Rebuttal to Patten Report and Long Now Foundation Report

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Rebuttal to Patten Report and Long Now Foundation Report

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Pertaining to:
Groundwater Applications 54003 through 54021 in
Spring Valley
and
Groundwater Applications 53987 through 53992 in
Cave, Dry Lake, and Delamar Valleys

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Rebuttal to Patten Report and Long Now Foundation Report

The general theme of Duncan Patten's report, "Comments on Effects of Proposed Groundwater Withdrawal in Eastern Nevada on Desert Springs and Associated Ecosystems" (GBWN Exhibit No. 057) ("Patten's Report"), is that groundwater withdrawal can cause detrimental impacts to desert springs and associated ecosystems, that it has at some locations at some times in the past caused detrimental impacts, and therefore groundwater withdrawal in the future will cause detrimental impacts. In sum, Patten's Report suggests that if something can happen, it surely will happen, even if good science suggests otherwise. Patten relies on projections from Myers (2011) regarding potential changes in depth to water (DTW), but in most cases Patten comes to the conclusion that there will be detrimental impacts without quantifying how much of a change in DTW is sufficient to cause a change in vegetation.

Patten's Report, and the article he co-authored, *Isolated spring wetlands in the Great Basin and Mojave Deserts, USA: Potential response of vegetation to groundwater withdrawal* (GBWN Exhibit No. 059) ("Patten's Article"),[1] from which much of Patten's Report was culled, contains incorrect ecological statements. The most common of these are incorrect statements about distribution patterns of certain plant species in relation to depth to groundwater and to salinity, root depths of major species, and certain soil conditions. These incorrect ecological statements could mislead a reader regarding whether certain species exist within Spring Valley as well as whether these species' rooting depth makes them susceptible to change based on a change in DTW.

Patten's Report and Patten's Article make valid, general statements but then speculate as to their application. For example, Patten's Report makes the valid general statement that wetland vegetation is dependent on its water supply. However, he speculates that if groundwater withdrawal occurs, the water supply to wetlands will be impacted and vegetation will change without quantifying how much of a change in water supply would be required to cause the speculated change in vegetation. Similarly, Patten's Article states, "At the peak of withdrawal the water table at Devil's Hole dropped from 0.42 to 1.12 m while other wells declined 0.1 to 0.2 m." He does not indicate how much pumping took place, he does not discuss the vegetation effects, and he does not reveal how the unspecified amount of pumping compares to that proposed for Spring Valley.

Wetland Indicator Score (WIS)

The WIS model is part of Patten's Report and Patten's Article. Species are scored on the basis of their presumed wetland status, with obligate wetland species given a score of 1 and upland species a score of 5. Sites are then sampled and the scores of the species present tallied and a mean score calculated. The lower the mean score, the more the site is likely to be a wetland and the higher the score the more likely the site is an upland. The major weaknesses in the approach are (1) arbitrariness in assigning

1. Patten, Duncan T., Leigh Rouse, and Juliet C. Stromberg, *Isolated spring wetlands in the Great Basin and Mojave Deserts, USA: Potential response of vegetation to groundwater withdrawal*, Environmental Management 41:398-413 (2008).

the indicator scores to each species, (2) sampling sufficient sites to get a representative sample, and (3) properly weighting the species sampled.

Patten sampled three sites: one in Spring Valley, one at Ash Meadows, and one in Lake Mead National Recreation Area. He does not indicate how many transects he ran to get species data. He only states "several" were run. He does not indicate whether he obtained a statistically or biologically adequate sample. It is also unclear whether he ran comparisons with data from other similar studies, as is the standard practice among ecologists.

Notably, the WIS formula as applied on Page 11 of Patten's Report has an r^2 value of 0.43, meaning that the majority (57%) of the variation in distribution of species is not a function of water table depth. This then is similar to other studies finding that precipitation and/or land use may be more significant factors than DTW in controlling changes in vegetation. Patten's Report at Page 7 recognizes the importance of land use as a factor when Patten discusses perforation of the impermeable clay layer by cattle hooves at Rose Spring.

Based on his data, Patten projects that temporal changes in DTW resulting from groundwater withdrawal will have similar impacts on the vegetation as his sampled spatial changes along the transects he sampled. The substitution of spatial differences for temporal changes is an ongoing controversy in plant ecology.

Incorrect Ecological Data

In the Patten Report, there are numerous factual errors. Among them:

Page 10, Figure 1 of Patten's Report, shows *Sporobolus airoides* (alkali sacaton) to be typical of the wetland/upland transition but *Distichlis spicata* (saltgrass), *Chrysothamnus nauseosus* (rabbitbrush), and *Sarcobatus vermiculatus* (greasewood) to be typical of the uplands. On Page 11 of Patten's Report, Patten again indicates that alkali sacaton is more of a wetland species than saltgrass.

- *Sporobolus airoides* (alkali sacaton) is typical of drier conditions (dry meadows to uplands), while *Distichlis spicata* (saltgrass) typically occurs in areas where DTW is 1 to 2 meters, and *Chrysothamnus nauseosus* (rabbitbrush) and *Sarcobatus vermiculatus* (greasewood) are more typical of areas where DTW is 1 to 4 meters.

On Page 12, Table 2 of Patten's Report, Patten includes *Descurainia sophia* (flixweed tansymustard) as a typical upland species.

- *Descurainia sophia* (tansymustard) is an early-seral species and is found throughout the western United States on disturbed sites without regard to DTW (except not where standing water is present).

On Page 12, Table 2, Patten's Report has (1) sacaton a more wetland species than saltgrass, (2) the only three upland herbaceous species as saltgrass, *Descurainia sophia* (flixweed tansymustard), and *Lappula redowskii* (stickseed), and (3) big sagebrush as more of a wetland species than either rabbitbrush or greasewood.

- (1) Instead, saltgrass is more of a wetland species than sacaton.

- (2) Saltgrass is a meadow species, not an upland species. *Descurainia sophia* (flixweed tansymustard) and *Lappula redowskii* (stickseed) are early-successional species that indicate disturbance. In undisturbed upland areas one would expect to see greater diversity of perennial herbaceous species.

- (3) Rabbitbrush and greasewood are more of an intermediate (between meadows and dry uplands) species than big sagebrush, which is an upland species.

On Page 7 of Patten's Report, he states, "Woody species are limited and may include Woods Rose (*Rosa woodsii*) and Big Sagebrush (*Artemisia tridentata*). These two species are not phreatophytic nor halophytic but depend on shallow fresh water from the outflow stream."

- Both Woods rose and big sagebrush are phreatophytic. Woods rose is an obligate phreatophyte in these areas, found only where ground-, stream-, or pond-water is available. Big sagebrush is a facultative phreatophyte (Schneegas and Nord 1967; Dileanis and Groeneveld 1989; Smith et al., 1991; Naumburg et al., 2005).

On Page 15 of Patten's Report, Patten seems to imply that halophytes require salts.

- However, most salt-tolerant species generally grow better without salts. Even if they were lost because of lack of salts, they would be replaced by non-halophytes.

In Patten's Article, from which his theories about halophytes in his Report are drawn, Patten states, "Percolation of salts to surface soils may be reduced, eventually altering desert shrub cover from halophytes to nonhalophytes."

- However, percolation is a downward process. The upward movement of soils is by wicking (Foth and Turk, 1972).

In his Report, Patten implies that a caliche layer is a salt layer.

- It is not. Caliche is indurated calcium carbonate (Foth and Turk, 1972).

Owens Valley

Patten makes the following statements about the effects of groundwater pumping in the Owens Valley:

On Page 2 of Patten's Report, he states, "In Owens Valley groundwater pumping near springs resulted in reduced species cover, lower species richness, and shifts from marsh vegetation to more drought tolerant species (Perkins et al., 1984)."

- This can be avoided if wells are not located near springs that are connected to the aquifer from which groundwater is withdrawn or designated for protection under monitoring, management and mitigation plans.

On Page 2 of Patten's Report, he states, "Pumping also caused a decrease in vegetation cover and increase in mortality of phreatophytic shrubs (Sorenson et al., 1991)."

- What Sorenson et al. (1991) stated was, "Greater than average ground-water pumping for in-valley uses and export to the city of Los Angeles during the 1970s, which included two years of low rainfall, may have caused the loss of much of the phreatophytic vegetation around some of the major well fields." There was a decrease in cover because of heavy pumping during a dry period. The impact of pumping on the associated vegetation depends on the type of vegetation, the amount of drawdown, and the rate of drawdown. The purpose of the experimental study by Sorenson et al. (1991) was to test the ability of selected major shrub species to adapt to water-table decline. After three years of monitoring the effects of pumping, they found that (1) change in shrub cover was positively correlated with the magnitude of water-table drawdown at one of their study sites but was negatively correlated with magnitude of water-table drawdown at their other site (i.e., shrub cover increased as often as it decreased when the water-table decreased); (2) during two of the years of the study, shrub cover decreased at all sites, regardless of differences in drawdown; and (3) growth of greasewood was independent of depth of the water table.

On Page 2, Patten writes, "For example, water tables and plant cover in the Owens Valley have fluctuated in tandem, in response to changes in annual groundwater extraction rate and weather patterns (Elmore et al., 2006). Groundwater levels rapidly declined in the Owens Valley in the 1970s, a result of increasing pumping and drought (LADWP/Inyo County, 1990), causing mortality of phreatophytic vegetation. In the 1980s, groundwater levels rose, a result of increased recharge owing to wet weather and decreased pumping because of lower water demand (Schultz, 2001)."

- The statement that "water tables and plant cover in the Owens Valley have fluctuated in tandem" is misleading. In the Owens Valley, the relationship between depth to groundwater and vegetation cover is inconsistent and is dependent on species, location, precipitation received, and the amount of change in depth to groundwater.

- Patten does not acknowledge what has happened since the 1980s. Pumping was reduced in the 1990s and precipitation and runoff also increased. In response, vegetation cover increased. Pumping has occurred since the early 1990s and vegetation cover has remained high.

- Patten equates pumping with low vegetation cover. Pumping does not categorically result in low vegetation cover. The effect of pumping on cover and composition depends upon how much drawdown occurs over what period of time.

On Page 3 of Patten's Report, he states, "Naumburg et al. (2005) demonstrated the importance of water table fluctuations in conjunction with soil texture on productivity of several desert spring herbaceous species."

- The article, of which I was a co-author, did not demonstrate the importance of water table fluctuations on productivity of spring herbaceous species. The article addressed four species, two shrubs and two grasses, none of which were "spring" species (Figure 4, p. 735).

- Specifically, our research (using the EDYS model) showed that (1) DTW = 4 m resulted in lower productivity than DTW = 1 m, but that all species except saltgrass remained productive; (2) fluctuating DTW was sometimes more detrimental than a constant 4 m DTW; and (3) the effects were species- and soil texture-dependent.

Long Now Foundation Report

The Long Now Foundation submittals (LONG Exhibit Nos. 001-004) attempt to compare a large lake in the Owens Valley to smaller playas in Spring Valley. Spring Valley contains two playas, which are ephemeral in nature and hold water only part of the year. Thus, they are too dry for wetland species once they dry out, and too wet for dry-site species when they contain water. No perennial plants can establish under both of these conditions. The Owens Valley is distinguishable. The Owens Valley has a dry lake, which is a dry lakebed not a playa. Below the lakebed surface, at depths of only 0.5 to 1.0 m at many locations, is hyper-saline groundwater, and near the center of the lakebed is a brine pool. These highly saline conditions prevent the establishment of perennial vegetation in many areas of the lakebed. The salts move upward by capillarity (wicking) forming salt crusts on the surface. As these crusts dry out, they are susceptible to wind erosion. The same factual situation does not exist in Spring Valley that exists in the Owens Valley, therefore, any suggestion that the dust problems in the Owens Valley would be replicated in Spring Valley should be disregarded.

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