Mojave Land Trust, group folks, and, working with the Native Lands Trust, folks.

Donna Miranda-Begay CA Tribal GIS: Yeah, there's all kinds of activities, like I said, happening in California for tribes, and I've been fortunate to be able to be part of that. In the lower right is I'm... I'm on site teaching, I think it's called Bear River Roanert, Tribe on how to do drone flying.

Donna Miranda-Begay CA Tribal GIS: So the summit itself, getting back to that, we were trying to establish, like, that draft agenda items on the right for two days.

Donna Miranda-Begay CA Tribal GIS: And we decided to build this from the bottom up. I threw out an email on January 21st this year, saying to a few friends of mine that work for the state and federal government, saying, hey, I'm thinking about this idea about having a GIS Summit.

Donna Miranda-Begay CA Tribal GIS: And right away, the Water Board replied back that it sounds like a great idea.

Donna Miranda-Begay CA Tribal GIS: So, we had a shared vision on what we wanted to do, as co-hosts. We planned out these meetings, invited a lot of the tribes and our partners that had an interest in GIS for, you know, natural resource management, EJ, and protecting our cultural sites. So, our momentum built, and we got going, and so then the governor's office

Donna Miranda-Begay CA Tribal GIS: And also, both Natural Resources Agency and Cal UPA started to really offer their support for the effort, so we were pretty happy with, getting this effort going. So from, February 5th through Janu-

Donna Miranda-Begay CA Tribal GIS: June 25th, there was planning going on, and so by July, we pretty much had these two agenda days, day one and day two, available. I'm going to be making sure that the PDF, this PowerPoint will be offered in a PDF format, and that these links will go to Google Drives, my Google Drives. I have all the webinars for these two days, except for day

Donna Miranda-Begay CA Tribal GIS: Day 2, there's a couple in the morning that we missed, unfortunately, but starting at 9.10 a.m, we were able to start recording our webinars with no problem.

Donna Miranda-Begay CA Tribal GIS: But anyway, the webinar recordings will be available, and all the presentations, the PDFs, all the presenters pretty much provided a PDF for their presentations, so you can access that. And again, there's really good topics there, so yeah.

Donna Miranda-Begay CA Tribal GIS: Again, getting back to the summit, out of the 109 federally recognized tribes and 40 non-federally recognized tribes, we had 90

tribes represented at this conference, or summit. And off to the right, you can see a ArcGIS Pro map that was generated with the help of state parks.

Donna Miranda-Begay CA Tribal GIS: And, there was 280 people participated in person and 230 virtually, and there was a lot of networking amongst the tribes and the federal folks, the state folks, nonprofits, and the academics, and so that was going really, really well. Also, too,

Donna Miranda-Begay CA Tribal GIS: We had, used, on the technical end, on the back end, we used ArcGIS, the survey 123, you know, online for generating, you know, ways to organize our summit, like, being able to do registration and present, getting the presenters, PDFs, and then exhibitors' information, sponsors' information, and doing, conducting workshop surveys on how we're doing with

Donna Miranda-Begay CA Tribal GIS: the summit.

Donna Miranda-Begay CA Tribal GIS: And then I use my GoDaddy website to create the webpages to make sure that we're staying on track with keeping everybody informed on how things are going with the summit.

Donna Miranda-Begay CA Tribal GIS: And finally, there's all these folks that were on the planning team. They attended those 7 planning meetings and, really helped us nail down what we needed to do. And again, special thank you to the Water Board's Office of Public Engagement, Equity, and Tribal Affairs. Again, like I said, on the 21st, I threw out an email, and in 9 minutes, I got a reply back from the office there.

Donna Miranda-Begay CA Tribal GIS: Saying that, this sounds like a great idea, let's do it. So we were able to take over this whole second floor of the CalEPA building, for the summit, and it was well attended.

Donna Miranda-Begay CA Tribal GIS: The summit outcomes, we had, policy, recommendations that GIS data be provided when these public notices get sent to tribes, and also, instead of just land back, that we also include the water, like, the water... water rights. If we're doing co-stewardship, then it's not just one person has the water rights, it needs to be both entities.

Donna Miranda-Begay CA Tribal GIS: We need to promote GIS data sovereignty in tribal engagement and consultation process. We need to allow for what we call

ground-truthing, rematriation, TEK, and decolonizing mapping when it comes to public natural resource management and planning and decision making.

Donna Miranda-Begay CA Tribal GIS: And, funding for the tribes, for GIS-based training and software, we need to really focus in getting that going for both federally and non-federally recognized tribes. The federally recognized tribes have some things going for them in regards to that through the Bureau of Indian Affairs.

Donna Miranda-Begay CA Tribal GIS: California tribal lands, when we say California tribal lands, we also need to include not just reservations, Rancherias, but also public domain allotment lands, and make sure to include them on the public maps, such as fire maps, and flood maps, and environmental maps.

Donna Miranda-Begay CA Tribal GIS: We had a great event, and it was great networking and sharing. We have, like I said, they recommended to have another summit, which we actually are going to be doing that later on next year.

Donna Miranda-Begay CA Tribal GIS: When we... when we started the summit, one of the things you have to think about is, it's not all about the science of GIS and data collection and, you know, those... that information. That's important.

Donna Miranda-Begay CA Tribal GIS: But also, with tribes, it's really good to start off with a tribal opening, but also focusing on tribal, or traditional ecological knowledge. And so we had a really wonderful keynote speaker, Jennifer Malone. She's a McChumne elder and traditional basket weaver. She's also on the board for California Indian Basket Weavers Association, CEBA, and she really explained a lot about the time to harvest

Donna Miranda-Begay CA Tribal GIS: harvest basket materials, the native plant cycle, and also it's...

Donna Miranda-Begay CA Tribal GIS: The impact of cultural burns, a good fire on these plants, making them very healthy in the life cycle, and protection of those basket materials.

Donna Miranda-Begay CA Tribal GIS: Making sure to get permission to document and map from the tribes, Indigenous approval, building up trust with new technologies is important, teaching our young tribal youth of TEK,

Donna Miranda-Begay CA Tribal GIS: work with tribal elders and listen to their cultural stories, and the design of a basket is what the basket materials are telling you. If anything, I learned that from her, and it's well said.

Donna Miranda-Begay CA Tribal GIS: Okay, so moving on to, the, mapping world of our summit. A couple of presentations that really stood out to me, and one was by Randall Race Richards. He's with the Tuality Nation.

Donna Miranda-Begay CA Tribal GIS: And I'm going to get a little more into his presentation, but I thought he did a really great job. Very advanced, very knowledgeable in GIS and all the different tools, and he actually, from the ground up, also has built his knowledge base and is really advanced in the use of GIS technologies, and he's really helping out his tribe quite a bit.

Donna Miranda-Begay CA Tribal GIS: And then Crystal West, I can't say enough about her. She's just a wonderful individual who's a researcher, and she's working... works with the North Fork Mono Tribe, and they were working on, decolonizing some maps for a trail, and I'll... I'll be talking about that here real soon.

Donna Miranda-Begay CA Tribal GIS: Another, couple other workshops that stood out as well is with Kent State University. They were focusing on land back and, using remote sensory, technology, teaching folks how to use Google Earth Engine.

Donna Miranda-Begay CA Tribal GIS: And again, focusing on land back in California. And they also did some literature review in regards to that, and through the literature review, they created this mind map, which is very, very, interesting. It looks pretty, pretty much, pretty close to what is happening out in California for tribes in regards to land back.

Donna Miranda-Begay CA Tribal GIS: And on the right, University of Berkeley, University of California, Berkeley, they had a workshop called CoEqual, which is Collaboratory for Equity in Water Allocation, and they utilized Mentimeter, a live survey tool, to ask the question about the 30-plus participants in their workshop, you know, both tribal and non-tribal in their, about their relationship to water, and so a word cloud was

Donna Miranda-Begay CA Tribal GIS: created, regards to the responses, and, very, very interesting, the feedback that they got. And they're continuing to work with tribes. They have a workshop being planned early December at, Buena Vista Rancheria, so they are definitely working with tribes, as is Kent State University. They're going to be doing another workshop, too, at Sac State University, probably in February of 2026.

Donna Miranda-Begay CA Tribal GIS: Okay, there is getting back to the Tallah Day Nation uses of GIS, there's Randall Richards, he's, again, the GIS specialist for that tribe, and in case you don't know, their tribe is located way up in the far west corner, Del Norte County there in California, and their tribe straddles the two states of California and Oregon.

Donna Miranda-Begay CA Tribal GIS: And here is a map that's more of a tribal map description in their language. They have their various locations and village sites located there, their waterways. And so, again, they're continuing to improve on their GIS environment and taking ownership of their GIS data.

Donna Miranda-Begay CA Tribal GIS: And, Randall mentioned there's the ways of using GIS in their scientific surveys, monitoring, managing, land surveying for tribal properties, they're using, information for public relations, their tribal heritage, culture, and Indigenous

Donna Miranda-Begay CA Tribal GIS: Traditional knowledge preservation and digitalization. And while they're all doing this, they're ensuring the data sovereignty, and they're building their own in-house capacity as a nation while doing this.

Donna Miranda-Begay CA Tribal GIS: I thought he was a really great presenter.

Donna Miranda-Begay CA Tribal GIS: So, yeah, and then you get into the decolonizing of maps and ground-truthing, and Crystal West, who I said is a really great researcher, on the right here is a typical forest map, a colonial map, which has, you know, non-traditional descriptions, there, and so...

Donna Miranda-Begay CA Tribal GIS: the task here was the Mono Tribe. North Fork Mono Tribe wanted to map out the Naomi Trail in California, and that trail is

located northeast of Fresno, and it goes all the way from the foothills to the Mammoth Lakes area, so it goes across the Sierras.

Donna Miranda-Begay CA Tribal GIS: And so, they wanted to,

Donna Miranda-Begay CA Tribal GIS: Take a look at that map, and then be able to draw out some of their significant archaeological sites, and also some of the allotment lands, and, you know, build up more of a tribal view of the mapping world.

Donna Miranda-Begay CA Tribal GIS: And so they were able to do this by looking at some of the researches that were done by some of their own folks way back when. Haini Noon and Bame Wisu. These folks had done some research on some of the tribal namings of the places.

Donna Miranda-Begay CA Tribal GIS: And then they also looked at, the interdisciplinary mapping and tribal knowledge, so they were looking at the botany, the ethnography, the archaeology.

Donna Miranda-Begay CA Tribal GIS: The wildlife, the fowl management, the ecology and hydrology, the aqua... aquatic biology, so all this was in consideration of their mapping.

Donna Miranda-Begay CA Tribal GIS: And, so then this is where they get out on the ground there and actually walk the earth there, the ground, the trails. They do observation of what they're seeing, and they're confirming the route.

Donna Miranda-Begay CA Tribal GIS: And there's, the view from, looking, west from the top of the Mammoth Mountain towards, Pawanini, Shut-Eye Peak. So they have both the tribal name, description, as well as the colonial name.

Donna Miranda-Begay CA Tribal GIS: And then to get into looking at some of the historic maps here. Don't know if you know, but way back when, with all these routes that we as tribal people had established, which also start... we gotta give credit to the animals, the deer, the elk, the bear, you know, we humans knew that, hey, we need to follow those trails because they're good ones.

Donna Miranda-Begay CA Tribal GIS: But also, what happens later is you get these folks that are non-tribal coming into California, or they're known as California, and here is the Mariposa Battalion campaign routes, so the military folks use the routes as well.

Donna Miranda-Begay CA Tribal GIS: And there's another map here of that, of a 1957 mapping of the battalion routes.

Donna Miranda-Begay CA Tribal GIS: And then, you look at 1890, you have, the Yosemite National Park starts to map out the, the trails, and so you see that set up. And also you see, there's going to be, the French trails also were included as well in that.

Donna Miranda-Begay CA Tribal GIS: Yeah.

Donna Miranda-Begay CA Tribal GIS: Then you get into the early ethnography, and this is important. It probably wasn't until about 2014, when AB52 in California, that bill was passed. It included ethnography focus and public planning of lands.

Donna Miranda-Begay CA Tribal GIS: So, that is important, it's the telling of our story. So this is a map in 1932 of the North Fork Hamlets, and Gifford was the creator of this map, and so it does outline those village sites and hamlets.

Donna Miranda-Begay CA Tribal GIS: And so you take all this information and, you know, you walk the earth, you walk the ground, you observe, you've taken historic information, archaeological information, ethnography, and you start to get to this type of map.

Donna Miranda-Begay CA Tribal GIS: And so, let's see what else. Oh, and then the archaeological, information, they know there's been obsidian found, there's grinding rocks located. This map was done in 1959 by Heinz, and so there's indication, obviously, that there were certainly, human beings there from the past, and so, yeah, some village sites.

Donna Miranda-Begay CA Tribal GIS: Next thing is, again, ground truthing. There is Jess Valdez of the North Fork Mona Tribe. He really helped out with, Crystal, West, who did a lot of the map research, but he did a lot of the ground research, and he encouraged us to get away from our computers.

Donna Miranda-Begay CA Tribal GIS: It's important to get out on the landscape, taking a look at food sources that are out there, animals, the water, sounds and smells, pay attention. Connecting sites and places with the landscape's important. So yeah, he's doing a great job.

Donna Miranda-Begay CA Tribal GIS: And so, when you talk about decolonizing mapping, their approach is very similar to a lot of other tribal approaches in California.

Donna Miranda-Begay CA Tribal GIS: And so from the... from the bottom up, you... you're looking at your base maps, your existing modern maps of today, the topo maps, the aerial maps, maybe an organization has a map, like U.S. Forest Service.

Donna Miranda-Begay CA Tribal GIS: And then you start to look at your stories, your Naomi stories, and your place, your names, doing some geo-referencing along the way of old historic maps, and then the ethnographic villages and historic allotment maps, if you have them.

Donna Miranda-Begay CA Tribal GIS: you know, any archaeological sites that are recorded, and then you start to do the ground truthing and walking the land and that. So that's kind of the layers of effort, and I think that's very common when we're working within the California area. I'm sure out of state, other tribes have gone through this process as well in creating their Indigenous maps.

Donna Miranda-Begay CA Tribal GIS: Okay, so we started off with this, and then they end up with this. So, it was a very good effort, and I really encourage you, if you could, to take a look at the webinar that was presented by North Fork Mona Tribe. They did a much better presentation than I did here in so many minutes. Tribes are also using story maps to tell their story, you know, aligning it with maps, as well as the

Donna Miranda-Begay CA Tribal GIS: Indigenous knowledge, and so, we're really moving forward. Probably in our next.

Donna Miranda-Begay CA Tribal GIS: Tribal Summit will probably have competition on best story maps by Tribes of California, so we'll see how that goes.

Donna Miranda-Begay CA Tribal GIS: Yeah, so...

Donna Miranda-Begay CA Tribal GIS: Anyway, I'm going to take a little bit of a turn here and talk a little bit about GIS data sovereignty, because that was a focus in the summit as well, and I will say that Louis Kherson Mayorga, he was a former student of UC Berkeley, and he, at the time, worked for United Auburn Rancheria up there in Northern California, and I liked his comparison chart.

Donna Miranda-Begay CA Tribal GIS: on, let's Talk About Tribal Values. And I won't go through each one of these, but because we're running out of time.

Donna Miranda-Begay CA Tribal GIS: But the archaeological descriptions, sometimes certainly are

Donna Miranda-Begay CA Tribal GIS: pretty black and white at times, and it's coming from that discipline, I get it. But then, on the left side is the tribal perspective of that description of the archaeological view. So, what archaeological views say is sites or scientific data sources.

Donna Miranda-Begay CA Tribal GIS: And then on the tribal side, we see sites as sacred living places with ongoing meaning.

Donna Miranda-Begay CA Tribal GIS: And then, let's drop down to, excavation and curation are standard treatment.

Donna Miranda-Begay CA Tribal GIS: And then we say, no, damage occurs when sites are excavated or curated without consent. So, you can see, kind of, the comparison, and I think the audience was really drawn into this particular perspective. And again, it has a lot to do with how we look at data sovereignty.

Donna Miranda-Begay CA Tribal GIS: And the other thing is, if you ever go to a tribe, you want to work for a tribe, especially one that's federally recognized, and they've got their GIS kind of going, usually that's housed at the Tribal Historic Preservation Office.

Donna Miranda-Begay CA Tribal GIS: And there's Tribal Council at the top, and you have your Tribal Historic Preservation Committee, maybe, set up, and they work in conjunction with the Tribal Historic Preservation Officer, who helps out with the tribal heritage, the cultural regulatory, and the Native American Graves Repatriation Act, known as NAGPRA. So, this is kind of the setting that's typical within a TIPL

Donna Miranda-Begay CA Tribal GIS: program. And again, in compliance with AB52 and Section 106, these are some of the guidelines that are required for the data sovereignty element in a tribe.

Donna Miranda-Begay CA Tribal GIS: My data sovereignty model, it's pretty complex, but I've been pushing it out there. On the very top, again, similar to what Lewis has, is at the very top, you have your tribal governance. On the left side, hopefully you document your GIS environment. On the right side, GIS training and information sharing and access, all that needs to be understood. And whether or not you're using ISRI or QGIS or any other product that might

Donna Miranda-Begay CA Tribal GIS: be cloud-based or locally, make sure you have storage needs addressed, your backup recovery, security, that's all in place. In California, though, when it comes to natural resources, the four quad areas I always focus on are you have public data that you can get to very easily, not a problem. Then you have your lower left, where you have to request for that information, like the California Historic Records

Donna Miranda-Begay CA Tribal GIS: Information Act. They have a system, they have data that you can request. Up in the upper right

Donna Miranda-Begay CA Tribal GIS: quad there, there's tribal-generated data, that, comes from our GPS field work, maybe, photos, ethnography, recordings, videos, and some of that, you know, you want to kind of keep together, maybe share or not. And then the lower right is very sensitive data, such as cultural site, cultural gathering, cultural monitoring.

Donna Miranda-Begay CA Tribal GIS: And traditional language, and other things that might be in the lower right, and that you really want to safeguard, okay?

Donna Miranda-Begay CA Tribal GIS: And there's a text description of what I just went over for my model.

Donna Miranda-Begay CA Tribal GIS: And there's all kinds of resources for, when you look at, data sovereignty, and this one comes from the National Indian Justice Center. Really good description, I can't say enough about a great job they did putting this together, and security measures. That's... if you're an IT manager, you probably really understand and relate to that. And then,

Donna Miranda-Begay CA Tribal GIS: There's also tribal data sovereignty, good resources here. University of Arizona has a couple of good areas. There's even UC Berkeley has an Indigenous Data Sovereignty area. United Nations Course Development Program, UNDP, they have some recommendations. And, yeah, so there's, there's that.

Donna Miranda-Begay CA Tribal GIS: Finally, the summit is coming up, 2026, in the green. These are things we'd let go. We're moving on it. We're already doing... the potential site already is, confirmed now at this point, Redlands University, 21st, 22nd, 26th. It's probably going to be free, I'm hoping. Right now, we're putting out the request for registration. My website is www.catribalgis.org. A reminder of all the past

Donna Miranda-Begay CA Tribal GIS: 2025 summit information is available, so I'll make sure I try to get this PDF file out to you guys. I want to thank you for all the work that you guys are doing out there in the GIS world. I don't want to take time for our other co-presenter. I just want to let you know that these are my current projects I'm working on. I'm affiliated with the California Geographical Information Association as a board member.

Donna Miranda-Begay CA Tribal GIS: And also with women in GIS. And I really, again, thank you for the opportunity to present here at your wonderful UC GIS Week. I'm hoping you're having a good one.

Donna Miranda-Begay CA Tribal GIS: Wow, one heart, yay! Thank you!

Maggie Tarmey, Moderator: Thank you so very much, Dr. Donna Miranda Begay. That was excellent. I know I certainly learned quite a bit.

Maggie Tarmey, Moderator: I think we can have time for one or two questions right now before we move over to Char's presentation, and then if you have questions that come up during then, of course, we can ask more questions, after Shar's presentation as well.

Maggie Tarmey, Moderator: I do want to ask you, how can those of us that are non-Native researchers in the UC help support you in the work of California Tribal GIS? And sort of, in line with that, how can we stay abreast and plugged into this work going on in this space?

Donna Miranda-Begay CA Tribal GIS: Yeah, just shoot me an email at, donabgay at yahoo.com and let me know, maybe, like, what you're doing, what kind of research you're doing, what your interests are. For me, the GIS Summit is really kind of the best way right now to help. These other projects right now, a lot of it, like the writing team for the Governor's Office on Truth and Healing, that's really my insight knowledge. I can't really reach out to anybody on

Donna Miranda-Begay CA Tribal GIS: on that. Same thing with the governor's office.

Donna Miranda-Begay CA Tribal GIS: But, when it comes to, putting on that summit, you know, certainly if you guys hit up the summit web page there for pre... you know, requests for registration, we're just looking right now for ideas. Even if you don't come, I mean, that's okay, or you just want to join virtually. We would love your insight, you know, like, you want to learn this, you know, so just, just let us know, and that's good.

Donna Miranda-Begay CA Tribal GIS: one good way of helping out. But yeah, I'm always looking for maybe some insight, volunteer work. Most of the stuff I do is I teach at the intro level in GIS to tribes.

Maggie Tarmey, Moderator: Excellent, thank you so much for that. And for folks in attendance, I just dropped the link to the Tribal Summit, webpage in the chat, if you'd like to go check that out.

Maggie Tarmey, Moderator: And maybe time for one question, before we move over to Char's presentation?

Maggie Tarmey, Moderator: Alright, in that case, Char, why don't you,

Maggie Tarmey, Moderator: Start up your presentation. Char comes to us from UC Berkeley and is going to talk to us about relational ontologies.

(Re)Thinking the 'Z Axis': A Case for Relational Ontologies in Vertical Worlds

Speaker: Char Tomlinson - UC Berkeley

Abstract:

Current cartographic standards for representing vertical terrain are embedded in two-dimensional, top-down, colonial perspectives, holding the possibilities of the vertical world at bay. For example, topographic maps marginalize the vertical world through a type of compression. To signify steepness, we place contour lines closer together, providing the slope less space on the map. In other maps, the vertical is represented through artistic hatching or shadowing. A more modern tool, like LIDAR, scans the landscape from the top-down and builds verticality into a model where the user can manipulate the view of each crevice. Vertical or volumetric spaces sit in tension with the space often made visible by the Cartesian system. Vertical spaces are not often a space of conquest, a space of property, or even considered a 'human space' (Elden). Rather, what we find is a space where the geologies, ecologies, and biologies operate with increasing entanglement under the influence of the consequences of gravity (i.e., everything must hold everything else together on a vertical landscape lest it fall). With this, my project asks: how do we create a relational mapping system based in critical cartographic theory that allows for both a different representation and also, fundamentally, an epistemological shift in how we understand the world through the undertheorized 'voluminous space'? And how might this system better represent the dynamics of a rapidly shifting world under climate change?

My proposal is to make a presentation on these questions for the audience of US GIS Week and to engage them in a thought experiment around what it might take to create these relational representations and get feedback on these possibilities.

Transcript: Video Timestamp: 00:28:58.400

Char Tomlinson (she/her): Hello, okay, share my screen briefly...

Char Tomlinson (she/her): Okay.

Char Tomlinson (she/her): Hi everyone. Thank you so much, Dr. Breguet, for that talk.

Char Tomlinson (she/her): And all the work that you're doing with California Tribal GIS.

Char Tomlinson (she/her): My name's Char. My project is about rethinking the z-axis and looking more at

Char Tomlinson (she/her): relational ways of being in vertical worlds, and before I get started, I wanted to just do a major disclaimer, is that my project is not Indigenous geographies, and I'm a little confused on why I was put in this block with people who are doing, like.

Char Tomlinson (she/her): real work in Indigenous geographies, whereas my project is more about,

Char Tomlinson (she/her): Being, like, extremely impacted by the magnitude of relationality in vertical landscapes, and trying to use that to really think outside of colonial boundaries and mapping, and to use those... those thoughts and that process in order to reimagine what our world can look like when we think about it more relationally.

Char Tomlinson (she/her): But it is not at the... the level of work that,

Char Tomlinson (she/her): like, Dr. Breguet is doing on actual, like, things that are impacting Indigenous communities and, tribal nations, so I just wanted to...

Char Tomlinson (she/her): do a disclaimer on that, and and talk a little bit about, my project, and it's more, kind of.

Char Tomlinson (she/her): esoteric, foundations. So that's just a disclaimer. And then, on the right-hand side here, I just have a list of people that have been really impactful in the ways that I think about relationality.

Char Tomlinson (she/her): And people who are actually doing Indigenous geographies. So, that's just a quick disclaimer before I get into my work.

Char Tomlinson (she/her): So today, I want to talk about... I'm going to start off with, you know, what are vertical and volumetric landscapes, going into the cartographic standards that we're using currently to represent those landscapes, and then some of my own experiences, and the reason why I came to this work

Char Tomlinson (she/her): In the first place, with looking at representations of, Janu, which is a incredible mountain.

Char Tomlinson (she/her): in northeastern Nepal, and then talk more about, co-constituting space and existing in the vertical, and the method and the place.

Char Tomlinson (she/her): aspect of things, but this is really, like, a way for me, as a first-year PhD student, to bring these ideas to people who have interest in them, and really get

Char Tomlinson (she/her): feedback and, and kind of inspire cartographic inquiry outside of the bounds of mapping that we're used to.

Char Tomlinson (she/her): So just a little bit about me. Before I came to the PhD program, I was working as a professional mountain guide, so I was doing a lot of,

Char Tomlinson (she/her): Just work in vertical terrain, using technical systems and risk assessment to...

Char Tomlinson (she/her): to teach and move people through that terrain safely, and I specialize in rock and alpine climbing. So, a lot of my work was on teaching, students how to navigate glaciated peaks, protect crack systems, climb blank faces, like, all of these

Char Tomlinson (she/her): really different aspects of existing in vertical terrain, in a lot of the places that I've worked,

Char Tomlinson (she/her): are completely different relationally with all the different ecology and geology, and human interaction that goes on in those places, so it really got me to ask a lot of questions about what we're doing and how we're doing it.

Char Tomlinson (she/her): Again, just going over my goals as kind of an opportunity to explain my research, inspire y'all's cartographic inquiry, and then engage with each other about ideas and feedback.

Char Tomlinson (she/her): So to get started, I want to explain what I'm talking about, which is vertical and volumetric terrain. So, the vertical is kind of this... this space that is,

Char Tomlinson (she/her): that exists in this z-axis, and I'll get into that later, but I'm specifically talking about geomorphologically produced vertical relief, in mountains and mountainscapes. So that's kind of... this is the rock aspect. I'm kind of... I'm...

Char Tomlinson (she/her): I'm considering the vertical to be more of the, like, vertical cliff sides.

Char Tomlinson (she/her): And then the volumetric is what I'm considering more with ice and water. So here we've got pictures of

Char Tomlinson (she/her): The... on the right is a glacier, it's called the Silver Star Glacier in, Washington State, and then on the left here, there's, a frozen ice waterfall in the Canadian Rockies, and you can see there's a very small person up there for scale. But these are landscapes where volume

Char Tomlinson (she/her): That is the main thing that you would be considering and trying to understand.

Char Tomlinson (she/her): How to map them, and specifically with glaciers, you're looking at volume that is this...

Char Tomlinson (she/her): this chronology of an extremely long time, and can tell us so much about the world in all those states of that time, which I think is really interesting.

Char Tomlinson (she/her): And here's kind of a combo of the two. This is, Keshinjanga in Nepal, it's the third highest mountain in the world, and you can see here that we have an immense amount of vertical relief. And then the...

Char Tomlinson (she/her): The mountainside, this is the north side of the mountain is just...

Char Tomlinson (she/her): has glaciers all over it, and then the tongue of the glacier is coming out there, and that's kind of what you can see in the foreground. And that's all, ice.

Char Tomlinson (she/her): So what's the z-axis? You know, when we think about mapping, so much of what we think about when we use is this top-down perspective.

Char Tomlinson (she/her): And in order to think about mapping outside of those colonial boundaries, we're thinking more about, okay, well, how do you, as Dr. Breguet mentioned, how do you map from the bottom up, and how do you map,

Char Tomlinson (she/her): more relationally is... is kind of what I'm... I'm really trying to figure out. And I see the z-axis as a...

Char Tomlinson (she/her): a space to do that in. If we... if we try to consider more, like...

Char Tomlinson (she/her): Looking at those landscapes not as this all-seeing view, but as the thing that really

Char Tomlinson (she/her): conveys the magnitude of those landscapes. And the X and Y being, like, traditional, like, latitude and longitude, the coordinate planes that we operate on, and that GIS systems operate on, in order to do our mapping, or in order to do our everyday lives.

Char Tomlinson (she/her): So, current cartographic standards, these are just a few that I'm mentioning, they're not... All of them. But...

Char Tomlinson (she/her): from what I have experienced, and what I've mentioned previously, is... is...

Char Tomlinson (she/her): These standards are embedded in this two-dimensional, top-down, colonial perspective that really holds the possibilities of that Z-axis, of that vertical world at bay.

Char Tomlinson (she/her): You can see this first one, topography, is a way that you can convey that three-dimensional aspect on the ground, but what you're doing is you're actually, you're flattening... you're flattening the world. And even on cartographic, or on topographic maps.

Char Tomlinson (she/her): the actual vertical parts of the map are much more approximately close together. They're compressed. So you can see that that's a place that you cannot go.

Char Tomlinson (she/her): But you can't see that... you can't see what that place actually looks like. All you can see is that it's extremely small, the lines are extremely close together. And it... it just lends to being like, okay, well.

Char Tomlinson (she/her): That terrain is not terrain that you're actually going to look at, because you can't necessarily navigate through it.

Char Tomlinson (she/her): You know, other historic things that have been used is hatching and shading, which is really beautiful. And that's this kind of the second picture down on the right.

Char Tomlinson (she/her): And that's been used in a lot of maps that are more, small scale, so zoomed out, to show how different mountain ranges move and... and, the verticality in that dimension, but they're still... they add more...

Char Tomlinson (she/her): Texture, but there's still that top-down.

Char Tomlinson (she/her): And then digital elevation models, which is a more present-day, thing that we're using, using satellite imagery to... to get images of

Char Tomlinson (she/her): the earth from above, and then use those to produce, the relief. And you can see in this model, it's, you know, they're using, like, a color gradient for that, and then...

Char Tomlinson (she/her): and sometimes you can generate, you know, a lot of the work that I've done is generating contour intervals and topographic maps from digital elevation modules, which is what I'll get into now in talking about the Johnny problem.

Char Tomlinson (she/her): Which is something that really inspired me to think a lot more about this work, which is, in November of 2024, I had the opportunity to go to the Himalaya with Professor Kurt Cuffey at UC Berkeley and, be an assistant guide on the trip, as well as a cartographer, for after the trip to make these maps. And, the trip was to focus on looking at debris covers

Char Tomlinson (she/her): glaciers.

Char Tomlinson (she/her): And when I got back, and I was creating the maps of the space, I was using remote sensing to...

Char Tomlinson (she/her): to build these contours, and these contour intervals, and something that I noticed, and I used satellites from

Char Tomlinson (she/her): all over the world, from many nations, many countries, trying so hard to figure this out. But I could not get an accurate representation of the north face of Janu, which is... if you look at the image on the left here, I don't know if y'all can see my mouse, but if you look at the image on the left, the north face of Janu is this.

ax000891: But then, I think...

Char Tomlinson (she/her): kind of all the way on the left here, and it's got this, this big, beautiful swoop, and the communities in this area, liken this mountain to, like, a hawk, that's, like, looking down into the valleys. And this...

Char Tomlinson (she/her): the... the mountain that you see there, that's 10,000 feet of vertical relief. I don't know if you all are familiar with LCAP in Yosemite, but that's about 3,000, 3,500 feet, so that's...

Char Tomlinson (she/her): three times the size of El Capitan and Yosemite is... is how large this face is. That's the scale of these mountains. And, I'm doing more mapping of the Himalaya now, and

Char Tomlinson (she/her): And this is a persistent problem in trying to remotely sense terrain that is so vast, and so condensed, and voluminous just in the aspects of the glaciers, but as well as the

Char Tomlinson (she/her): The sheer amount of... mountains in that area, it's really challenging, and

Char Tomlinson (she/her): And it just got me thinking a lot about how this top-down perspective, you know, I already considered it having all of these issues, but then, you know, when you're actually trying to do a technical mapping component, and you can't

Char Tomlinson (she/her): get that information, I feel like it's a very apt example of where that,

Char Tomlinson (she/her): Where those technologies are failing, and where you can't... you can't understand the magnitude of the landscape like this.

Char Tomlinson (she/her): From a top-down perspective.

Char Tomlinson (she/her): And then I just wanted to talk about other kinds of mapping, right? So I went into some more current cartographic standards with topography and hatching and DEMs, but in a lot of what I've been experiencing in these landscapes, I'm using maps like this to figure out how I'm going to experience the landscape and how I'm going to move through it. So...

Char Tomlinson (she/her): This is a map of the Triple Direct, which is a route on LCAP. And then on the right, you can see an image, of me climbing.

Char Tomlinson (she/her): You can kinda see...

Char Tomlinson (she/her): It's kind of towards the top of the... the lines on the very far right side of the,

Char Tomlinson (she/her): of the image of the topo. This is what climbers call these topos. And I think what's really interesting is this is a more relational way to engage with the landscape, but it's for an entirely different purpose. And that's something that I...

Char Tomlinson (she/her): I think is intriguing. Like, we have all these efforts to use maps as a medium to represent vertical worlds in their respective knowledge areas.

Char Tomlinson (she/her): But they're all embedded in and deeply siloed within this... this... this Cartesian perspective, and...

Char Tomlinson (she/her): I consider vertical space as a landscape sitting outside of that... that current ontology, and I feel like it presents a chance to represent the world within the context of its own relationships. And you can kind of see that starting to happen.

Char Tomlinson (she/her): a bit within these... these topos, where you can see foliage, and you can see, maybe there's, like, a bush, or there's, like, this is a big ledge, and that's how you can experience that you can sleep on that ledge, or you can use that tree to make... to make it a little bit easier to get up, but it doesn't actually...

Char Tomlinson (she/her): convey the magnitude of the entanglements that are happening in those landscapes.

Char Tomlinson (she/her): And then I wanted to talk more about this

Char Tomlinson (she/her): GPS limitations in the vertical as well, and this is just an example of me trying to use GPS to track

Char Tomlinson (she/her): my movement, and what I've noticed is that, you know, they overly focus on the location of body in space from that X and Y axis, and...

Char Tomlinson (she/her): And they're trying to flatten this experience in the vertical that, obviously, as you can see from the map on the far left.

Char Tomlinson (she/her): Does not convey the actuality of moving through that space.

Char Tomlinson (she/her): On the far right, you'll see an image, that's me and a few colleagues on the top of

Char Tomlinson (she/her): This mountain in the middle. And the...

Char Tomlinson (she/her): Like, the mountain in the middle is on the far left, kind of where this red marker is, and we did not go zigzagging all around the drainages and to these other three

Char Tomlinson (she/her): peaks. You know, we were just on the side of this mount, so this... so it just shows this kind of abstraction, how... how even contemporary GPS can't really locate the body in space.

Char Tomlinson (she/her): And so I wanted to talk about this, this code constitution, a space that I think, existing in the vertical can really

Char Tomlinson (she/her): Like, lend us to a different perspective.

Char Tomlinson (she/her): You know, what we find in these spaces is that geologies, ecologies, and biologies are... they're operating with this increasing entanglement, and that entanglement is under the influence of the consequences of gravity. All these things are holding each other together.

Char Tomlinson (she/her): And if they don't, the landscape will fall. And so, you know, using that as...

Char Tomlinson (she/her): As a point of inquiry, like, how can we think about these landscapes differently, and convey them in a way that conveys their magnitude, as well as

Char Tomlinson (she/her): How they're being affected in our changing world.

Char Tomlinson (she/her): And so these are kind of the entities that I'm really trying to combine in this experimentation, and...

Char Tomlinson (she/her): I see it as a constellation that would put in... into conversation conceptions of space, and knowledge production and order, and situated knowledges, to quote Donna Haraway.

Char Tomlinson (she/her): And then pulling in, kind of.

Char Tomlinson (she/her): Like, that geographic theory, theory on verticality and volume, and this historic and contemporary arc in verticality, and cartography, and then entangling all of that through this lens, this biophysical geographic phenomena lens, you know, vertical, geomorphologically produced, and ecologically diverse terrain.

Char Tomlinson (she/her): So, to do that, I intend to use my ability to exist in those spaces.

Char Tomlinson (she/her): And investigate those entanglements, and... The... the actual movement of...

Char Tomlinson (she/her): existing in that terrain and climbing in that terrain, you have to engage with those interstitial zones that hold the landscape together. You know, for instance, I talked about triple direct on LCAP earlier, but

Char Tomlinson (she/her): LCAP in general is... is well-researched for many purposes, for rockfall hazards, for lichen species, peregrine falcon nests, monkey flower habitats, and climbing roots.

Char Tomlinson (she/her): But all of those things co-create and shape one another, and looking at it from a relational perspective would help to conceptualize the space itself, and...

Char Tomlinson (she/her): Inform a temporary cartographic meshing of historical methods, present data, and cartographic experimentation for a changing world.

Char Tomlinson (she/her): Other ideas that I potentially have in this space is looking at...

Char Tomlinson (she/her): the Arctic and, kind of mapping and glaciers specifically, because

Char Tomlinson (she/her): Recently, in my work, I've been thinking a lot about glaciers as this...

Char Tomlinson (she/her): icon of global climate change, when people... I was in a class the other day where everyone was like, okay, what do you think when you think about glaciers? And I was like.

Char Tomlinson (she/her): polar bears, and climate change, and sea ice melting. And, you know, what does it mean when we have a conception of something that really takes away any of

Char Tomlinson (she/her): The actual context of what those things are, and how they move through space, and what they do to space.

Char Tomlinson (she/her): Another issue I'm thinking about is, the Himalaya, and I've already mentioned that with the Johnny problem that I discussed earlier, but as well as the Karakoram effect, which is that in the Karakoram, which is a mountain range that's

Char Tomlinson (she/her): very close to the Himalaya, but just over the border in Pakistan. That's one of the only mid-latitude places in the world where glaciers are still growing, and people don't really know why that is.

Char Tomlinson (she/her): And then Yosemite Valley, which is kind of just the most apt example of

Char Tomlinson (she/her): really dramatic vertical relief in the United States. It's very, maybe easier to access.

Char Tomlinson (she/her): So yeah, those are my thoughts. I would love to hear your thoughts on my presentation, and

Char Tomlinson (she/her): on these questions of verticality and relationality, and I can maybe just go back to these... these kinds of questions that I'm thinking about.

Char Tomlinson (she/her): You know, creating relational mapping systems based in critical cartographic theory that allow for both the different representation and epistemological shift in how we understand the world through vertical and volumetric landscapes. And then how might that system better represent the dynamics

Char Tomlinson (she/her): Of this rapidly shifting world that we're in.

Char Tomlinson (she/her): So yeah, thank you.

Maggie Tarmey, Moderator: Yes, thank you so much, Char. Definitely opened my eyes, definitely gave me a lot to think about.

Maggie Tarmey, Moderator: How about we give a big round of applause for both of our excellent presenters in this session, and we are ready to open the floor for a few questions.

Q&A

Maggie Tarmey, Moderator: Questions, responses, comments, feedback?

Maggie Tarmey, Moderator: And you can always leave a question in the chat, or raise your Zoom hand and unmute yourself.

Maggie Tarmey, Moderator: I know, I'm curious if, something like, VR, like augmented reality tools are something that comes up in this convers... sort of conversation as something to explore. I know those have their own issues, but I'm curious what are some of your thoughts on tools like that?

Char Tomlinson (she/her): Yeah, I think those tools are super valuable in a lot of different contexts, and... and...

Char Tomlinson (she/her): you know, I think when I think about VR, augmented reality, or, something I didn't really mention in my presentation, but LiDAR, which is kind of on a similar vein, where you're...

Char Tomlinson (she/her): You're really focusing in on this area and mapping with this insane amount of detail that can show

Char Tomlinson (she/her): Show that space, but it's so computationally heavy, and it doesn't actually...

Char Tomlinson (she/her): like, convey the... the ecological kind of aspects of what I'm really trying to focus on. And it still uses those, like, ideally.

Char Tomlinson (she/her): in my dreamscape, you know, I wouldn't need to use colonial Cartesian grids in order to create these representations of these landscapes. Like, really, how do you operate outside of it all completely? And that kind of technology is still very much situated within that.

Maggie Tarmey, Moderator: Absolutely, and that's why I was so curious what your response on that would be. We have a question from Audrey in the chat as well, asking if you can speak more to the difference between vertical volumetric spaces and the implications of this differentiation.

Char Tomlinson (she/her): That's a great question, thank you, Audrey. Yeah, this is something I'm still trying to figure out in my... and it's my own definitions, right? I consider, you know, vertical landscapes to be...

Char Tomlinson (she/her): And, like, for simplification purposes, I'm thinking about cliff sides, right? And when I'm thinking about volume, I'm thinking about this aggregation over time of more dynamic elements, so not geology, but more, like, water and ice and how those things build up.

Char Tomlinson (she/her): But... but they go together, and, I'm still trying to figure out if it is wise to...

Char Tomlinson (she/her): have a differentiation within that, and how to represent them in a way that can show

Char Tomlinson (she/her): you know, how these things move together throughout time to create the landscapes that we operate in now. But to answer the question simply, I guess I would... I think more of volume as, like, ice and water and,

Char Tomlinson (she/her): And things that are, like, things that fill up a space, whereas I think more of the verticality is the boundaries of that fill.

Maggie Tarmey, Moderator: And I think we have time for maybe one more question.

Maggie Tarmey, Moderator: In that case, let's do one final round of applause for our two excellent, excellent presenters today. I know I certainly got a lot out of this.

Maggie Tarmey, Moderator: I encourage you all to join us for our two remaining sessions this afternoon. At 2pm, we have a GIS grab bag session, and at 3pm, a session on campus operations and collaborations, as well as another full day of programming tomorrow. Oh, Phillip's got a hand. Go ahead, Philip.

Maggie Tarmey, Moderator: You can go ahead and unmute to ask a question, Philip.

Maggie Tarmey, Moderator: Oh, no question, okay.

Maggie Tarmey, Moderator: Yeah, so otherwise, enjoy the rest of your GIS Week programming, if you're able to attend. We have our feedback survey in the chat as well, if you'd be so kind as to take a few minutes to fill that out. And otherwise, happy GIS Week and happy mapping!

Char Tomlinson (she/her): Thank y'all.