Notes from Restoration Ambassadors Training
Autumn 2015

Please also refer to the PDF versions of the presentations on the Laguna Education Volunteers webpage under "Field Notes" to put these notes into context.

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

- **An ecosystem has recovered and is restored when it contains sufficient biotic and abiotic resources to continue its development without further assistance or subsidy**

Welcome to Your Watershed: How water works and moves in the Laguna Watershed.

- Watersheds are like a funnel. Water comes in at the top and goes out at the bottom
    - Watersheds are nested (like Russian dolls). For example:
        - Santa Rosa Creek watershed is part of the Laguna watershed
        - The Laguna watershed is part of the Russian River watershed
        - The Russian River Watershed is part of the Pacific Ocean watershed.
- **Plate tectonics:** The theory that the Earth's outer shell is divided into several plates that glide over the mantle and act like a hard shell. We're moving around on plates that float and run into each other!
    - The San Andreas Fault marks the boundary between the Pacific Plate and the North American Plate.
        - Pt. Reyes (on the Pacific Plate) is moving north headed to Alaska.
        - Juan de Fuca plate is moving east being pushed down under the continental plate.
    - Oceanic plates are made of denser heavier materials and tend to get pushed *under* the continental plates.
    - The Mendocino Triple junction (at Punto Gorda) is where the Pacific Plate, the North American Plate and the Gorda Plate meet
    - 8M to 2.5M years ago, that triple junction was right off shore here, and a gap in the plates created Sonoma Volcanics
    - The Franciscan Complex was created around the same time when islands in the Pacific Plate were spread on the side of the continent as the Pacific Plate was pushed down
    - During this time there was an inland sea covering what is now the Santa Rosa plain

        - Sebastopol was at the edge of this inland sea. The Wilson Grove formation under Sebastopol is sandstone that was deposited on the beaches of the inland sea.
        - The mud deposited under the sea make up what is now the Petaluma Formation.
    - The reason all this is important is that it's the material all our area is made of!
        - Some formations don't hold as much water as others.
        - Mountains are constantly being washed down into the valleys.
        - Faults push water up to the surface.
        - Serpentine rocks come from the bottom of the ocean (as part of the Franciscan complex).
    - Some key local soil/bedrock types:
        - Wilson grove (Sebastopol) porous sandstone, stores groundwater well
        - Sonoma Volcanics (Santa Rosa plain): volcanic rocks only stores groundwater in cracks
        - Petaluma Formation is fine-grained clay; stores groundwater water poorly
- Laguna watershed:
    - Wettest and rainiest: Sonoma Mountain (~60")
    - Driest: Cotati (~29-30") and Downtown Santa Rosa
    - Water in the upper watershed is mostly taken up by Mark West and Santa Rosa Creek sub- watersheds
- Giant bedrocks are constantly being broken into smaller rocks and moved down streams.
- At times of high flow, water can pick up all sizes of sediment. As the water slows down, larger sediments drop out.
- Stokes Law relating to sediment transport:
    - Big heavy things are harder to move that small light things
    - As water slows, items are sorted by size (cobble → clay)
- Alluvial fans are half-conical fan-shaped piles of rocks and soil at the base of mountains. Water moves quickly out of mountains and drops the big stuff first, then finer and finer grain as you move out.
    - They are dynamic systems. Channels block other channels and water jumps over thus creating braided systems.
    - At the base of the Mayacamas there are coarse-grained alluvial fan deposits.
    - Further out are the finer grains.
        - Vernal pools were created from the way the water slows down and deposits those super fine sediments.
- Once water gets to the Laguna from the creeks, water really slows and drops its sediment load.
- Historically, sediment dammed the Laguna to create seasonal lakes.

    - Lake Ballard associated with Mark West Creek
    - Lake Sebring associated with Santa Rosa Creek
- The 1917 soils map shows that Santa Rosa Creek sub watershed moved a lot of sediment far to the west. Where it met the Laguna there was a lot of associated marsh land
- Historically, the Laguna did not reach the Russian River in summer.
- From hydrograph data recorded in a December 2014 storm we see that in periods of high flow, water flows "backward" from the Russian River back into the Laguna.

Plant Communities: From a watershed perspective, there is a mosaic of different ecosystems including emergent wetlands, floodplain, meadow, cottonwood & willow forest, mixed riparian forest & oak woodland. Disturbance to ecosystems can and has created succession within the watershed. Examples of disturbance include: volcanic eruptions, earthquakes, wildfire, severe infestations of insects, disease, harvesting of forests, pollution, etc.

- Successional series:
    - Uplands
        - Grassland to Chaparral to Oak/Madrone forest to Douglas fir forest
    - Wetlands
        - Emergent marsh (rushes, sedges, small seeded plants) to Floodplain meadow to Cottonwood/willow forest to Mixed riparian forest (ash trees) to Oak woodlands
- Native Americans introduced disturbances (mainly fire) to maintain resource-rich habitats.

Water Management

In the early 1960's & 70's the population of Sonoma county took off! Everyone needs clean drinking water, something to do with waste and protection from flooding.

    - History 1800s-1960s:
        - Channelization of creeks & the Laguna for flood control & reduction of flooding impacts in farms, neighborhoods and businesses
        - Diversions and dams to maintain water supply
        - Sewage treated with chlorine and deposited into holding ponds near the Laguna. Every year the Laguna came up and washed the sewage downstream. That system became less and less viable as the population grew.
            - Sebastopol wastewater ponds and the dump were located where Sebastopol's Laguna Wetland Preserve is today.
    - In late 1960s, ecological disasters sparked public interest in clean environments
        - In 1972, Department of Fish and Game determined that the Laguna was "virtually devoid of aquatic life."

        - Also in 1972 the Clean Water Act was instituted, establishing the basic structure for regulating discharges of pollutants into the waters and regulating quality standards for surface waters
    - Current management
        - The Sonoma County Water Agency supplies water to the populace from Eel River through a complex system of aqueducts & collection from the Russian River basin
        - Wastewater is processed by Laguna Treatment Plant, the treated/recycled water is then:
            - sent to the Geysers to generate power (~2/3)
            - Used for irrigation (~1/3)
            - In rare overflow periods, some treated wastewater is released into the Laguna
        - Wide variation in annual water availability based on amount how much water comes into the system via precipitation and the amount "lost" to evapotranspiration (the sum of evaporation and plant transpiration from the Earth's land and ocean surface to the atmosphere.)
        - Land use effects: Comparing 1974 to 2012, we're irrigating agriculture a lot more and we have "roofed" and paved over a large part of the watershed.
            - Paved over land = impervious surface
                - Precipitation and surface water cannot infiltrate into ground water
            - Result is more flooding and less recharge of stream flow and groundwater
            - Now the message is SLOW IT, SPREAD IT, SINK IT to help recharge groundwater, especially in creeks
        - Trapezoidal, straightened & channelized waterways:
            - These channels lack disturbances that create variety of habitats/succession stages
            - Many such channels have been refurbished and planted as oak woodlands for public use with trees for shade and still moves water quickly but is that restoration?
                - Not really because the system is not self-sustaining.
                    - Requires tree maintenance: maintaining even spacing and appropriate species mix, limbing up, etc.
            - Can serve as migration corridor but NOT spawning habitat for salmonids

        - Because we need protection from flooding, Santa Rosa Creek cannot be allowed to return to natural meandering state. We still need to funnel water quickly across Santa Rosa plain
- **Not all water channels are controlled by the Water Agency, many channels are open for restoration projects that might foster more natural characteristics, including:**
    - Meanders
    - Variety of succession stages