

Spring 5-7-2015

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Recommended Citation

Fowler, Cynthia T. 2015. Socioecological Processes in the Science of Planetary Change. Presentation delivered at the 38th Annual Conference of the Society of Ethnobiology. Santa Barbara, CA.

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Socioecological Processes in the Science of Planetary Change
by Cynthia Fowler, Wofford College
Delivered at the 38th Annual Society of Ethnobiology Meeting, May 6-9, 2015

Abstract

This presentation seeks to further understandings of human encounters with socioecological change and also of socioecological processes in the science of planetary change. In this presentation, I interpret the space-time involvements of two social groups. Using one filter, I do basic science by examining the ways Sumbanese construct the monsoonal landscapes which they communicate about, within which they move, and where they interact with other constituents of their environments. Using an alternate filter, I engage critical theory by deconstructing the ways scientists' visualize changing landscapes with the aid of geospatial technologies. Whose purposes do geospatial scientists serve in documenting the anthropogenic drivers of global environmental change? What is at stake in imaging land cover change? Who benefits and who does not benefit from geospatial science? This presentation both participates in and critiques Earth imaging projects.

Note: Text highlighted in grey indicates a corresponding PowerPoint slide.

Opening Gambit about an Ethnobiologist's Positioning

Imagine you, an ethnobiologist fieldworker, are studying in a rural community where the local agropastoralists, who are completely and totally invested in managing the plants and animals, soils and waters in their homelands, see, discuss, think about, direct, encourage, resist, and in other ways interact with change in their environment.

Then, picture yourself, the ethnobiologist student or professor, conducting a literature review about your fieldsite. You find authors who include geodata such as satellite images and maps in their texts. You are intrigued by the academics' descriptions of and conclusions about your fieldsite because the authors describe that landscape in novel ways based on their ability to view it from remote altitudes. These privileged folks are able to see changes in the landscape at various time intervals, and spatial and spectral resolutions in remotely sensed images.

So here you are: an ethnobiologist observing a "digital divide of the geoweb" (Elwood 2010:352). As an ethnobiologist who is straddling this digital divide, I have chosen to engage the "mechanism of exclusion" (Elwood 2010:352) by sharing geodata with my interlocutors, by asking them to describe what they see in satellite imagery of their landscape, and by bringing their voices into the scholarly dialogue about their changing landscape. For the project of understanding human perceptions of and knowledge about change more generally across cultures and locations, I compare components of culture and cognition linked to spatiotemporal processes: i.e., space-time culture.

Divisions in the Global Geoweb

Apparent in the comparison of indigenous agropastoralists and published academics –two groups separated by a wide gap in access to geospatial science and technology – is that the ways humans perceive change varies across cultures. Perceptions of change are governed by subjectivities, where social and geographic positions come into play – by who is on the ground everyday and who can view the ground from the sky everyday. Space-time culture also shapes perceptions of change, as illustrated in the following comparison of two cultures moving through space-time and in the comparison of their interpretations of geodata.

Data

1. Labeling, Classifying, and Assigning Meanings to Earth's Surface Features

2. Everyday Routes of Kodi and of Scientists' Sensors

Labeling, Classifying, and Assigning Meanings to Earth's Surface Features:

In NASA's online instructions for a general lay audience about how to interpret satellite images, the instruction's author, Holli Riebeek, comments, "One of the first things people want to do when they look at a satellite image is identify the places that are familiar to them: their home, school, or place of business; a favorite park or tourist attraction; or a natural feature like a lake, river, or mountain ridge" (Riebeek 2013).

If we accept this as a cross-cultural truth, then we could conclude that the places Kodi people will point to first are the ones most familiar to them; that are, of course, visibly discernable in satellite images. Thus, for Kodi, the most familiar, or culturally salient, places are agroforests; gardens; forests; political/ethnic boundaries; hilltops; houses; roads and paths; burial grounds; *Mori Cana* (Lord of the Land trees); schools and health clinics.

Within the category of agroforests and gardens the most culturally salient visible features are coconut and banana trees, which are icons of the agroforests surrounding every Kodi hamlet. In gardens, they see maize, rice, and taro, which are three symbolically important crops. Another moment when interlocutors named taxa was when they identified non-Kodi spaces in relation to Kodi spaces. Thus, an interviewee identified a teak plantation by referencing Malimbi Hamlet and the neighboring Wejewa District where the Wejewa people, an/other ethnolinguistic group, live. These features are actually outside the image's scope. The teak plantation is a government-owned, monocropped teak plantation marking the boundary between the Kodi and the Wejewa subdistricts, which lends it a certain political significance. Political/ethnic boundaries are salient for Kodi.

Kodi interviewees pointed out a topographical feature of a hilltop that, while not visible in the satellite imagery, is politically strategic and sociologically meaningful. An interviewee described Ngadu Bolu Hamlet as being located on top of a hill. He pointed also to the forested hilltop in the upper left corner of the photo of Ngadu Bolu.

Kodi interlocutors recognize and describe prominent patterns in the cultural landscape. In the image of Ngadu Bolu Hamlet, an interviewee described Ngadu Bolu Hamlet as being a group of houses surrounding the graves of two subclans, or *kabisu*: 1) Kabisu Japa Lolu and 2) Kabisu Ndara Bula. Each *kabisu* has its own *Mori Cana* (Lord of the Land), a tree that signifies a descent group's historical claims to tenure in a place. An interviewee pointed out that Subclan Ndara Bula has the bigger tree and more graves in the more northerly grouping.

Another culturally salient feature is the patterning of emic land use types. This culturally meaningful arrangement of land use types is visible in all of the photo prompts except for the image of Sumba Island as a whole, which not everyone recognized as their own island. In this image of Lombo Hamlet, for example, an interviewee described the positioning of the subclan's (*kabisu*) graveyards in front of houses, and agroforests behind the houses.

Kodi interlocutors pointed out roads and paths. In pointing out these features on the satellite images, people labeled them in terms of the places they went to or came from – in terms of the connections they made between hamlets and other spaces. In the Lombo Hamlet image, Domingus pointed to a road and said, "If you take this road, you *terus dapat* (continue along) all the way to the road to Waitabula [the major town in the Southwest Sumba Regency]." Looking at the image of Tei Kowewar Hamlet, Domingus identified the road as coming in from Waiholo Hamlet on the right/West (he had the image oriented with the South on top and East on the right) and going to Bondo Kahele Hamlet to the left/East.

When attempting to interpret the satellite images, Kodi interlocutors frequently reoriented their view by rotating the printed 8.5" x 11" versions of the satellite images. Judging from the preferred orientation of Kodi interviewees, they prefer to have South at the top and North at the bottom of the

frame. Another orientation that made the image interpretable for Kodi interviewees is one where East is at the top with the West at the bottom, the North at the right, and the South at the left.

In their interpretations of the satellite photos, Kodi people mentioned change in numerous forms. One change noticed by Kodi is in house types; more specifically, in roofing materials. Domingus noticed that the satellite photo of Malimbi Hamlet was out of date because, in the photo, most houses have along grass (*Imperata cylindrica*) roofs whereas many Malimbi residents had replaced the organic materials with metal panels. On Sumba, house styles index status, wealth, and development. Families with higher status and greater wealth can afford to construct their houses with 'modern' materials such as metal panels instead of thatch bundles and concrete blocks instead of bamboo poles. Marteus noticed the satellite photos of Ngadu Bolu were outdated for this reason: a house with an along roof in the photo of Ngadu Bolu Hamlet now has a metal roof. Marteus also noticed more graves in the center of the hamlet than are now in Ngadu Bolu since clan members had already moved several graves to their clan's seaside ceremonial center.

The space-time culture of global change scientists is culturally conditioned and also technologically mediated, as evidenced in the ways geodata delivery and analysis programs display satellite imagery (e.g., with a North-South orientation). Satellite imagery reveals, at low resolution, the occurrence of the land cover types "Forest," "Grassland," "Shrubland," and "Cropland." Some geospatial analysis tools pool all land cover types into either "Forest" or "Non Forest," and human data analysts attach further information and meanings to the labels and the spaces. At this stage in the development of technology, only the human interpreter, and not the computer software, can distinguish between, for instance, anthropogenic monocropped plantations and relatively non-anthropogenic diverse primary forests (Tropek et al. 2014), or between a diverse, multi-storied, heavily-managed agroforest and a secondary forest growing on a fallow garden plot. While Landsat does not tell us everything we want to know about land cover, its data sets enable us to visualize the Earth in very powerful ways.

A team of social and natural scientists at the Australian Centre for International Agricultural Research and the Tropical Savannas Management Cooperative Research Centre in Australia have published the most texts that use satellite data to analyze socioecological change on Sumba. In one paper published by this research team (Fisher et al. 2006), the authors used satellite imagery in fire mapping. Their analysis of Landsat and MODIS/AVHRR satellite images yielded information about fire frequency and burned area. Among their findings, Fisher et al. notice that savanna accounts for 71.7% of land cover type in Kiritana Village, relative to 2.2% cultivated land, 13.8% regenerating forest, and 12.3% forest. They also noticed that in arid East Sumba, 28.8% of the land burned in 2003-4. In 2004, 23.6% of the savannas and 10.8% of cultivated lands, 0.8% of regenerating forest, and 0.4% of forest in Kiritana burned.

Both locals and non locals see land cover in satellite images. Non locals lump these into generic (shall we call them globalized and etic?) categories while locals identify comparable emic spaces.

Whereas non locals 'see' vegetative classes first in satellite maps and subsequently link land cover to capitalist economics, locals also 'see' vegetative taxa but not as they link to the non locals' political economy. Instead, Kodi link vegetation to kinship (graves of dead kin and distinction between graves of 2 clans in Ngadu Bolu), territory (Mori Cana), wayfinding (roads and paths), dwelling (houses), and the Kodi subsistence economy (gardens, agroforests, forests). Clearly, Kodi project their own cosmivision onto these 'objective' artifacts. Whereas in the Kodi cosmivision, human and spiritual activities are the context for land cover, for scientists human economic activities are the cause of land cover changes. Taken together, we find both Kodi and scientists voicing the architecture of their cosmivisions that derive from cognitive models of society and nature.

Everyday Routes of Kodi and of Scientists' Sensors:

In the Kodi conceptualization of space-time, change over time co-occurs with movement in space (Hoskins 1994). Common greetings reveal motion through space and time as a cognitive underpinning. People track each other's space-time movements in their greetings. Two of the most common greetings are, "*Gek pla mu?* (Where are you going?)" and "*Gek wali mu?* (Where are you coming from?)." "*Wondo ana hamama* (Give me betel-areca)" is a very common greeting that reflects the importance of frequent exchanges in social relations, the emphasis on sharing, and not incidentally the degree to which Kodi enjoy chewing the betel quid.

Concepts related to movement reveal the Kodi cosmovision which is "the *structured view* in which [people combine] their notions of cosmology relating to time and space into a systematic whole" (Ashmore 2015:293-297 quoting Broda). Kodi express their cosmovision in concepts about motion by living people and the spirits of formerly living people through the natural and supernatural landscapes. *Halakona ni* (walk, walkabout, journey) is an especially intriguing space-time concept. *Halakona ni* is "irreversible" change (Hoskins 1994). When people die, they are no longer with us because they *halakona ni* (journeyed into the afterlife). When living people leave a place to go somewhere else, they *halakona ni*. *Halakona ni* is people-powered change. When describing an especially lengthy walkabout—one that requires lots of time and energy, is exhausting, and covers great distance—the second 'a' is lengthened to become "*halaaaaakona*" and the arm is used to point in the direction and to outline the general shape of the route. *Halako* is a similar term meaning to travel around, go somewhere, or arrive somewhere, as in *haloko kanheng* (come alone, came by yourself). *Haloko witi* means to travel by foot.

Movement through landscapes during which people interact with other humans and nonhumans and experience their surroundings via their senses are generative forces in space-time culture. Most Kodi move through their landscapes mostly by *witi* (foot), but also increasingly by moped and, on market days or for trips to town, by minibus or bus. Compare this to the scientists who produce or analyze geodata about Sumba. Scientists' know Sumba via the images captured remotely by satellite sensors: the Multispectral Scanner on Landsats 1-5, the Thematic Mapper on Landsat 4 and 5, the Enhanced Thematic Mapper on Landsat 7, and the Thermal Infrared Sensor and Operational Land Imager on Landsat 8 to list merely a few examples. These instruments travel far overhead: Landsat 8, for example, orbits the Earth at an altitude of 705 kilometers.

Describe 2 slides comparing the everyday routes in Kodi compared to Landsat 8

Conclusions

Using visual and quantitative data obtained from flying over the landscape to 'know' a place produces a particular/peculiar kind of knowledge in which "landscapes are known from a distance, from passing through them, around them or, lately, over them but not from immediate personal experience with them, entering into them, or entering into relations with them, through what Ingold (1993) calls a "dwelling perspective"" (Heckenberger 2006:316).

The preceding illustrations – about movements through space-time and about readings of geodata – represent interventions of culture and cognition into perceptions of and knowledges about planetary change. From the comparison of a few elements in the space-time cultures of two social groups, we gain some insight into the construction of perceptions of and knowledges about planetary change: modes of communication and forms of movement construct (i.e., cause) space-time culture and cognition.

Kodi involvements with space and time are mostly territorial. The dialectics between language, symbols, meanings, "sensory engagement [aural, visual, tactile, etc.] and bodily movement" (Ashmore 2015:294) produce this territoriality. Individual Kodi materialize their learned space-time orientations

when they engage directly in everyday land use activities. Whereas their orientations are dynamic hybridizing cognitive orientations, Kodi people are continuously reshaping land cover and inscribing particular “pattern(s) of traces” (Carter 2008) on landscapes

Satellite imagery is produced by and in part produces the culture of geospatial science – an extraterritorial space-time culture. The U.S. space program produces extraterritorial optic regimes fronted by space-going, picture-taking vessels, analytical software, and the military-industrial complex (Carruth and Marzec 2014). The space program’s extraterritorial optics cause scientists (the space program’s primary audience) to build “an attachment to territory” that is “created by departure from it” which constructs “a simultaneous connection and disconnection” (DeLoughrey 2014:270).

Satellite planetarity (DeLoughrey 2014) is both a modern detachment from the Earth generated by photos of our planet taken from outer space as well as a radical alterity where sociological gaps in power and identity dissolve, and where the Self merges with biotic and abiotic Others. Whereas geospatial scientists visualize Sumba’s landscapes in culturally specific yet internally diverse ways, Kodi interpretations of satellite imagery and the territorial Kodi space-time culture stands as a countervisual.

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