

## Design to Dirt: Monitoring

**Peter Dunwiddie, The Nature Conservancy** – pdunwiddie@natureconservancy.org

### I. Why Monitoring Programs Fail

4 Main types of projects

- Research Projects- question to answer, Monitoring is used to answer the question or a related question
- Accounting and Certification – compliance related, monitoring for legal purposes.
- Status Assessment – simply to assess the condition of the site
- Effectiveness Measure – answering the question of how a particular method worked and whether it is worth repeating.

Reasons Monitoring Fails:

1. Failure to clearly articulate your goals

- Restoration goals
- Monitoring goals
- Both must be clearly articulated

\* Ask the question- What does success look like? Without this question it is difficult to evaluate.

- Expert opinions
- Research similar projects
- Make a best guess
- Develop an ecological model
  - Verbal description
  - Visual Diagram
- Restoration Goal needs to be as specific as possible and as quantitative as possible
- EXAMPLES
  - Golden Paintbrush – develop and restore new populations
    - “What to maintain a viable population.” What does that mean?
    - More specific: Let’s maintain an average of 500 individuals on the site. – But does that really mean that the population is going to be viable?
    - Very Specific: Concentrate in one area – Seed production/viability, pollinators, etc.
  - Wetland replication
    - “We want to restore a native wetland”
    - More specific: Specify a particular diversity or a particular abundance of a particular species and specify physical parameters. How closely have we matched the substrate? Have we met the slope and topography?
    - Plant cover is good, but it may not be the most valuable when you go back to your goals.

2. Want to make sure that your monitoring goal and your restoration goal are very closely linked.
  - This often happens.
  - The default is often to concentrate on the biological aspects of the site, when the non biological aspects are very important as well
    - The non biological aspects tell you why the site has problems
      - If your plants are not reproducing, why?
      - You will be in a better position if you have considered the key components of that system that will make the site go one way or another.
      - Hydrological components are often a key component to success
    - The effects of invasive species and the effects of funnel interactions can change the interactions on your restoration site
      - Example of burning prairie land experience.
    - We need to pay attention to more than just the immediate focus of the restoration.
      - If you studied plants, you cannot just study the vegetation; maybe look into the insects and the hydrology as well.
  - Not everything can be monitored. Indicators hopefully truly show the status of the larger system. This is one approach to narrow down the spectrum of monitoring possibilities.
    - If indicators can be found this can be a good method
    - Usually restoring an entire habitat does not work with indicator species.
      - Good indicators need to be sensitive
      - Good indicators need to be anticipatory you need to have lead time
      - Good indicators need to be cost effective and easy to monitor
        - This can be the key reason a monitoring systems fails or succeeds
      - Good indicators need to help differentiate between human causes and natural causes
3. Poorly defined Monitoring protocols can mean the failure of the monitoring goal

Q. What is a protocol?

A. What methods are you going to use to make your plots and analyze your data.

- Monitoring protocols are often designed very uniquely to that site and it is hard to communicate or compare.

- Don't be totally generic, just make sure that you have good reason to go outside the norm so that the method can be explained and carried out.
- Standard methodologies are very useful to transfer and compare to other projects.
  - Example, general plots with standard methodology could be used to answer questions from other purposes that weren't originally a concern.
- Be sure that you are not just monitoring for the sake of monitoring. Make sure that the data you are collecting is still a useful approach that is providing information for the question you are trying to answer.
  - Is this really getting at the information we are trying to get
- Not Statistically sound or rigorous
- Biologically meaningful protocols are necessary
  - Example, statistically sound monitoring for detecting a change of 30% doesn't matter to a population that can shoot up and down in population normally. What matters is whether the population stays up or down over a few years.

Q. How would you approach that fluctuation in the species?

A. There are no good answers, it depends on how much you know about the site, what is the natural variation of the site or the species and when have I deviated from that threshold. Finding that threshold is the million dollar question. That is tough and requires a knowledge of the system and its natural variability. The real problem is in most systems is what happens in most years is not the kicker. The kicker is what happens once every 25, 100 years, floods, fires, hurricanes. These things happen in normal systems, but they are hard to understand and study them because they happen infrequently. What will happen with your restoration when that happens and is it ok or has your restoration failed.

Q. Would following for long term trends help?

A. Over the long term is there a trend that is happening there. It's really good setting up a monitoring protocol to see what happens the first few years. What really is important is what happens when you repeat the maintenance for 20 or 50 years. What happens when you keep burning a field every year for 50 years. Long term trend is what really matters to me.

- Monitoring at infrequent time periods
    - What is success? Vision of success can be skewed by when you look at a healthy system. Healthy systems can change over time.
    - Be careful not to claim success and then just stop monitoring.
4. If goal is only attainable after 15 or 25 years, this is difficult for funding sources

- A need for interim goals is important to make sure a long term project is on track and making progress
  - Set up check points or standards to see along the way, measurable objectives for the short term
  - Identify the interim goals from the beginning.
5. Not enough documentation. Document everything you do.
- People do cool things and then later, no one knows what they did.
  - Tough to build upon what has been done
  - Records of methodologies, share it with other people and spread it around
    - If no one remembers that you were monitoring then the data has no purpose

Q. Would you elaborate a little about being able to relocate these plots in 20 or 30 years

A. I tend to take a 15000 year perspective, what that does to me is I always think "what would be useful to someone coming back in 100 years" I take photographs, -then you need a permanent reference in the photo so that the photo can be relocated. Even if it is just a reference point that will last ten years, that is better than nothing. There are a lot of new possibility for making permanent plots with GPS and such technology.

T-Posts

Q. How would we find this data without being part of the educational community

A. Word of mouth. It's rare that you will know every research project or that there is a catalog record. That is why it is important to spread it around and let people know.

Q. So how are we going to hear about that scotch broom study

A. Drop me an email from time to time

Q. Does the NC put up results on their website that hasn't necessarily been peer reviewed

A. That is changing rapidly with web technology, there is one record "conserveonline.org" that is a source for unpublished "gray" literature. Another site I send people to is TNC weed out of Davis that has a large site about invasive species.

Q. When I set up my monitoring transects and start measuring, I borrowed my methods from natural distribution, now would the spacing or clustering change that method

A. Yes, you would not want a measuring scheme that would be effected by that pattern, the pattern may change over time and may not be the most obvious, so it is hard to record for the skewing that would occur. Those changes can be really important. I'm not quite sure what the answer is, the statistical answer is random placement of plots and many plots, but often the best thing to do is opposite of that. Think through the system and ask how is this likely to occur, maybe all the monitoring should be along the trails or along the edge if measuring for invasive spp. Spread throughout the preserve cannot be anticipatory or as sensitive. You need to tailor the monitoring design to your particular goal.

Q. You mentioned statistical rigor that can cost a lot of time money and equipment. What are your thoughts on the conserving resources?

A. I like monitoring that gives me information that will push me to change my restoration regime. Not necessarily statistically rigorous, I need to find the balance of resources between what answers I need. It depends a lot on how much I know about that system. The final answer is "It depends." Try to set it up in a way that is simple enough or easy enough for someone to be able to do it again. It no one can ever do it again it's pointless.

Q. Don't you have a responsibility to add the justifications onto your data?

A. Yeah, and I guess this is partly why I keep harping on recording what you are doing and why you are doing it. Years later someone could come back and throw it out because its not statistically rigorous... as long as you address this upfront and be frank, people down the road will understand that you did the best you could with what you had.

## **Questions We Ask. Case Studies: Monitoring Resources, Methods, and Tools**

### **Scott Moore, Snohomish County Public Works Riparian Restoration Monitoring with Interns and Volunteers**

Q. If you are going to do an annual walkthrough and assessment of site, when is it best to go?

A. I like to do it in spring because the plants (and weeds) are starting to grow at that time. However, it may depend on when is convenient for you. We try to assess before the summer, when most of our maintenance is performed, so that we know what needs to be done for each of the sites.

Q. How are the larger (5" or so in diameter) cottonwood stakes doing?

A. Varied range of failure/success. We are still in the process of determining how the success of the large posts.

Q. What is the benefit of the larger stakes vs. 2" stakes?

A. We are trying to discourage farmers from building up levees. The cottonwood stakes act as large strainers helping to keep large woody debris in the stream from going into farmers' fields. After the first year, it became clear that the post were doing their job, and are actually creating a natural levee. The other issue is that we had the material easily available, so let's use it.

Q. How do you install these larger stakes?

A. Post-hole diggers, large dibbles, augers on a backhoe install the post then backfill.

Q. Have you tried this method with other species than cottonwood?

A. No, but mostly because they haven't been readily available to us.

Q. Over the long term don't you run the risk of creating a raised river?

A. Well, the corps of engineers will do it, or it will be this more natural process.

Q. Are these areas in the backwaters?

A. They are in all areas: directly next to the stream, 100 ft away, in floodplains, etc.

Q. What was your decision making process for the length of the logs?

A. As long as possible that can be legally transported in a truck without a permit.

Q. How deep do you sink the stakes, and is this for standing up or for rooting?

A. Planted half of each post in the ground, so the depth varied depending on the length of the post, not necessarily on a defined depth for every stake. The location of the water table would effect this decision.

Q. What protocol to you use for a large site where your percent cover is going to be basically only what you've planted?

A. We tended to evaluate about 20% of the site as a baseline for what species are present. We don't measure the percent cover at all for the first few years since it is so small initially.

Q. Have you interfaced your database with GIS yet?

A. Yes, we have begun this process, but it hasn't been completed yet. The challenge is when your GPS isn't working due to canopy cover.

**Lucinda Tear, Consultant**

**Changes in Monitoring Design at Spencer Island. Was it worth it?**

Q. What were you reporting on your 7 transects in the phalaris zone?

A. At every 5 meters we would report what plant species were present, and it was always phalaris. We knew that if other species were arriving, it would be readily clear with this system.

Q. If you do new random samples every year, doesn't this skew your data?

A. That was why we always went back to the same general area and sampled randomly within that area. This shows generally what species are present in an area. Our larger concern was more to do with general changes in species and larger patterns, not necessarily what is in a small 1 meter squared area.

Q. I've read that in a rectangular quadrat helps to give more information than in a square quadrat. What if the macroplots had been measured rectangularly would you have a greater chance of capturing more species?

A. I'm not really sure. It seems possible, but it would depend on the species gradients on the island, which we were not sure of. If the rectangle was going across the gradient we may capture more species, but we were not sure where these gradients were. This would be one of the many ways to tweak the project without increasing cost or effort, and would be an excellent idea to try.

Q. Over time are the dikes being maintained?

A. No. They have actually breached the cross dike, so hopefully the northern 2/3rds of the island can be monitored we are looking for volunteers. There are at least 3 other dike breaching projects going on around the area if you are interested.

Q. What kind of interpretation techniques did you use for the aerial photos? Could volunteers help with this?

A. I think the processes were actually very qualitative, and volunteers would probably quite capable of finding this data.

Q. How do you get expertise in your volunteers?

A. Many of the volunteers, like the native plant stewards, are skilled, but another technique is to train the volunteers. Encourage QA and QC between volunteers and researchers.

Q. Aren't there companies who do spectral analysis who would do all of this for you?  
A. You run into problems because the light conditions can change, people have different interpretations of the data, etc. You still need on the ground quality checking of data.

Q. What time of year are you taking the photos?  
A. They are taken at the end of summer during the peak growing season.

**Fred Bergdolt, Washington Department of Transportation**

**[bergdof@wsdot.wa.gov](mailto:bergdof@wsdot.wa.gov) (360)705-7408**

**Vegetation Monitoring from a Compliance Perspective**

Q. Is your macroplot covering the entire area of interest in the estuary?  
A. Yes, we laid the rectangle over a slightly larger area than the estuary. Any points outside of the area of interest were disregarded.

Q. How did you choose where to put the baseline?  
A. We walked through the site and chose a baseline that would cover all the zones, would go across the primary environmental gradient (water, marsh, buffer), would logistically make sense, and that would be physically simple to implement.

Q. What is a sample unit?  
A. Example: to determine the approximate average height of the people in this room, a set of ten people from the room would be the sample, while each of the individual people in that set are the sample units.

Q. What is the gap rule?  
A. Example: A gap of less than half a decimeter in the line transect method is considered continuous coverage.

Q. Does the point frame method bend the vegetation over?  
A. Yes, it is not very practical for taller species of plants, it works best in areas of low growing herbaceous species.

Q. Is there a particular reason you chose 30 points for the point frame?  
A. Time and resources. It depends on your plant community; higher diversity will need more points. The same factors come into play when deciding the size and shape of the frame. Rectangular configurations are more able to span random clumps of plants on the site.

Q. Your sample sizes have increased significantly over time. How did this affect your volunteer hours?  
A. We've tried to stay very focused on particular species that we are interested. We stopped keeping track of species that were not as important to us. We train volunteers, a set of 16 interns, who work with us over the summer.

Q. You used a confidence interval of 90%, others use 80%, is there a reason for this difference?

A. We tighten our confidence interval in more sensitive areas, like an estuary that is particularly sensitive to invasive species.

Q. What happens if an invasive species comes into the site that you're not looking for?

A. Hopefully we'll catch it. We keep up to date with the invasive species that are potential risks. Counties each have an invasive list available to us. If we are unsure of a species we bring a sample home and research it.

Q. How are your 60 sites doing?

A. Better than average, but the bar is set fairly low.

Q. It seems that DOT has very good mitigations compared to other agencies. What is driving that commitment?

A. Visibility is a major issue. Regulators include DOE, Army corps of Engineers, EPA, tribes.

Q. Is it easier to restore and maintain an existing wetland than to create a wetland from scratch?

A. Yes.

Q. Then why do you continue to create them from scratch?

A. We are actually working to change our methods based on problems we've had in the past.

Q. Are your methods available online?

A. Most of our methods are from: Elziga et al, and Bonham – see reference list

Q. The point line technique seems appropriate for middle school aged children. Are there other methods that would be suitable for this age group?

A. We work with young children who work well in circular plots measure height and diameter.

**Lucinda Tear, Consultant**

**Using Multivariate Methods to Investigate Changes in Species Assemblages at Restoration Sites. An Introduction**

--My email address is [lucindatear@msn.com](mailto:lucindatear@msn.com)

Q. It seems pretty technical, is there a reference you recommend?

A. Well, different people learn and relate to different books. I like McCune and Meferd from PCOrd. They have a general book and a packet. They discuss multivariate statistics in biological reference. They also give good explanations on why different methods are used.

-- There is an excellent class on how to use PCOrd that you can find by looking at their website.

Q. My understanding of statistics was you can only do one test on your data or you lose reliability.

A. It's the difference between having a testable hypothesis with a probability of chance (P) and with multivariate calculations you do not get a P value. But it does become less objective and more subjective. Be careful about not deluding yourself and making assumptions that you have not properly retested. In an ideal world with lots of funding and time we would retest with each new calculation method

#### General Comments and Questions from the Entire Day

Q. One thing that is a slightly different topic, what will the goals be for tomorrow?

A. Basically we will use a protocol that we have used in Sno County. We want to look at a variety of techniques here in the forest or down the road and use 3 diff types of line intercept vs point intercept and compare the results.

Q. Do we need boots

A. No

Q. I think it might be useful to have reports from these techniques so we can see what we get

A. Yeah, we can get that.

Q. do we get coffee

A. No, you are on your own

Q. meet here at 9?

A. yes 9am

Q.

A.