



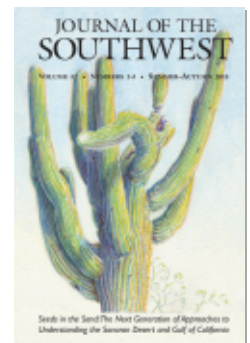
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Human Dimensions of Research in the Sonoran Desert: Next Generation Sonoran Desert Researchers

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Human Dimensions of Research in the Sonoran Desert: Next Generation Sonoran Desert Researchers

JENNIFER N. DUBERSTEIN AND ANDRÉS LIRA-NORIEGA

INTRODUCTION

Next Generation Sonoran Desert Researchers (N-Gen) is a growing community of researchers dedicated to the study of society, culture, geography, and ecology in the Sonoran Desert. It was formed to facilitate communication and collaboration among early-career researchers in the region, as well as to support connections and build bridges between this new group and later-career researchers.

In April 2012 N-Gen hosted an inaugural summit in Tucson, Arizona. Participants came from Mexico and the United States, representing 16 different disciplines and 37 different institutions, including non-governmental organizations, academia, indigenous communities, and government agencies. The overarching goal of the summit was to establish lasting connections and develop a network of collaborators from a group that was previously largely unconnected.

Before N-Gen there was no organized network for Sonoran Desert researchers. Further, our understanding of the networks connecting those working in the region was limited. With few exceptions (see Marcos-Iga's 2004 master's thesis looking at networks of conservation organizations in the Colorado River Delta and Laird-Benner and Ingram's 2011 study of network "weavers" in the U.S.-Mexico border region of Arizona and Sonora), little is known about how researchers in the Sonoran Desert are connected.

Here we use social network analysis and cluster analysis to examine the patterns of connections between N-Gen summit participants (for a more detailed explanation of social network analysis and how it relates to natural resource management, see Bodin et al. 2006; Carlsson and

Sandström 2008; Bodin and Prell 2011). Past studies of networks of those working on conservation issues in the U.S.-Mexico border region have shown that activities such as the N-Gen summit can positively impact the environment in the long term (Laird-Benner and Ingram 2011). In this research we show that the creation of this new international network engenders multidisciplinary linkages and collaboration and fills an important gap in the Sonoran Desert region.

METHODS

Survey

In the weeks following the summit we conducted an online survey of all participants to better understand how the summit impacted professional connections. We gathered information about primary and secondary disciplines of work or research interests, geographic region of study, and ways in which respondents were connected to other summit attendees. The relationships of interest were: worked together (shared information/knowledge, published together, collaborated on projects, or conducted fieldwork together), was a mentor of the respondent, or met for the first time at the N-Gen summit. We got information about primary and secondary disciplines and geographic region of study for summit attendees who did not respond to the survey by mining information from the member directory on the N-Gen website (<http://nextgensd.com/researchers/>). This allowed us to construct more complete matrices for our three different relations even though some attendees did not respond to the survey.

Social Network Analysis

We built symmetrical matrices of 87 N-Gen summit participants for three social networks: work together,¹ mentor, and met for first time at N-Gen summit. We used UCINET (Borgatti et al. 2002) to calculate network density and degree centrality. Network density is the proportion of actual ties to the proportion of possible ties. It can help understand how quickly network members share information with each other (Wasserman and Faust 1994; Hanneman and Riddle 2005; Prell 2012). Degree centrality is a count of the number of ties of each network member

and is a measure of power. Network members who are well connected (i.e., have a high degree centrality), and particularly those who have connections that are not duplicated by others in the network, are in advantageous positions. They may serve as brokers between otherwise unconnected network members, helping to transfer information and resources (Wasserman and Faust 1994; Hanneman and Riddle 2005; Prell 2012), serving as mentors, or connecting those who work in different disciplines or different geographic regions. Finally, we created an attribute data set with individual-level characteristics for each network member (e.g., discipline, geographic region of study). We used this data set for the cluster analysis described below, as well as to provide richer detail to the network analyses.

Cluster Analysis

We used data from the survey to build a matrix of 82 N-Gen members² and 45 variables representing primary and secondary disciplines and geographic regions of study. We coded the variables from 0 to 4, with 4 indicating a primary discipline or geographic region and 0 indicating the respondent did not work in that discipline or geographic region. We assigned each variable a weight of 0.5 as a way to give equal importance to variables describing members' disciplines and regions of study. We focused on these dimensions because they demonstrate the multidisciplinary nature of the N-Gen members and the potential for collaboration among them. We computed this with the package “cluster” in R (Maechler et al. 2014) with the “daisy” function to look at similarity between pairs of N-Gen members, with the “mcquitty” agglomerative method to produce a dendrogram. This approach placed people in groups based on their similarity of primary and secondary disciplines combined with the geographic regions in which they worked.

RESULTS

Summary Statistics of N-Gen Summit Participants

The survey had a response rate of 61% ($n = 55$; 49% Mexican citizens, 38% U.S. citizens, and 13% from other countries but working in the

Sonoran Desert region). They represented 27 different primary and secondary disciplines and 18 different geographic regions of study.

Social Network Analysis

The density of the “new connections” network was highest, followed by the “works together” network and the “mentor” network (table 1). Summit participants worked with an average of 7 other attendees (table 1; figure 1A) and made an average of 24 new connections at the summit (table 1; figure 1B). Twelve of the 87 summit participants were named as mentors, and those who were named reached across disciplines and regions (figure 2). There was also a broad range of expertise spread across the geographic region (figures 1–3).

Table 1. Summary Descriptive Network Statistics

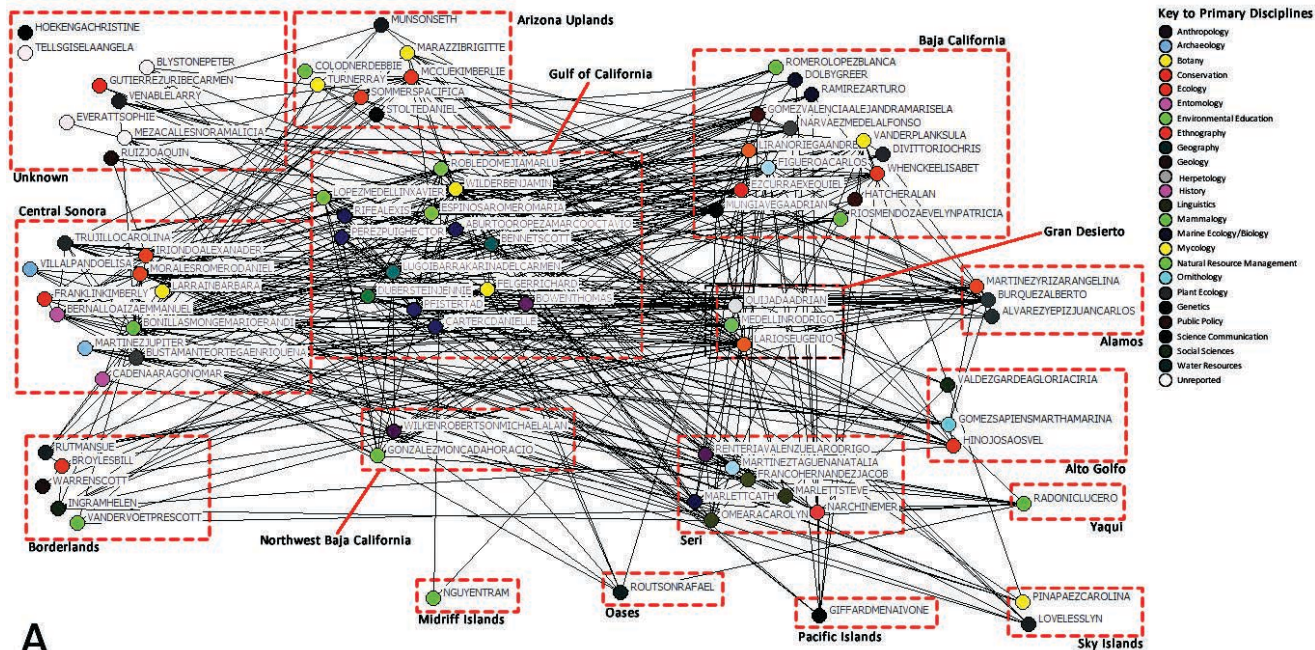
Network	Density	Average # of Connections per Respondent
Works together	0.08	7
Mentor	0.004	0.33
Met for first time at summit	0.286	24

Cluster Analysis

The cluster analysis grouped respondents based on similarity of primary and secondary disciplines combined with regions of study within the Sonoran Desert (figure 4). Clusters are first grouped according to geographic region, and subsequent groupings within larger clusters for most cases are based on similarity of primary and secondary disciplines within each region.

DISCUSSION

The results of our analysis demonstrate that the N-Gen summit played an important role in forging connections between summit attendees. The summit helped create new relationships across disciplines and across geographic regions of the Sonoran Desert, underscoring the importance of a group like N-Gen in supporting future multidisciplinary work in



A

Figure 1. Network of N-Gen summit attendees. Graph A shows the “works together” network. Graph B (on next page) shows new connections made at the N-Gen summit. Nodes are grouped by region. Colors represent different primary disciplines. The boxes demarcate the geographic region in which attendees work (to simplify graph B, we left the boxes out). This figure shows the large number of new connections forged at the N-Gen summit and underscores the value of the gathering.

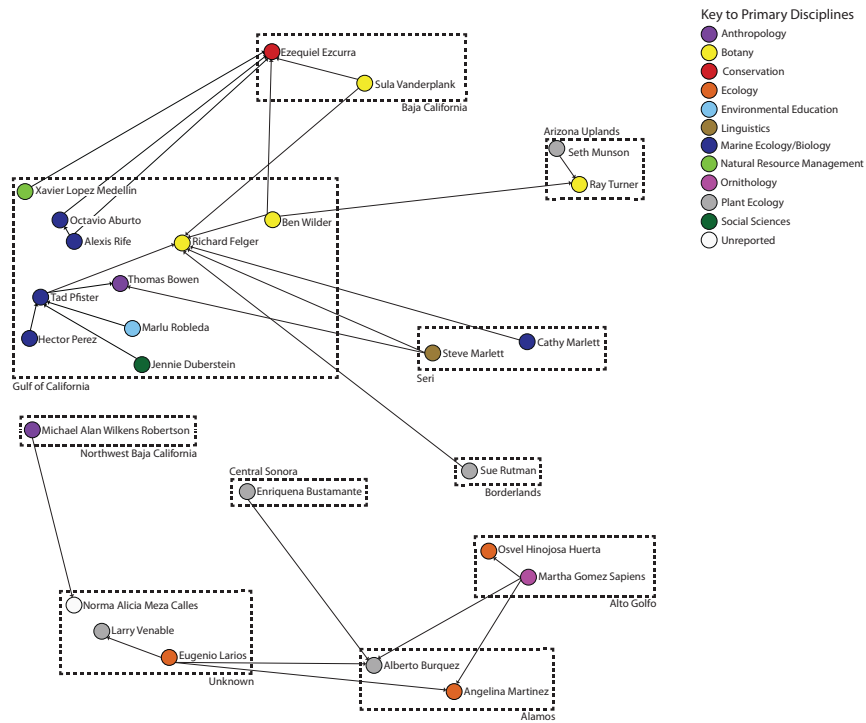


Figure 2. Map of mentorship of N-Gen summit attendees. Arrows go from the mentee to the mentor. Nodes are grouped by region in which respondents work. Colors represent primary disciplines. This figure shows how mentors connect disciplines, which in turn provides mechanisms for mentees to forge cross-disciplinary connections.

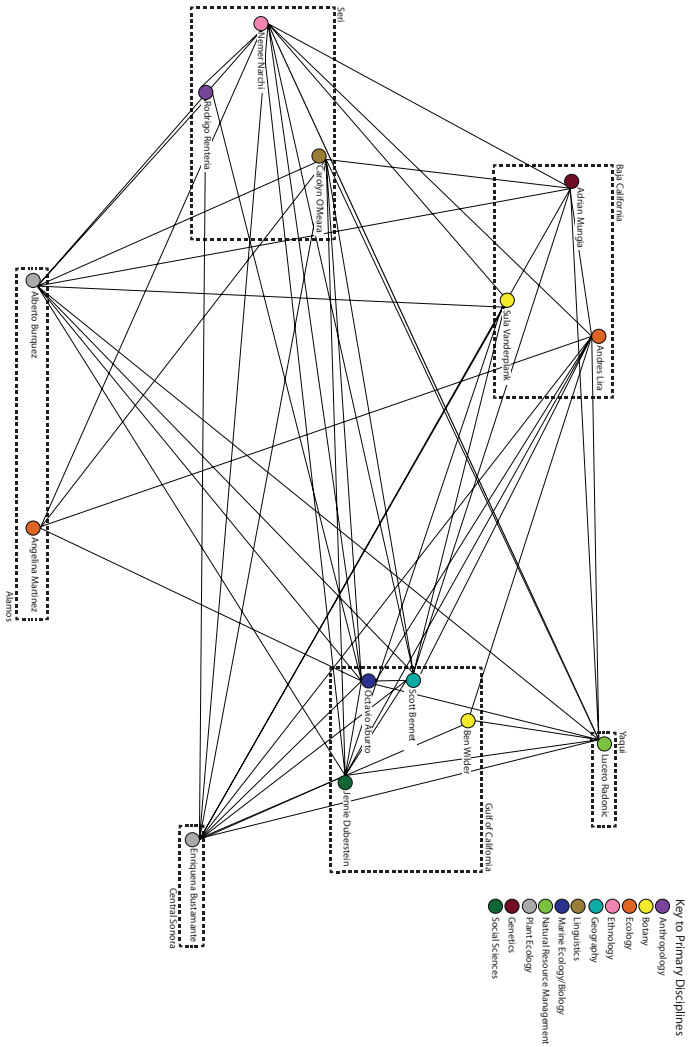


Figure 3. Network of N-Gen Executive Committee and board members,³ showing who met for the first time at the N-Gen summit. Nodes are grouped by region. Colors represent primary disciplines. This figure shows for a specific group (N-Gen leadership) the ways in which the N-Gen summit forged new connections between both individuals and regions of the Sonoran Desert.

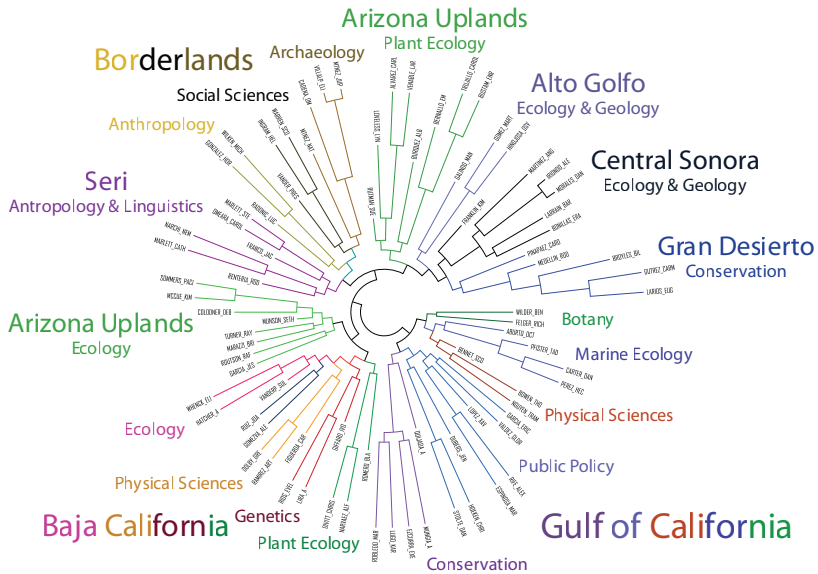


Figure 4. Dendrogram of N-Gen members based on their similarities of primary and secondary disciplines and the geographic regions in which they work. Colors represent different clusters within the dendrogram and are labeled according to the primary disciplines and geographic regions of the members in each group. We slightly modified branch lengths to resize the figure for printing and visualization, so length should be used only to interpret similarity and grouping patterns among N-Gen members (see “Methods” above). This diagram, combined with the network analysis, shows the multidisciplinary potential of the network. It provides a visualization of the capacity for cross-disciplinary as well as cross-regional collaboration among researchers in the Sonoran Desert. It may serve as an impetus for new partnerships and considering research questions in a more comprehensive manner.

the region. Relationships that started or grew at the N-Gen summit have resulted in new publications⁴ and novel collaborations, such as joint research expeditions⁵ and developing proposals for innovative research.⁶ An example of this can be seen in the network of new connections created at the summit among the group that currently comprises the N-Gen Executive Committee and board members (figure 3). This previously sparsely connected group is now working together to manage and support the growing N-Gen group.

Our analysis demonstrates the diversity of disciplines among N-Gen members, within both the Executive Committee and board, as well as within the larger group (figures 1–4). It also underscores the need to bring together more people working in certain disciplines; for example, those working specifically in oases, in Pacific islands, and with the Yaqui were poorly represented in the network. This analysis may help identify both geographic regions and areas of expertise to target for future member recruitment for N-Gen.

Although the mentorship network was sparse, this was expected as summit invitees focused on younger researchers in the region who are less likely to have served as a mentor. Of the small group of later-career Sonoran Desert researchers who attended the summit, all were named as mentors (figure 2). We can also see that several of these mentors reach across disciplines and geographic areas of the Sonoran Desert, acting as bridges across otherwise unconnected groups (Burt 1992).

Our analysis shows the important current and potential future role of N-Gen in supporting multidisciplinary collaboration in the Sonoran Desert. It also shows the ways in which N-Gen members may share common interests, even if they are not currently working together or do not yet know each other. Dr. Sula Vanderplank, from the Botanical Research Institute of Texas and N-Gen board member, summarized the importance of the group:

As young scientists it often takes us a long time to reach a level where we're recognized and known throughout our community and people are aware of our research and able to find us. But putting us all in communication early in our careers and also giving us some leadership and guidance from the experts in this region . . . it's just so wonderful to meet people with similar interests. (Next Generation Sonoran Desert Researchers 2013). ❖

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NOTES

1. To create the “work together” network we merged responses for “share information and knowledge,” “collaborate on projects,” “conduct fieldwork,” and “published together.”

2. We did not have enough information about disciplines or geographic area of work for five members, which is why this number differs from the number used for the social network analysis.

3. One board member, Jorge Torre, is not denoted in this graphic because he did not participate in the summit or the survey but rather became engaged later.

4. This special issue of *Journal of the Southwest* was a direct outcome of the N-Gen summit. The authors of this paper met for the first time at the N-Gen summit, and other included papers represent first-time collaborations. For a list of recent publications from N-Gen members, see <http://nextgensd.com/news/recent-publications/>.

5. See <http://nextgensd.com/uncovering-the-dryland-biodiversity-of-the-cabo-pulmo-region/>.

6. Duberstein, J. N., E. Riordan, S. Vanderplank, S. Veloz, H. Tjarks, C. Guerrero, and D. LaFer. 2014. “Integrating Climate Change into the Adaptive Management of Shared Habitats in Southern California and Northwestern Baja California.” A proposal submitted to the California Landscape Conservation Cooperative.

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