LOCKHEED MARTIN

Phytostabilization and Habitat Restoration of Copper-contaminated Mine Tailings

Jianwei Huang*, Lockheed Martin REAC,
Brenda R. Jones, U.S. EPA Region V
Rich Henry, U.S. Fish and Wildlife Service
David W. Charters, U.S. EPA ERT


Lake Superior
HWY 26
GAY RD
GAY SANDS
LAKE LINDEN
TAMARACK
MASON
TROESCH
Lake Superior

Background

- The mine site is located on the Keweenaw Waterway in the Upper Peninsula, MI.
- From 1890-1969, Cu mining and processing activities produced mill tailings (stamp sands) that contaminated lake sediment and shoreline.

LOCKHEED MARTIN

What is Stamp Sand?

Unremediated stamp sand
at the Gay Sands Area

Water erosion of stamp sands
at the Gay Sands Area

Remediation at Torch Lake Site

- In 1988, US EPA began investigations focusing on the characterization of tailings, slag piles, surface water, sediment, and ground water. Studies were completed in 1992.
- Remediation action: to construct a 6-inch soil cap on the stamp sands around the shoreline of the lake, and create a vegetation cover.
- By fall of 2001, over 330 acres of stamp sands along the shoreline had been remediated with a 6-inch soil cap and planted with selected grass and wild flower species.

Construction of a 6-Inch Soil Cap to Cover Mine Tailings

One year following remediation (Mason)

LOCKHEED MARTIN

There years following remediation (Lake Linden)

Sampling Locations (The Lake Linden Area (3 Years)

Survey Subjects

- Small mammal live trapping
- Bird community survey
- Soil sampling
- Plant community survey
- Plant biomass measurement
- Examine root penetration

LOCKHEED MARTIN

Check Traps Twice Daily

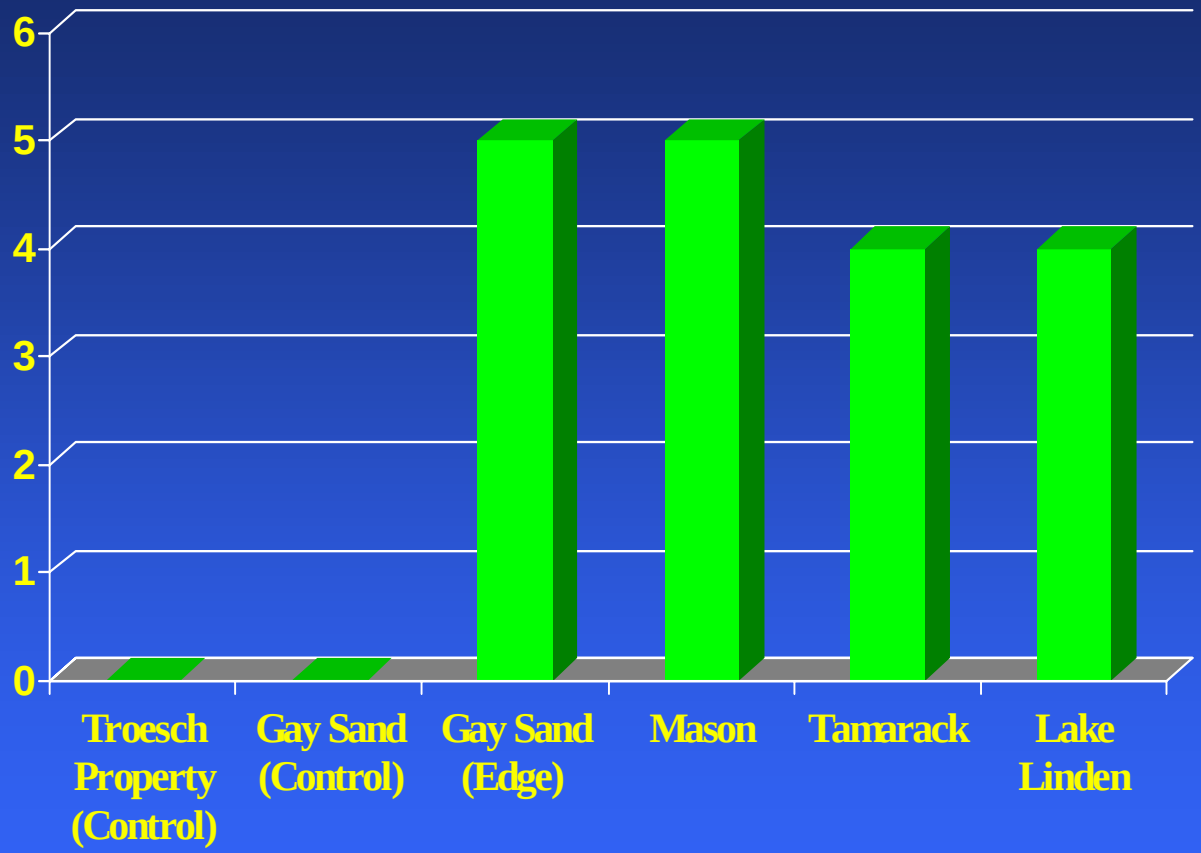
LOCKHEED MARTIN

Small Mammal Live Trapping

LOCKHEED MARTIN

Live Trapped Small Mammal

Number of Small Mammal Species Captured



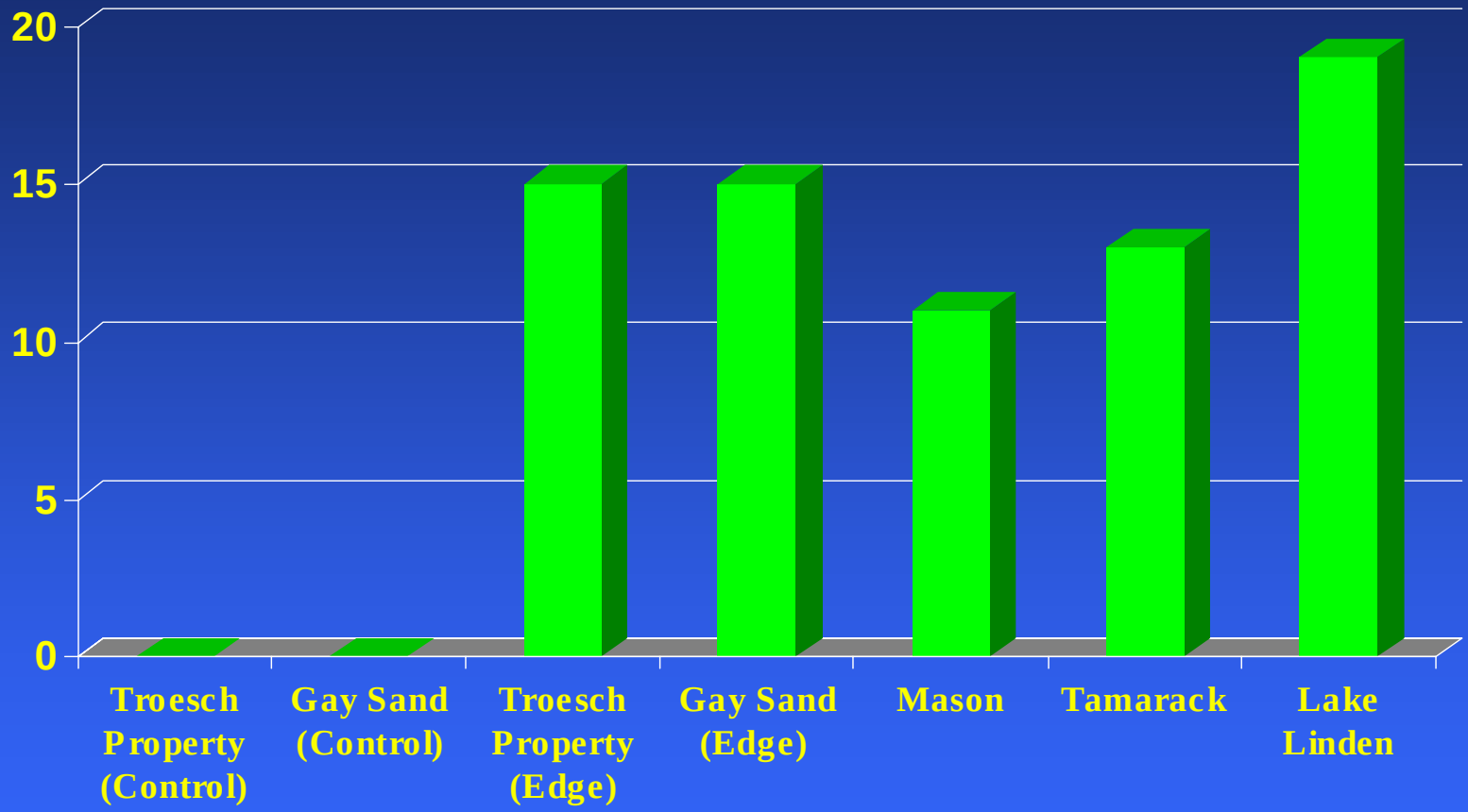
LOCKHEED MARTIN

Bird Community Survey

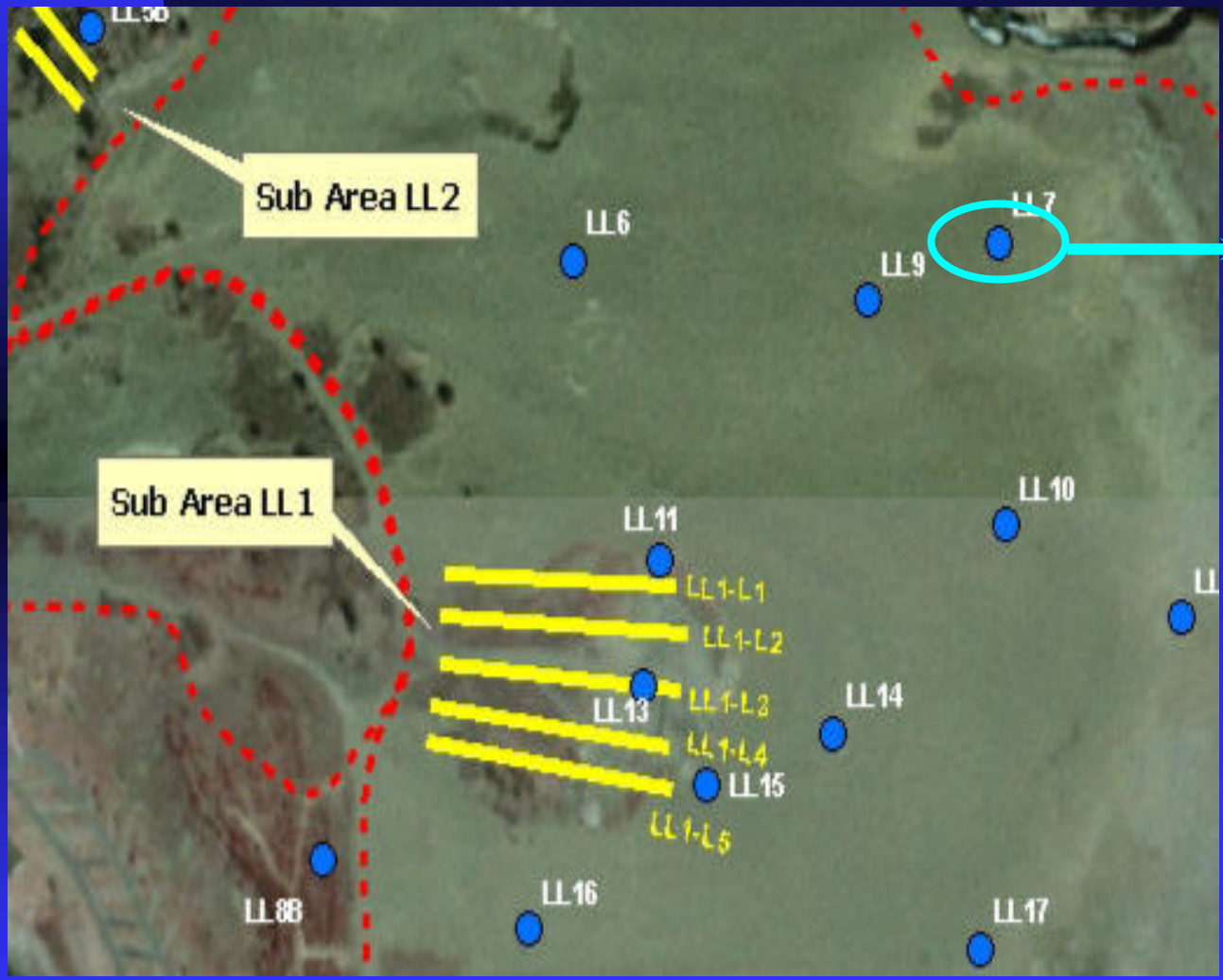
Canada Geese at the Lake Linden

Bird Community: Sandhill Crane at Mason

Number of Bird Species Observed



Plant Community Survey



NW	NE
SW	SE

NW: Plant biomass, root growth
NE: Soil Samples
SW: Plant community
SE: Plant coverage

The Lake Linden Area (3 years)

Plant Voucher Collection

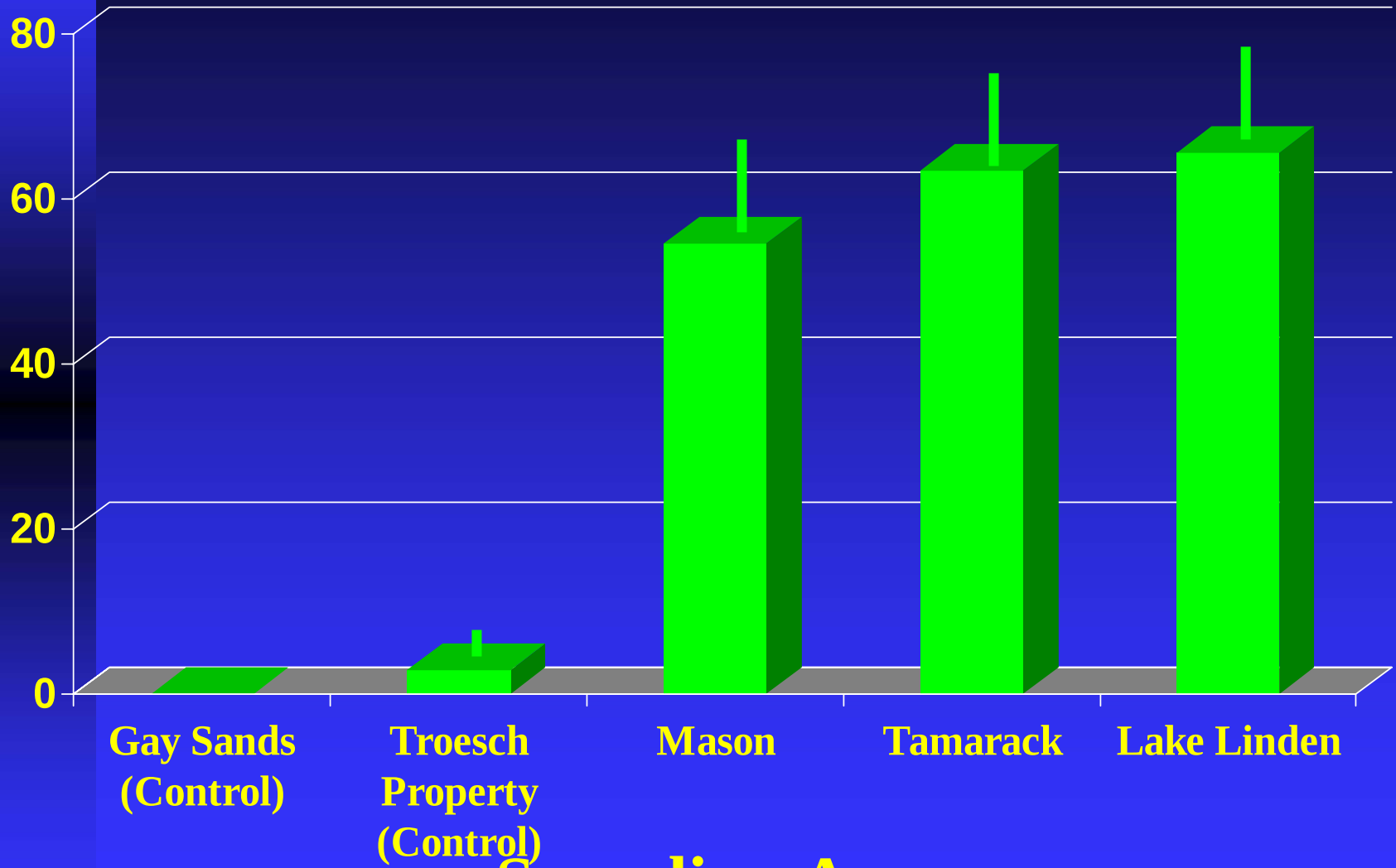
Tansy

Mullein

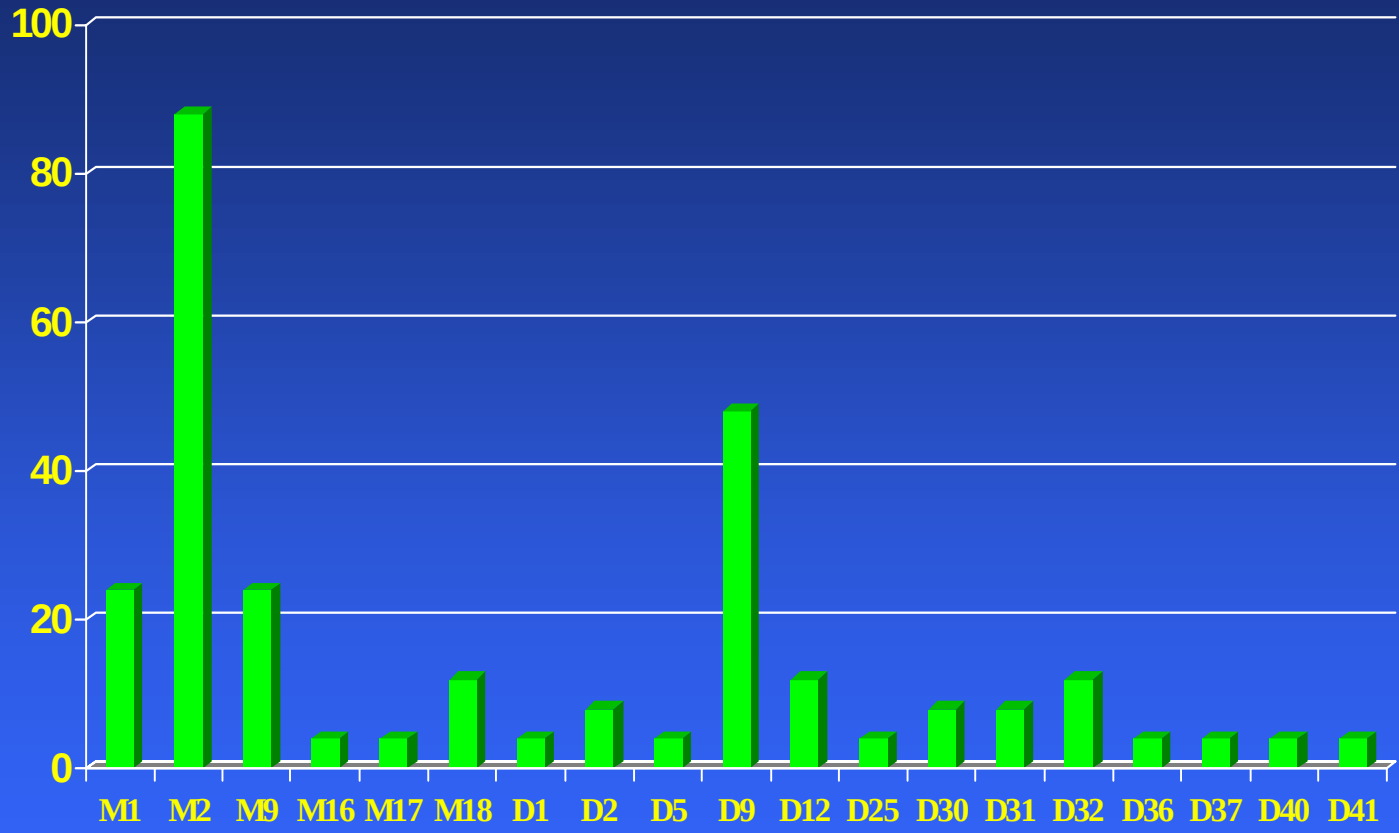
Plant Species Identified

- 7 plant species were planted in the treated areas
- 76 plant species were identified in the survey
- 69 additional plant species were introduced to the remediated areas in 3 years

Percent soil surface coverage by plants



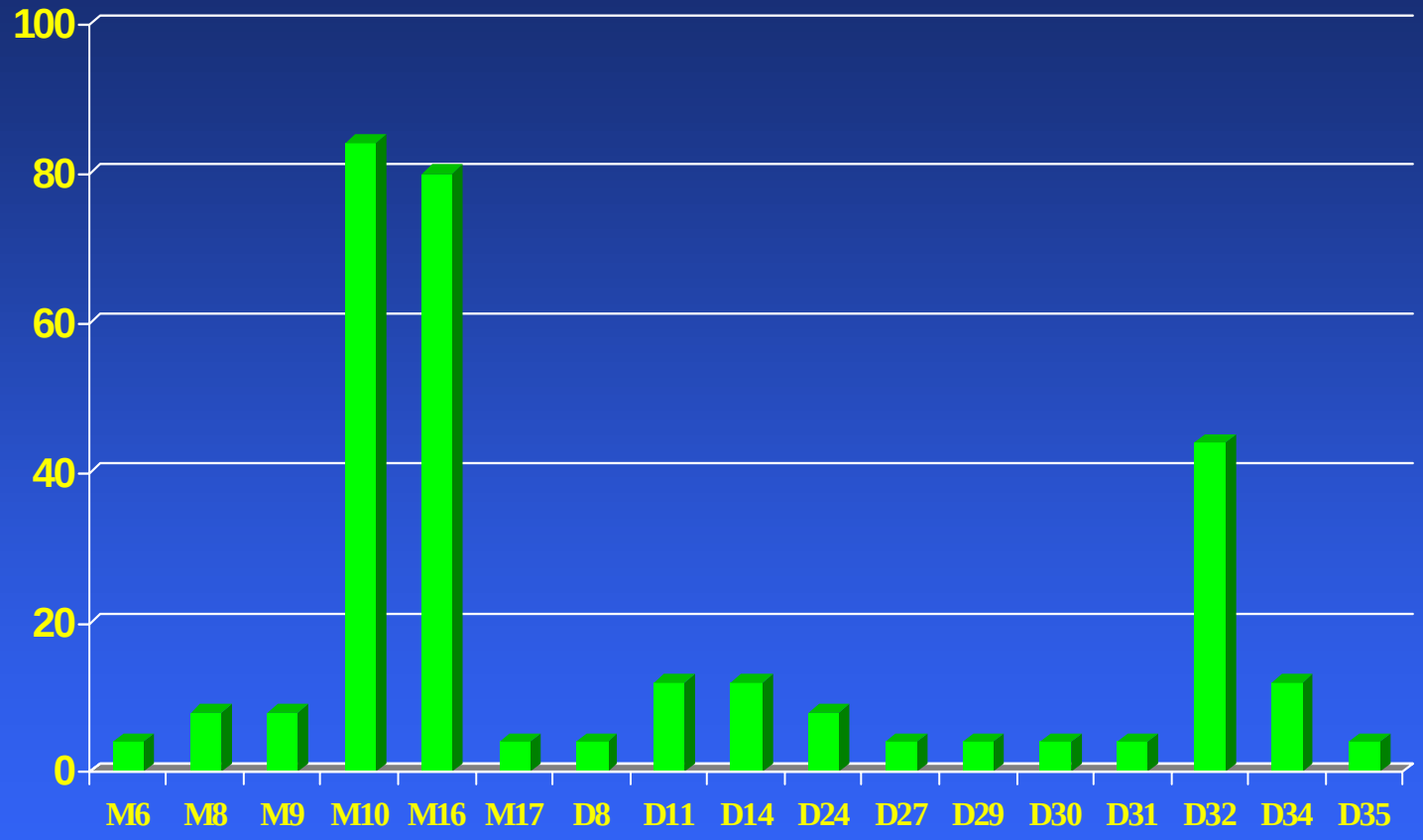
Frequency of occurrence for each plant species
The Mason Area



M2=Wildrye; D9=Red clover, D32=Alfalfa

Frequency of occurrence for each plant species

The Lake Linden Area

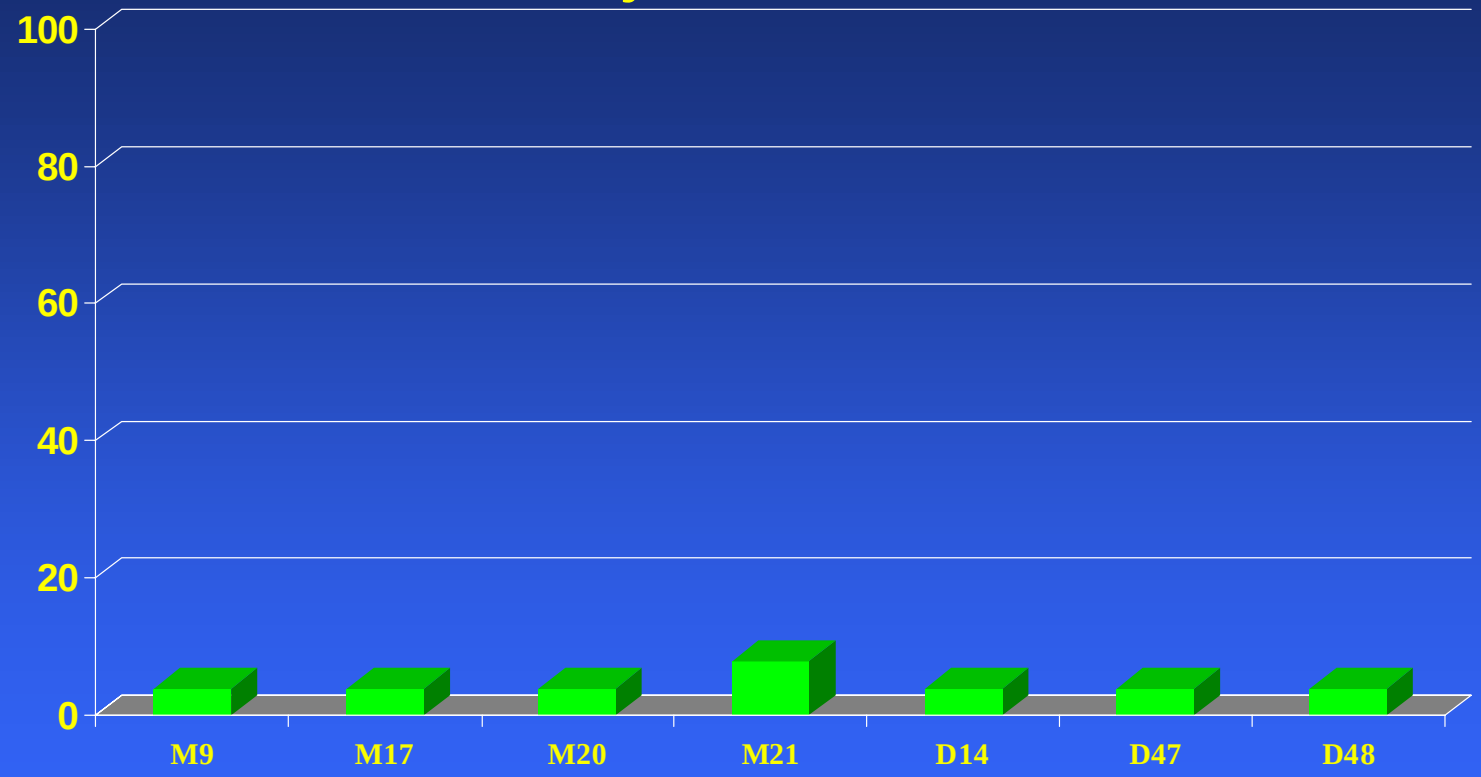


M10=Tall Fescue; M16=Bentgrass; D32=Alfalfa

LM

Frequency of occurrence for each plant species

The Gay Sand Area



M21 (Sedge) and M17 (Horsetail) were in control area, and other plant species were in the surrounding area

LOCKHEED MARTIN

Conclusions

- Remediation created a vegetation cap which had a soil coverage of more than 55% in the first year. Plant coverage consistently increased with time following remediation.
- Remediation also attracted birds to the areas. More than 10 bird species were observed at each remediated area, but none in the control areas.
- Remediation played a key role to attract small mammals to the affected areas, and created habitat for animals living in the area.

LOCKHEED MARTIN

Acknowledgments

- US EPA / ERT
- US EPA Region V
- NRCS

  Gary Aho

- Lockheed Martin / REAC

  Dan Cooke, Chris Gussman

  Scott Grossman, Amanda Maxemchuk

  Mike Nigro