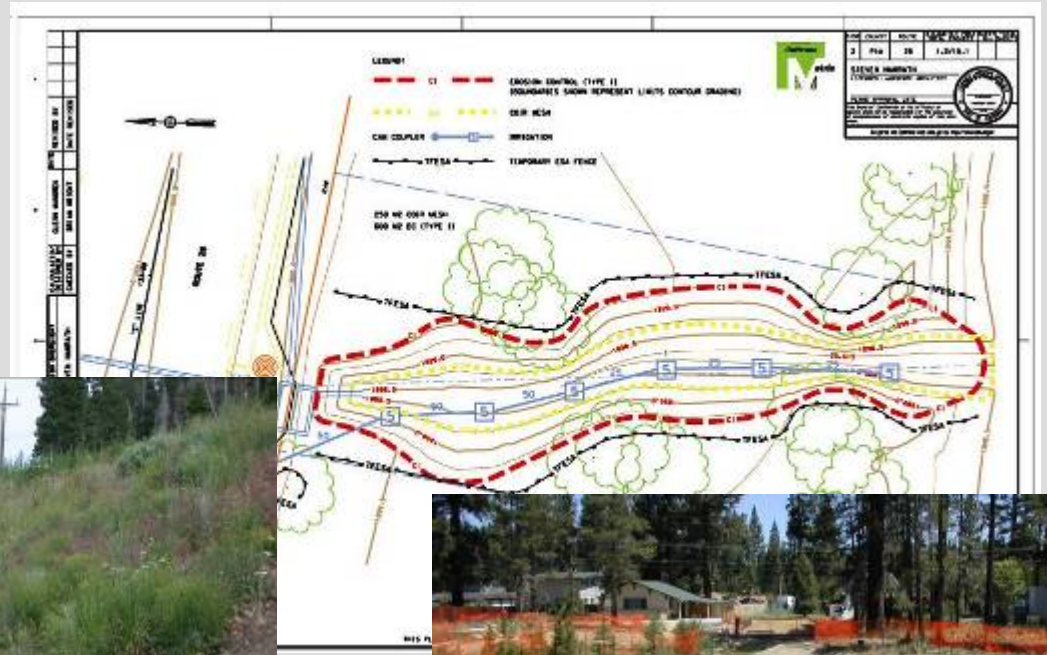
Case Study-PLA 267 Brockway Summit

Improving Roadside Revegetation With Soil Treatments



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CALTRANS North Region Office of Landscape Architecture

Improving Roadside Revegetation with Soil Treatments

OVERVIEW

1. Goals of program
2. Research
3. Treatment
4. Results
5. Benefits
6. Application/Recommendations
7. Unit Synergy

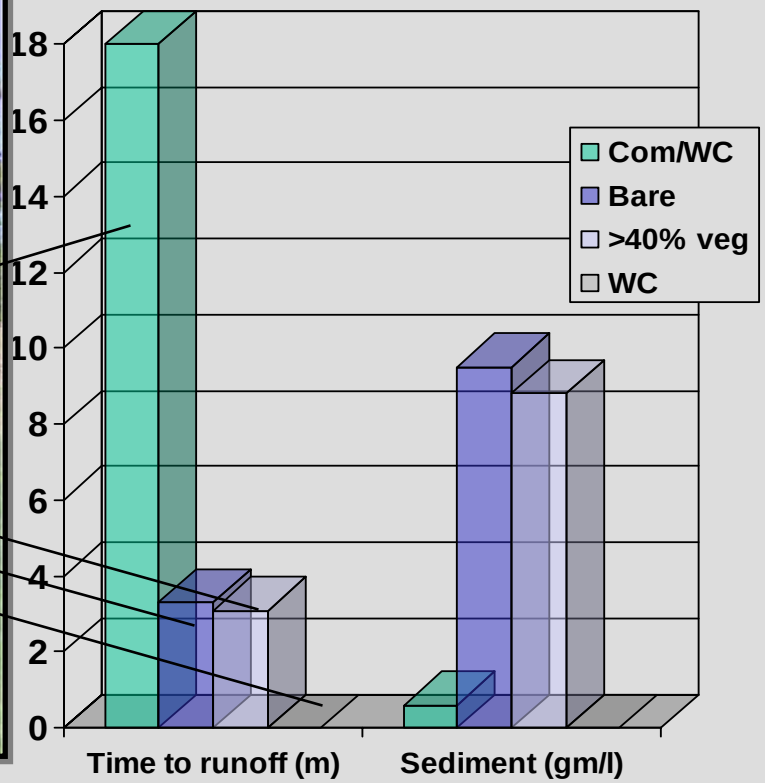
Goals of program

- Reduce erosion
- Establish vegetative cover
- Meet regulatory requirements
- Increase knowledge with each project
- Transfer knowledge to other users

Revegetation/Erosion Control Problems Encountered

- Vegetative cover not meeting expectations
  - Erosion control/storm water goals or regulatory requirements
  - Revegetation
  - Esthetic
- Poor vegetation establishment
- Good initial growth, then declines
- Questionable infiltration/erosion control
- Failures

Are we confusing vegetation with erosion control?



Improving Revegetation with Soil Treatments

Myers Erosion Control Project -ED 50

Observations:

- Excellent initial germination of seed species
- Difficult to dig holes for container plants
- Low water holding capacity in soil
- Low nutrients/organic matter

Observations:

- Spacing reflects low water holding capacity in soil
- Slow woody plant growth, not vigorous
- Early dormancy of grass and forb species
- Drought stress in woody plants earlier in dry season


Why did this slope fail?
Vegetation? Soil?

Research Findings-Factors Limiting Growth

- Water infiltration
- Water holding capacity
- Rooting depth
- Soil nutrients
- Soil organic matter

Improving Roadside Revegetation with Soil Treatments

GOALS AND OBJECTIVES

Goals

- Soil regeneration and Long-Term Sustainable Revegetation
- Improve Water Quality by Reducing Erosion and Improving Infiltration
- Maintain slope integrity

Objectives

- Stabilize and Vegetate Slopes
- Introduce Nutrients to sterile soils
- Improve Infiltration
- Increase Water Holding Capacity
- Introduce Microbial Activity, Nutrient Cycling and Fungi to Disturbed Soils
- Promote Deeper Rooting Depth for Plants
- Improve Conditions for Native Plants that Exclude Invasive Weed Species

Improving Roadside Revegetation with Soil Treatments

Regulatory Requirements- Tahoe Basin

Lake Tahoe 303d Listed Water Body for Sediment

Lahontan Regional Water Quality Control Board

(401 Permit)

- Non-point source pollution (slopes and other disturbed soil areas must be revegetated)
- Mitigate impacted sensitive habitats (wetlands and jurisdictional waters mitigation)

Tahoe Regional Planning Agency

(TRPA Permit)

- Must meet "Scenic" threshold requirements (improve corridor and lake view scenic quality)
- Must meet "Water Quality" threshold requirements

  (Any new "Hardcover" must be offset by revegetation of "Soft Cover" areas)

  (Impacts to "Stream Environment Zones" or SEZ must be revegetated to pre-construction conditions)

Improving Roadside Revegetation with Soil Treatments

Treatment – PLA 267 Brockway Summit

Site Conditions

- High elevation conditions
- Soils are Lahar (slurry when wet, hard pack when dry)
- 2:1-1 ½:1 slopes- working on new cut slopes, into older fill slopes.

Soil Treatment

- Application of unprocessed compost on soil surface of finished grade
- Compost Type- 100% Fines (50% Humic Fines/50% Wood Overs)
- Compost Depth- 4” (100 mm) or 525yd^3/acre
- Incorporation Depth- 12-18” (300-450mm) minimum 12 inches
- Application of EC Type D- Seed, fertilizer, mulch (pine needle) and tack
- Pine needle mulch 1-inch or 25-mm thick


6.88


CAT
CAT
312

Seed, Fertilizer, Mulch (pine needle) and Tack

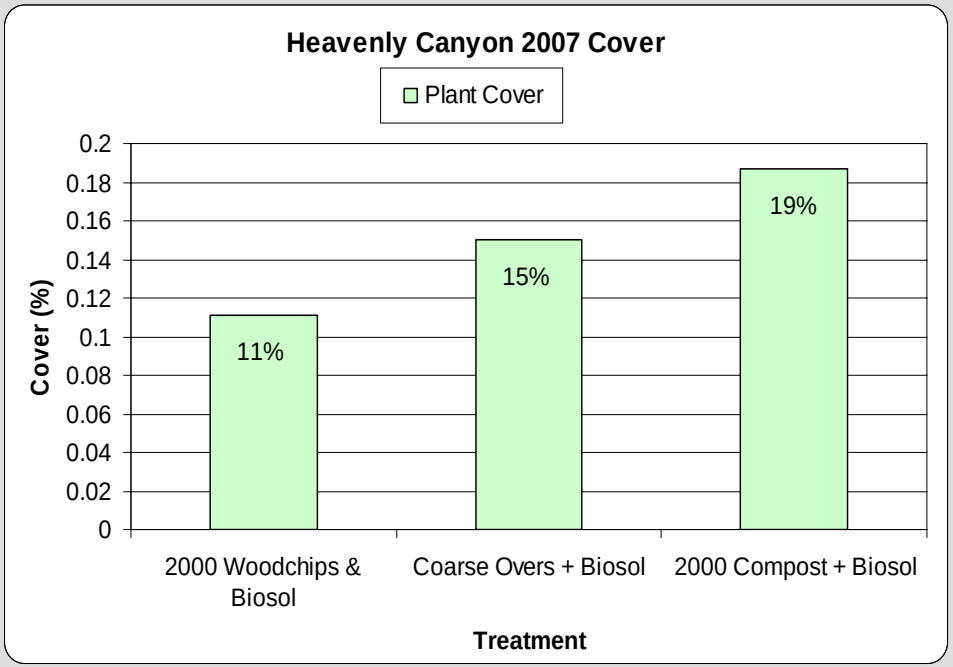
Improving Roadside Revegetation with Soil Treatments

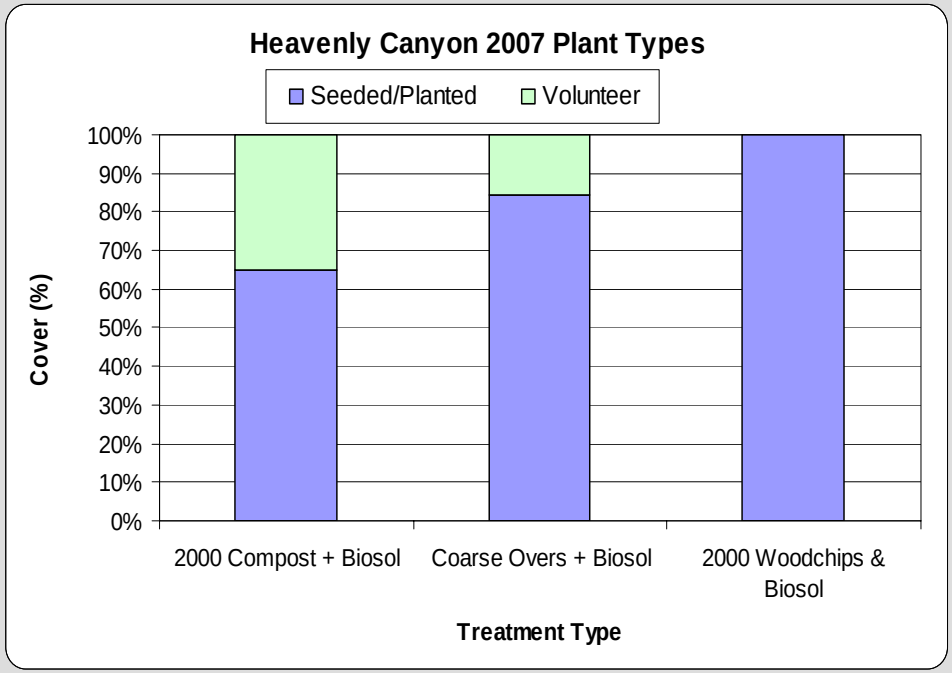
Brockway Summit Project 2004

Summary of Monitoring Results

Restoration methods that loosened the soil to at least 12 inches and incorporated ***coarse*** organic material to that depth, had the greatest increase in onsite infiltration, the largest decrease in sediment yield and the highest cover by native perennial bunch grasses, when compared to surface treatments on cut and fill slopes.

Compost and vegetation trends

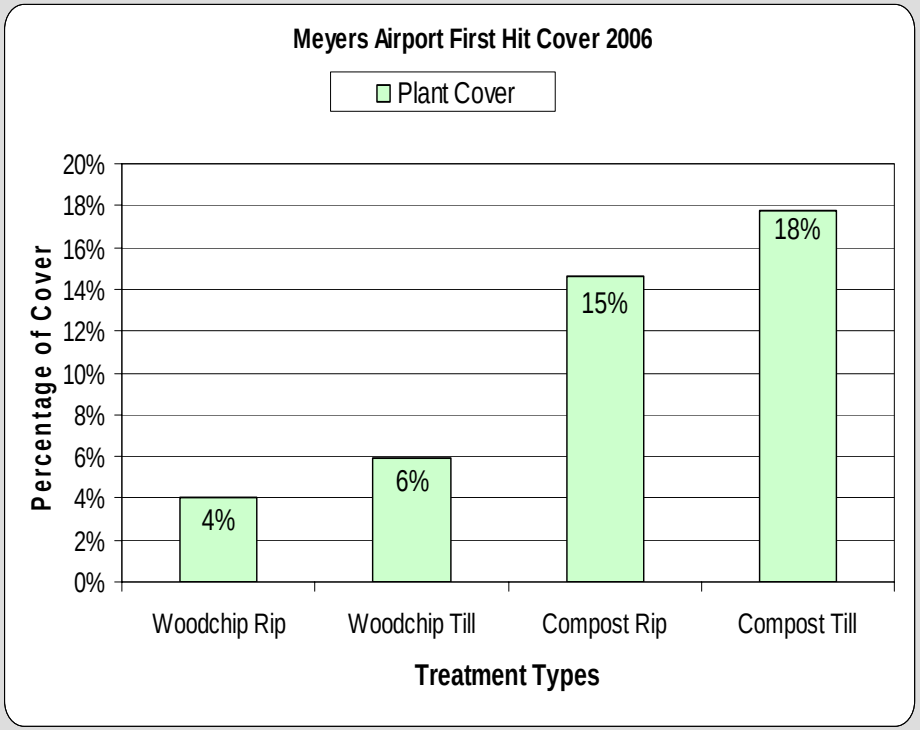


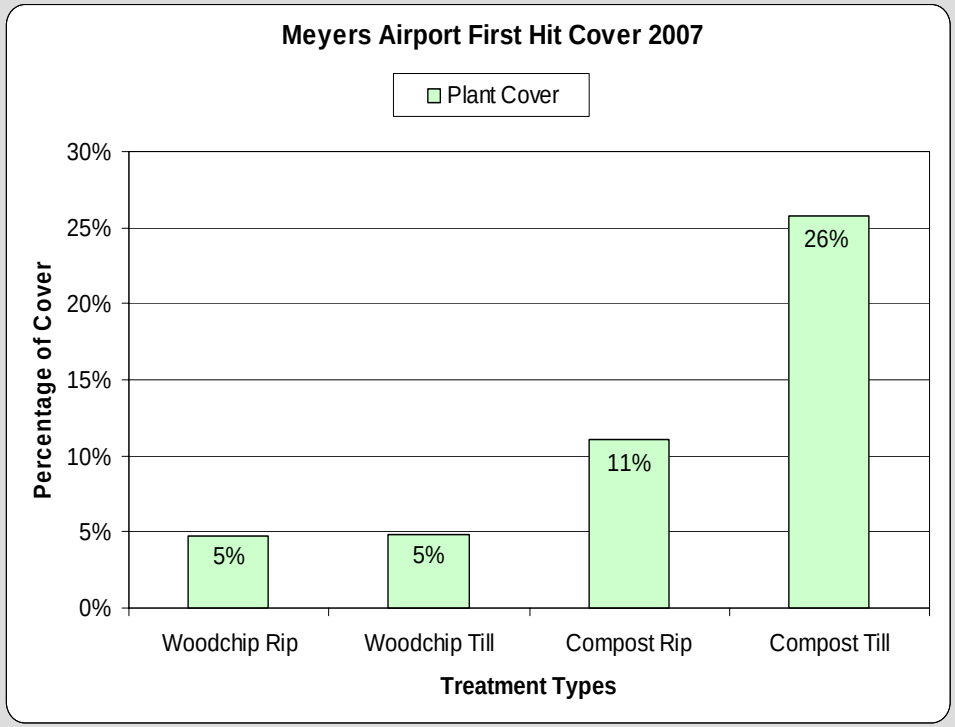


- Compost plots have highest plant cover

- Compost plots have highest volunteer plant cover

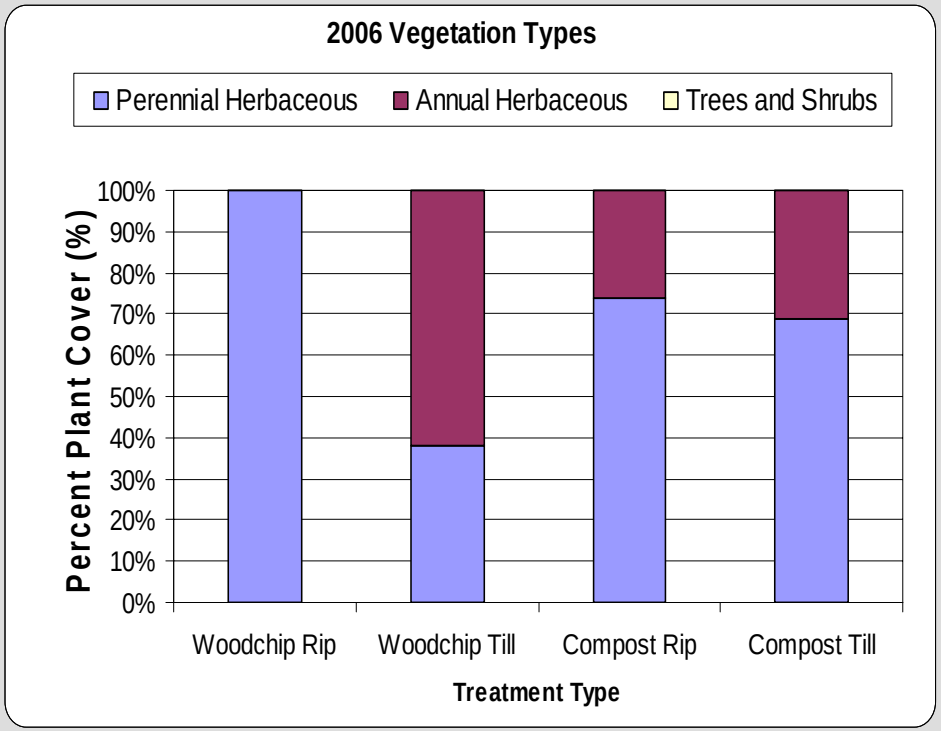
Plant Cover

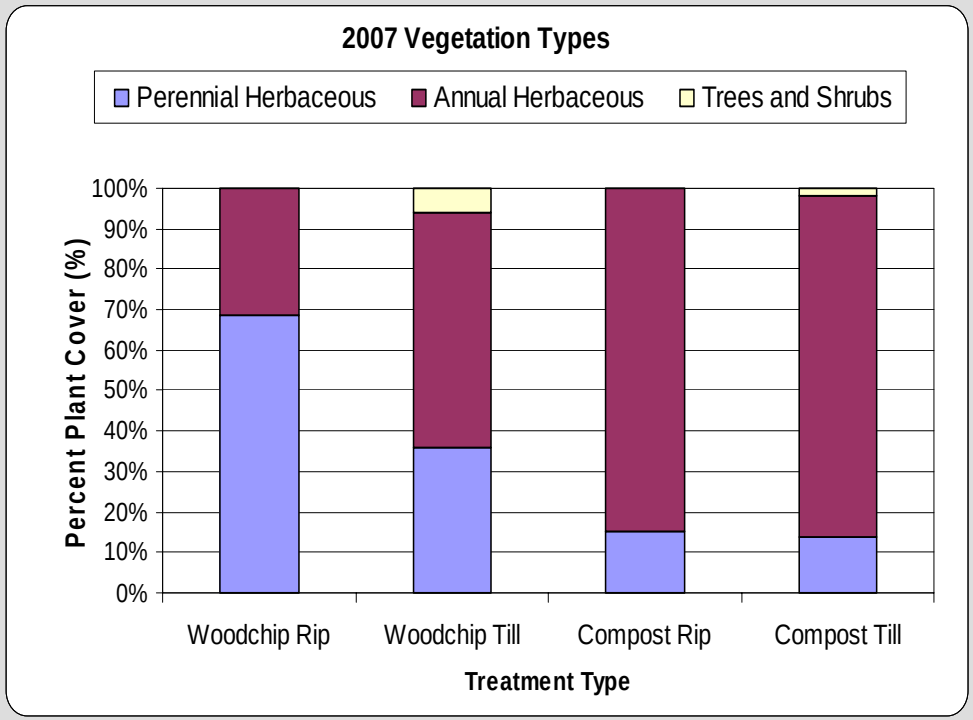




- Compost plots have the highest plant cover over two year period when compared to woodchips

Perennial vs annual

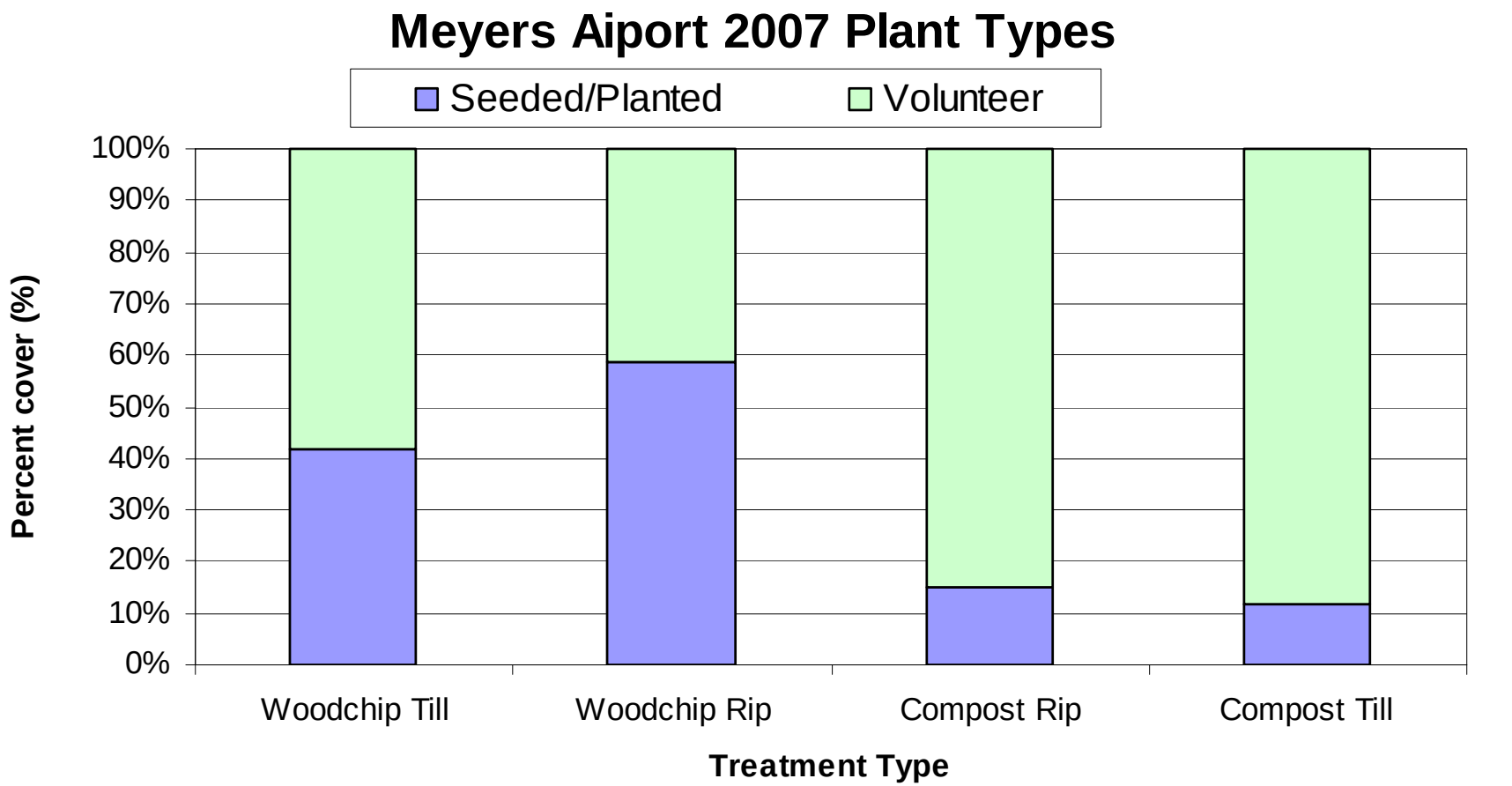




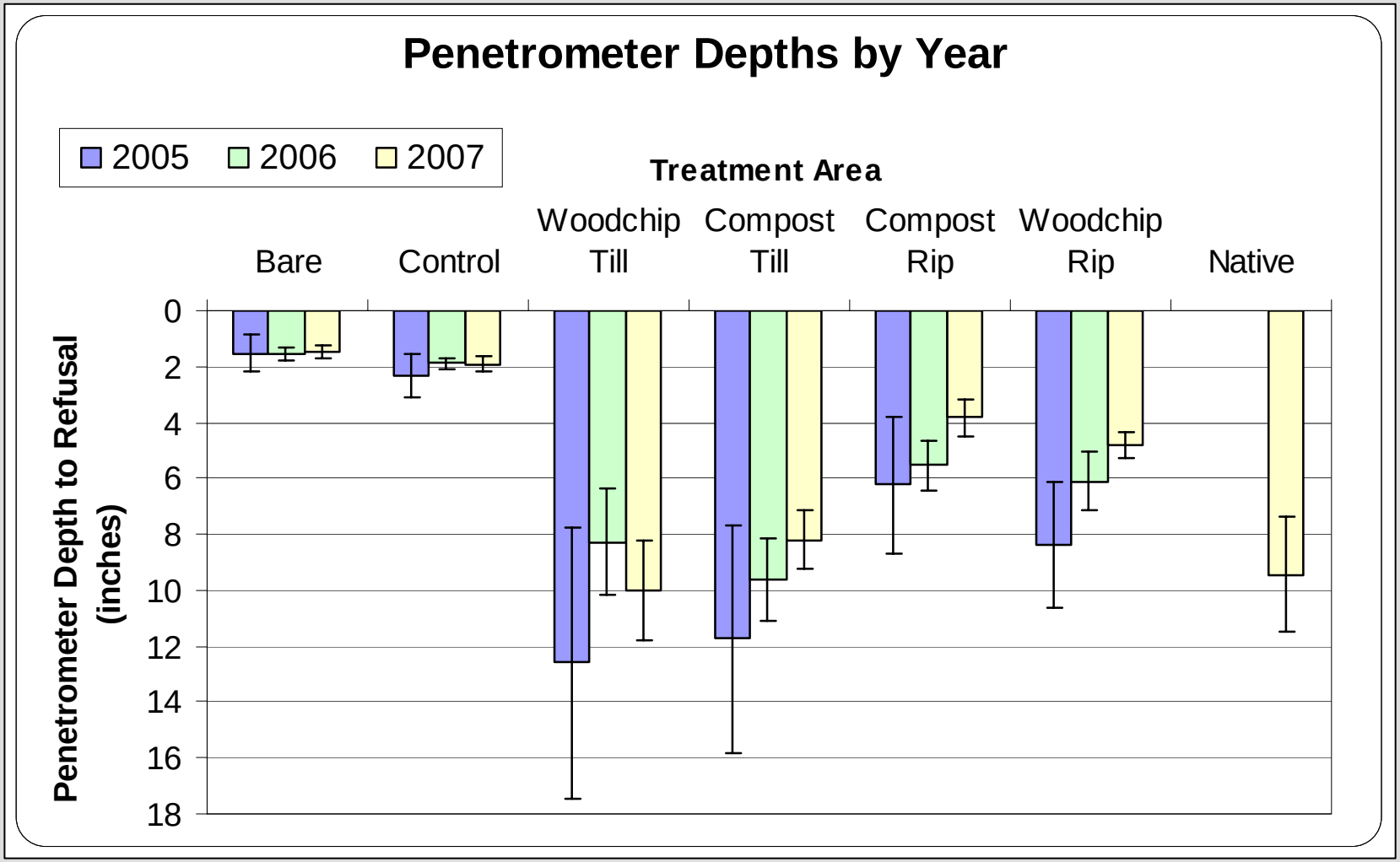
- Wet year (2006) – compost has lower perennial plant cover than some woodchips plots

- Dry year (2007) – compost has lower perennial plant cover than all woodchip plots

Seeded vs volunteer



- Higher volunteer plant cover at compost plots



-Increase in soil density over time

-Woodchip till=native after 3 seasons

Monitoring results

Rainfall simulation results

- In general, no runoff or sediment yield with tilled, composted and mulched plots, at 2.8in/hr or 4.7 in/hour (which is many times the 0.7-1.0 in/hour of the Tahoe 20 year/1 hour storm. Maximum infiltration rate unknown.
- Surface treatments under the same conditions had infiltration rates of 2.3 in/hour and a sediment yield of 407 lbs/acre/inch.
- At Buckhorn Summit (Sha 299 PM 0.06), sediment loss was reduced from an estimated 200-300 cubic yards per year, to a minimal amount that required no maintenance attention.

Erosion Control (Type I)- Compost Incorporation

Pros

- **Improves infiltration and reduces runoff/sedimentation**
- **Improved underlying soil conditions for long term vegetation establishment (perennial natives)**
- **Improves water holding capacity/water availability**
- **Improves rooting depth**
- **Nutrient/organic matter**
- **Aesthetics**
- **Improves Caltrans ability to meet permit requirements**

Cons

- **Higher cost relative to other "Erosion Control" types)**
- **Unfamilar treatments and methods**
- **Difficult to implement on long steep slopes and other hard to access areas**
- **Must delineate on plans**
- **Need to address stability of uncompacted soil surface**

To Summarize

Slopes incorporated with compost have:

- Increased potential for slumping in the first year IF vegetation in not established
- Reduced surface rilling in the first year
- Reduced runoff, increased infiltration, increased water holding capacity
- Increased capability for preventing erosion and storm water pollution after the first year
- Higher native perennial vegetation cover and plant diversity.

To Summarize

Compacted slopes without incorporated compost are:

- Good at initial resistance to slumping
- Not good at resistance to surface rilling
- Typically do not have long term native vegetation establishment
- Do not provide long term protection from erosion and storm water pollution.

Application

- Regulatory requirements for SW
- Requirements for revegetation
- Sensitive biological resources
- Aesthetics
- Infiltration Basins
- Bio-swales and Strips
- Environmental Restoration Areas


09/12/2007

Recommendations for Use

- Fill slopes (current draft spec for incorporation tells the designers only on slopes <5:1, unless they get geotech approval).
- Reconstructed cut slope (in conjunction with reinforcement)
- Cut slope (no standard spec requirement regarding compaction, but must still address stability)
- Site Specific strategy-what are the conditions and needs to determine what is going to work best in a particular site

Unit Synergy

- Geotech
- Hydraulics
- Project Development
- Landscape Architecture
- Construction
- Environmental
- Maintenance
- Storm Water

Designing Compost Into Highway Projects

QUESTIONS

RESOURCES

- **CALTRANS (Headquarters)**

  Gregory Balzer-Specifications

  Doug Brown-Research

- **CALTRANS (North Region Resources)**

  Monica Finn- Revegetation Specialist

  David Moffat- Landscape Architect

- **UC Davis**

  Vic Claassen- Soil Scientist

- **Consultant**

  Michael Hogan- Integrated Environmental