

A stone arch bridge with three visible arches spans a river. The banks are heavily vegetated with tall green reeds and other plants. The sky is clear and blue.

# **Seasonal Activity and Impacts of *Arundo donax***

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# *Arundo donax* Biology

- Family: *Poaceae*
- $C_3$  Metabolism (Rossa et al. 1998)
- Deep rooting pattern (Sher et al. 2002)
- Vegetative reproduction
  - produces flowers, but no viable seeds have been found in California



# *Arundo donax* Impacts

- Invasive (CalEPPC, HEAR, NPS)
- Found in riparian zones
  - Forms monocultures
  - Displaces native species (Zemba 1990)
  - Utilizes large amounts of water (Enright 2000, Iverson 1993)
  - Alters fire cycle (Flack & Benton 1998)
  - Can cause damage to roads and bridges



# What are the seasonal trends in the activity and impacts of *A. donax*?

## Common Garden Experiment:

-Determine the seasonal photosynthetic activity of *A. donax*.

## Field Survey:

- Determine what aspects of the abiotic (nonliving) environment are altered by the presence of *A. donax*.

# Common Garden Experiment

- Plants originate from a statewide collection
- Rhizome samples weighed, cleaned, and planted in a randomized complete block design
- Grown until mature, then used for monthly photosynthetic measurements
  - IRGA – stomatal conductance, CO<sub>2</sub> assimilation rate, light levels
- Temperature data
- Water use efficiency, photosynthetic rate

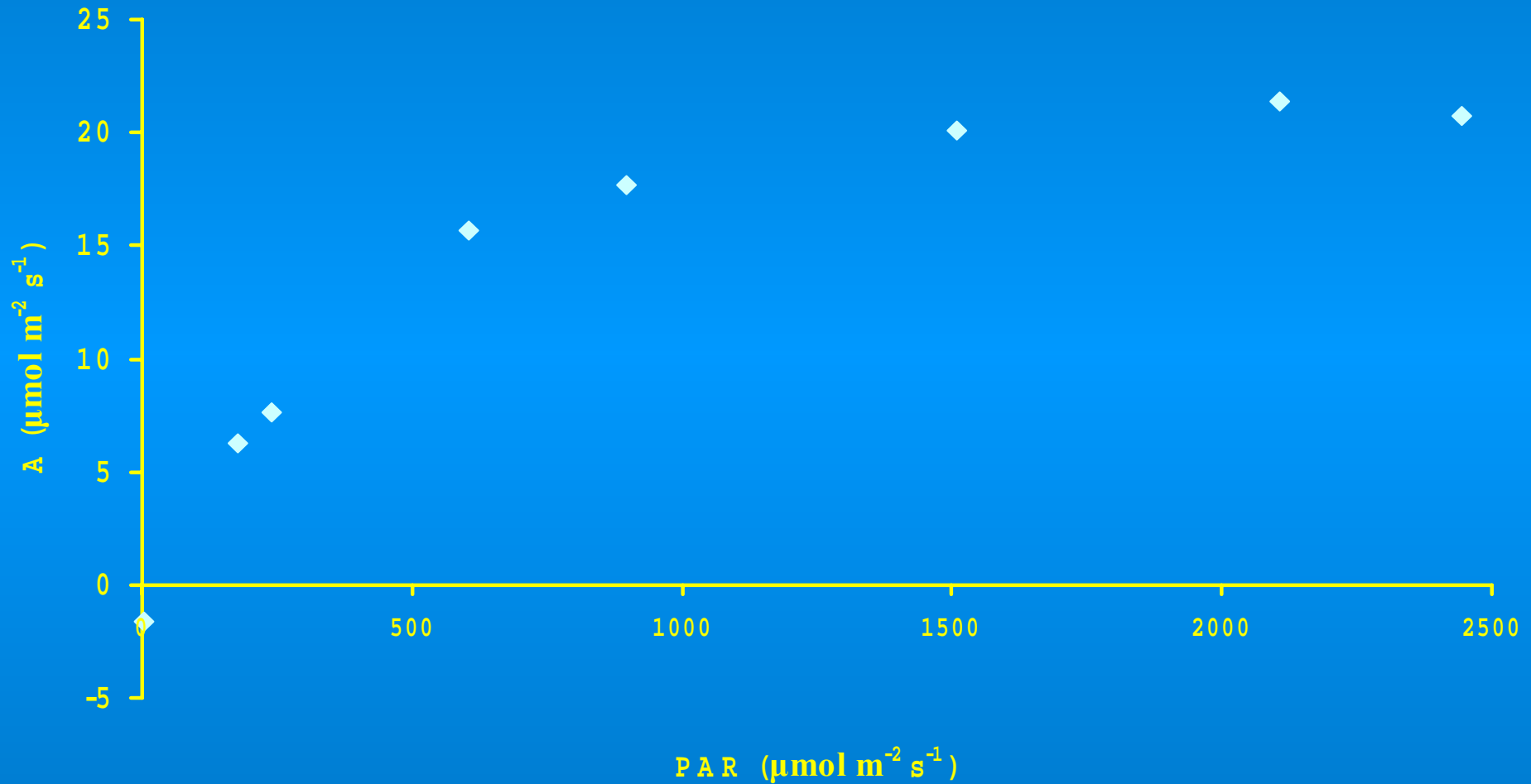


# Fluctuations in the Photosynthetic Rate of *A. donax*

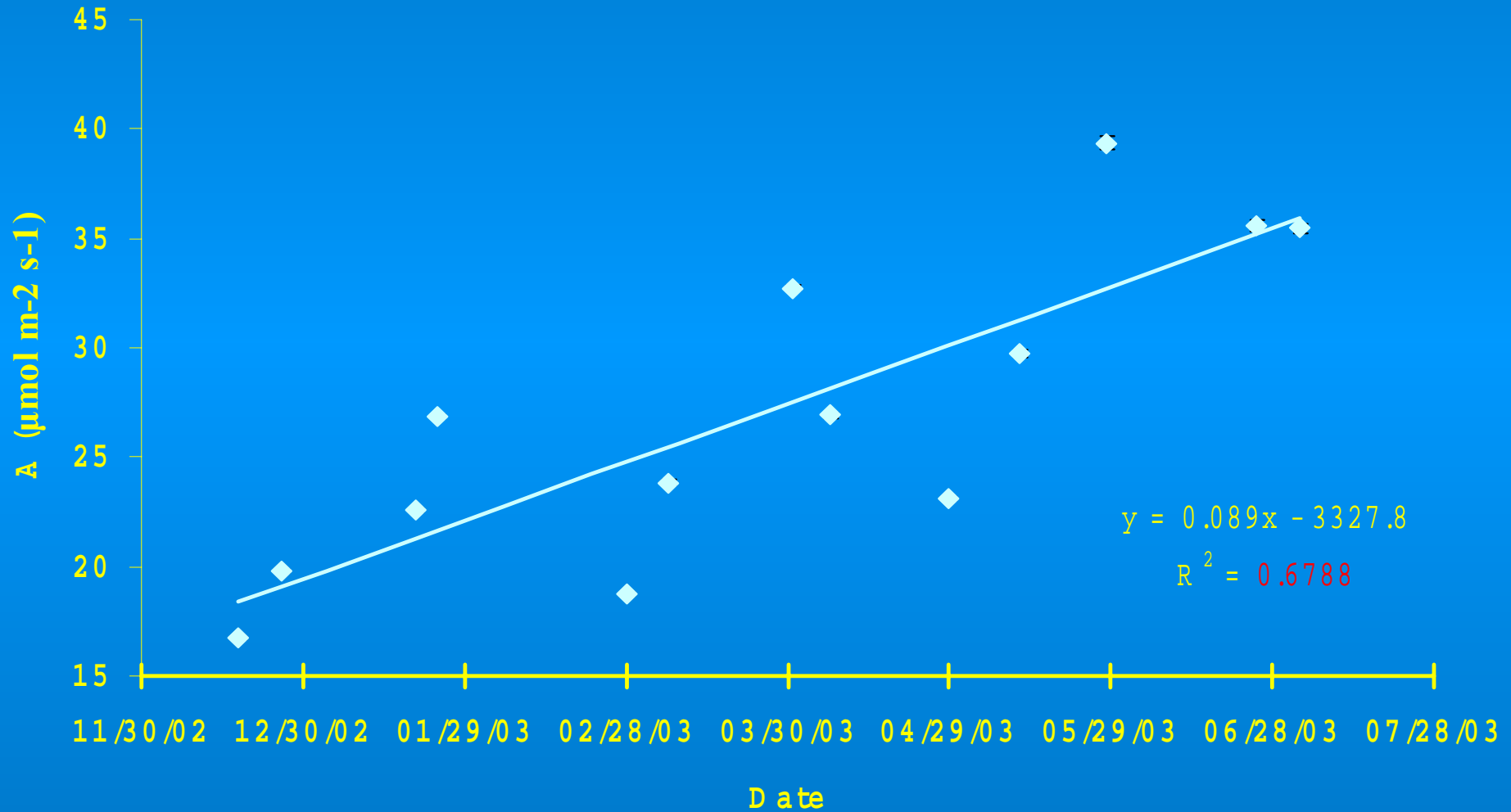
- There is a strong positive correlation ( $R^2 = 0.8446$ ) between the low temperature on a day and the average photosynthetic rate.
  - Weaker correlations between:
    - high temperature on a day and the average photosynthetic rate
      - $R^2 = 0.7884$
    - date and the average photosynthetic rate
      - $R^2 = 0.6788$
    - light levels and the average photosynthetic rate
      - $R^2 < 0.0001$

# Carbon assimilation rate vs Light intensity

9/2002

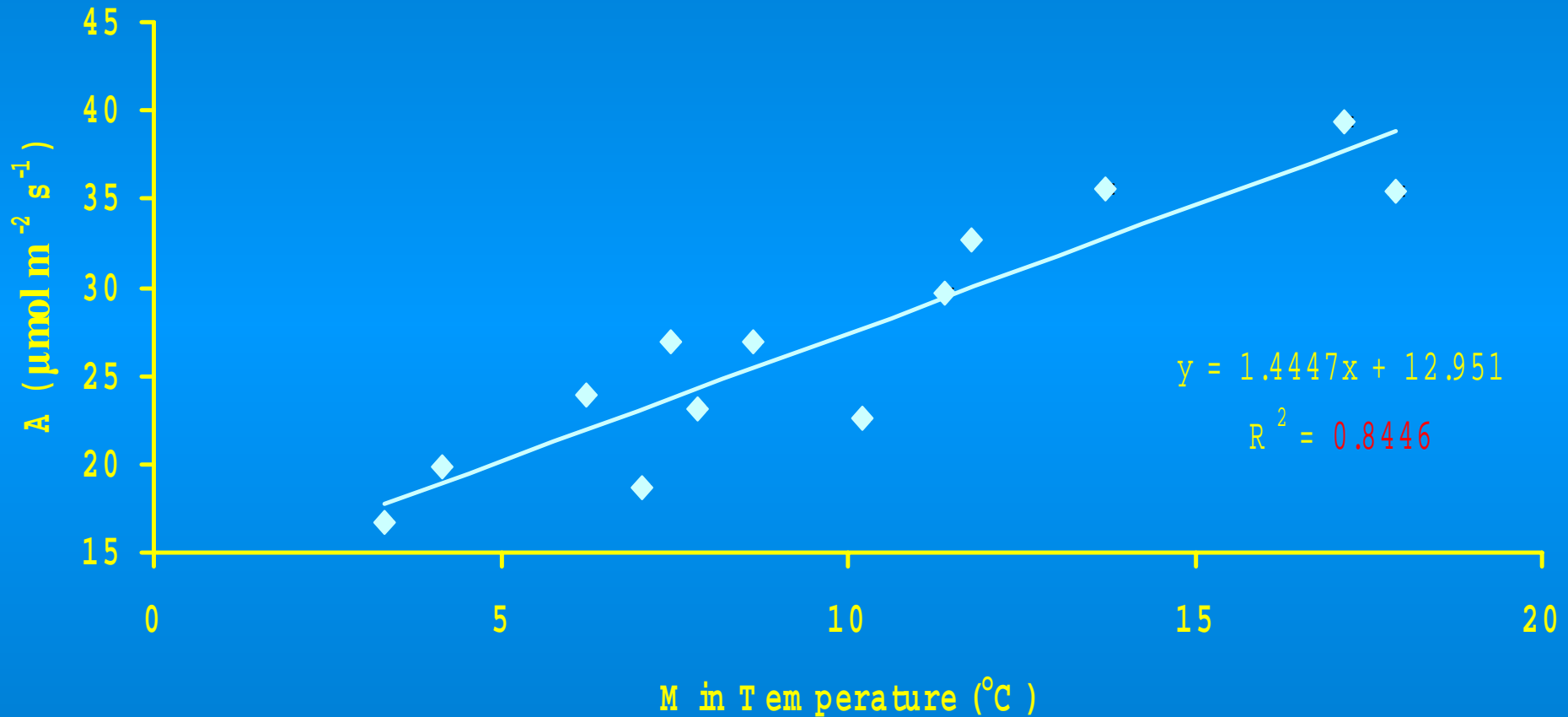


# Date vs Carbon Assimilation (12/18/2003 - 07/03/2003)





# Minimum temperature vs average carbon assimilation rate (12-18-2002 to 7-03-2003)



Under ideal conditions:

Maize  $\sim 26 \mu\text{mol m}^{-2} \text{s}^{-1}$

Wheat  $\sim 8.5 \mu\text{mol m}^{-2} \text{s}^{-1}$  (Lewis et al. 1989)

# What are the seasonal trends in the activity and impacts of *A. donax*?

## Common Garden Experiment:

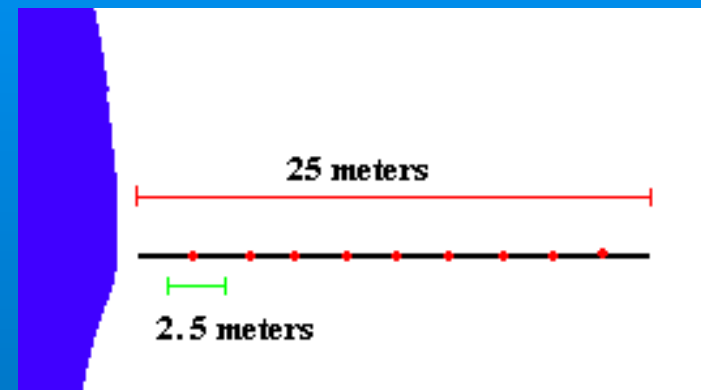
-Determine the seasonal photosynthetic activity of *A. donax*.

## Field Survey:

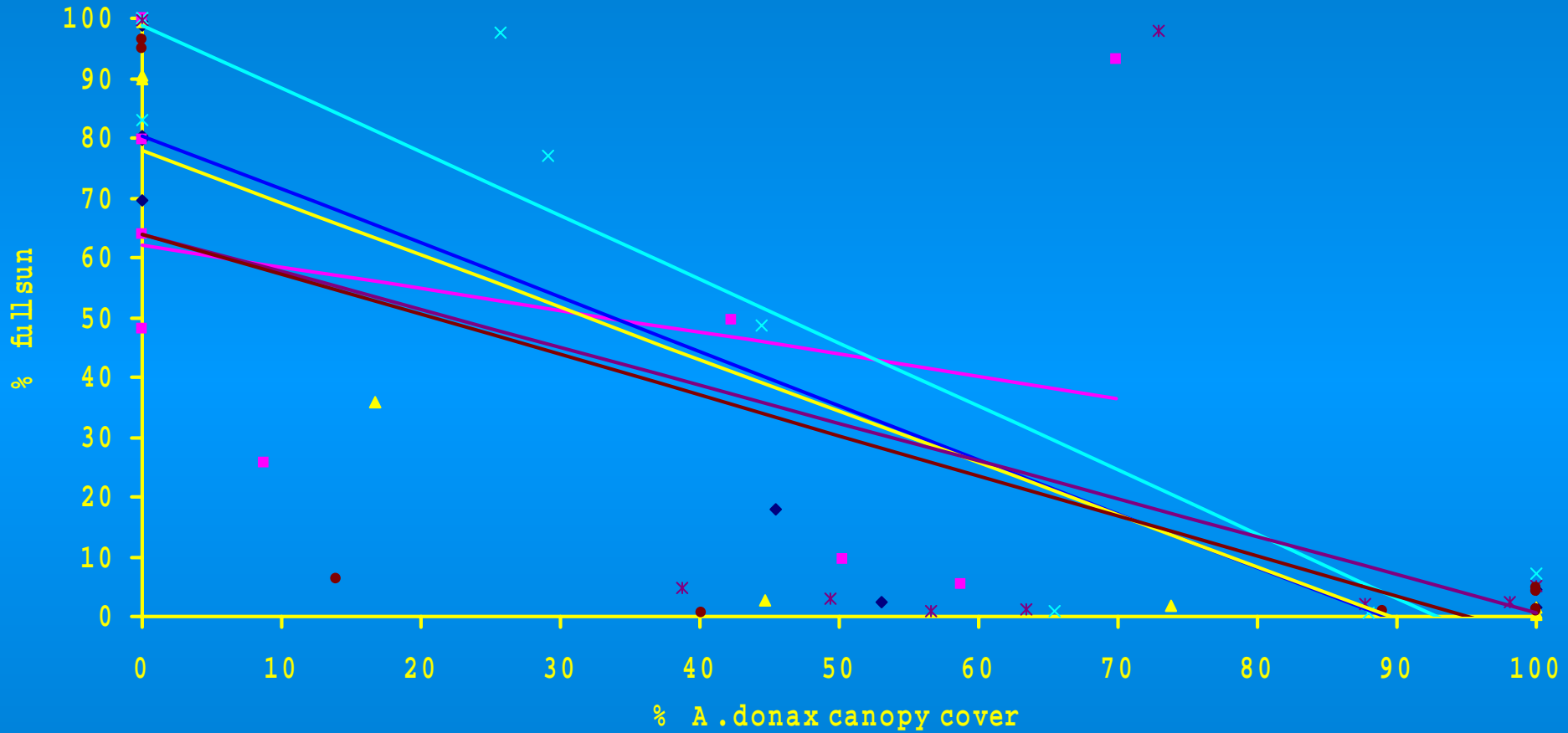
-Determine what aspects of the abiotic (nonliving) environment are altered by the presence of *A. donax*.

# Alteration of sites due to the presence of *A. donax*

- 2 sites on different watersheds
- 6 transects at each site (25 m)
- Species cover
- Measurements (every 2.5 m)
  - Soil moisture
  - Soil temperature
  - Light (PAR) levels
  - Soil nitrogen

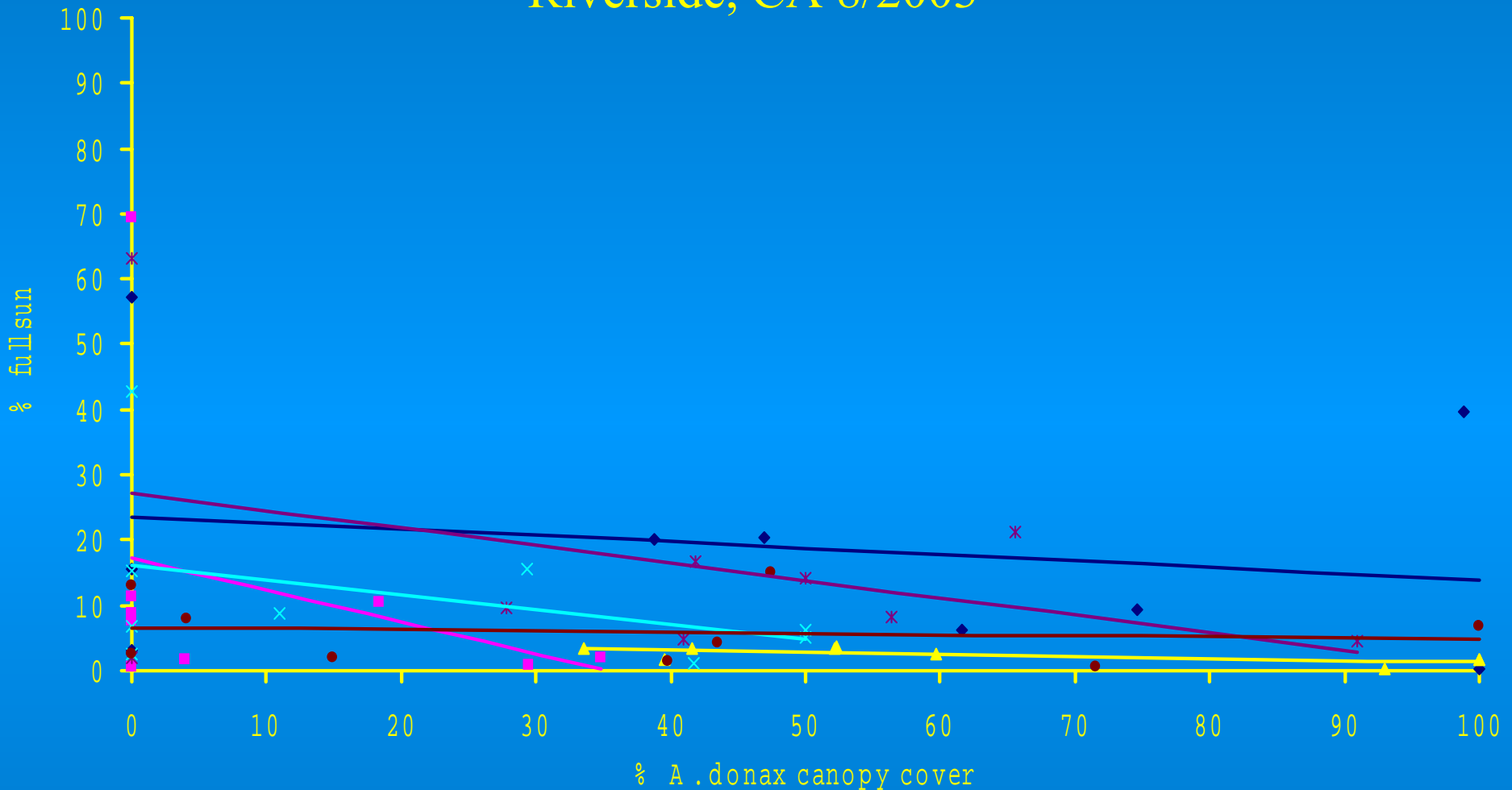


# Percent *A. donax* cover vs Percent full sun at 1.5m above soil level Oceanside, CA 8/2003



◆ 0 cn1	■ 0 cn2	▲ 0 cn3	× 0 cn4	× 0 cn5	● 0 cn6
$y = -0.903x + 80.404$	$y = -0.3666x + 62.131$	$y = -0.8689x + 77.788$	$y = -1.0639x + 98.912$	$y = -0.6334x + 63.971$	$y = -0.6725x + 63.88$
$R^2 = 0.8295$	$R^2 = 0.096$	$R^2 = 0.7922$	$R^2 = 0.8658$	$R^2 = 0.2263$	$R^2 = 0.5671$

# Percent *A. donax* cover vs Percent full sun at 1.5 m above soil level Riverside, CA 8/2003

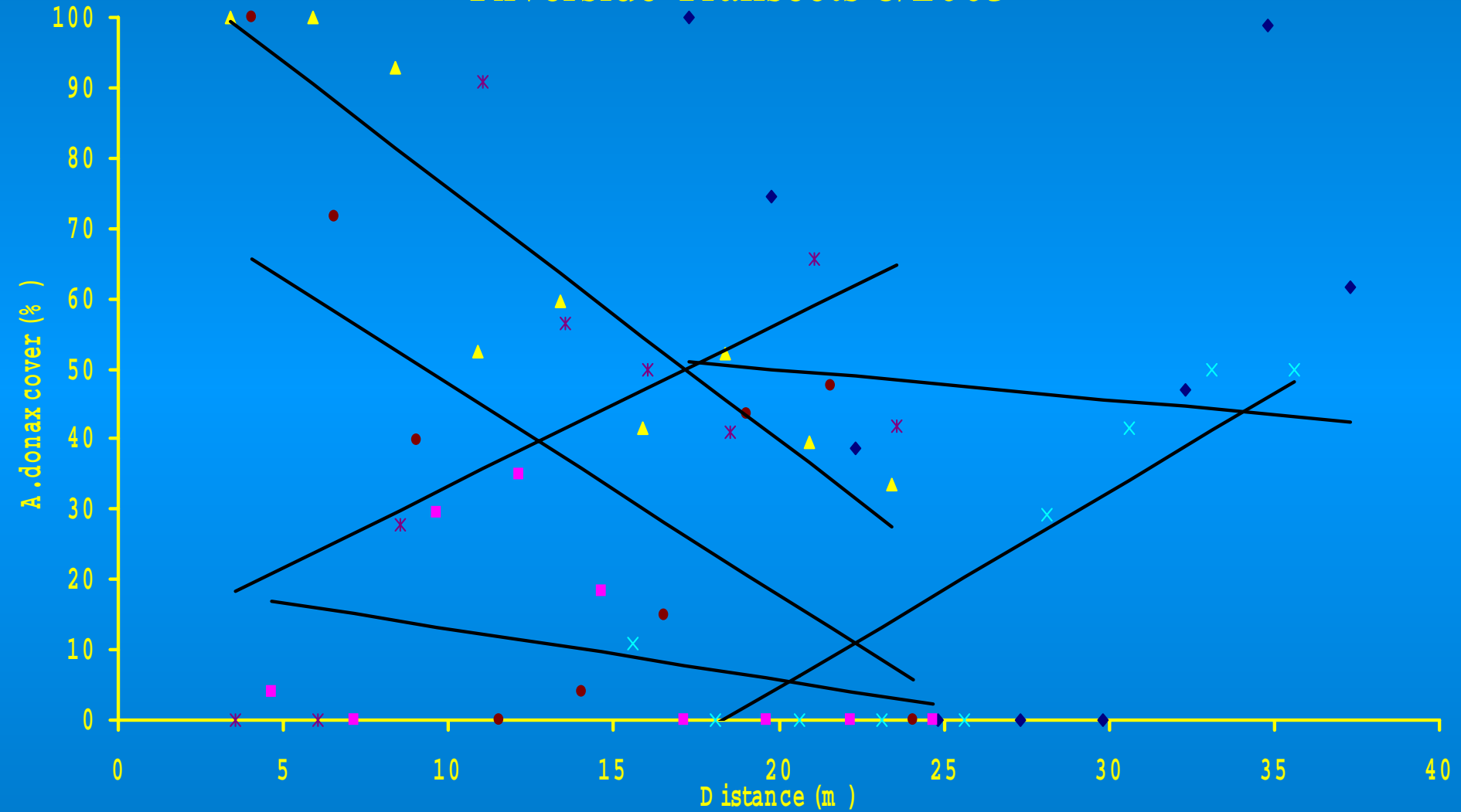


Series	Regression Equation	$R^2$
R iv1	$y = -0.0972x + 23.641$	0.0449
R iv2	$y = -0.49x + 17.259$	0.102
R iv3	$y = -0.0308x + 4.3799$	0.5297
R iv4	$y = -0.2301x + 16.223$	0.1663
R iv5	$y = -0.2671x + 27.185$	0.1764
R iv6	$y = -0.0179x + 6.5994$	0.0144

# Preliminary Results

- Data collected 6/2003 – 9/2003
- No strong correlations found between % *A. donax* cover and:
  - Soil nitrogen ( $\text{NH}_4$  and  $\text{NO}_3$ ) levels
  - Soil moisture
  - Soil temperature
  - Light levels
  - Distance from water's edge

# Distance from the water's edge vs Percent *A. donax* Riverside Transects 8/2003



# Preliminary Conclusions

- Through the summer months, *A. donax* does not strongly alter the nitrogen, moisture, or temperature of the soil in which it is found.
  - The lack of strong correlations could be the result of the interactions of the diverse species found at the two sites
- *A. donax* appears able to establish in any location at which it is introduced, regardless of distance from the water.



# Other Experiments

- Characterize the relative effects of nitrogen availability on the growth of *A. donax* and native riparian species.
- Characterize the effects of shade on the growth and photosynthetic rates of two native riparian species.

# Applications of this work

- Add to the growing knowledge of the physiology of *A. donax*.
- Contribute to the understanding of how native riparian species perform with comparison to and in the presence of *A. donax*.
- Be useful in timing the treatment of *A. donax* and planting of native species.

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