# Social Network Analysis Report

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## I. Rationale

Social networks underpin many processes in team science. They both enable and constrain creativity, innovation, and impact (Guimerà et al. 2005; Börner et al. 2010). The properties of networks make them an important topic for investigation within the Science of Team Science (Falk-Krzesinski et al. 2011). Despite their importance, many questions remain regarding the role of networks in supporting effective team science.

TERAA research focuses on team interactions and dynamics towards generating Science, Policy and SES management outcomes. SNA provides an excellent approach to empirically explore how team members have participated in each kind of output. The triangulation between survey, interview and SNA results may provide us with a better understanding of how individual interactions work at different levels. Relying on project reports to construct networks also allows us to explore which team members interact with each other in relation to material results explicitly declared to have been achieved in terms of Science, Policy and SES management outcomes.

## II. Research Questions:

1. What types of outputs do projects report as achieved in terms of Science outputs, Policy outputs, SES outputs?
2. What was the level of individual scientific, government and stakeholder involvement per output?

## III. Research Design

The documents analyzed will be Collaborative Research Network (CRN) and Seed Grants (SG) (CRN A, CRN B, SG A) year reports, in case reports are cumulative, only the last known report will be taken into account.

The nodes will be classified in Individuals and in Outputs. The relations will be established based on the explicit mention of involvement of individuals in any given output. Individual Nodes will be classified into PI's and Co-PI's (no associates were registered in the network), Natural Scientists, Social Scientist, Interdisciplinary Scientists, Government, and Stakeholders. The information of how to classify each individual will be extracted from CV's available online.

Output nodes will be classified into Scientific outputs, Policy outputs and SES outputs.

- Scientific outputs will include any of the following: Papers, scientific book chapters, science reports, Undergrad students, MSc students, PhD students, scientific meetings, seminars, workshops, and any other kind of activity with an explicit scientific objective to it.
- Policy outputs will include any of the following: Policy briefs, policy reports, specific meetings with policy makers, policy oriented workshops, and any other kind of activity with an explicit policy objective to it.
- SES outputs will include any of the following: Outreach documents, outreach workshops, specific meetings with stakeholders, and any other kind of activity with an explicit grassroots objective to it.

## IV. Results

### A. CRN A: Land Use Change in the Rio de la Plata Basin

This was a large Collaborative Research Network funded project that involved 18 researchers and lasted four years (2006-2010). We analyzed all project reports on an annual basis and present the findings below.

**Year 1 – 2006-07**

The first year of CRN A produced a number of team-generated outcomes across the categories (i.e., science, policy, SES management) (Figure 1). The PI was the most productive team member; however, many team members were engaged in producing multiple products (Figure 3). Also, the products were typically the result of two or three team members working together (Figure 4).

**Year 2 – 2007-08**

The second year of CRN A was considerably less productive than the first year. Only scientific outputs were produced during the second year (Figure 1), and many team members were not engaged in developing products (Figure 3). The PI was again the most productive team member. Additionally, products were typically produced by researchers independently, as opposed to through teamwork (Figure 4).

**Year 3 – 2008-09**

The third year of CRN A was once again productive. The team was focused on scientific and SES management products (Figure 2). The PI was the most productive team member; however, multiple team members were involved in two to five products (Figure 3). Despite the increased team engagement, there were still a significant number of team members who did not participate in developing products. Products were once again produced largely without broad team engagement; however, there is some indication of products being produced by between two and three team members working collaboratively (Figure 4).

**Year 4 – 2009-10**

The fourth year of CRN A was the most productive, with the team focused once again on all types of products (Figure 2). The PI was most productive, but team members were engaged in multiple products (Figure 3). Although individual work is still significant, teamwork between two or three team members is the predominant mode of producing products (Figure 4).

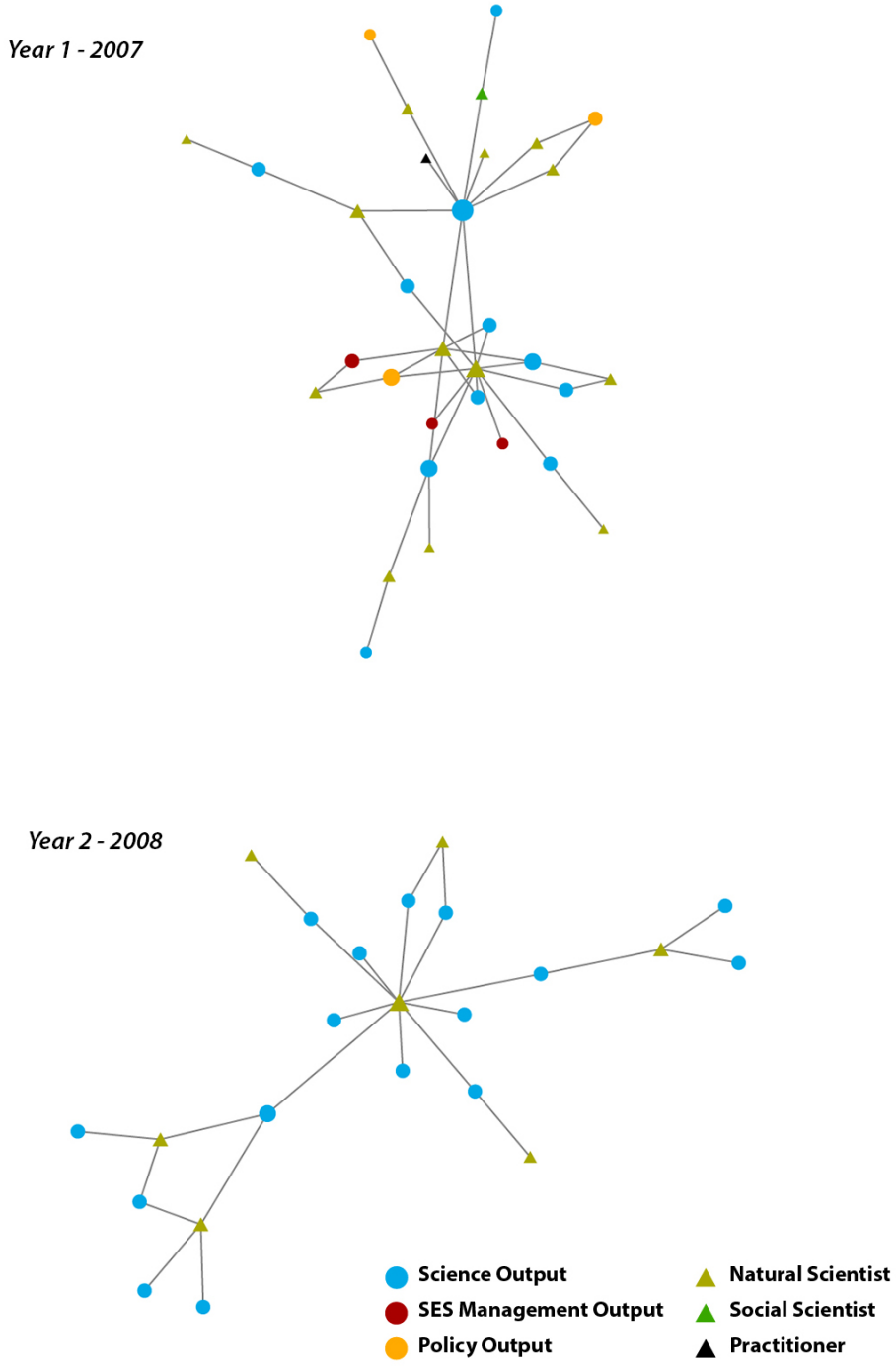


**Figure 1.** Network diagrams for CRN A, 2007 (Year 1) and 2008 (Year 2).

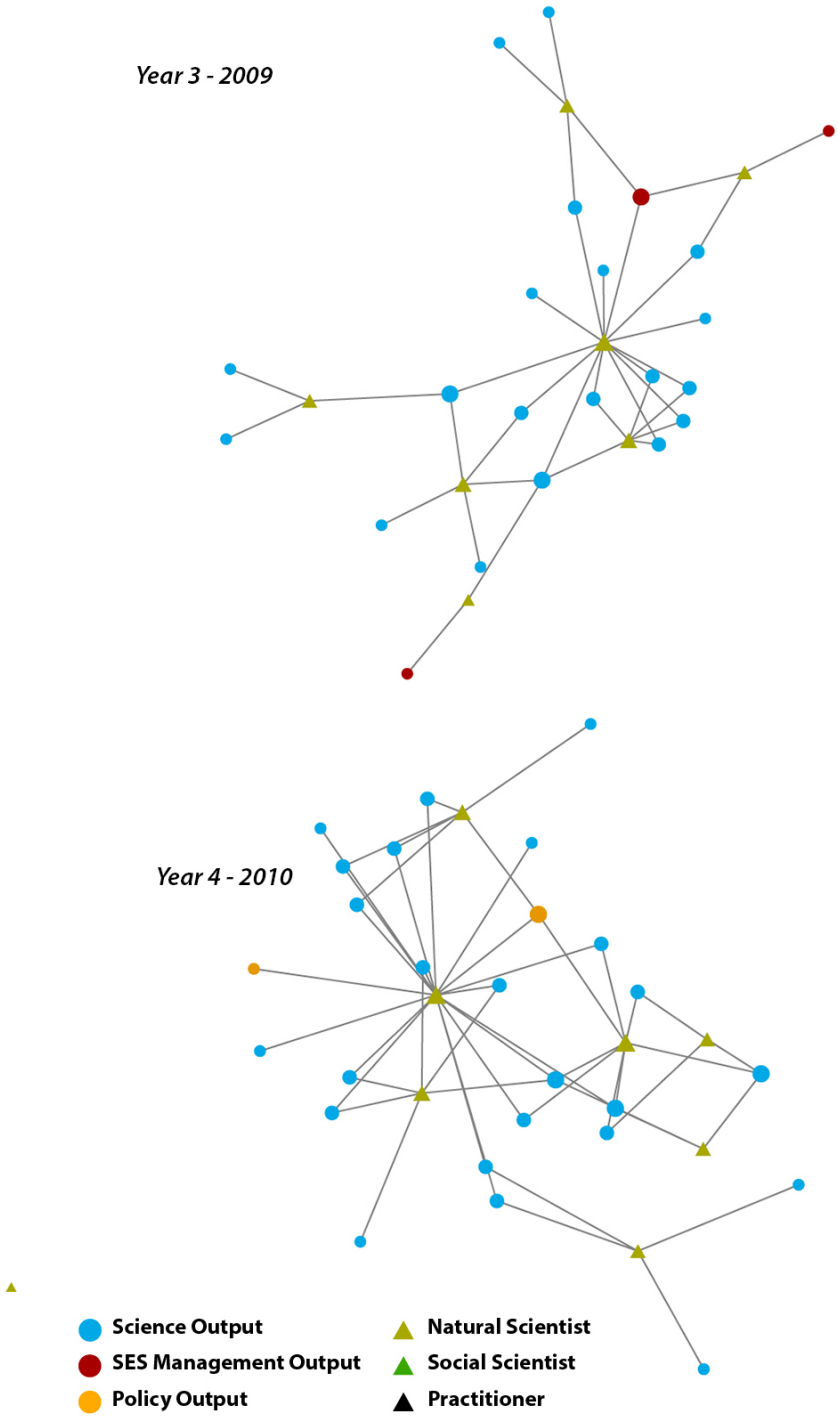


**Figure 2.** Network diagrams for CRN A, 2009 (Year 3) and 2010 (Year 4).

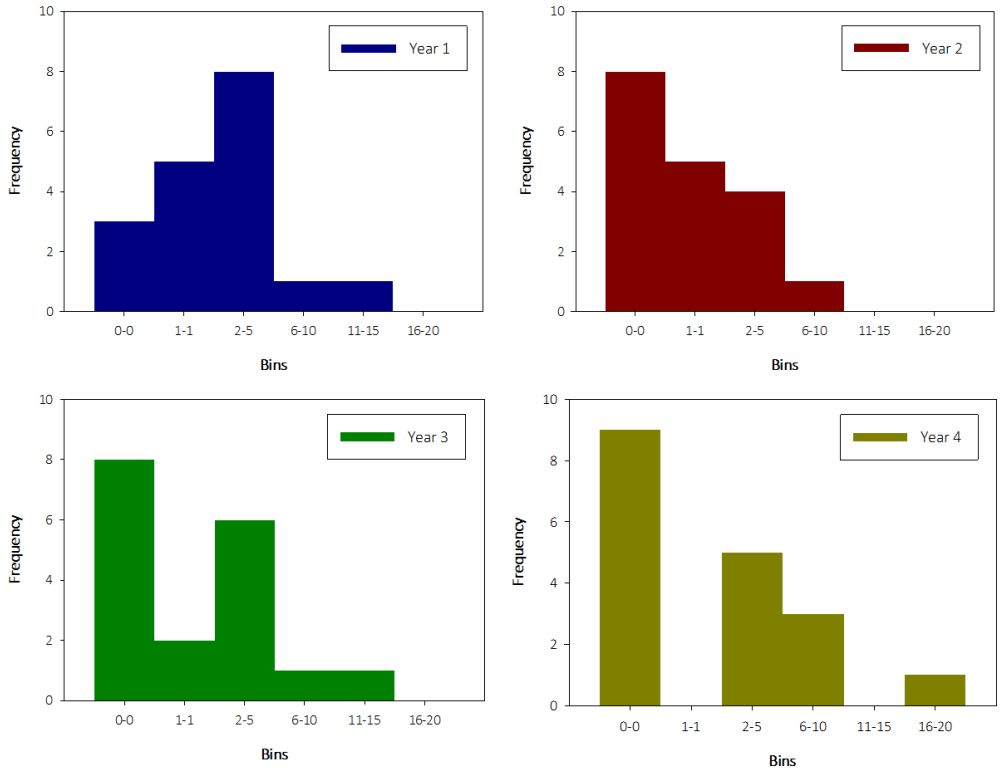


**Figure 3**. Performance of researchers.

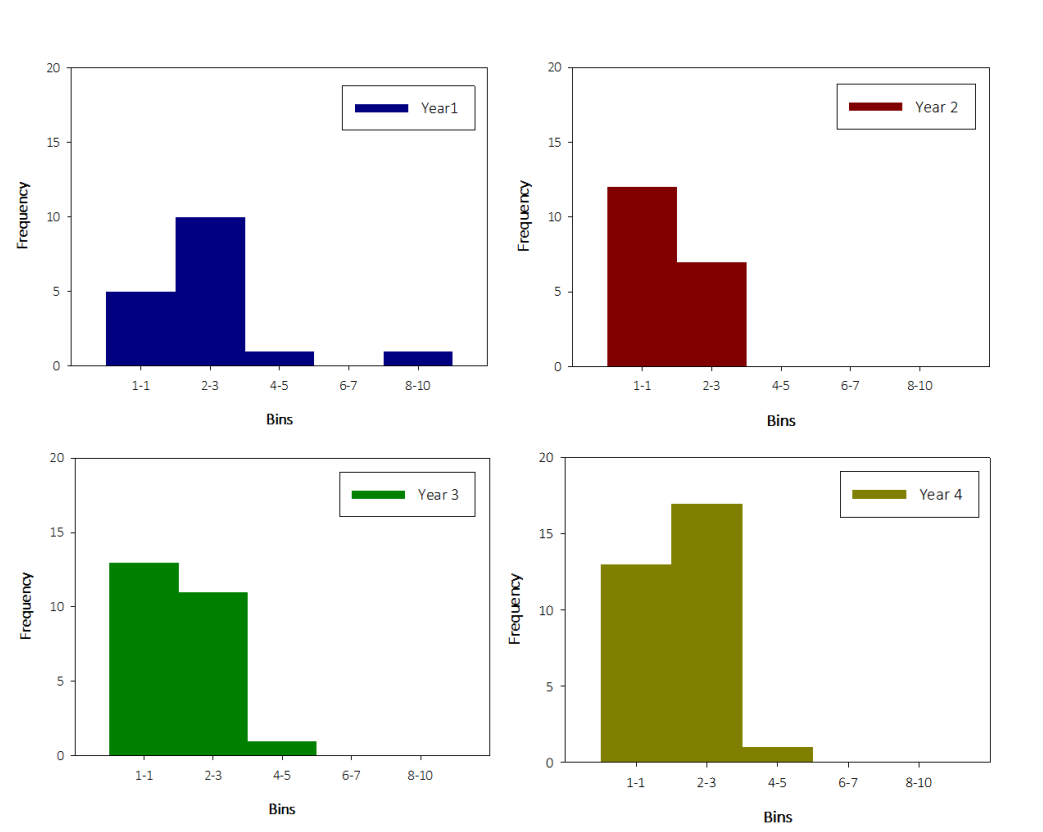


**Figure 4.** Number of team members contributing to products.

**B. SG A (2012-2013)**

This is a small 1-year grant with 5 researchers. We performed the analysis on the single final report submitted. We present results based on this report.

**Year 1**

During the implementation of this project we registered a total of 5 outputs in which team members were directly involved. 2 were strictly scientific outputs, and 3 were SES oriented outputs.

The network diagram shows team collaboration where social sciences and natural sciences are well integrated in the production of a single product and with few individualized outputs. In this case there doesn't seem to be a central role occupied by any of the researchers but rather the central role is occupied by the product in which all researchers are working together. This project seems to be product oriented rather than researcher oriented.

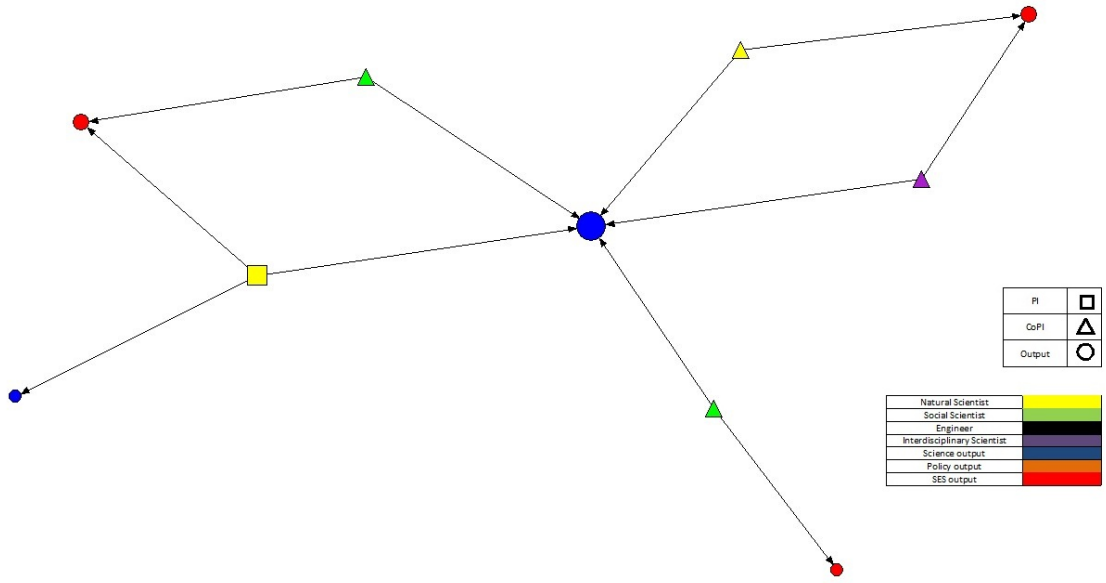


**Figure 5.** SG A (2012-2013) Network Diagram of year one with degree of centrality. The bigger nodes are central nodes in relation to the rest.

At an individual level, the PI barely stands out in terms of productivity in relation to the rest of the team. All the team has an equal level of productivity in terms of outputs directly associated to their work.

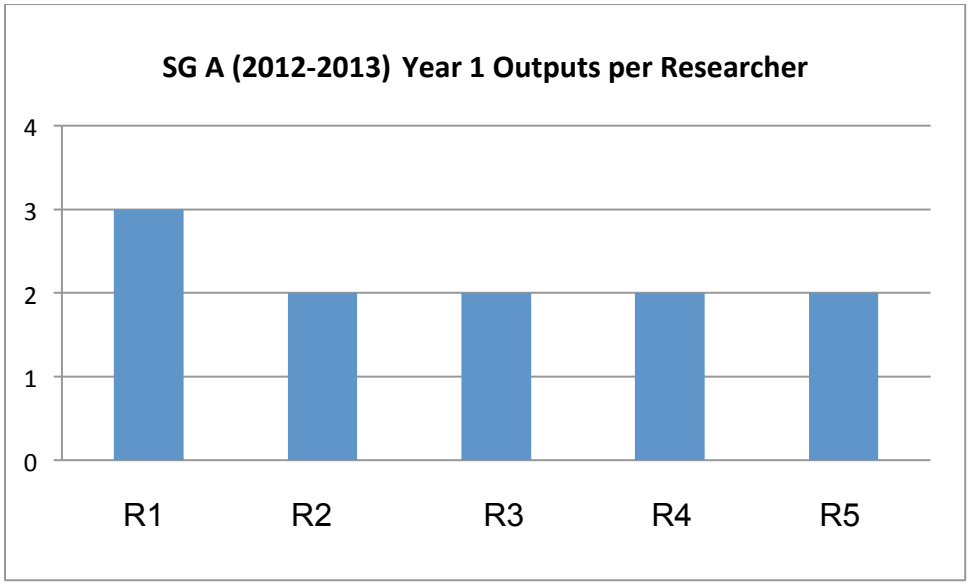


**Figure 6.** Graph showing the amount of products which researchers (R1-R5) were involved with at an individual level from project SG A (2012-2013) during Year 1.

From the total outputs generated this project, only 2 outputs involved a single researcher, 2 other outputs involved collaborations of two researchers, and 1 output involved all 5 researchers.

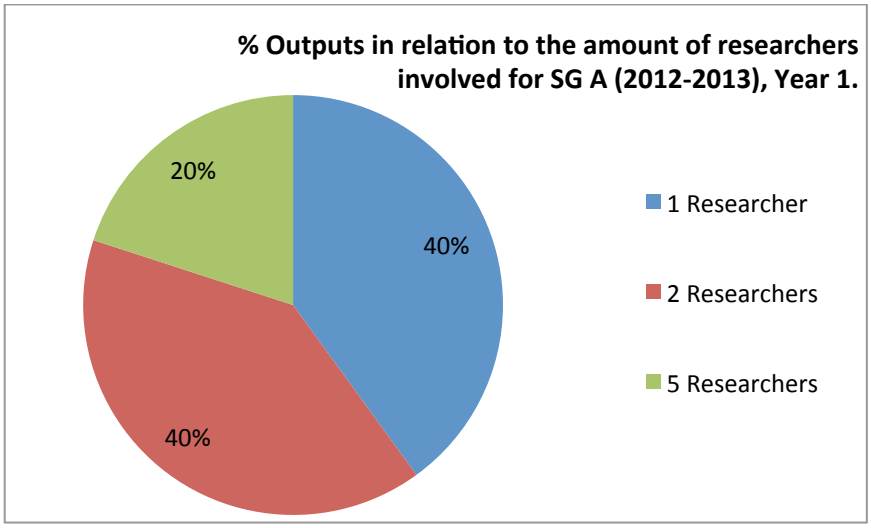


**Figure 7.** Graph showing the percentage of outputs that involved, 1 or more than 1 researcher for project SG A (2012-2013), Year 2.

At this point we can't observe any stakeholders as part of the team, but we can observe some interdisciplinary collaborations between the PI and Co-PI's at a team level. Also there doesn't seem to be a clear central vertical leadership role of the PI and rather a horizontal organization of work. Finally, the main focus of the outputs during this project is also well distributed in scientific and SES oriented outcomes.

## C. CRN B

The team of PI's and Co-PI's was formed by 8 members. This is a large project 5-year project in its third year of implementation. We analyzed two year reports handed in to date and will present results individualized per year of implementation and year report.

### Year 1

During this first year we registered a total of 52 outputs in which team members were directly involved. 42 were strictly scientific outputs, 4 were policy outputs, and 6 were SES outputs.

The network diagrams show fragmentation of work between social science Co-PI and the rest of the team, and some collaboration between the rest of the Natural Scientists and Engineer. The central role of the team in terms of productivity as well as connectivity falls upon the PI and the Co-PI in engineering (Figure 8).

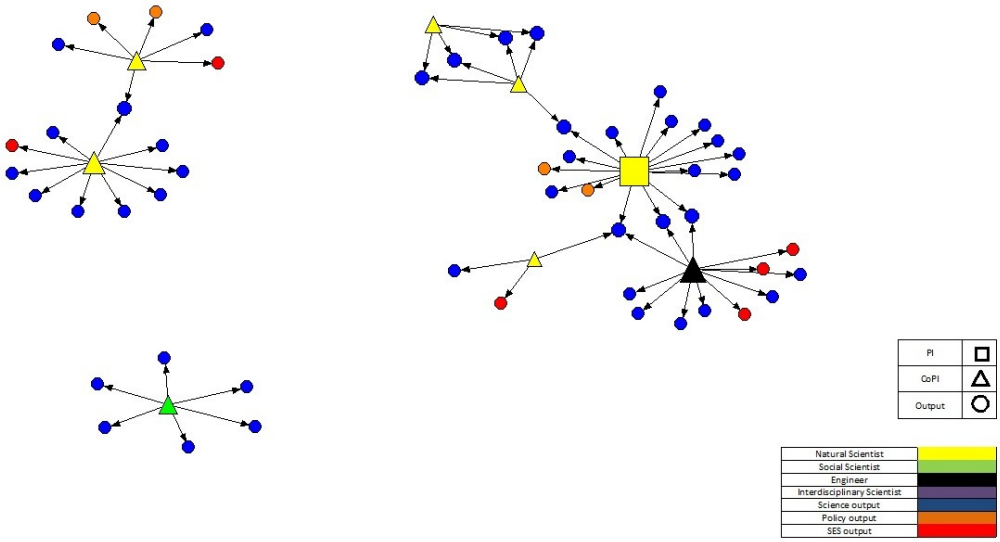


**Figure 8.** CRN B Network Diagram of year one with degree of centrality. The bigger nodes are central nodes in relation to the rest.

At an individual level, the PI is the researcher involved in the most outcomes, followed by two Co-PIs, while the rest of the team were involved in fewer outputs (Figure 9).

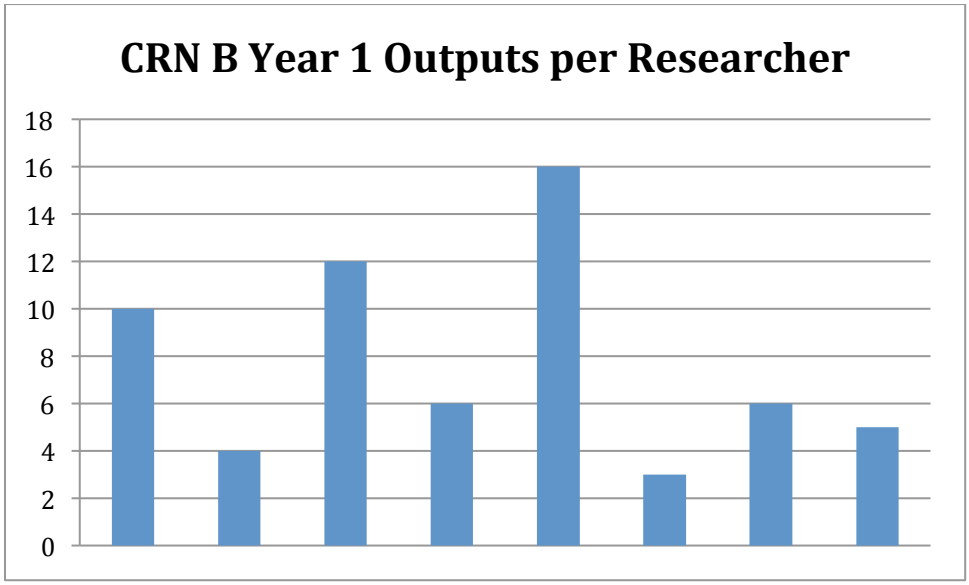


**Figure 9.** Graph showing the amount of products which researchers were involved with at an individual level from project CRN B, Year 1.

From the total outputs generated in this first year of project, only 9 outputs involved more than 1 researcher collaborating, and only 1 output involved more than 2 (Figure 10).

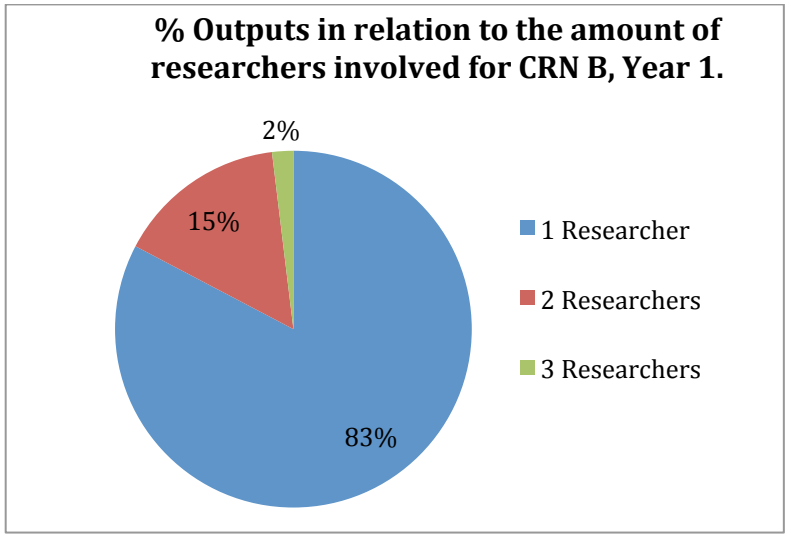


**Figure 10**. Graph showing the percentage of outputs that involved, 1 or more than 1 researcher for project CRN B Year 1.

At this point we cannot observe any stakeholders as part of the team, nor can we observe any clear inter or transdisciplinary collaborations between the PI and Co-PI's. Though this doesn't mean that within each of these PI's and Co-PI's individual research associates there might, we are only assessing collaborations between PI's and Co-PI's. Finally, the main focus of the outputs during this year was clearly scientific with a few policy and SES outputs.

**Year 2**
During this second year a total of 75 outputs, 62 were scientific outputs, and 13 were SES outputs.

The network diagram at this stage shows more collaborations than in the previous year and more integration between social science CoPI and the rest of the team. The diagram also shows higher concentration of collaboration of all PI and CoPI's in two scientific outputs. The general characteristic of predominant individual outputs in relation to each researcher is maintained. The central role of the team in terms of productivity as well as connectivity again falls upon the PI (Figure 11)

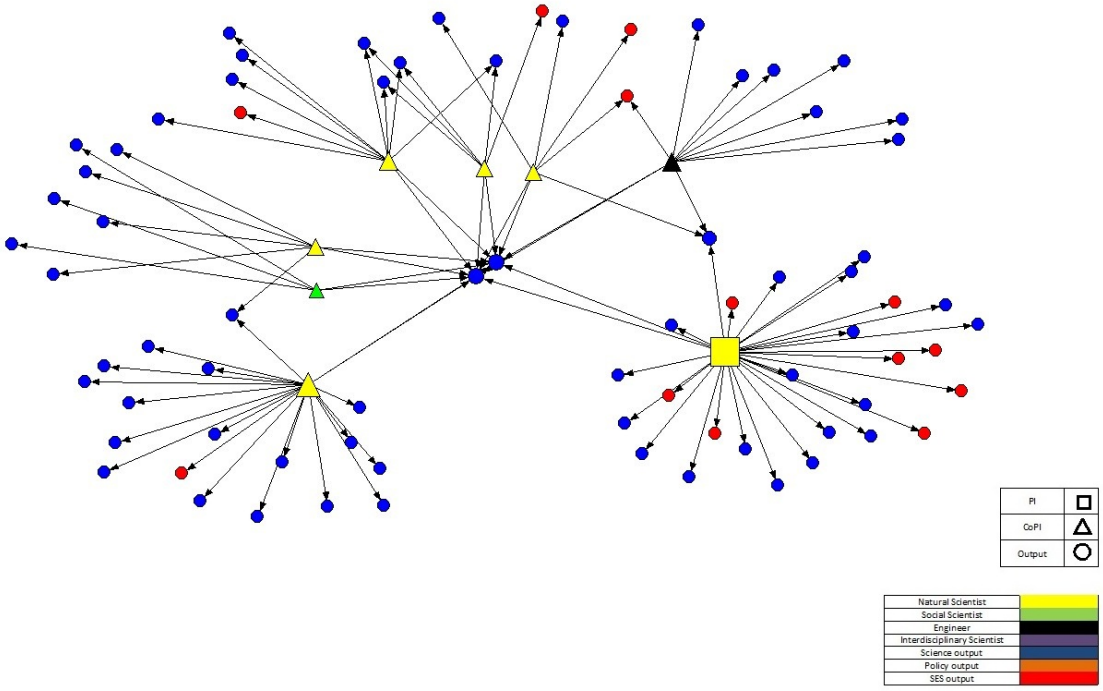


**Figure 11.** CRN B Network Diagram of year two with degree of centrality. The bigger nodes are central nodes in relation to the rest.

At an individual level, the PI is the researcher involved in the most outcomes while the rest of the team were involved in fewer outputs (Figure 12).

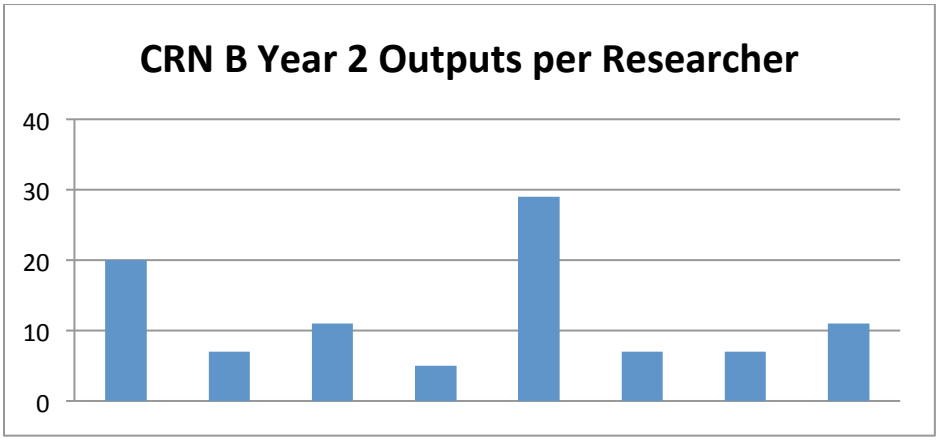


**Figure 12.** Graph showing the amount of products which researchers were involved with at an individual level from project CRN B, Year 2.

From the total outputs generated in this second year of project, again only 9 outputs involved more than 1 researcher collaborating, but at this point 2 outputs involved more than 2 researchers (all researchers) (Figure 13).

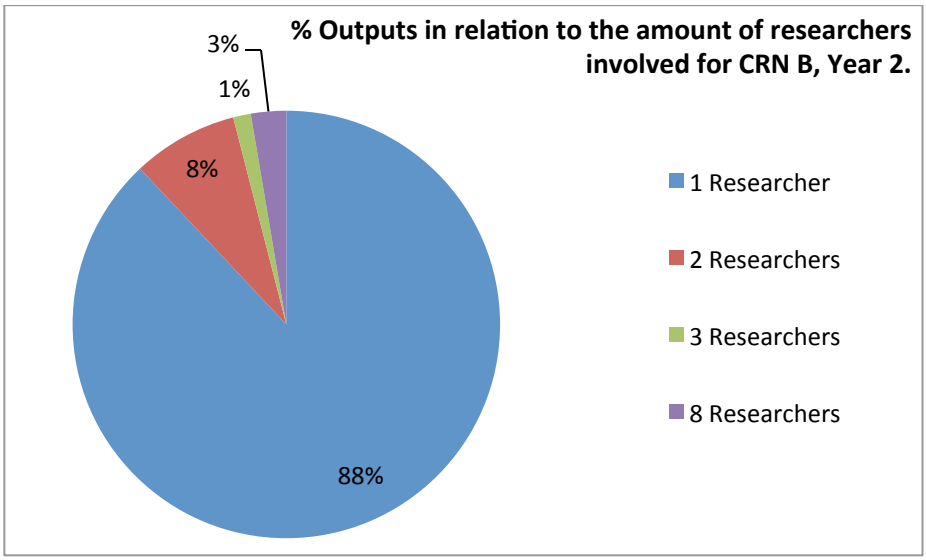


**Figure 13.** Graph showing the percentage of outputs that involved, 1 or more than 1 researcher for project CRN B, Year 2.

Again we can't observe any stakeholders as part of the team, nor can we observe clear predominance of inter or transdisciplinary collaborations between the PI and CoPI's, although there are differences in terms of more collaborations between all researchers focused in two outputs. Finally, the main focus of the outputs during this year again was clearly scientific with a few SES outputs and no Policy oriented ones.

**V. Discussion and Conclusions**

- There seems to be a clear difference in ways of organizing work between the larger CRN projects and the smaller SG project, as well as a difference in the orientation of the output objectives each team achieved.
- In the case of CRN B there seems to be an evolution in time in terms of the type of collaborations within the team, specifically in terms of integration between social and natural scientists.
- CRN project has a clear leadership role of the PI in terms of productivity, while the SG project seems better distributed.
- There is a significant difference in the level of productivity of individual researchers per year between CRN and SG, being the first a lot more productive than the later.